

14th International Forum on Knowledge Asset Dynamics

PROCEEDINGS

Knowledge Ecosystems and Growth

5-7 June 2019
Matera, Italy

IFKAD 2019



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WELCOME TO IFKAD 2019

Welcome to the 14th edition of IFKAD. This 2019's edition is taking place back to Matera, where for the first time our scientific knowledge-based community gathered in 2006 to start an open and interdisciplinary debate about the role and relevance of knowledge assets dynamics for the value creation mechanisms of organisational systems. Since then, our community has been growing, and IFKAD is nowadays one of the leading and most prestigious international scientific conferences focusing on the relationships between knowledge resources and organisational growth.

This year's IFKAD is supported by the University of Basilicata, the University of Rome Tre and the Chinese Culture University and it is happening in a special time for Matera, during the celebration of its appointment as European Cultural Capital. Matera is the ideal location to discuss the role of knowledge ecosystems in shaping a sustainable future as the town is developing the cultural program for the nomination of European Cultural Capital, under the label "Open Future".

Since 2006, the first edition of IFKAD was held in Matera; the world has experienced critical advances and challenges while characterised by greater complexity and multiplicity. Now, more than ever, we need scholars and practitioners who can navigate and make sense of these tensions by thinking in broad and integrative ways. Thus, during our Forum, let us imaginatively and importantly use our capabilities and voices to examine management and organisations questions that advance our understanding of the role of knowledge ecosystems for growth and a sustainable future. Indeed, the competitiveness of organisations seems more and more related to their ability to be part of knowledge ecosystems that provide the ideal conditions in terms of human, socio-cultural, and relationship capital to shape a cognitive atmosphere catalysing and supporting open innovation.

Over the past decades, management scholars from different research perspectives have extensively explained the role of knowledge as a crucial driver for the growth of organisational systems both at the micro and the macro level. Knowledge resources and dynamics represent the strategic foundations for the creation and management of any form of the firm as well as cities, local territories, regions and nations. At the 14th edition of IFKAD, by acknowledging knowledge assets as key values drivers for growth, we wish to extend our theories, findings and business discourses about the value creation dynamics of knowledge to further understand the role of knowledge ecosystems to shape a sustainable future. Today's business landscape is characterised by global and local trends that call for an extension of our understanding of the role of knowledge as a strategic resource and source of growth. Global challenges include population growth, increased diasporas, commoditization of knowledge, the pace of innovation, the digital revolution and technological advances, business model transformations, growing gig economy, while local challenges consider local development, citizen

FOREWORD

inclusiveness, employability, and quality of life. They call for a better understanding of how knowledge dynamics can properly address sustainable wealth creation, particularly through the development of knowledge ecosystems.

The mission of IFKAD is the development of research and scientific conversations aimed at contributing to theory-building as well as to the managerial practice about the role of knowledge as an organisational value-driven source. Our view is that organisations are primarily in the business of knowledge and from their capacity of managing knowledge depends on their future business sustainability and value creation capacity.

I want to extend my thank to all those colleagues and friends that every year work to make IFKAD a successful scientific event as well as a great social gathering where to meet old friends and make new once. I wish you a fruitful and inspiring conversation capable of nurturing your curiosity and scientific expertise.

Prof. Giovanni Schiuma

University of Basilicata, Italy



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Digitally Enabled Servitization Strategy in Manufacturing Firms

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Abstract

The current surge of new digital technologies such as artificial intelligence, big data, blockchain, and internet of things have revitalized the interest in the effects of technological changes on organizations and individuals. Linked to this interest is also the potential for efficiency gains from automation, growth through scalability and connectivity in ecosystems offered by these technologies. Some researchers suggest that digitalization might play out differently contingent on the context in which the digitalization occurs. However, to date we have limited understanding of how the digital technologies are used and utilized and what effect they have in different knowledge domains. Consequently, there is a pressing need for more insights into the contingency factors associated with the digitalization in different industries. This paper focuses on servitization where digitization plays a crucial role in traditional manufacturing transformation from offering physical products to offering services. The transition from product- to service-oriented business models is very challenging because companies need to develop new services that are not yet in the marketplace. The utilization of digital technologies is of increasing interest as this type of manufacturing firms seek service-based strategies.

Keywords – Digitalization, digital transformation, manufacturing firms, servitization.

Paper type – Academic Research Paper

1 Introduction

There is no established framework with digitalization theory. Preliminary research offers a fragmented landscape around digitalization, often driven by an understanding from informatics. This professional perspective is more often focused on the technological complexity, and less on the understanding of the organizational complexity in which the technology is implemented and utilized. Therefore, it remains to be seen which established framework from management and organizational fields proves effective to explain particularly complex factors, such as the use of digital technologies, the commercial and organizational implications of introducing this technology and type of digital technology (i.e. artificial intelligence (AI), Internet of things (IoT), blockchain, augmented reality (AR) and virtual reality (VR) with digital ambition (digization, digital automation, digital transformation; i.e. Loebbecke & Picot, 2015). Moreover, a prerequisite condition for assessing the eligibility of different theoretical perspectives on digitalization is a further understanding of how digital technology is implemented and used in different contexts. Accordingly, this empirical paper aims at revealing how digital technologies are implemented and used in a particular context: Industrial product manufacturing firms embarking on a digitally enabled servitization strategy. Luz Martín-Peña, Díaz-Garrido, and Sánchez-López (2018) implicitly assumes a close relationship between digitalization and servitization strategies in a recent review of literature on digital business models. Moreover, harnessing digital technologies are of increasing importance as product firms organize for service led growth (Sklyar, Kowalkowski, Tronvoll, & Sörhammar, 2019). Hence, we ask: How does digitalization enable servitization? How are the technologies that are used to develop new services enacted?

While extant literature has clearly pointed out that the transition from products to services is a strategic one and requires the attention and support from top management, it is still unclear of how the actual strategy is relating the firms agility and capabilities in the digital transformation process (Bustinza, Gomes, Vendrell-Herrero, & Tarba, 2018). This is important, because this transition is likely to involve tensions and contention between product and service units (Palo et al., 2018). However, there is also likely to be ample synergies between service, enabling companies to offer entire solutions to greater customer problems (Tuli et al., 2007, Ulaga and Reinartz, 2011). This obviously requires strategic sensitivity from the company, paying attention into the differences between different type of services and the oftentimes dynamic connections between products and services. Several companies delivering technologically advanced products to the global energy and maritime sectors have experienced increased price pressure and falling margins. One way to meet these challenges for manufacturing firms is to increase the revenue from services through digitalization. Such a transition from product- to service-oriented business is called servitization (Lightfoot, Baines, & Smart, 2013). Servitization is therefore the transition manufacturing firms are within when shifting focus from tangible products to intangible services (Partanen, Kohtamäki, Parida, & Wincent, 2017). To date there exist limited empirical research addressing how digitally driven

servitization strategies in manufacturing firms are underpinned by integration and clever utilization of digital technologies.

We conducted a qualitative study with five manufacturing firms in one industrial maritime and energy cluster servicing the North Sea oil industry. In our data gathering efforts we have accessed a variety of data sources such as; visits with observation at five different production facilities, 43 in-depth semi-structured interviews with strategic decision makers, relevant customers and suppliers, as well as document studies in relation to strategic practices as well as documents studies (e.g. minutes-of-meetings, internal reports and annual reports).

The unit of analysis in this study is services where digitization plays a crucial role. Digitization is referred to as the pace of change in society driven by digital technological development (McAfee, 2009). The digitization trend consists of a number of new technologies at different stages of maturity and acceptance in the market, and these technologies will converge and create new technologies (Manyika, Chui, Bughin, Bisson, & Marrs, 2013). The consequences of digitalization for society and business can be understood in different stages (Loebbecke & Picot, 2015). Step 1 is called Digitization and refers to conversion of analogue to digital information (Negroponte, 1995). Step 2 is called digitization, which is about the process of using digital technology, where ICT is used to replace or streamline work tasks (Aron & Waller, 2014). Step 3 is referred to as digital transformation or digital switching. In this digitalization step the process development improves the organizational structure and the underlying business model, creating new markets and new business areas (Andal-Ancion, Cartwright, & Yip, 2003). These three development steps are useful as analytical tools to identify where the different service innovations are in the application of digital solutions. This can also help to develop, simplify, improve or streamline services.

Our analysis reveal that there are large variations between the companies' products and services in relation to digitization for servitization. Our study contributes to organizational studies on the role of digitalization for servitization. We found five different groups of technologies used in servitization: 1) Web-based, 2) Sensors and IoT, 3) Virtual reality and simulations, 4) Augmented reality and finally 5) Automation/Robotics. The five uses of technology are enacted in different ways and expose different commercial needs and organizational implications.

2 Theory

Servitization can strengthen companies' performance and competitiveness, especially in the long term (Visnjic, Wiengarten, & Neely, 2016); however, the transition from products to services is very challenging (Alghisi & Saccani, 2015), since they are based on different logics (Wikström, Hellström, Artto, Kujala, & Kujala, 2009). Product-oriented businesses are often characterized by standardized homogeneous solutions and volume production, while higher service orientation are characterized by heterogeneous specialized knowledge-intensive deliveries (Fisk, Brown, & Bitner, 1993) that often are customized to the specific needs of one single customer. We combine literature on

standardization and customization in services in order to identify the different strategy practices needed for different service offerings for servitization.

2.1 Strategy and servitization

Servitization relates to different functional areas in companies, and research shows that strategic management and involvement of managers are prerequisites for success (Gebauer, Fleisch, & Friedli, 2005). Since servitization both requires changes in the company's internal organization and external relationships (Alghisi & Saccani, 2015), it is likely that different types of strategy practices associated with servitization will be utilized. Recent strategy literature highlight that more companies choose completely open strategy practices to bring about tough organizational changes. However, empirical research has hitherto not explored the link between open strategy and servitization. More empirical research is needed to fill this knowledge gap. To be able to identify different types of strategy practices with servitization, we first expose theory regarding classification of industrial services before we turn to differences of customer interaction and customization.

Existing research has identified how manufacturing firms develop their service business and has classified industrial services (Parida, Sjödin, Wincent, & Kohtamäki, 2014; Partanen et al., 2017). The classification is useful for understanding how services can be divided into portfolios of services and viewing service bundling and product-service configuration. Partanen et al. (2017) set forth five dimensions or bundles of services, with a total of 15 types of services (Figure 1). This service classification can both be used to identify different service bundles and view how different bundles are used from different firms to different customer segments. Furthermore, products and services have different roles when suppliers and customers take part in the product specification or service creation, co-creating value (Vargo & Lusch, 2008). Moreover, there are different ways these services are intertwined with technology and digitization

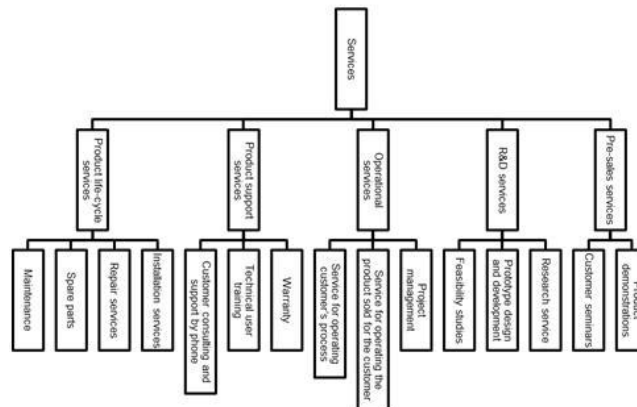


Figure 1 Dimensions of industrial services (Partanen et al., 2017)

Standardization, customization and customer interaction

To understand how customers take part in product and service creation, there are two dimensions that are often used to explain the variety: *the degree of standardization/customization* and *the degree of customer interaction* (e.g. Consoli & Elche-Hortelano, 2010; Hansen, Nohria, & Tierney, 1999; Larsson & Bowen, 1989; Løwendahl, 1997; Maister, 1993; Ramírez, 1999; Schmenner, 1986). *The degree of customization* influences the extent to which the product or service can be codified and delivered independently of specific people and locations (Hansen et al., 1999; Løwendahl, 1997; Maister, 1993). Customization means that the provided offer meets a customer's specific needs. The method of standardization is used to reduce or eliminate customized, one-time, and seldom-used processes that introduce variability while potentially adding costs and quality problems. The degree of customization influences the extent to which products and services can be commoditized (Hansen et al., 1999).

The degree of customer interaction is related to how involved the customer is during provision of the offer. Typically, the degree of customer interaction is higher for services than products. According to the literature, the quality of services is evaluated in the “moment of truth” (Normann, 1984), and services are co-produced by the customer and the service provider (Amara, Landry, & Doloreux, 2009; Bettencourt, Ostrom, Brown, & Roundtree, 2002; Ordanini & Pasini, 2008). This explanation, however, is a simplified picture of service provision (Breunig, Kvålshaugen, & Hyde, 2014). Sometimes, services are created in collaboration with the customer, and the consumption and provision go hand-in-hand. Other times, the customer is not involved in the service production at all. In such cases, the service provider receives orders from the customer and delivers the requested output. Kvålshaugen, Hyde, and Brehmer (2015) identified four generic types of services which they called standardized-provided, standardized-co-produced, customized-provided, and customized-co-produced (Figure 2).

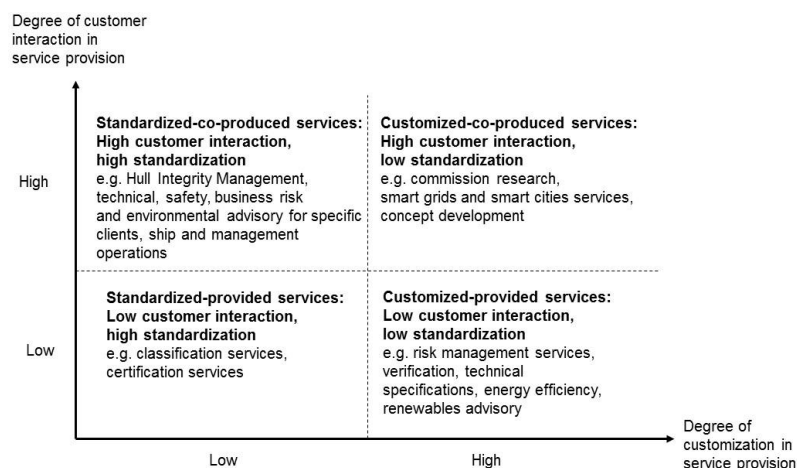


Figure 2 Customer interaction and customization (Kvålshaugen et al., 2015)

The extant literature on customer interaction and customization has so far discussed products and services in isolation, and not the bundles of products and industrial services that result from servitization processes. We believe that the relationship between customer interaction and customization are together powerful constructs to understand servitization. In order to be able to identify how companies servitize and customize their products and industrial services and their related strategizing, we therefore combine the findings from Partanen et al. (2017) regarding the different industrial service offerings, with the understanding of service customization from Kvålshaugen et al. (2015).

3 Methods

The explorative nature of our research problems warrants a qualitative approach. For the purpose, we use an embedded single-case study design aiming at building new theory (Yin, 2009). The case is an industrial cluster of equipment manufacturers within the Norwegian energy and maritime sector. Within the cluster, we have so far interviewed 43 managers from five companies from different parts of the industry value chain. The current degree of service orientation in the case organizations' business models vary, but all firms are in an ongoing process of increasing the service orientation in their business models, especially by making more extensive use of digital technologies. We collected data mainly through semi-structured, in-depth interviews with employees involved in servitization in the case organizations. The interviewed persons represented both product and service units as well as top management. The interviews varied in length between 60 and 75 minutes. All four authors of this paper participated in the interviews and at least two of the authors participated in each interview. The interview guide was discussed and developed on beforehand to secure common ground and understanding of the phenomenon at hand and the purpose of the questions. The interviews were recorded and will be transcribed. In addition, notes were taken during the interviews. We also received some information from the companies such as power point presentations and product or service brochures. Table 1 provides an overview of the cases. We analysed the interviews in an abductive manner. First, we performed a within-case analysis, trying to form an understanding of each individual company and its servitization process. Next, we did a cross-case analysis to identify possible patterns across the cases.

Table 1 An overview of the companies and the number of interviews in each of them

<i>Name</i>	<i>Offering</i>	<i>Number of interviewees</i>
Alpha	Engineering, Procurement, Fabrication, Transportation, Construction, Installation supervision, Project management (on an Engineer-to-Order basis).	8
Beta	Tailor made drilling equipment and systems, and related life-cycle services such as training and remote diagnostics and online support.	11
Gamma	Lifting equipment and related life-cycle services such as training, remote diagnostics and online support.	7
Delta	Custom-made operator chairs in small series.	7
Epsilon	Lay flat hoses. Sensoring of hoses as future prospects.	10

4 Findings

Across the five firms, there were different services that were provided and several planned services, for servitization. For each service type identified by Partanen et al. (2017), there were different services and projects using digitalization. Table 2 gives an overview of each technology used, which will be further exposed below with illustrative examples.

Table 2 Servitization and digitization

<i>Servitization/ Digitalization</i>	<i>Pre-sales services</i>	<i>R&D services</i>	<i>Operational services</i>	<i>Product support services</i>	<i>Maintenance and life-cycle services</i>
Web based	Selector		My operations app		
Sensors and IoT			Operation performance: Real time, big data for decision support		Machine prognostics; Condition based maintenance
Virtual reality and Simulations	Simulator service	BIM Modelling	Planning operations; Training	Simulator service; Location independent training; Equipment training	
Augmented reality				Digital twin	Remote repair
Automation; robots			Assist functions, CAM		

4.1 Web-based technology

The firms in our sample used web-based technology to communicate efficiently with customers during the provision of pre-sales services and operational services. The following quote from one of the managers in Epsilon illustrates the practices in this area:

«We are planning to make a web-based hose selector where the customers can choose for example the type of liquid they want to transport - Drinking water, dirt, oil, gas, compressed air – and the quality - high quality, low quality (...)»

4.2 Sensors and IoT

We found that the firms in our sample integrated sensors combined with communication technology in the equipment to a large degree. Data from these sensors were used during the provision of operational services as well as maintenance and life-cycle services. The following statement from one of the managers in Gamma illustrates how this type of data may be used to improve the customer's operational process:

«Helicopters today have health indicators monitoring their rotary equipment (...) to see for example if there are any frequencies that indicate errors. We have

a pilot project where we see if we can use this technology on cranes. We have begun to install this equipment (...). It is not a problem to make things smart.”

One of the informants in Delta also explained how they could use sensor technology to improve the customer’s use of their equipment:

«We can install sensors in the chairs. In this way they can automatically recognize the person and adjust automatically - pre-set memory setting. »

We also identified several examples on how this technology could be used to provide maintenance and life cycle services. One informant from Epsilon for example stated:

«We can install vibration meters on the looms to be able to identify when it is bad (...). This is standard equipment on wind turbines and helicopters. We can perhaps also combine this with artificial intelligence. This will enable us to provide condition-based maintenance – maintenance based on the condition of the loom (...). The customers can perhaps lease the looms instead of buying them (...). »

Another example was related to Beta. One informant stated:

«The sensors enable us to change maintenance strategy (...) From calendar-based maintenance strategy where it does not matter how much the product is used (...), to a condition-based maintenance strategy where maintenance is based on the condition of the equipment. We can do less maintenance in this way (...) When using this maintenance strategy, we get a bag of money that we have to capitalize on (...) We used to get perhaps 100 million to conduct calendar-based management every five years. But now we do not need to do this that often. So, when we get that money bag here, and only conduct maintenance based on analysis, there are margins that are amazing ...»

Our findings also suggested that this maintenance strategy is not feasible in all industries and markets. It has to be in markets that are willing to pay and where it is crucial to have such advanced data about the condition of the equipment. An informant in Epsilon for example stated:

“We might make the hose smart, especially in subsea mining. For a smart hose, there has to be willingness to pay a lot, such as for a Subsea riser. The world's toughest hose with sensors and instruments making the host costs the double. We could do that smartly. Since the subsea pump costs so much, the hose price is maybe not an issue and it matches the subsea context”

When maintenance of equipment is based on data about the condition of the equipment, ownership and sharing of data becomes an issue that need to be handled carefully and also provided some new opportunities. One informant from Beta stated:

“We need to describe how to share real-time data in the contract from the start. (...). [anonymised] is a platform that we use for making data accessible. We are early there. We are on track and the next step is to have rig data on the platform and try to get some value out of them and make them available (...). Today we collect a lot of data without having a user case (...)”

4.3 Virtual Reality

In the firms, virtual reality (VR) is both used and planned to be used in services regarding pre-sales services, R&D services, operational services and product support

services (such as training). An example from both R&D services and operational services was related to Gamma, and one informant explained:

“We want to use simulation tools to plan the operation and use it as a decision support. The fact of knowing and gain clarity about the critical phase of a big lift from a boat to the port for instance and manage to use simulations and help them make the decisions. We have made simulations of marine operations and corresponding measurements with sensors to see if we can simulate this. We can have it on the vessel and detect how this will evolve. They will use it as a decision tool and a training tool. A tool for all involved, including the captain. And we who sit on the simulation models look at how the waves will affect the operation. We can use this and manage to combine that type of service with products”

VR was mainly emphasized to plan operations and to support decision making on the use of different products. An informant described a typical context for such services.

“It's about planning and what's happening on land in relation to a heavy lift. A difficult lift, they can spend 2 years planning it. There is great potential for helping them with planning. There are extreme cases: Lifting in the borderland of what the equipment capacity can handle ... a lot of dynamics, due to sea and wind, and the equipment has its limitations and scratches when descending on the seabed and buoyancy due to the land and getting too loose, and The whole wire can snap and everything falls on the seabed and you lose the construction that costs millions. A gas module costs one billion Norwegian kroner. This involves a lot of expertise from many. And they lack a lot of information, which makes them take many assumptions, like how much flexibility is needed of our crown constructions, and there they make assumptions about which we can assist them and communicate via simulation models. This is about, for example, Subsea cranes that are on construction vessels and which will make installations on Subsea and maintain Subsea installations.”

4.4 Augmented Reality

Two of the firms also explained how they explored augmented reality (AR) for product support services and maintenance and life-cycle services through remote repair. The envisaged case is that whenever there is a problem, the person operating the machines will put on AR glasses and follow instructions from the firm about what to do. A manager from Beta explained:

“With augmented reality, as in remote repair, the rig crew calls us, and we go in digitally: We will tell the maintenance guy at the rig ‘you have to change that valve’, and all the documentation, drawings, how to put on the equipment and all the info comes up.... The business case is a reduced crew and a well-paid service, so the maintenance man only needs to be good at following instructions and using AR”

AR for servitization entail a business model where the companies are taking over part of the operations and the maintenance although at a distance. To be able to offer such services, the companies only need an internal digital twin.

“AR is low threshold, and low cost. With a digital twin in our training rooms, we can use this business model and use the digital twins internally to offer such services externally.”

4.5 Automation technology

We found that the studied firms used automation technology to provide operational services. One informant from Gamma stated:

“Today the operation of a crane is very dependent on the crane operator. We can use automation technology to make the operation more consistent. We talk about automation and assistance. An analogue is hatch parking - Automatic parking, some make it without trouble while others have problems. We can have assist functions that help the operator and make the performance less dependent on his/her skills (...). Another project we have started is to build a robot that can move vessels. It has resulted in a long-range robot and a prototype (...). We have sold this to [anonymised] (...)”

5 Concluding discussion

The analytical tools to identify the use of digital solutions together with the industrial service offerings are helpful to answer our first research question: “How does digitalization enable servitization?”. We identified several different services as described above. Most of the services are operational in Partanen et al’s (2017) categorization. Overall, the services we studied exhibit various levels of digitalization. We have categorized some of the identified services in terms of the three digitalization steps (Loebbecke & Picot, 2015) as explained in table 3.

Table 3 Examples of level of digitalization of the observed services

Step	Example of service	
0. Analog	Spare part sales	While spare parts are physical matter, their design and installation still require the effort of skilled engineers and technicians, typically on behalf of the service provider.
1. Digitization	Web-based technologies, IoT, Sensors	The web can be used to document a customer dialogue. Turning analog data into digitized in the studied context of IoT and sensors involves a human process of deciding which parameters and variables that are to be monitored and how they can be processed to yield results comparable to the human senses that are replaced. Also, eventually many decisions are still merely supported by the data that sensors provide.
2. Digitization	VR, AR, Automation	As in the previous step, technology is used to support decisions or tasks. This is most obvious in the use of AR and VR. Wherever automation is used it is still mainly used for performing limited operations and sub-tasks.
3. Digital transformation	Leasing services Performance-based contracts	These types of services already require a cultural and contractual changes in the concerned organizations as they alter their roles and responsibilities. This is, however not a result of the technology per se, but the organization uses the technology.

The second research question was, “How are the technologies that are used to develop new services enacted?”. To answer this, we follow the premises of practice theory and sociomateriality, re-interpreting the previously described technology used for services. This enables us to highlight features of embodiment.

We found five different groups of technology used services: Web based, Sensors and IoT, Automation/Robotics, Virtual reality and simulations and Augmented reality. These five different uses of technology expose how these are enacted. 1) The web based involve users to type on a keyboard for using a PC accessing the Internet or use their smart phone for accessing an app. 2) Sensors and IoT provide real time data for decision support, involving the user to thing in a different way. 3) For virtual reality and sensors, the technology enhances the user to become familiar with the equipment through training and embodiment. The technology enables the users to embody the skills of using the equipment, without actually using the equipment. For instance, to use a large crane and perform a difficult lift in rough sea and weather conditions, can be virtually trained through the simulator services. 4) The augmented reality services enhance the user to see exactly what an expert sees and without training can perform the same activities. For instance, a crew member on a rig can use AR equipment such as glasses and headphones and repair some equipment based on what is shown and told through the technology.

References

- Alghisi, A., & Saccani, N. (2015). Internal and external alignment in the servitization journey – overcoming the challenges. *Production Planning & Control*, 26(14-15), 1219-1232. doi:10.1080/09537287.2015.1033496
- Amara, N., Landry, R., & Doloreux, D. (2009). Patterns of innovation in knowledge-intensive business services. *Service Industries Journal*, 29(4), 407-430. doi:10.1080/02642060802307847
- Andal-Ancion, A., Cartwright, P. A., & Yip, G. S. (2003). The digital transformation of traditional business. *MIT Sloan Management Review*, 44(4), 34-41.
- Aron, D., & Waller, G. (2014). *Taming the digital dragon: The 2014 CIO agenda*. Retrieved from www.gartner.com/imagesrv/cio/pdf/cio_agenda_insights2014.pdf
- Bettencourt, L. A., Ostrom, A. L., Brown, S. W., & Roundtree, R. I. (2002). Client co-production in knowledge-intensive business services. *California Management Review*, 44(4), 100-128.
- Breunig, K. J., Kvålshaugen, R., & Hyde, K. M. (2014). Knowing your boundaries: Integration opportunities in international professional service firms. *Journal of World Business*, 49(4), 502-511. doi:http://dx.doi.org/10.1016/j.jwb.2013.12.004
- Bustinza, O. F., Gomes, E., Vendrell-Herrero, F., & Tarba, S. Y. (2018). An organizational change framework for digital servitization: Evidence from the Veneto region. 27(2), 111-119. doi:10.1002/jsc.2186
- Consoli, D., & Elche-Hortelano, D. (2010). Variety in the knowledge base of Knowledge Intensive Business Services. *Research Policy*, 39(10), 1303-1310. doi:10.1016/j.respol.2010.08.005
- Fisk, R. P., Brown, S. W., & Bitner, M. J. (1993). Tracking the evolution of the services marketing literature. *Journal of Retailing*, 69(1), 61-103.
- Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the Service Paradox in Manufacturing Companies. *European Management Journal*, 23(1), 14-26.
- Hansen, M. T., Nohria, N., & Tierney, T. (1999). What's Your Strategy for Managing Knowledge? *Harvard Business Review*, 77(2), 106-116.

- Kvålshaugen, R., Hydle, K. M., & Brehmer, P.-O. (2015). Innovative capabilities in international professional service firms: enabling trade-offs between past, present, and future service provision. *Journal of Professions and Organization*. doi:10.1093/jpo/jov005
- Larsson, R., & Bowen, D. E. (1989). Organization and customer: Managing design and coordination of services. *Academy of Management Review*, 14(2), 213-233.
- Lightfoot, H., Baines, T., & Smart, P. (2013). The servitization of manufacturing: A systematic literature review of interdependent trends. *International Journal of Operations & Production Management*, 33(11/12), 1408-1434.
- Loebbecke, C., & Picot, A. (2015). Reflections on societal and business model transformation arising from digitization and big data analytics: A research agenda. *The Journal of Strategic Information Systems*, 24(3), 149-157.
- Luz Martín-Peña, M., Díaz-Garrido, E., & Sánchez-López, J. M. (2018). The digitalization and servitization of manufacturing: A review on digital business models. 27(2), 91-99. doi:10.1002/jsc.2184
- Løwendahl, B. R. (1997). *Strategic management of professional service firms*. Copenhagen: Copenhagen Business School Press.
- Maister, D. H. (1993). *Managing the Professional Service Firm*. New York: The Free Press.
- Manyika, J., Chui, M., Bughin, J., Bisson, P., & Marrs, A. (2013). *Disruptive technologies: Advances that will transform life, business, and the global economy*. Retrieved from San Francisco, CA, US:
- McAfee, A. (2009). *Enterprise 2.0: New collaborative tools for your organization's toughest challenges*. Boston, MA.: Harvard Business Press.
- Negroponte, N. (1995). *Being Digital*. New York: Vintage Books.
- Normann, R. (1984). *Service Management*. Chichester: Wiley.
- Ordanini, A., & Pasini, P. (2008). Service co-production and value co-creation: The case for a service-oriented architecture (SOA). *European Management Journal*, 26(5), 289-297.
- Parida, V., Sjödin, D. R., Wincent, J., & Kohtamäki, M. (2014). Mastering the Transition to Product-Service Provision: Insights into Business Models, Learning Activities, and Capabilities. *Research-Technology Management*, 57(3), 44-52. doi:10.5437/08956308X5703227
- Partanen, J., Kohtamäki, M., Parida, V., & Wincent, J. (2017). Developing and validating a multi-dimensional scale for operationalizing industrial service offering. *Journal of Business & Industrial Marketing*, 32(2), 295-309. doi:10.1108/JBIM-08-2016-0178
- Ramírez, R. (1999). Value co-production: Intellectual origins and implications for practice and research. *Strategic Management Journal*, 20(1), 49-65.
- Schmenner, R. W. (1986). How can service businesses survive and prosper? *Sloan Management Review*, 27(3), 21-32.
- Sklyar, A., Kowalkowski, C., Tronvoll, B., & Sörhammar, D. (2019). Organizing for digital servitization: A service ecosystem perspective. *Journal of Business Research*.
- Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: continuing the evolution. *Journal of The Academy of Marketing Science*, 36(1), 1-10. doi:10.1007/s11747-007-0069-6
- Visnjic, I., Wiengarten, F., & Neely, A. (2016). Only the Brave: Product Innovation, Service Business Model Innovation, and Their Impact on Performance. *Journal of Product Innovation Management*, 33(1), 36-52. doi:10.1111/jpim.12254
- Wikström, K., Hellström, M., Artto, K., Kujala, J., & Kujala, S. (2009). Services in project-based firms – Four types of business logic. *International Journal of Project Management*, 27(2), 113-122. doi:https://doi.org/10.1016/j.ijproman.2008.09.008
- Yin, R. K. (2009). *Case study research: Design and Methods* (4th ed.): Sage Publications.

T-Shaped Skills in Knowledge-Intensive Work Environments in the Era of Digitalisation - an Analysis of Scrum Master Profiles

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Abstract

Digitalisation is leading to massive change processes in organisations, which increasingly intensify the relevance of knowledge management for companies. Especially, knowledge creation and transfer are central processes for gaining and sustaining competitive advantage in a knowledge-intensive environment. Researchers identified that enablers (culture, structure, people and IT) are increasing the efficiency of these processes. Here, the people element is one of the most important factors. However, current empirical studies have focused on knowledge enablers on the organisational level. But there are no concepts for the operationalisation of knowledge enablers on individual level. The present study is addressed to fill this gap. The concept of T-shaped skills seems to be suitable for the operationalisation of the knowledge enablers. Therefore, we analysed 489 job advertisements of Scrum Masters by using a mixed-method approach (qualitative and quantitative content analysis as well as variance analysis) to shed light on the explicit T-Shaped skills. With regard to his role we assume that the Scrum Master covers and portrays the needed skills in knowledge-intensive environments. It can be stated that he fills up the key role on knowledge transfer and knowledge creation in companies. Thus, he can be seen as a knowledge enabler on

individual level. The results of the analysis were tested for group differences by using an ANOVA. There are no significant major effect for industry sectors and the company size. Thus, suggests that the T-shaped concept is static. As an implication for practitioners the present study could give an important indication for the search and selection for personalized T-shaped knowledge enablers. Further, the results can be used by companies for orientation, in particular in the development of personnel development concepts.

Keywords – Knowledge Enabler, T-shaped skills, Digitalisation, Scrum Master, Mixed Method

Paper type – Academic Research Paper

1 Introduction

In the period of “Post-Industrialisation” or “Knowledge Age”, the primary resource of organisations, especially for knowledge-intensive organisations, is moving away from classical tangible production factors towards intangible intellectual assets (Drucker, 1993). The competitive advantage of an organisation increasingly depends on being innovative and seeking complex solutions in order to adapt to a fast-changing environment. Against this background, knowledge creation and transfer are central processes for gaining and sustaining competitive advantage in a knowledge-intensive environment (knowledge is one of the core intangible assets).

Furthermore, recent developments in the corporate environment (e.g. internationalisation and digitalisation) reinforce the significance of knowledge management in organisations. In particular, digitalisation and automation are key drivers for increasing knowledge-intensive work and services (Hossain and Lassen, 2017). At the same time, progressive development of information technologies promises new possibilities to support critical knowledge processes in organisations and offers new ways for employees to transfer and create knowledge. For example, developments in artificial intelligence, virtual simulation- and virtual collaboration tools, opens up new ways and tools for networking, transferring and creating innovative knowledge among distributed individuals. However, despite these emerging opportunities, digitalisation comes with special challenges for knowledge management. That is, today’s knowledge workers have to deal with complex, dynamic and volatile working environments and with increasing amounts of knowledge resulting from digitalisation (Bennett and Lemoine, 2014).

A concept that provides guidance on how to promote effective knowledge management under these challenging conditions is the enabler approach. Following this approach certain organisational elements, particular culture, structure, people and IT (Lee and Choi, 2003), help to foster knowledge consistently through the organisation by stimulating knowledge creation and facilitating the sharing of knowledge.

Studies on the influences of knowledge enablers on effective knowledge management show, that human resources (the people element) are one of the most important factors for

enabling knowledge processes and creating knowledge (Andrawina et al., 2018; Lee and Choi, 2003).

However, people as enabling factors have rarely been considered yet. For example Lee and Choi (2003) provide a first contribution to conceptualise the people element as an enabling factor for knowledge management on an organisational level. With regards to the people element the authors use the concept of “T-shaped skills”, originally proposed by Leonard-Barton (1995). According to Lee and Choi (2003), T-shaped skills of employees are most often associated with core capability of knowledge management:

“People with T-shaped skills are extremely valuable for creating knowledge because they can integrate diverse knowledge assets. They have the ability both to combine theoretical and practical knowledge and to see how their branch of knowledge interacts with other branches. Therefore, they can expand their competence across several functional branch areas, and thus create new knowledge. T-shaped skills may enable individual specialists to have synergistic conversations with one another.” (Lee and Choi, 2003, p. 188).

Despite the encouraging conceptualisation of Lee and Choi (2003), a detailed analysis and operationalisation of T-shaped skills of individual knowledge enablers for actual working contexts are missing. The current paper contributes to close this research gap and analyses T-shaped skills of a knowledge enabler on an individual level. For this, we analysed required competencies, skills, attitudes, knowledge, experiences, education and qualification of knowledge-workers based on job advertisements of Scrum Masters. The position of the Scrum Master is responsible for ensuring the transfer and creation of knowledge in enterprises (Takpuie and Tanner, 2016). Thus, we assume that the Scrum Master can be seen as a knowledge enabler on individual level.

The key questions of the present study are:

- What are the T-shaped skills of Scrum Masters?
- Which industry and company size specifics exist?
- How to operationalise T-shaped skills on individual level?

To answer these research questions, 489 job advertisements were examined as a part of a mixed-method approach (qualitative and quantitative content analysis as well as ANOVA).

In the following, the theoretical background, consisting of the enabler approach, the T-shaped concept and the Scrum framework, will be described.

2 Theoretical Background

2.1 Enabler of Knowledge Management

Knowledge creation and knowledge transfer are central processes of creating competitive advantage in knowledge-intensive environment/digital working context. Based on several views of researchers, we define knowledge enablers as influencing factors and organizational elements that foster knowledge creation, knowledge sharing and knowledge protecting within organisations (Lee and Choi, 2003; Krogh et al., 2001).

Examples of frequently listed and examined enablers are culture, organizational structure, technology, people respective human resources (Alavi and Leidner, 2001; Gold et al., 2001; Lee and Choi, 2003; Pan and Scarborough, 1998).

Most of the current studies focus on organizational structures and processes as enabling factors (e. g. Burke and Litwin, 1992; Gold et al., 2001; Razi and Karim, 2010). In contrast, the importance of individuals has been examined rarely. However, human resources take an essential role in fostering critical knowledge processes in organizations since they build the central knowledge base (Razi and Karim, 2010). Andrawina et al. (2018) examined the influence of individual factors for enabling knowledge processes in organizations. They identified the individual factor as the most important indicator (3.27) for knowledge management in a company. Further, the individual factor is highlighted in the research model of Lee and Choi (2003). The authors state, that the people are a core/central element. Furthermore, they are the first to describe concrete features, properties and skills of individual knowledge enablers. They characterized the individual factor by T-shaped abilities. This can be attributed to a claim by Leonard-Barton (1995, p. 75): “The need for T-shaped skills surfaces anywhere problem solving is required across different deep functional knowledge bases or at the juncture of such deep knowledge with an application area. [...]. People possessing these skills are able to shape their knowledge to fit the problem at hand rather than insist that their problems appear in a particular, recognizable form. Given their wide experience in applying functional knowledge, they are capable of convergent, synergistic thinking.” In the following chapter T-shaped will be introduced further.

2.2 State of Research on T-shaped skills

T-shaped skills have already been studied for different professions (Oskam, 2009; Uhlenbrook and de Jong, 2012) and organisational units (Hansen, 2001; Hamdi et al., 2016). There are several definitions in the literature of what T-Shaped skills are, generally they refer to arrange individual abilities and their formation. Demirkan and Spohrer (2015) identified important elements of personal capabilities. According to them, T-shaped workers have deep knowledge in one area as well as a broad level of knowledge, communication skills and competences in many other areas. They also feel empathy and are critical thinkers. Demirkan and Spohrer (2015) have systematized this conglomeration. Boundary-crossing competencies are strategic thinking, people engagement, empathy, business functions, vertical industry expertise, and geographical experiences. These competencies are combined with deep knowledge in at least one discipline, business function, one system, vertical industry expertise, one culture or geographical experience (see Figure 1).

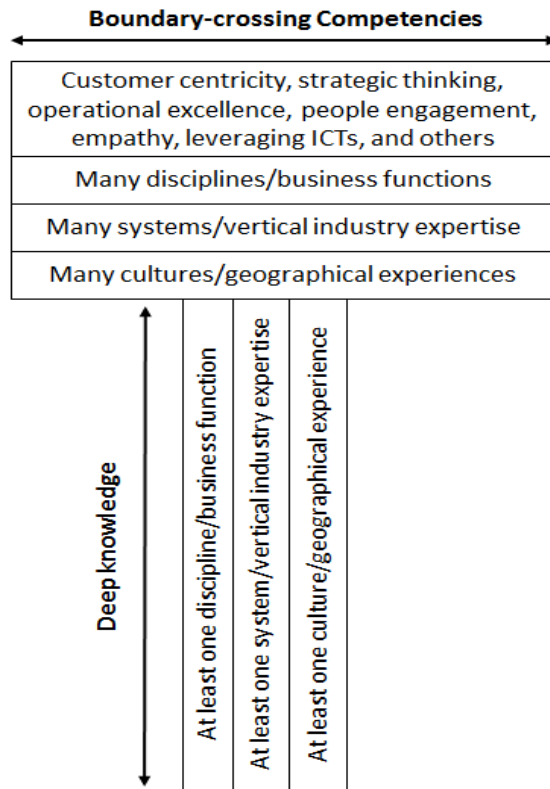


Figure 1: The T-shaped professional (Demirkan and Spohrer 2015, p. 13)

2.3 Scrum in an knowledge-intensive working environment

The focus on knowledge creation and transfer needs methods, which can increase the communication between team members and structure the process of efficient information distribution. For that agile methods are particularly suitable because they are geared towards the transfer of knowledge (Fowler and Highsmith, 2001; Boyatzis, 1998). In this context different methods are used in companies. One approach that focus on the transfer of knowledge is the Scrum framework (Boyatzis, 1998; Mirtalebi, 2017). The main principles of the Scrum method are (Lin et al., 2015):

- Mobilisation of the collective intelligence
- Ensuring efficiently teamwork with permanent feedback loops
- Mediator between relevant stakeholders
- Focus on knowledge transfer and knowledge creation in teams

Today Scrum is the most popular agile project management method (Cockburn and Highsmith, 2001; Takpuie and Tanner, 2016). Central for managing projects with this approach is a controller - called Scrum Master. According to the Scrum framework, the role of the Scrum Master is characterized as an organizer, a moderator and a process consultant for development teams (Karabulut and Ergun, 2018; Moe et al., 2010; Pfeffer

and Berchez, 2017). He “encourage[s] the team, help[s] with problems and remove[s] obstacles” (Davidson and Klemmer, 2016, p. 38). He ensures the transfer and creation of knowledge in enterprises (Takpuie and Tanner, 2016). Therefore he can be seen as an knowledge enabler on individual level. With regard to his role we used job advertisements for Scrum Masters to shed light on the explicit skills, which are requested by companies. We assume, that the T-shaped concept can be found in these job offers.

3 Methodology

We followed a mixed-method approach with a qualitative and quantitative content analysis as well as a variance analysis. The data collection (selection of job offers) will be described in detail below. On the one hand, the use of job offers is due to the fact that they are reflecting the current and future needs of companies. On the other hand, we used them because they already explicitly search for T-shaped persons. Therefore, as described above, we assume that the Scrum Master is a personalized T-shaped knowledge enabler in the digital work context.

3.1 Data collection and Sample

To achieve our research aim we analysed job postings for Scrum positions (keywords: “scrum master” or “product owner”) on a job portal, which is most used in Germany and awarded for its amount of offers, usability and search quality. The selection date was March 12th 2019. We found 556 job offers. After removing duplicates, 489 cases remained, which we included in the analysis. To cluster the industry we used the statistical classification of economic activities in the European Community (Regulation (EC) No 1893/2006). The following distribution resulted for our sample (see Figure 2 and Figure 3).

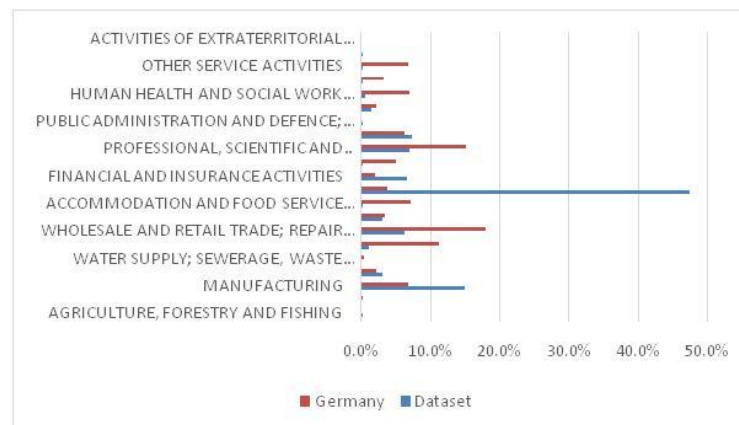


Figure 2: Distribution of companies by industries

47.4% of the posted job offers were advertised by IT companies. By comparison, these companies account for 3.8% of the total share in Germany. Manufacturing (14.9% vs. 6.7%) and financial and insurance activities (6.5% vs. 2.0%) are also over-represented in the sample. Electricity, gas, steam and air conditioning supply (3.1% vs. 2.1%), transportation and storage (3.1% vs. 3.3%) as well as administrative and support service activities (7.4% vs. 6.3%) are equally distributed. Underrepresented are accommodation and food service activities (0.2% vs. 7.1%), real estate activities (0.2% vs. 4.9%) and arts, entertainment and recreation (0.2% vs. 3.3%). The sample mainly includes companies with more than 250 employees (~88%). In Germany, only 0.4% of firms belong to this category.

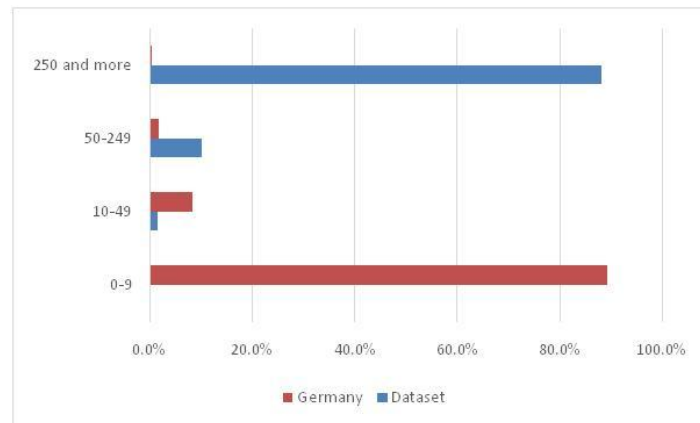


Figure 3: Distribution of companies by number of employees

3.2 Methods

We evaluated our data by using an inductive qualitative and quantitative content analysis to bring together all required competencies, skills, attitudes, knowledge, experiences, education and qualification named in the job offers. Afterwards, the results of the analysis were tested for group differences by using an ANOVA. We proceeded as follows (see Table 1):

Table 1: Steps of analysis

Step	Methods	Result
(1) Generating the dataset	Collecting data from job portal	489 cases
(2) Data analysis	Inductive, qualitative content analysis and frequency analysis	289 codes with 6.095 codings
(3) Moderated workshop: (3a) Discussion and reduction of the results	Comparison of the analysis results	127 codes with 5.420 codings

(3b) Definition of the main categories	Modeling of main categories	6 main categories
(4) Modeling the T-shaped concept	Integration of the results	see Figure 4
(5) Test of group differences	Variance analysis	see p. 11

For the qualitative content analysis and frequency analysis we used MAXQDA. To judge the criteria for the quality of our research design we follow the suggestions of Neuendorf (2016) and Krippendorff (2012). First, we collected the dataset as described above. Afterwards, we subjected the data to qualitative content analysis and generate inductive codes. At that three researchers analyzed the data in parallel. The goal was to ensure the intercoder reliability of the results (Neuendorf, 2016, pp. 122). As an outcome, we received 289 codes with 6.095 codings (Step 2). In a moderated workshop we summarized the code categories and reduced the codes from 289 to 127. Codes that had less than 0.5% share of the total codings (less than 20 codings) were excluded from further analysis. As a result, we received a record of 127 codes with a total of 5.420 codings (Step 3a). The classification into the various categories was based on the standard typology of competences developed by Heyse and Erpenbeck (Heyse and Erpenbeck, 2009; Le Deist and Winterton, 2005). We defined six main categories: Competencies, Skills, Attitudes, Knowledge, Experiences, Education and Qualification (Step 3b). Subsequently, we transferred the results to the T-shaped concept (Step 4) and tested them to group differences (Step 5). Thus, we performed an analysis of variance. As the dependent variable, the codes mentioned were included in the analysis as a percentage of the total number of codes per case. As independent variables, we included first the size - measured by the number of employees- and second the industry of the company. The size of the company was described using the classes listed above (see Figure 3). The results are presented in Figure 4. The absolute and relative distribution of the codes and codings are shown more detailed in Appendix.

4 Results

According to the T-shaped concept the six identified main categories can be subdivided into boundary-crossing competencies and deep knowledge (see Figure 4). At the horizontal leg of the T, 59.7% of the main categories can be located. More than one third of the boundary-crossing competencies of the T-shaped Scrum Master consists of competencies (35.7%): specialist and methodical, social communicative, activity and action as well as personal competencies. 13.6% relates to knowledge, in particular language (German and English), project management and testified Scrum knowledge. 8.1% refer to attitudes (motivation and passion, flexibility, self-initiative, agile values, digital affinity, creative power and interest) and only 2.3% to skills (ability to motivate, empathy, creativity). At the vertical leg of the T, 40.3% of the main categories can be

classified. This deep knowledge consists of a fifth of experiences (19.8%) in agile methods, project management, Scrum, software development, agile software development, project leader, requirements management, product management, leadership, digitalisation, several industries. 14.2% can be attributed to the category education and qualification. The focus here is on study graduation and apprenticeship. 6.3% include knowledge about software / IT, agile methods, Scrum, economics and industry specifics.

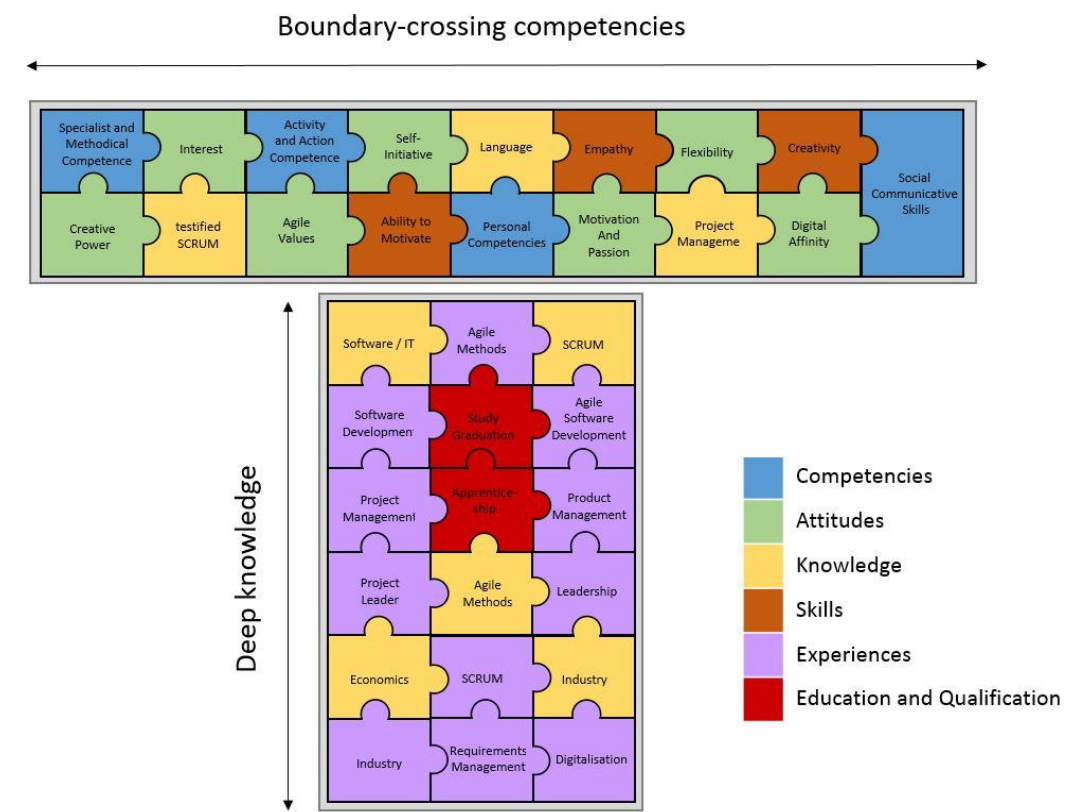


Figure 4: Classification of the investigated main categories in T-shaped concept

In order to evaluate whether the main categories differ significantly between industries and company size, we conducted one-way analysis of variance. The fixed factor in the ANOVA was a six-stage variable for industry, including the following sectors: manufacturing, wholesale and retail trade; repair of motor vehicles and motorcycles, information and communication, financial and insurance activities, professional, scientific and technical activities, administrative and support service activities. The other sectors were excluded since they had too few cases (less than 20). Their inclusion would have led to systematic distortions, in particular, the criterion of variance homogeneity would have been violated. Results showed no significant major

effect for the industry sector and company size over all categories, with the exception of social competencies showing significant major effect for industries with $F(5, 422) = 2,577$ ($p = 0.026$); $r^2 = 0,018$. In sum, these results indicate that the required T-shaped skills do not differ across industries or company sizes.

5 Conclusions

What are the T-shaped skills of Scrum Masters?

We intended to create a competence portfolio for employees in knowledge-intensive work environments (knowledge enablers) in digitally driven working contexts. In doing so, we found typical competencies, skills, attitudes, knowledge, experiences, education and qualification. In the past, a strict separation between generalists and specialists has been enforced (see Cesare and Thornton, 1993; Becker and Murphy, 1992). Our findings show a combination of boundary-crossing competencies and deep knowledge of T-shaped skills of a Scrum Master as a knowledge enabler, which consists of ~60% of boundary-crossing competencies and ~40% of deep knowledge. Thus, the T-shaped concept can be found in the data. This underlines the change in requirements in knowledge-intensive and digital working environments.

The horizontal level consists of the four main categories competencies, attitudes, knowledge and skills. More than a third of this level are specialist and methodical competencies (9.5%), social communicative competencies (18.1%), activity and action competencies (2.0%) and personal competencies (6.1%). From the job offers it is noticeable that companies look for Scrum Masters with analytical and organizational skills. Next to guaranteeing an efficient teamwork with permanent feedback loops is another key role the mediation between relevant stakeholders. Thus, communication and team skills as well as interface management and problem solving skills are in the job offers in demand. The competence to act is demanded above all solution orientation. The personal competencies of the Scrum Masters are above all responsibility and independence. According to the function of the knowledge enabler on an individual level, these categories enable knowledge generation and exchange. The same results are shown in the required skills, attitudes and knowledge of the generalist: the ability to motivate, to feel empathy and to work flexibly can be found again. These competencies are important to ensure, that the Scrum Master is able to mobilise the collective intelligence. The basis for this are the required language skills (German and English) as well as training in the field of (agile) project management.

The vertical level examines the required expert or deep knowledge. In the job advertisements this is reflected in the three categories knowledge, experience, education and qualification. The sought experience (19.8% of total) consists mainly of scrum and industry experience. An important role play project management, agile methods and (agile) software development. The required education and qualification (14.2%) entails academic and professional degrees. Mainly computer science, economics and (industrial) engineering was sought. The third category consists of the required knowledge of the

Scrum Master. Especially knowledge about software and agile methods is important for the enterprises.

To summarize, the profile of Scrum Master equals the T-shaped concept. It can be stated that he fills up the key role on knowledge transfer and knowledge creation in companies. Thus, he can be seen as a knowledge enabler on individual level.

Which industry and company size specifics exist?

With regard to our second research question we performed an analysis of variance to test group differences between the industry sectors and the company size. The results show no significant major effect for both, industry sectors and the company size, over all variables except the social competency variable. There is a significant major effect for the industries financial and insurance activities, wholesale and retail trade and administrative and support service activities. In these areas social communicative skills are more important than in the others. This can be explained by the customer-centric focus of these industries. Further, the results suggest that a similar combination of T-shaped skills is required in all industries.

A first indication for the occurrence of T-shaped skills in German companies is the distribution of companies by size and industry. With regard to the enterprise size we find in our sample especially enterprises with more than 250 employees. In comparison: In Germany 98 % of enterprises have less than 50 employees (see Figure 3).

Also interesting is that mainly companies from the information and communication sector are seeking for Scrum Masters. This can be a first indication that T-shaped people are especially sought in industries with a high need for digitalisation (see Figure 2).

How to operationalise T-shaped skills on individual level?

Based on our results, it is possible to measure T-shaped skills on a dichotomous scale. This is a first step in the development of an operationalisation of T-shaped skills on an individual level. The results therefore could give companies an important indication for the search and selection for personalized T-shaped knowledge enablers. Further, they can be used by companies for orientation, in particular in the development of personnel development concepts. This is our contribution to the existing methods of the operationalisation of T-shaped skills that are currently limited to the organizational level (see Lee and Choi, 2003).

The generalizability of this study is limited. On the one hand, there is a pre-selection of companies due to the sample, for example due to the use of the chosen recruiting portal. To keep this bias to a minimal level, we used the platform which is used most in Germany and awarded for its amount of offers, usability and search quality. Further, our evaluation is based on the inductive content analysis. To increase the reliability of the data, we used the methods suggested by Neuendorf (2016), as the evaluation was conducted by three researchers independently.

This paper is a first step towards developing a scale for measuring T-shaped skills at the individual level. This is necessary to prove the importance of T-shaped enablers in companies for knowledge management. Future research should focus on a review and

further development of a scale to measure T-shaped skills at the individual level. Our study suggests that this is a static concept (based on findings with regards to industry and company size). It could be further researched whether the concept is sustainable under other influencing variables. Research on this should be given greater attention in this regard in the future.

References

- Alavi, M. and Leidner, D. E., (2001) "Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues", *MIS Quarterly*, Vol 25, No. 1, pp. 107-136.
- Andrawina, L., Soesanto, R. P., Pradana, S. I. and Ramadhan, G., (2018) "Measuring Knowledge Management System Implementation Readiness", *Pertanika Journal of Social Sciences & Humanities*.
- Becker, G. S. and Murphy, K. M., (1992) The division of labor, coordination costs and knowledge, *Quarterly Journal of Economics*, Vol. 107, No. 4, pp. 1137–1160.
- Bennett, N. and Lemoine, G. J., (2014) "What a difference a word makes: Understanding threats to performance in a VUCA world", *Business Horizons*, Vol. 57, No. 3, pp. 311-317.
- Boyatzis, R.E., (1998) *Thematic Analysis and Code Development: Transforming Qualitative Information*, Sage Publications, Thousand Oaks.
- Burke, W.W. and Litwin, G. H., (1992) "A causal model of organizational performance and change", *Journal of Management*, Vol. 18, No. 3, pp. 523-545.
- Cesare, S.J. and Thornton, C., (1993) "Human Resource Management and the Specialist/Generalist Issue", *Journal of Managerial Psychology*, Vol. 8, No. 3, pp.31-40.
- Cockburn, A. and Highsmith, J., (2001) Agile software development, the people factor, *Computer* 34, Vol. 11, pp. 131-133.
- Council of the European Union, European Parliament (2016). Regulation (EC) No 1893/2006 of the European Parliament and of the Council of 20 December 2006 establishing the statistical classification of economic activities NACE Revision 2 and amending Council Regulation (EEC) No 3037/90 as well as certain EC Regulations on specific statistical domains [<https://publications.europa.eu/en/publication-detail/-/publication/361cc2e8-c462-4088-8e87-ba6c99b84588/language-en>]
- Davenport, T.H. and Prusak, L., (1998) *Working knowledge: How organizations manage what they know*, Harvard Business School Press, Boston.
- Davidson, A. and Klemmer, L., (2016) "Why a CEO should think like a Scrum Master", *Strategy & Leadership*, Vol. 44, No. 1, pp. 36-40.
- Demirkan, H. and Spohrer, J., (2015) "T-shaped innovators: Identifying the right talent to support service innovation", *Research-Technology Management*, Vol. 58, No.5, pp. 12-15.
- Drucker, P. F., (1993) "Post-Capitalist Society", Elsevier Butterworth Heinemann, Oxford.
- Fowler, M. and Highsmith, J., (2001) The agile manifesto, *Software Development* 9, Vol. 8, pp. 28-35.
- Gold, A. H., Malhotra, A. and Segars, A. H., (2001) "Knowledge management: An organizational capabilities perspective", *Journal of management information systems*, Vol. 18, No. 1, pp. 185-214.
- Hamdi, S., Silong, A. D., Binti Omar, Z. and Mohd Rasdi, R., (2016) "Impact of T-shaped skill and top management support on innovation speed; the moderating role of technology uncertainty", *Cogent Business & Management*, Vol. 3, No. 1, pp. 1-13.

- Hansen, Morten T., (2001) "Introducing T-shaped managers. Knowledge management's next generation", *Harvard Business Review*, Vol. 79, No. 3, pp. 106-16.
- Heyse, V. and Erpenbeck, J., (2009) "Kompetenztraining. Informations- und Trainingsprogramme", ed. 2, Schäffer-Pöschel-Verlag, Stuttgart.
- Hossain, M. and Lassen, A. H., (2017) Digital platforms as enablers for digital transformation, *Proceedings of ISPIM Conferences*, pp. 1–6. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=124004930&site=ehost-live>
- Karabulut, A. T. and Ergun, E., (2018) "A New Way of Management: A Scrum Management", *International Journal of Commerce and Finance*, Vol. 4, No. 2, pp. 108.
- Krippendorff, K., (2012) "Content Analysis: An Introduction To Its Methodology", ed. 4, Sage Publications, Thousand Oaks.
- Krogh, G., Nonaka, I. and Aben, M. (2001) "Making the most of your company's knowledge: A strategic framework" *Long Range Planning*, Vol. 34, No. 4, pp 421-439.
- Le Deist, F. D. and Winterton, J., (2005) "What is competence?", *Human Resource Development International*, Vol. 8, No. 1, pp. 27-46.
- Lee, H. and Choi, B., (2003) "Knowledge Management Enablers, Processes, and Organizational Performance: An Integrative View and Empirical Examination", *Journal of Management Information Systems*, Vol 20, No. 1, pp. 179-228.
- Leonard-Barton, D., (1995) "Wellsprings of knowledge: Building and sustaining the sources of innovation", Harvard Business School Press: Boston.
- Lin, Y., Descamps, P., Gaud, N., Hilaire, V. and Koukam, A., (2015) "Multi-Agent System for intelligent Scrum project management", *Integrated Computer-Aided Engineering*, Vol. 22, No. 3, pp. 281-296.
- Mirtalebi, M., (2017) "Embedded Systems Architecture for Agile Development: A Layers-Based Model", Apress.
- Moe, N.B., Dingsøyr, T. and Dybå, T., (2010) "A teamwork model for understanding an agile team: A case study of a Scrum project", *Information and Software Technology*, Vol. 52, No. 5, pp. 480-491.
- Neuendorf, K. A., (2016) "The Content Analysis Guidebook", ed. 2, Sage Publications, Thousand Oaks.
- Nonaka, I. and Takeuchi, H., (1995) "The knowledge-creating company: How Japanese companies create the dynamics of innovation", Oxford university press.
- Olak, A. and Szopa, A.M., (2018) "Agile Behaviors in Organizations", *Archives of Business Research*, Vol. 6, No. 4, pp. 77-83.
- Oskam, I. F., (2009) "T-shaped engineers for interdisciplinary innovation: an attractive perspective for young people as well as a must for innovative organisations", 37th Annual Conference– Attracting students in Engineering, Rotterdam, The Netherlands, pp. 14.
- Pan, S. and Scarbrough, H. A., (1998) "A socio-technical view of knowledge-sharing at Buckman laboratories", *Journal of Knowledge Management*, Vol. 2, No. 1, pp. 55-66.
- Pfeffer, J. and Berchez, J.P., (2017) "Agile working practices with scrum", *ATZelektronik worldwide*, Vol. 12, No. 5, pp. 52-55.
- Razi, M. J. and Karim, N. S., (2010) "An instrument to assess organizational readiness to implement knowledge management process", *Information Technology International Symposium*, pp. 3.
- Takpuie, D. and Tanner, M., (2016) "Investigating the Characteristics Needed by Scrum Team Members to Successfully Transfer Tacit Knowledge During Agile Software Projects", *Electronic Journal of Information Systems Evaluation*, Vol. 19, No. 1, pp.36-54.
- Uhlenbrook, S. and de Jong, E., (2012) "T-shaped competency profile for water professionals of the future", *Hydrology and Earth System Sciences*, Vol. 16, No. 10, pp. 3475-3483.

APPENDIX

Table 2: Boundary-crossing competencies (horizontal)

Category			Codings	% of T-shaped
Boundary-crossing competencies (horizontal)			3.234	59,7
Total of T-shaped				
Competencies	Specialist and methodical	TOTAL	513	9,5
		conceptual and analytical competence	194	3,6
		coordination skills	107	2,0
		moderation skills	56	1,0
		IT skills	72	1,3
		entrepreneurial thinking	46	0,8
		presentation skills	38	0,7
	Social communicative	TOTAL	984	18,2
		communication skills	315	5,8
		team ability	207	3,8
		interface competence	113	2,1
		problem solving skills	110	2,0
		customer orientation	98	1,8
		conflict resolution skills	40	0,7
		team management skills	38	0,7
		general social communicative skills	33	0,6
		intercultural skills	30	0,6
	Activity and action	TOTAL	108	2,0
		results orientation	108	2,0
	Personal competencies	TOTAL	332	6,1
		sense of responsibility	100	1,8
		independency	95	1,8
		learning and reflection skills	37	0,7
		enforcement capability	52	1,0
		sovereignty and professional appearance	48	0,9
Skills	TOTAL		125	2,3
	ability to motivate and enthusiasm		56	1,0
	empathy		36	0,7
	creativity		33	0,6
Attitudes	TOTAL		435	8,0
	motivation and passion		119	2,2

	flexibility	110	2,0
	self-initiative	63	1,2
	agile values	47	0,9
	interest	35	0,6
	digital affinity	31	0,6
	creative power	30	0,6
Know-ledge	TOTAL	737	13,6
	English language	313	5,8
	German language	254	4,7
	Scrum	117	2,2
	project management	53	1,0

Table 3: Deep knowledge (vertical)

Category		Codings	% of T-shaped
Deep knowledge (vertical)		2.186	40,3
Total of T-shaped			
Know-ledge	TOTAL	344	6,3
	software/IT	133	2,5
	agile methods	100	1,8
	scrum	37	0,7
	economics	37	0,7
	industry	37	0,7
Experiences	TOTAL	869	19,8
	scrum	234	4,3
	industry experience	204	3,8
	agile methods	140	2,6
	project management	135	2,5
	software development	113	2,1
	agile software development	53	1,0
	project leader	51	0,9
	requirements management	40	0,7
	product management	37	0,7
	leadership	35	0,6
	digitalisation	31	0,6
Education and qualification	TOTAL	769	14,2
	study graduation	702	13,0
	computer science	219	4,0
	economics	162	3,0
	industrial engineering	144	2,7
	engineering	141	2,6
	natural sciences	36	0,7
	apprenticeship	67	1,2

The Digitalization of Cultural Heritage: the Impact of EUROPEANA

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Abstract

The process of digitalization has enhanced opportunities for exchanging economical and reliable information, consequently it has become a priority in many fields. Particularly in cultural sector digitalization can be considered a key challenge in the process of modernizing. The European Commission has studied the best ways to preserve, enrich and make available the cultural heritage for the benefit of present and future generations. On this basis was created an European platform for the management of cultural heritage called Europeana. This paper aims to analyse and assess the impact of this cultural platform through the study of digitalization process. The results show that Europeana is a tool able to create new knowledge and consolidate value chains. Moreover, from the economic perspective Europeana is able to generate welfare effects of digital cultural heritage, among them there are usage value on the one hand and indirect effects economic and social on the other hand.

Keywords – Digitalization, cultural heritage, impact assessment, Europeana

Paper type – Academic Research Paper

1 Introduction

Europe needs a new action plan in order to make the best use of information and communication technologies (ICT), this plan could contribute to accelerate economic recovery and lay the foundations for a sustainable digital future. The new action plan suggests to eliminate current obstacles to maximize the potential of ICT, making long-term investments to minimize future problems (Digital Agenda for Europe 2020).

It is widely agreed that digital technology play an important role for the innovation of cultural sector and valorization of cultural heritage. Digitalization and publication of collections online can potentially allow access to content across the globe, and as such, liberate this huge knowledge (Borowiecki and Navarrete, 2017). In this sense, digitalization is a means both for safeguarding cultural heritage for future generations and for providing access to cultural values (Marcum, 2007). Digitalization applied to cultural heritage transposes the essence of cultural objects presented in physical format into digital world and make this essence available to visitors from any place and any time in a effectively and efficiently way.

In order to reach the aim of present work among several definitions of digitalization we refer the digitalization as the process whereby by scanning or some other method of reproduction an electronic copy of a specific analogue information carrier is created (Borissova, 2018). Following these premises, the present paper aims to provide a general understanding of the digitalization phenomenon/process and its dynamics in order to better analyse and assess the impact of Europeana, the European platform for the management of cultural heritage.

2 Digitalization in Europe

The European Commission General Directorate for communications networks, content & technology has conducted extensive action to supplement Member States' cultural policy in digitalization area and online access to cultural material and digital preservation.

Digitalization turns Europe's cultural resources into an important pillar of the digital economy. Indeed, digital technologies offered huge opportunities for improving public access to different forms of cultural assets and its reuse (European Commission, 2013). Thanks to the support provided by national and international programs, in the past years, almost everywhere in Europe big efforts were put in place by public institutions and private bodies for converting the "physical cultural heritage" into "digital".

Despite the lack of information about the data on digitalization in Europe and the weak of coordination between existing ones the Report ENUMERATE Core Survey 4 provided an overall perspective on current state. This report is the fifth study of a series started in 2008 and is the second organized under the umbrella of Europeana. The participating institutions are n°983 came from n°28 countries, distinguished in four types: museum 37%, library 27%, archive/record office 21% and other type 15%. The survey was composed by five dimensions: the state of digitalization activity, the dimension and characteristics of collections, digital access, preservation strategy and expenditure (Report on ENUMERATE Core Survey 4, 2017). Highlights of the report's findings are summarized in the table 1.

Table 1: five dimensions of survey

Digital Collections - 82% of institutions have a digital collection or are engaged in digitalization activities - 42% of the institutions have digital strategy
Digitalization Activity - 59% of the institutions have born digital items - 58% of the heritage collections has been catalogued in a collection - 22% of the heritage collections has been digitally reproduced - 54% still needs to be reproduced
Digital Access - Overall institutions declare that they have 51% of their descriptive metadata online for general use - Academic research is the most important reason to provide digital access to the collection - 51% of the digital objects available on line are consulted within the institutional website, which is still the most popular channel for the institutions to provide access to their digital collections; - Channels for which a substantial growth is expected over the next two years are Social media platforms (+25%); Wikipedia (+14%); (other) aggregators (+11%) and Europeana (+5%);
Digitalization Activity - 59% of the institutions have born digital items - 58% of the heritage collections has been catalogued in a collection - 22% of the heritage collections has been digitally reproduced - 54% still needs to be reproduced
Participation - 49% of all institutions measure the use of digital collections - 90% of the institutions that do measure the use, use web statistics
Digital preservation - 27% of the institutions have a written digital preservation strategy - 45% of the institutions do not yet have a solution for long term preservation based on international standards for digital preservation

Source: our elaboration on results of “Report ENUMERATE Core Survey 4”

Although data coming from Enumerate Core Survey 4, they are useful to provide us a clearer picture of the contest but we have to consider that the sample is not representative and suffers of self-selection bias, so these results must be used under the right consideration.

3 Theoretical Framework

Digitalization of cultural content is a time-consuming process whose ultimate goal is to build a participatory social memory by connecting past, present, and future in terms of cultural heritage. Within digital networks, information is obviously physically present some-where, on a specific support, but it is also virtually present at each point of the network where it is requested (Lévy, 2002). This process has important consequence on cultural field, in particularly on production, distribution and consumption of cultural goods.

Some studies analyse the general impact of digitalization on cultural policy (Flew and Swift 2013) and on museums and libraries specifically (Navarrete2013a, b; Paolini et al.2013; Salau 2013). But this flourishing literature is until now, with a few exceptions (Borowiecki and Navarrete2015), rarely used to investigate the implications of digitalization for archives that retain data and preserve cultural heritage.

According to Daniel et al (2012) cultural heritage is an expression of the legacy of physical artefacts and intangible attributes of society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations (Daniel et al., 2012). As Rizzo (2016) suggests new technologies produce a substantial change of the distribution asset model from controlled access (in a real market who does not pay the ticket price is excluded) to a network economy model (the only cost is the reduction of time for other activities). Moreover, a digital consumption could generate a learning effect, thus encouraging future (paid for) consumption so that the two consumption are not substitutes. In fact, in a recent work conducted at Louvre Museum by Evrad and Krebs (2017) is showed how the two experiences of the real and virtual visit are complementary from the point of view of interdependence and/or additional dimension of the cultural experience, but not substitutable because there is no equivalence between the digital experience and the real visit. The importance of the topic is also emphasized by Digital Agenda presented by the European Commission for the Europe 2020 strategy which sets objectives for the growth of the EU by 2020 in which proposes to better exploit the potential of information and communication technologies in order to foster innovation, economic growth and progress. One of the seven pillars proposed in fact is related to “ICT-enabled benefits for EU society” with the aim to exploit the potential offered by the use of ICTs in the area of digitalization of content through dedicated channels.

4 Research methodology

This study is based on exploratory and qualitative analysis research method developed along two stages.

In the first stage, on the desk, we used the following databases: Scopus, Elsevier, Science Direct and Springer in order to create and subsequently re-organized the findings as theoretical framework. We considered only articles which contained keywords as: digitalization, cultural heritage and impact assessment published on empirical journal, book reviews and report as for example those provided by European Commission and Strategy 2020. Finally, n°80 articles were taken into account.

The second stage, on the job, has been carried out through case study method (Yin 2002) this is particularly suitable to investigate the complex and dynamic nature of the cultural sector. Research activity has been carried out between October 2018 and March 2019. Data has been collected in three phases. The first one concerned on a detail search and analysis of information, institutional documents and publication available through the web. The second phase is based on no-participant observation of the main social channels that Europeana used as interactive tools, with the aim to better understanding how digital cultural portal communicate with the principle social media. Finally, the third phase has been focused on the data analysis in order to define the possible economic impact and value chains deriving from the platform.

4.1 The case study: Europeana's experience

The analysis begins with the study of cultural sector which look to digitalization not only as promotional tools but also and mainly as dynamic and relational platforms for the development of a proximity strategy to active cultural stakeholders (not only employee and consumers but also public/private decision-makers). This relational approach, based on interactions and cooperation between digital portal and its wide community, features the Europeana case study strongly.

Europeana is Europe's largest cultural heritage portal launched in November 2008 is co-funded by the European Commission as the most cultural and artistic institutions publicly-funded for operating as a non-profit organization.

Bakhshi and Throsby (2012) propose a generalised model of behaviour of a non-profit cultural institution composed by five objectives, two of these: objectives relating to access (making their output available for many and wide range of consumers as possible) and educational services (often through specific programmes to engage and educate young people or to enhance the learning experience of their consumers more generally) are part of the wider mission of Europeana. The simplest way to give access to the data is by opening up a digital portal; in fact Europeana project uses the same method of many institutions to make cultural data available but on a European level. On the homepage there is a research box that allows access to all the contents of Europeana (figure n°1).



Source: "Guide to using Europeana in Education"

Figure n°1: Europeana Homepage

It is possible to start the research by entering a keyword (figure n°2):

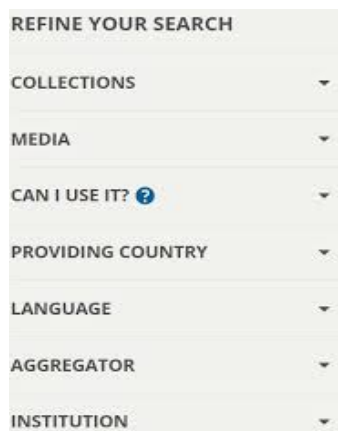


Source: "Guide to using Europeana in Education"

Figure n°2: box entering for keywords in Europeana

It is noted that in the box can appear many results, the user in fact can choose between list view or grid view and change the number of visible objects for every page.

To facilitate the search on the left side of the screen are present filters to set in order to search objectives for related contents (figures n°3):



Source: “Guide to using Europeana in Education”

Figure n°3: search terms

Table n°2: Meaning search terms

Collections	As of March 2017, Art, Fashion, Music.
Media	Images, Texts, Sounds, Video, 3D Tip: by selecting ‘only items with links to media’ you get content that can be downloaded directly from Europeana.
Can I use it?	Search by license type.
Providing country	Content from institutions in specific countries.
Language	In case you search for content from a specific provider.
Institution	In case you search for content from a specific provider.

Source: our elaboration of “Guide to using Europeana in Education”

Digital collections can have multiple uses compared to those related with the portal. They can be connected, for example, with other collections, geographical points, or be accessible through mobile phones with a GPS tracker. Application Programming Interfaces (APIs) allow developers to build new tools able to ensure data access for the creation of new products and services in the light of innovation (Dietrich and Pekel, 2012). Currently Europeana platform provides access to over 50 million objects from European libraries, museums, archives, galleries and audio-visual collections. More than 3,500 cultural institutions contribute sharing their cultural content with Europeana. They range from international museum to regional archives or other smaller realities from every country member of the European Union. Among the most important institutions can be mentioned for example the Rijksmuseum in Amsterdam, the Louvre in Paris and the international libraries as British Library in London. The digital objects and collections that users can find within Europeana are not saved on a central computer, but remain available for cultural institution that hosted them on their networks. Europeana collects contextual information – or metadata – about the items, including a small picture. Users search this contextual information. Once they find what they are looking for, if they want obtained the access to full content of the item, they can click on the original site that holds

the content. It is important underline that Europeana accepts metadata about digital objects, it does not make any decisions about digitalisation. The decision about which objects are digitalized is the responsibility of organisation that holds the material. For this reason the process of digitalization by cultural institutions appears to be preeminent and useful.

4.2 Europeana vs social media

Social networks represent a significant resource available for the wider community. In accordance with the specific rules of each different platform, users can share information, opinions, knowledge and interests, but generally they can make the uses that they prefer without particular limitations. Specifically the purpose for which Europeana uses social networks is to increase access to digitalized cultural heritage and make it easily shareable. On this basis, the second phase of the present work has the aim to better understanding how Europeana communicates with the principles social media that are sponsors on its official web site: facebook, pinterest and twitter¹. The platform uses different tools to communicate their activities, projects, news and etc. but social pages have the great benefit to be more direct and easily usable allowing maximum dissemination of information, goals, mission and vision of Institution. From the analysis of these channels, realized through a non-participant observation, the following data presented in the table n.3 are emerged.

Table n°3: Official social media used by Europeana

Facebook
The Europeana Facebook page includes links for the official platform and others general information as telephone number and address. The page offers the same features as the pages of any individual, thereby, only the page's manager can post and share all types of content on its wall. The users can comment and post within the comment also photo, videos and link. Posts vary from the demonstration of appreciation through short comments or emoticons, additions of short personal experiences. Actually, the page has more than 109.061 likes, 112.101 total follower, 282 reviews, score 4,7 out of 5, 47 events advertised more than 2000 photos posted, 77 videos posted.
Pinterest
The Europeana profile includes links for the official platform and brief explanation of the content. The platform allows to create thematic virtual blackboards on numerous topics. Through Pinterest is possible to explore all the favourite categories and put the pin (that is, virtually pin) all images can be saved and categorized under a virtual theme board, called notice-board. The Europeana pinteres page have 9884 pin, 15032 followers. In the bulletin board the pins are proposed in temporal order and they are generally chosen on the basis of a specific theme or historical period.
Twitter
The Europeana twitter account includes links for the official platform and others general information. Among them it is interesting to note that Europeana is not located in a specific place in fact the location given on account is "Europe". Other general information refers to the financing source of the platform. Actually, the account has more than 35.000 follower, and more than 17.000 tweet. Moreover, in the account are present about 3.467 photos, of cultural images and public events related to cultural policies. Instead tweets refer strategic and cultural information and events but also it provides content exchange.

Source: our elaboration

¹ Although Eureopena has other profiles on other social networks, in this work are taken into account only those it advertises on the official web site

When looking at Europeana's social media analysis it is possible to observe that currently social media represents a small minority of its traffic but the statistics show that end-users that arrive at Europeana via social media *are more engaged* and more likely to share and use the content, coherently with the major *mission of Europeana that is "transform the world with culture and build and make Europe's rich heritage easier for people to use, whether for work, for learning or just for fun"*.

4.3 Impact assessment

The third and last stage of this research closes with the data analysis in order to define the possible economic and social impact generated by Europeana. Impact assessment is a very interesting but complex area of research especially in cultural field. The cultural sector generates a multiplicity of benefits (and therefore implies many costs); for this reason measuring them appear a very hard task. The problem is being able to build a hierarchy between the different benefits, which are divided in direct and indirect. The direct benefits are related to issue as for example employment or technology innovation, while indirect benefit also involve the immaterial sphere as the aesthetics, symbolism, spirituality (Trimarchi, 2004). In 2006 still Throsby proposes a possible evaluation strategy based on the willingness to pay of the people that will be greater for a cultural object that they considered particularly deserving, but he emphasizes that not all social implications can be measured monetarily. Also, Matarasso (1997) tries to shed light on the point through his famous study "Use or Ornament?" in which divided the social impact of participation in the arts into six different themes¹, relating to people as individuals or community change. This theoretical framework can be used as evaluation frameworks. Europeana is financed through a project of the European Union and as almost all projects funded by the public sector requires an evaluation scheme, as far as possible, closer to the classic economic paradigms. In order to continue to receive funding also for the years 2015-2020 Europeana in 2014 decide to evaluate the social-economic value of its action through a cost benefit analysis carried out by a research institute² of the Faculty of Economics at the University of Amsterdam. Among the results it is useful preliminary analyse the identification of users and the possible benefits that they receive by using Europeana. The results are presented in the table n.4

Table n°4: benefits by using Europeana

User Group	Benefits
Institution	Shared infrastructure leading to cost savings for stand-alone use and co-operation
General Public	Welfare/utility of visiting website or visiting virtual and offline exhibitions. Both directly via Europeana and via institutions through redirect or as a result of using Europeana inputs.

¹ Personal development, Social cohesion, Community empowerment and self-determination, Local image and identity, Imagination and vision, Health and well-being

²SEO Economic Research. Refer to <http://www.seo.nl/en/home/>

Tourism	Better access to heritage information improves position of EU for tourism
Creative industries	Database with metadata, making content accessible throughout institutions
Education and Research	Access to content for digital teaching material or cost saving on travel expenses and improvement of productivity

Source: our elaboration of “The value of Europeana”

The users group range from institution to community in a broad sense. In fact, the institution categories include: galleries, libraries, archives and museums, but also educational institutions. Instead the community is represented by general public, people inside and outside Europe who are interested in arts, culture and heritage, tourists and researchers. Finally, there is a distinct category that is Creative industries composed by institution and people, this category in fact range from publishers who make books on arts, culture, heritage or traveling guides, journalists looking for historic information, artists and designers. Regarding the benefits it is possible to distinguish two macro-categories of users, however connected among them and that fertilize each other. The first uses Europeana as any digital platform without further creation of knowledge and value (institution and tourist); the second reuses the contents to produce knowledge, value and additional services (general public, creative industries, educational institutions and researchers). Regarding the effects it is possible to make an assessment in monetary (economic) and non-monetary terms on the value of Europeana. From the first point of view the most significant benefits that the cultural platform produces are cost savings for institution and tourism. Obviously, these results referred to indirect effect that can be supposed connected with Europeana, for example the contents that can be used in order to create tools for tourism purposes. Then the economic value in generally can be associated with tourist expenditures (a better visibility of European cultural heritage which can act as a tourist attractor for international tourism) and cost-saving by institution. Regarding the last point the analysis is referred to smaller institutions, who have difficult to develop adequate digital service platforms from themselves, and helps institutions in the development of digital services which enables them to integrate their digital collections. Instead non-monetary effects are referred to: usage value, option value, existence value and social value.

Table n°5: non-monetary effect

Usage value	Option value	Existence value	Social value
Consumer or producer surplus derive from using digital cultural heritage	Option to make use of material and offered service	Contribution derived from existence of Europeana in terms of contribute to person's pride and identity	Positive effect deriving from consuming arts, culture and heritage on education, quality of life and health

Source: our elaboration by “The value of Europeana”

5 Conclusion

Europeana creates a service platform for digital cultural heritage and content from libraries, archives, galleries and museums generating spill-over effects on economic and social aspect but also in the creation process of knowledge and value chain. Based on these results it is possible to draw several conclusions about the value of Europeana. The digital platform guarantees the widest fruition of the contents and in the same time their reuse in different fields. They range from tourism to education, marketing option or simply private enjoyment. These processes act like multiplier of creativity in which the innovation deriving from digitalization promotes shared knowledge.

In the next future, in which the physical and digital world tend to merge more, Europeana ensures the preservation of the cultural collective memory through the creation of material resistant in the future. For institutions involved in the sharing process of contents with Europeana the benefits derive from an improvement of the value of their materials and this confer to them a different position in terms of visibility in the society. Through the use of social media, Europeana contributes to the exchange cultural content in a virtual society. This expansion makes the public generally interested in art, culture and heritage wider and diversified for age, social background, interests and education. Finally, from an economic perspective Europeana contributes directly to the correction of some typical market failures. First of all, it reduces transaction costs related to licensing content to third parties or creates positive external effects for copyright holders if it leads to additional licensing. Second Europeana shows that cultural products can survive to market power, without commercial purposes and even reduce costs related to finding heritage and cultural information. Also, without Europeana the fragmentation of databases used by different institutions lead to development costs and underinvest in enhancing and maintaining digital resources, its presence instead balances this underinvestment. Finally, Europeana coordinates standardization actions for digital infrastructure reducing possible operations of adaptations to standards of countries outside the Europe. The results must be considered as preliminary; further research is required to achieve deeper insights and better understanding the process of digitalization of cultural heritage. The present research in fact is to be considered as a base for insights that go in the direction of survey with privileged observers of the phenomenon and comparison with other similar platforms to discover limits and advantages.

References

- Bakhshi, H. and Throsby D., (2012) "New technologies in cultural institutions: theory, evidence and policy implications", *International journal of cultural policy*, Vol.18, No. 2, pp. 205-222.
- Borissova V., (2018) "Cultural heritage digitization and related intellectual property issues", *Journal of Cultural Heritage*, Vol.34, pp. 145,150.
- Borowiecki, K. J. and Navarrete T., (2015) Digitization of heritage collections as indicator of innovation, in *Discussion Papers on Business and Economics*, University of Southern Denmark, No. 14.

- Borowiecki, K. J. and Navarrete T., (2017) Digitization of heritage collections as indicator of innovation, *Economics of Innovation and New Technology*, V.26, Cheltenham, England: Edward Elgar, No.3, pp. 227-246.
- Ciurea, C. and Filip, F.G. (2016) The Role of Virtual Exhibitions in Cultural Heritage Digitization, Preservation and Valorization, *Informatica Economica*, Proceedings of the International Conference on Informatics in Economy, IE 2016.
- Daniel, T. C. and Muhar, A. and Arnberger, A. and Aznar, O. and Boyd, J. W. and Chan, K. M., ... and Grêt-Regamey, A. (2012) Contributions of cultural services to the ecosystem services agenda, *Proceedings of the National Academy of Sciences*, Vol. 109, No.23, pp. 8812-8819.
- Dietrich, D. and Pekel, J. (2012) Open Data in Cultural Heritage Institutions, *European Public Sector Information Platform Topic Report*, No.4.
- ENUMERATE Report Core Survey 4 (2017), make the case for investments in our digital activities, *Europeana-pro*.
- European Commission (2013), Directorate General for Communications Networks, Content & Technology. ©Unione Europea 2013.
- European Commission, Digital Agenda for Europe 2020: key initiatives.
- Evrard, Y. and Krebs, A. (2017) The authenticity of the museum experience in the digital age: the case of the Louvre, *Journal of Cultural Economics*, pp1-11.
- Flew, T. and Swift, A. (2013) Cultural policy, in Towse, R. and Handke C. (Eds.), *Handbook on the digital creative economy*, ed. Cheltenham, England: Edward Elgar, pp. 155–161.
- Guccio, C. and Martorana, M.F. and Mazza, I. and Rizzo, I. (2016) Technology and Public Access to Cultural Heritage: The Italian Experience on ICT for Public Historical Archives, *Cultural Heritage in a Changing World*, pp. 55–75.
- Guide to using Europeana in Education, (2017), *Europeana education*.
- Levy, P., (2002), “Electronic Mediation Series”, *Cyberculture*, vol. 4, University of Minnesota, 2002.
- Marcum, D. B., (2007) Digitizing for access and preservation strategies, of the Library of Congress. *First Monday*, 12(7).
- Matarasso, F., (1997) “Use or ornament. The social impact of participation in the arts”, Vol.4, No.2.
- Matei, D. and Ceobanu, I. (2018) Digital Culture and Internet Consumption, *Cultural Consumption Barometer*, pp. 207–231.
- Navarrete, T., (2013b) Museums., in Towse, R and Handke, C. (Eds.), *Handbook on the digital creative economy*, ed.Cheltenham, England: Edward Elgar pp. 330–343.
- Navarrete, T.,(2013a), Digital cultural heritage. in Rizzo, I. and Mignosa A., (Eds.), *Handbook on the economics of cultural heritage*, pp. 251–271.
- Paolini, P. and Mitroff Silvers, D. and Proctor, N. (2013) Technologies for cultural heritage, in Rizzo I. and Mignosa A. (Eds.), *Handbook on the economics of cultural heritage*, ed.Cheltenham, England: Edward Elga pp. 272–289.
- Poort, J. van der Noll and R., Ponds, R. and Rougoor, W. and Weda, J. N. T. (2013). The value of Europeana: the welfare effects of better access to digital cultural heritage. *SEO economisch onderzoek*.
- Reina, R., (2015) *Organizzare i sistemi informativi*, Giuffrè Editore.
- Rizzo, I., (2016). Technological perspectives for cultural heritage, in *The Artful Economist* Springer, Cham, pp. 197-214.
- Rodil, K. (2018), “A Perspective on Systems Design in the Digitization of Intangible Cultural Heritage”, *International Journal Intangible Heritage*. Vo.12, pp.190–198.

- Salau'n, J.-M., (2013) The immeasurable economics of libraries, in Rizzo I. and Mignosa A. (Eds.), Handbook on the economics of cultural heritage ed, Cheltenham, England: Edward Elga pp. 290–305.
- Throsby, D. ,(2006) The value of cultural heritage: What can economics tell us? in Clark, K. (ed.), 'Capturing the Public Value of Heritage: The Proceedings of the London Conference 25-26 January 2006', ed. London: English Heritage pp40-44.
- Trimarchi, M., (2004) "Regulation, integration and sustainability in the cultural sector", International Journal of Heritage Studies, Vol. 10 No. 5, pp. 401-415.
- Vecco, M., (2010) "A definition of cultural heritage: From the tangible to the intangible", Journal of Cultural Heritage, Vol.11 No. 3, pp. 321-324.
- Yin, R. K., (2002) Applications of Case Study Research Second Edition Applied Social Research Methods Series, Volume 34.

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Adoption of Digital Manufacturing Technologies in Smes: a Dynamic Capability and Absorptive Capacity Perspective

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Abstract

Using the dynamic capabilities and absorptive capacity as theoretical lenses, this paper investigates the capabilities required to exploit digital technologies in products and/or in processes. We propose that the capabilities to acquire knowledge from external sources, internal sources and manufacturing operations drive the assimilation and transformation capabilities through the formulation of a digital manufacturing strategy, which in turn determine the capability to exploit digital technologies in products and/or in processes.

This paper has adopted a quantitative survey. The respondents are from a sample of innovative SMEs of the Piedmont region, a high innovative region with a historical industrial tradition that represent a fruitful context to investigate how SMEs approach Industry 4.0.

Employing the factor analysis and structural equation modelling we found that: (1) the use of multiple external knowledge sources supports SMEs both in the introduction of product and process innovation using both operational and informational technologies; (2) the use of multiple internal knowledge sources support SMEs in the introduction of process innovation using information technologies; (3) multiple manufacturing capabilities are positively related with the introduction of digital product innovation strategies.

The sample of SMEs is limited to the Piedmont region (North Italy) which limits the generalizability to other contexts. Future research should enlarge this study in other empirical settings.

Keywords – Industry 4.0; SMEs; capabilities

Paper type – Academic Research Paper

1 Introduction

The concept of Industry 4.0 has been conceptualized as the fourth industrial revolution that refers to how a bundle of partly related digital technologies will bring major disruptions to manufacturing industries enabling major business improvements in productivity and shaping current business models (Kagermann et al., 2013).

Indeed, the digital transformation ignited by Industry 4.0 pose significant challenges for established firms (Warner and Wäger, 2018) and in particular for manufacturing SMEs given their limited financial and managerial resources, low digitalization level (Müller et al., 2018a) and low attractiveness for IT talents. Still, there is little empirical research that investigates at a company level how to deal with these challenges or has given advices on how to develop the capabilities needed to adopt Industry 4.0 (Schneider, 2018). Current studies are limited in suggesting the skills that may be required (for instance in data analytics, cyber security etc.), but fail to investigate how to develop the capabilities at a strategic level. This study aims to bridge this gap by looking at the required capabilities to master the digital manufacturing technologies. Using the dynamic capabilities and absorptive capacity as theoretical lenses, we propose that the capabilities to *acquire* knowledge from external sources, internal sources and manufacturing operations drive the *assimilation* and *transformation* of these knowledge sources through the formulation of a digital manufacturing strategy, which in turn determine the capability to *exploit* digital technologies in products and/or in processes.

2 Theoretical background

2.1 Industry 4.0

Industry 4.0 is a widely accepted term originated in Germany in 2011 to refer to the Fourth Industrial Revolution, but still lacks a generally accepted definition (Schneider, 2018). We lack a conceptualization of what actually constitutes Industry 4.0 (Schneider, 2018), despite some key design principles and technological trends are proposed. (Brettel, et al., 2014, Ghobakhloo, 2018, Hermann, et al., 2016, Kagermann, et al., 2013, Lasi, et al., 2014). Literature converges on cyber physical systems (CPS) as the main technological drivers of this industrial revolution (Li, et al., 2018, Liao, et al., 2017, Schneider, 2018). CPS are integrations of computations and physical processes with embedded computers and networks that monitor and control physical processes, usually with feedback loops where physical processes affect computations and vice versa (Wang, et al., 2015). Frequently CPS communicate over the Internet of Things, enabling further amount of Big Data related to physical systems available for analysis. Thus, technologies

such as Internet of Things, Big Data and analytics, cloud manufacturing and cybersecurity belong to the CPS domain. In addition to CPS, scholars and practitioners include in Industry 4.0 other production technologies as Additive Manufacturing, Virtual and Augment Reality, Robotics and other advanced manufacturing solution (e.g. collaborative robots, drones etc.). In line with that, in 2016, the Italian Ministry of Economic Development has delimited the scope of Industry 4.0 to nine technologies (i.e. Industrial Internet of Things, cloud computing, cybersecurity, Big Data and analytics, simulation, horizontal and vertical integration, additive manufacturing, advanced manufacturing solutions, augmented and virtual reality) and launched an industrial policy for Industry 4.0 to support firms in exploiting the opportunities of this industrial revolution. Given that firms are familiar with this national plan and following other studies on Industry 4.0 (Agostini and Filippini, 2019, Tortorella and Fettermann, 2017), we operationalize Industry 4.0 with this broad bundle of digital technologies of Industry 4.0, ranging from CPS domain to operational technologies.

2.2 SMEs and Industry 4.0

SMEs represent the backbone of many economies. In particular, in the European Union 99% of the companies are SMEs, hire between 50 and 70% of the full time equivalent of people employed and they produce over 50 % of the gross value added (Müller, et al., 2018). Therefore, SMEs require research that help them in dealing with this new industrial revolution. The academic research should not treat SMEs as small scales of their large counterparts and therefore using the same theoretical approaches in the context of Industry 4.0. Rather, it should study SMEs as a single unit of analysis considering the key challenges of these firms:

1. *low digitalization levels*: the third industrial revolution has been mostly incomplete in SMEs due to organizational and structural reasons (Buonanno, et al., 2005)
2. *limited financial resources* (Lubatkin, et al., 2006) that limit their capacity to experiment with Industry 4.0
3. *limited managerial resources* with not formalized managerial practices and centralized decision making (Cagliano, et al., 2001)

Due to these challenges, SMEs risk to be drive out of the market by more advanced competitors (Müller et al. 2018), their products becoming commoditized, or they may be relegated to the role of OEM supplier, with system integrators or who manage the data platform in control (Porter and Heppelmann, 2014). Yet, a study already acknowledges that “*the smaller SMEs are, the higher the risk that they will become victims instead of beneficiaries of this revolution*” (Sommer et al. 2015; pp 1).

Therefore, the necessity to build the required capabilities to exploit digital technologies in products and/or in processes is even higher for SMEs. Literature suggests the necessity to provide an internal integration of competencies, centralization of (already available) expertise (Agarwal and Brem, 2015) as well as strategic partnerships with other firms, industry associations and trade unions well as collaborations with higher education

institutions (Kagermann et al., 2013). Despite these exceptions, literature has not yet proposed the capabilities required by SMEs to use and implement digital technologies in products and/or processes.

2.3 Dynamic capabilities and absorptive capacity

Dynamic capabilities (DCs) have been introduced in the context of strategy as an extension of the Resource Based View (Barney, 1991) to explain how firms create, extend or modify their resources and skills in response to changing competitive environments (Kale and Singh, 2007, Teece, et al., 1997) to enhance the competitive performance of firms (Teece 2007).

Absorptive capacity has been proposed as a dynamic capability that denotes firms' ability to identify valuable external knowledge, assimilate or transform this knowledge into firm's knowledge base, and apply this new knowledge through innovation and competitive actions (Cohen and Levinthal, 1990).

The new technological revolution brought by Industry 4.0 is an *activation trigger* that lead firm to change the degree of acquisition of external knowledge (*acquisition capability*), which in turn should trigger the understanding and interpretation of these Industry 4.0-related knowledge (*assimilation capability*), the internalization of what constitute Industry 4.0 for the firm (*transformation capability*) and finally the exploitation of knowledge of Industry 4.0 (*exploitation capability*) through the use of digital technologies in products and/or in processes. We propose that the acquisition of knowledge may come from external sources as well as from internal sources in relation to internal integration and manufacturing operations capabilities. In addition, we propose that the assimilation and transformation capabilities entail the capability to formulate a digital manufacturing strategy. This reflects the capacity of the firm to integrate and internalize digital technologies within firm's boundaries, with the routines and operations currently in place.

3. Theoretical model and hypotheses development

3.1 Hypotheses development

There are several reasons which could explain the exploitation (i.e. the purposefully adoption) of digital technologies. As put forward by Cassiman and Veugelers (2006), firms may search and scan for new knowledge within and outside their boundaries. This search processes are usually complementary but bring with them significant information and knowledge which may differently impact on several performance metrics, as competitive success and cost of development (Kessler, et al., 2000), or productivity (Cassiman and Veugelers, 2006).

Following this approach, we advance that knowledge acquisition capabilities enabling the adoption of digital technologies are triggered by the use of multiple external knowledge sources (*external search depth*), the use of multiple internal knowledge

sources which denote the *internal integration* of the firm, and the presence of *multiple manufacturing capabilities*.

External factors consist in the external search depth of SMEs, namely how firms scan for new technologies within the actors of their ecosystem (Laursen and Salter, 2006). Conversely, the internal factor we identified is related with the degree of internal knowledge exchange that exists between different functional units and the manufacturing competitive priorities of SMEs (Kathuria, 2000).

The external search depth that SMEs decide to set are crucial in promoting search and scan of new technological opportunities across different business actors, but also in understanding and recognizing significant environmental shifts in the industry which may represent threats to current SME's operations.

The development of digital technologies has not achieved a high degree of maturity yet (Ganzarain and Errasti, 2016). In this vein, SMEs engaged in collaborations with actors as universities and research labs have a higher opportunity to tap into emerging technologies radically different from those currently adopted in their production process. A complementary position recognises the idea according to which the scarce development of digital technologies triggers SMEs in collaborating with actors outside their boundaries to codevelop solutions for integration within their production process (Reischauer, 2018). In this vein, the recent emergence of competence centres favouring the exchange of knowledge, ideas and technologies between universities and firms represent a significant evidence of this trend (Müller and Hopf, 2017).

Beside university-industry relationships, the openness of SMEs toward other actors may represent a trigger for the exploitation of digital technologies. For instance, customers may push both suppliers and distributors to collaborate since they have adopted digital technologies. Because of their low level of standardization, all the value-chain actors require cooperation to align their operations and this may further trigger the diffusion of the technology along the value chain.

Summarizing, it is clear that SMEs collaborating with more partners (as suppliers, distributors, universities, consultants) have superior probability to tap into different digital technologies and then to exploit them.

H1: SMEs performing external search with multiple sources have a higher degree of adoption and exploitation of digital technologies.

Literature on absorptive capacity acknowledged that, in order to assimilate, transform and exploit new external knowledge, firms need to establish ties *within units* (Jansen, et al., 2005) in addition to establish ties with external knowledge sources. Indeed, knowledge diversity facilitates both learning and innovation processes by enabling the individual to make novel associations and linkages (Cohen and Levinthal, 1990). In their study of organizational antecedents to absorptive capacity, Jansen et al. (2005) find that cross-functional interfaces (e.g. liaisons, teams etc.), and connectedness and socialization tactics enable determine the absorptive capacity of firms.

Similarly, literature on organizational knowledge creation acknowledges the importance of socialization, a process of sharing experiences that create and combine tacit

knowledge (Nonaka and Takeuchi, 1995). This literature further argue that internal integration, through for instance formal and informal communication networks, create redundancy of information, an enabling condition for knowledge creation as it facilitates the sharing of both tacit and explicit knowledge (Nonaka and Takeuchi, 1995).

H2: SMEs with a superior degree of knowledge exchange within functional units have a superior degree of adoption and exploitation of digital technologies.

In the last years, the competitive environment and the pressure of large OEMs (for which many SMEs are suppliers) have forced SMEs to shift strategic priorities from a single positioning toward hybrid positionings, which encompass the contemporary competition on multiple strategic levers (Salavou, 2015). In response to this, SMEs has adopted several managerial practices (TQM, JIT, WCM etc.) associated with world class practices (Cagliano, et al., 2001) to develop multiple manufacturing capabilities (Frohlich and Dixon, 2001). It is therefore not surprising to see SMEs competing not only on differentiation or cost-leadership strategies (Porter, 2008), but also considering as competitive levers factors such as service level (Guajardo, et al., 2015), flexibility, quality and design (Battistella, et al., 2012), and more recently on sustainability (Moore and Manring, 2009).

Firms with multiple manufacturing capability may have higher degree of adoption of digital technologies because they are continuously performing continuous improvement initiatives (e.g. quality circles, suggestions etc.) to develop continuously manufacturing capabilities. This enables them to recognize more easily opportunities to invest in digital technologies that can sustain efficiency, flexibility, quality and sustainability.

HP3: Multiple manufacturing capabilities enables the adoption and exploitation of digital technologies.

Digital technologies entail new innovation problems associated with unknown and latent customer needs, internal users and other stakeholders (Nambisan, et al., 2017). This implies that - for SMEs - knowledge related to Industry 4.0 cannot be simply acquired from the internal or external environment, but also needs to be fully integrated and shared within the firm. Such integration is crucial in enhancing the fit between operations and technologies currently adopted by the firm and those brought by Industry 4.0. We recognize that SMEs may achieve this fit through the development of a digital manufacturing strategy which allow firms to purposefully extend and modify their resource base (Helfat et al., 2007).

The digital manufacturing strategy encompasses the definition of ex-ante objectives related with the assimilation of digital technologies and enables the application of digital technologies for the development of new digital products or for the development of new processes. In this sense, we contend that:

H4: The formulation of a digital manufacturing strategy mediates the impact that external depth search, internal integration and multiple manufacturing capabilities have on the adoption and exploitation of digital technologies.

A representation of the theoretical framework is reported in Figure 1.

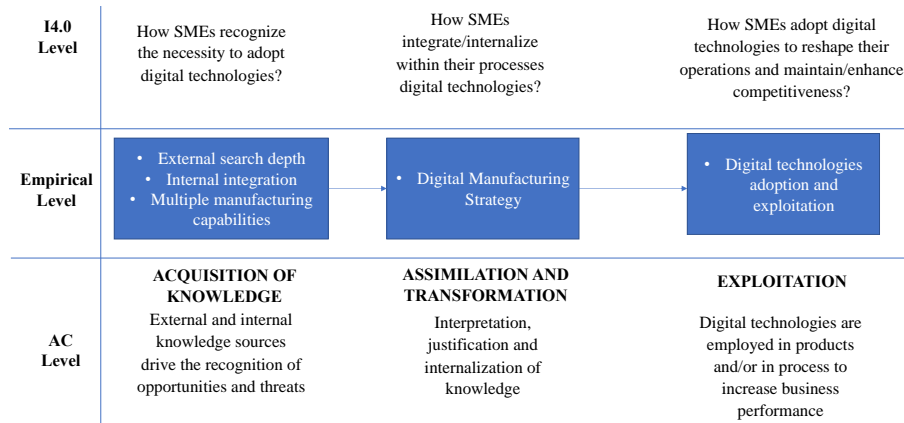


Figure 1. Representation of the theoretical framework and of the underlying hypotheses

4. Empirical methods

4.1 Data

Our empirical analysis is based on a recurrent survey of the Piedmont observatory of innovative firms. Piedmont, and Turin in particular, has long industrial tradition with a strong presence of innovative SMEs that either operates in niches in an international environment or works as supplier of large companies settled in Piedmont (e.g. FCA, Ferrero etc.). As a result, Piedmont represents an interesting setting to investigate the digital transformation of manufacturing companies

In the 2018 survey of the observatory, we include a section on Industry 4.0 which investigates current and future adoption of digital technologies, strategic opportunities, fiscal incentives adopted of the “Piano Industria 4.0” and supporting initiatives related to Industry 4.0 as well as the use of information systems (ERP, CRM etc.), considered as precursor of industry 4.0. We use questions from the other sections of the survey, not specifically related to Industry 4.0, to retrieve data on knowledge sources within and outside companies’ boundaries (suppliers, universities, distributors, customers etc) as well as for control variables (R&D expenditure, size, age etc.)

Out of 1851 email surveys, we received 367 usable responses achieving a response rate of 19,8 %. Excluding companies from non-manufacturing industries, start-ups and large companies we obtain 176 usable responses of manufacturing SMEs. Similar to other studies (Müller, et al., 2018), we consider SMEs those firms with less than 250 employees and with an annual turnover less than 50 M€. We retrieve these data from the AIDA database, a comprehensive dataset containing financial data of Italian firms.

The data analysis comprised two steps. Firstly, we used explorative factor analysis to group the digital technologies of Industry 4.0 and the other to group the strategic

opportunities driving the adoption of such different configurations. Secondly, we test the theoretical model using the structural equation modelling (SEM) technique.

4.2 Measures

Digital technologies and digital manufacturing strategy employ a 5-point Likert scale. For digital technologies the levels range from 1 indicating that there are no potential applications for the firm to 5 indicating that they already using the technology in the products and/or in processes. For digital manufacturing strategies each company was asked to indicate from 1 to 5 the importance of each investment objectives ranging from increased flexibility and efficiency to new products and services. External search depth, internal integration and multiple manufacturing capabilities were operationalized from a 5-point Likert scale into a sum of binary variables. Each variable item was coded 1 to corresponding level of 4 and 5, and 0 to corresponding to level 1, 2 and 3. In this way, we express the depth of knowledge search both internally and externally.

4.3 Control variables

We control for SMEs' innovation capability: R&D intensity, constructed as R&D expenditures to total sales. We control also for the adoption of information systems (e.g. ERP, CRM, PLM) as they are often considered precursor of Industry 4.0 (Müller, et al., 2018), constructed as a binary variable with 1 whether the firm has at least one information system adopted, 0 otherwise. Considering the high investment required by Industry 4.0, we control also for the size of investments, constructed as the total of depreciation. We control for other factors that may influence the assimilation of digital technologies namely size, age and industry.

5. Results

Table 1 and Table 2 present the results of the factor analysis regarding Industry 4.0 technologies and digital manufacturing strategies. The path coefficients of the empirical model are provided in figure 2. Table 3 reports the control variables.

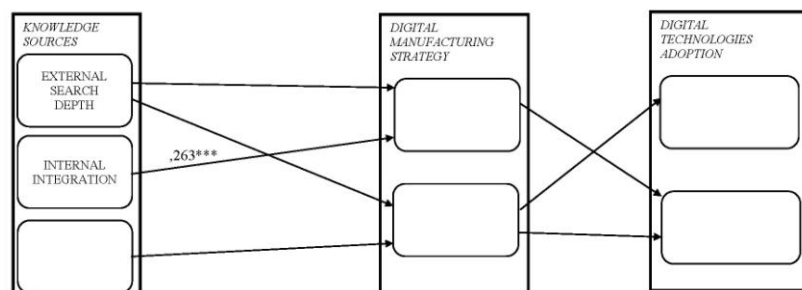


Figure 2. Results of the model using SEM. Note: $N = 176$; * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.
Non-significant results are not shown

Table 1. Explorative factor analysis for smart technologies configurations. Rotation method: oblimin with Kaiser normalization

Smart technology	Factors	
	Information Technologies	Digital Operational Technologies
Big data	,818	
Internet of things	,730	
Simulations	,714	
Integration of information systems	,650	,107
Virtual and augmented reality		,797
Additive manufacturing		,754
Advanced applications of robotics		,751
<i>Cronbach's alpha</i>	0,711	0,642

Table 1. Explorative factor analysis for digital manufacturing strategy. Rotation method: oblimin with Kaiser normalization

Investment objectives of Industry 4.0 projects	Factors	
	Operational Excellence	Digital Product Innovation
Improving control and quality of production processes (e.g. through monitoring and sensors)	,934	-,134
Decreasing costs and lead times	,922	
Improving the capability to plan, schedule and control of production	,882	
Increasing production automation	,852	
Increasing flexibility of production processes	,815	,119
Improving workers' conditions in relation to safety, ergonomics and physical effort	,719	,207
Develop integrated platform of product/service to perform servitization strategies		,941
Enter new markets through new trough new products and services enabled by smart technologies		,928
Add functionalities to our products enabled by smart technologies		,832
Improving collaboration with customers and/or suppliers for new product development	,297	,601
<i>Cronbach's alpha</i>	0,934	0,878

Table 2. Control variables. Results of the model using SEM. Note: N = 176; * p < 0.1; ** p < 0.05; *** p < 0.01

Control variable	Variables			
	Operational excellence	Digital product innovation	Information Technologies	Digital operational Technologies
R&D intensity	,252	,543	-,142	,833
Information system adoption	,541***	,366**	,041	-,021
Industry	-,022	,031*	,013	,022**
Size	-,001	-,001	,001	,107
Investments (depreciation)	,000	,000	-,000	-,000
Age	,000	-,004	-,002	-,003

5.1 Factor analysis

The first factor analysis reveals two main groups of digital technologies. The former is related to information technologies and CPS domain, while the latter is related to operational technologies. Thus, the technologies such as Internet of Things, Big Data and advanced analytics, simulation and information system integration have been grouped into a factor called *information technologies*. Virtual and augmented reality, additive manufacturing and advanced application of robotics have been grouped into a factor called *digital operational technologies*.

The second factor analysis reveals two main digital manufacturing strategies. The former strategy aims at increasing the efficiency, quality and flexibility of manufacturing processes. We called this factor *operational excellence*. The latter strategy aims at developing smart, connected products to offer new services and enter new markets. We called this factor *digital product innovation*.

5.2 Results of the empirical model

The results of SEM can be summarized as follows:

1. External knowledge search from the external ecosystem drives both the operational excellence ($\beta=0,189^{**}$) and the digital product innovation ($\beta=0,227^{***}$), driving in turn the adoption and the exploitation of both information and operational technologies. From this finding, it emerges the positive role of the ecosystem (e.g. learning factory and competence centres) that shows the potential of Industry 4.0 both for process and product innovation.
2. Internal integration drives only the operational excellence ($\beta=0,263^{***}$), driving in turn the adoption of information technologies ($\beta=0,166^{***}$). From this finding, it emerges that SMEs too focused internally may miss opportunities for product innovation, by focusing only on process innovation.
3. The capability to compete on multiple priorities drives the digital product innovation, driving in turn the adoption of both information and operational technologies. Thus, SMEs with multiple manufacturing capabilities seem to have achieved such a level of operational excellence that can exclusively focus on product innovation.
4. The digital manufacturing strategy mediates the use of external and internal knowledge sources for the adoption of digital technologies. In fact, we find non-significant direct effects among knowledge sources and the adoption of digital technologies¹.

Summarizing, we found three main patterns of adoption of Industry 4.0 by SMEs. Specifically, we find that (1) SMEs that extensively use their innovative ecosystem absorb knowledge relevant for Industry 4.0 to pursue both product and process innovation through the adoption of both information and digital operational technologies; (2) SMEs that use internal knowledge sources tend to achieve operational excellences through the

¹ Mediation analysis is not reported here but can be provide on request by the authors

use of information technologies; (3) SMEs with multiple manufacturing capabilities pursue mainly product innovation strategies using both types of technologies.

This paper contributes to the emerging literature on the antecedents of Industry 4.0 adoption (Agostini and Filippini, 2019, Müller et al., 2018b) finding that searching knowledge on multiple external sources, integrating knowledge from internal sources and multiple manufacturing capability, mediated by a digital manufacturing strategy, are positively related with Industry 4.0 adoption.

6 Limitations

This research is not free of limitations. First, our study is limited to a sample of innovative SMEs in the Piedmont region. While this offers a fruitful context to investigate Industry 4.0, given the historical industrial tradition of the region, this limit the generalizability to other contexts. Future research should enlarge this study in other empirical settings. Second, we did not control for endogeneity problems. Future research should employ tool that control for these, such as instrumental variable.

Future research should also investigate the presence of different patterns of adoption of digital technologies in SMEs. This can be verified for instance through a cluster analysis.

References

- Barney, J. (1991), 'Firm Resources and Sustained Competitive Advantage', *Journal of management* Vol. 17, No. 1, pp. 99-120.
- Battistella, C., G. Biotto and A. F. De Toni. (2012), 'From Design Driven Innovation to Meaning Strategy', *Management Decision* Vol. 50, No. 4, pp. 718-743.
- Cagliano, R., K. Blackmon and C. Voss. (2001), 'Small Firms under Microscope: International Differences in Production Operations Management Practices and Performance', *Integrated Manufacturing Systems* Vol. 12, No. 7, pp. 469-482.
- Cassiman, B. and R. Veugelers. (2006), 'In Search of Complementarity in Innovation Strategy: Internal R&D and External Knowledge Acquisition', *Management science* Vol. 52, No. 1, pp. 68-82.
- Cohen, W. M. and D. A. Levinthal. (1990), 'Absorptive Capacity: A New Perspective on Learning and Innovation', *Administrative science quarterly* Vol. 35, No. 1, pp. 128-152.
- Frohlich, M. T. and J. R. Dixon. (2001), 'A Taxonomy of Manufacturing Strategies Revisited', *Journal of Operations Management* Vol. 19, No. 5, pp. 541-558.
- Ganzarain, J. and N. Errasti. (2016), 'Three Stage Maturity Model in Sme's Towards Industry 4.0', *Journal of Industrial Engineering and Management* Vol. 9, No. 5.
- Guajardo, J., M. Cohen and S. Netessine. (2015), 'Service Competition and Product Quality in the U.S. Automobile Industry', *Management Science* Vol. 62, No. 7, pp. 1860-1877.
- Jansen, J. J., F. A. Van Den Bosch and H. W. Volberda. (2005), 'Managing Potential and Realized Absorptive Capacity: How Do Organizational Antecedents Matter?', *Academy of management journal* Vol. 48, No. 6, pp. 999-1015.

- Kale, P. and H. Singh. (2007), 'Building Firm Capabilities through Learning: The Role of the Alliance Learning Process in Alliance Capability and Firm-Level Alliance Success', *Strategic Management Journal* Vol. 28, No. 10, pp. 981-1000.
- Kathuria, R. (2000), 'Competitive Priorities and Managerial Performance: A Taxonomy of Small Manufacturers', *Journal of Operations Management* Vol. 18, No. 6, pp. 627-641.
- Kessler, E. H., P. E. Bierly and S. Gopalakrishnan. (2000), 'Internal Vs. External Learning in New Product Development: Effects on Speed, Costs and Competitive Advantage', *R&D Management* Vol. 30, No. 3, pp. 213-224.
- Lasi, H., P. Fettke, H.-G. Kemper, T. Feld and M. Hoffmann. (2014), 'Industry 4.0', *The International Journal of WIRTSCHAFTSINFORMATIK* Vol. 6, No. 4, pp. 239-242.
- Laursen, K. and A. Salter. (2006), 'Open for Innovation: The Role of Openness in Explaining Innovation Performance among U.K. Manufacturing Firms', *Strategic Management Journal* Vol. 27, No. 2, pp. 131-150.
- Lin, H. W., S. V. Nagalingam, S. S. Kuik and T. Murata. (2011), 'Design of a Global Decision Support System for a Manufacturing Sme: Towards Participating in Collaborative Manufacturing', *International Journal of Production Economics*.
- Moore, S. B. and S. L. Manring. (2009), 'Strategy Development in Small and Medium Sized Enterprises for Sustainability and Increased Value Creation', *Journal of Cleaner Production* Vol. 17, No. 2, pp. 276-282.
- Müller, E. and H. Hopf. (2017), 'Competence Center for the Digital Transformation in Small and Medium-Sized Enterprises', *Procedia Manufacturing* Vol. 11, pp. 1495-1500.
- Müller, J. M., O. Buliga and K. I. Voigt. (2018), 'Fortune Favors the Prepared: How Smes Approach Business Model Innovations in Industry 4.0', *Technological Forecasting and Social Change* Vol. 132, pp. 2-17.
- Nambisan, S., K. Lyytinen, A. Majchrzak and M. Song. (2017), 'Digital Innovation Management: Reinventing Innovation Management Research in a Digital World', *Mis Quarterly* Vol. 41, No. 1.
- Nonaka, I. and H. Takeuchi. (1995), *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford university press.
- Reischauer, G. (2018), 'Industry 4.0 as Policy-Driven Discourse to Institutionalize Innovation Systems in Manufacturing', *Technological Forecasting & Social Change* Vol. 132, pp. 26-33.
- Salavou, H. E. (2015), 'Competitive Strategies and Their Shift to the Future', *European Business Review* Vol. 27, No. 1, pp. 80-99.
- Shuen, A., P. F. Feiler and D. J. Teece. (2014), 'Dynamic Capabilities in the Upstream Oil and Gas Sector: Managing Next Generation Competition', *Energy Strategy Reviews* Vol. 3, pp. 5-13.
- Teece, D. J., G. Pisano and A. Shuen. (1997), 'Dynamic Capabilities and Strategic Management', *Strategic Management Journal* Vol. 18, No. 7, pp. 509-533.

Role of Smart Destination in Hospitality Enterprises Sustainability: an Empirical Study on Booking Channels Management and Revenues

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Abstract

This paper draws on the literature on innovation in tourism industry to investigate how the promotional tools developed by destinations – websites for information and booking, apps, e-commerce websites, tourist cards, BI and CRM software – may contribute to long-term development of accommodations in the territory. It is assessed by analysing impacts on booking channels, direct and intermediated (both online and offline), and revenue. Hypotheses are tested with a generalized linear model and an ordered logistic regression on data retrieved from 1,226 accommodations distributed in the Italian territory. Empirical results evidence the contribution of smart destinations in increasing the competitiveness of the tourism firms in the same area.

Keywords – Smart destination, Accommodation, Digital marketing, Booking channels, Revenues

Paper type – Academic Research Paper

1 Introduction

Rapid development of the Internet and wide introduction of ICTs in tourism and hospitality industry have modified the competitive landscape (Hojeghan and Esfangareh, 2011). New virtual actors, such as Online Travel Agencies (OTAs), travel metasearch engines, infomediaries (i.e. Google, Facebook) and sharing economy players, have entered the sector and gained importance. For accommodation facilities, this implies considerable complexity to manage the relationships with customers and an imbalance of power, since they largely depend on online intermediaries to reach a wide customer base,

paying commissions up to 30% of the transaction (Di Cesare, 2014; Buhalis and Law, 2008). On the other hand, the introduction of innovations has opened new possibilities of collaboration. In particular, partnerships could arise between Destination Management Organizations (DMOs) and accommodation facilities located in the same territory as they are interwoven realities (Correia and Brito, 2014; Buhalis and Molinaroli, 2003): while DMOs create and maintain the touristic demand, accommodations provide the supply.

Despite the growing interest of the literature on the topic, at our best knowledge the benefits of partnership among the industry have not been analysed with quantitative data. For this reason, the aim of this paper is to assess the effectiveness of such collaboration for accommodation facilities based on the usage of digital tools. Research draws on 1,226 accommodations located in the entire Italian territory interviewed during 2015. The empirical part uses a generalized linear model and an ordered logistic regression to measure the impact of use of digital tools developed by DMOs on revenue and booking channel management.

The rest of the paper is organized as follows. In Section 2, we present the theoretical background and research questions. Section 3 is devoted to model and data description. The empirical analysis is conducted in Section 4. Section 5 concludes.

2 Literature review

2.1 Theoretical background

The literature has largely underlined the tourism industry has been affected by a rapid change (Firoiu and Dodu, 2010) due to the introduction of the ICTs (Information and Communications Technologies) that have assumed a central role in its development and growth (Buhalis and Law, 2008). The transformation in the competitive landscape (Hojeghan and Esfangareh, 2011) led the birth of new virtual actors and the creation of new market relationships (Aldebert, Dang and Longhi, 2011) with consequently changes in the market share and bargaining power (Buhalis and Law, 2008). Above all, OTAs gained the greatest popularity, but also players who do not sell directly to the final customer but promote the tourist offers are assuming an increasingly important role (Podu, 2013). As a result, service providers experiment a more complicated management of relationships with their customers, who now interface with a large number of actors (Mihălcescu and Sion, 2011; Ruiz-Molina, Gil-Saura and Moliner-Velázquez, 2011). More specifically, in the hospitality industry, the survival of accommodation facilities is threatened by OTAs that leverage on low-cost offers and high commissions (Buhalis and Law, 2008). These changes, in addition to the fragmented nature of the tourism industry, should stimulate the many actors to develop entrepreneurial networks, supported by ICTs, for the creation and delivery of tourism products and the development of common resources (Buhalis and Molinaroli, 2003). However, the sustainability of these cooperative relationships is confined to the return gained by each single side (Berné, García-González, García-Uceda and Múgica, 2015). Common interests are expected for tourist destinations and accommodation facilities situated in the same territory since they

are related entities; such collaborations could result into positive outcome. In fact, the destination is one essential motivating factor behind the tourists' decisions, which in turns are the result of the marketing strategies adopted by its various stakeholders. Consequently, touristic enterprises have to market both their own product and the area as a single unified product. Marketing a tourist destination is often difficult to organise, since there are many actors involved, all with their own goals that have to co-exist (Grängsjö, 2003). They need to adopt innovative methods to strengthen their competitiveness. The spread of ICTs is large; they can be used both for operational and strategic objectives (Buhalis, 1998), affecting not only the volume of information exchanged, but also the value of long-term relationships (Firoiu and Dodu, 2010). In addition, the information-intensive nature of the industry should push enterprises to rely on Big Data, considered the new key source for value creation. Through datamining and statistical techniques the knowledge exploited from tourists' data can be transformed into competitive assets (Del Vecchio, Mele, Ndou and Secundo, 2018). The available technology, therefore, contributes to provide better services and offer valuable experiences for tourists and to create wealth, profit, and benefits for the organizations and destinations (Boes, Buhalis, & Inversini, 2015). Technology is the enabler to network, as internet tools are instrumental in facilitating tourist destination to develop such dynamic connections (Del Vecchio, Mele, Ndou and Secundo, 2018).

Innovative destinations, making use of websites and mobile apps, communicate with tourists with the aim to promote and raise their awareness on both the destination itself and the tourism firms (Gretzel et al., 2000). Moreover, in order to facilitate the tourist experience and increase the use of tourist services, DMOs in collaboration with the tourism destination stakeholders realize the tourist cards (Zoltan and Masiero, 2012). They are cumulative tickets that allow the tourists to access a range of services offered by destination at a total price lower than single purchases. The major benefit for service firms lies on their informative power: companies who choose to join the program have the opportunity to receive useful information to profile visitors, gain insight about their consumption behaviour and model appropriate marketing actions (Angeloni, 2015). Business Intelligence (BI) and Customer Relationship Management (CRM) software are other tools DMOs can make available to help accommodations to make a clever use of customer data and consequently develop a well-addressed communication, with relevant and personalized contents that push people to perform the desired action (Milović, 2012).

Thus, destinations assume a significant role within the tourism context as they promote the tourist offers without selling them directly to customers (Podu, 2013). Accommodation facilities could benefit from their support for both increasing sales and shifting the received bookings from intermediated channels to direct ones. Thanks to a well-managed distribution system, they can make a difference in the market, becoming leading companies instead of struggling to survive (Kotler et al., 2013).

2.2 Research objective

Despite the growing interest of the literature on the topic, empirical researches remain scarce. This paper investigates how the digital tools developed by destinations – websites

for information and booking, mobile apps, e-commerce websites, tourist cards, BI and CRM software – may contribute to long-term development of accommodations in the territory, in terms of booking channels and revenue. In specific, their contribution is considered positive if they increase revenues and favour direct bookings and diminish the intermediated ones, as they are subject to fees. Thus, following hypotheses are formulated:

Hypothesis 1. Websites for information and booking, mobile apps, e-Commerce website, tourist card and BI and CRM software will be positively associated with direct bookings.

Hypothesis 2. Websites for information and booking, mobile apps, e-Commerce website, tourist card and BI and CRM software will be negatively associated with intermediated online bookings.

Hypothesis 3. Websites for information and booking, mobile apps, e-Commerce website, tourist card and BI and CRM software will be negatively associated with intermediated offline bookings.

Hypothesis 4. Websites for information and booking, mobile apps, e-Commerce website, tourist card and BI and CRM software will be negatively associated with destination intermediated bookings.

Hypothesis 5. Websites for information and booking, mobile apps, e-Commerce website, tourist card and BI and CRM software will be positively associated with revenue.

3 Method

3.1 Model

Hypotheses are tested with two statistical models. A generalized linear model with a binomial distribution and a logit link function is used for the dependent variables related to booking channels, which are proportional. An ordered logistic regression is implemented for the variable indicating the percentage of increase and decrease of revenues compared to the previous year, which is divided into ordered classes.

3.2 Data and variables

Data are from accommodations distributed in the Italian territory, interviewed in 2015 with CAWI (Computer Assisted Web Interviewing) methodology. The survey consisted of 37 questions, in addition to the request of personal data, and has been structured into five sections: technological equipment, data management and communication with customers, promotional activities to attract new customers, reservation channels and impressions on future. 24,407 accommodation facilities have been contacted; 2,016 are the questionnaires gathered, with an 8% redemption rate. High nonresponse rate can be imputed to many causes: period of survey administration – during summer – coincided with the most work intensive months for accommodation facilities; low engagement with research study since they were contacted only by email; considerable length of the survey and complexity of some questions. Final sample, after the elimination of incomplete

questionnaires, consists of 1,226 accommodations. Panel data is statistically representative of the population of accommodation facilities situated in the country, as resulted by a comparison with the data from Italy's National Statistics Institute (Istat).

There are five dependent variables, one for each hypothesis to be tested. *Direct_bookings*, *Intermediated_online_channels*, *Intemediated_offline_channels* and *Destination_intermediated_channles* are proportional variables with values from 0 to 1, which represent the percentage of bookings coming from the related type of channel. *Direct_Bookings* are bookings received from a direct contact of the client (e.g. by email, phone, walk-in, website, app). *Intermediated_online_channels* are intermediated bookings (e.g. from OTA, metasearch) through online channels like websites and apps. *Intemediated_offline_channels* are the ones coming from traditional means, namely travel agencies and tour operators. *Destination_intermediated_channels* are bookings intermediated by DMOs. The last variable, *Revenue*, is ordinal divided into six classes, according to the percentage of increase or decrease of revenue compared to the previous year (1: < -10%; 6: > 10%). Independent variables are binary, taking value equal to 1 if the linked promotional tool provided by the destination is used by the accommodation facility. The selection of the digital tools is carried out taking into account their spread, accessibility and usability. According to this criterion we've included in the models websites, mobile apps, tourist cards and BI and CRM software. Summary statistics of the variables employed in the analysis is provided in Table 1.

Table 1 Summary statistics

Variable	Mean	Std. deviation	Min	Max
Direct_bookings	0.4520	0.2752	0	1
Intermediated_online_channels	0.4152	0.2779	0	1
Intemediated_offline_channels	0.0999	0.153	0	1
Destination_intermediated_channels	0.033	0.1021	0	1
Revenue	3.6256	1.3942	1	6
Website_Info_Book	0.6852	0.4646	0	1
Mobile_app	0.1525	0.3597	0	1
Website_eCommerce	0.1166	0.3211	0	1
Tourist_card	0.3613	0.4806	0	1
BIandCRM_sw	0.0693	0.2541	0	1

Obs: 1,226

4 Results

4.1 Main results

Table 2 shows the output of the generalized linear model, while Table 3 presents the results of the ordered logistic regression.

Table 2 Generalized linear model results

	Direct_bookings		Intermediated_online_channels	
	<i>Coef</i>	<i>p-value</i>	<i>Coef</i>	<i>p-value</i>
Website_Info_Book	.1216359	0.092*	-.2693717	0.000****
Mobile_app	.0321509	0.727	-.0771829	0.417
Website_eCommerce	.0733814	0.457	-.1282451	0.219
Tourist_card	.124955	0.077*	-.0543885	0.459
BIandCRM_sw	-.1035951	0.370	-.0043005	0.972

	Intermediated_offline_channels		Destination_intermediated_channels	
	<i>Coef</i>	<i>p-value</i>	<i>Coef</i>	<i>p-value</i>
Website_Info_Book	.1928427	0.095*	.7574764	0.004****
Mobile_app	.1014701	0.438	.0078409	0.972
Website_eCommerce	-.1025447	0.532	.4904055	0.066*
Tourist_card	-.1327132	0.206	-.1826409	0.359
BIandCRM_sw	-.0298011	0.872	.6068399	0.037**

Obs: 1,226. **** p < 0.001; *** p < 0.01; ** p < 0.05; * p < 0.1

Table 3 Ordered logistic regression results

	Revenue	
	<i>Odds ratio</i>	<i>p-value</i>
Website_Info_Book	.7828108	0.039**
Mobile_app	1.340244	0.067*
Website_eCommerce	.89754	0.531
Tourist_card	.9932481	0.953
BIandCRM_sw	1.081171	0.713

Obs: 1,226. **** p < 0.001; *** p < 0.01; ** p < 0.05; * p < 0.1

Nine coefficients resulted significant. In particular, one of them has a p-value of 0.000, one below 1%, two below 5% and five below 10%. The highest coefficients are related to the model with destination booking channels as dependent variable; in descending order they are the coefficients of the following variables: website for information or booking (0.76), BI and CRM software (0.61) and e-Commerce website (0.49). The odds for mobile app of having a revenue increase over 10% versus the lower categories are 1.34 greater. The odds for information/booking website, instead, indicate accommodations which use these tools are more likely to get lower revenue in comparison to previous year. Actual signs only partially correspond to expected signs for the nine significant variables. Consequently, hypotheses 1, 2 and 5 are partially confirmed. Hypothesis 3 and 4 are rejected because the significant coefficients are positive, assuming that the presence on destination's digital tools stimulates the bookings arriving from offline intermediated and destination's channels.

4.2 Discussion

Empirical results evidence the contribution of smart destinations in increasing the competitiveness of the tourism firms in the same area. In particular, accommodation facilities that are present on destination's websites (for informative and/or booking purposes) receive more direct bookings and less intermediated bookings from online channels (OTAs, metasearch engines and other third parties portals). Anyway, it is also increased the quota of intermediated bookings from traditional channels (travel agencies and tour operators). It could be the case of consumers who use the web for gathering information about the travel, but prefer to establish a face-to-face relationship with the seller in order to feel reassured with the opinion of an expert. This possibility draws attention to the omnichannel journey the tourists go through, with a mixed use of digital and traditional touchpoints along the traveling purchasing process. Tourist cards, instead, increase the percentage of direct bookings without any significant effect on intermediated ones. This highlights the mainly advertising nature of the tool: it sponsors the accommodation facilities that have joined the program. Results show smart destinations themselves become new intermediaries: the ones offer information and booking websites, e-Commerce portals and BI and CRM software address accommodation facilities a greater quota of bookings. Anyway, these platforms are often free and therefore they can still be considered a good brokerage channel. Moving to revenues, two variables result statistically significant: the presence of accommodations in information/booking destinations' websites and in destinations' mobile apps. Specifically, regarding accommodations that use the destinations' apps, they have a greater probability to experience a revenue increase. A possible explanation is that accommodation facilities that choose to join destination mobile program have at their disposal a large quantity of data that reveal precious insights on users' habits and movements. Companies then can customise their services according to customers' needs and obtain such financial benefits. Indeed, tourism industry is becoming even more customer-centric and customer satisfaction is highly rewarded, since it automatically brings to the accommodations new customers through positive reviews of their service. Instead, it is interesting to note that the probability to increase in sales over the previous year is lower for accommodations present on information or booking websites. This evidence shows that destinations' websites seem to act more as booking routers than as promotional showcases.

5 Conclusions

This paper investigated the links, in hospitality industry, between the marketing tools developed by DMOs and the distribution of bookings received through the different channels and the revenues. The models predict that a positive correlation with direct bookings and revenue may exist, while the relationship with intermediated bookings may be inversely proportional. The empirical analysis provides evidence in their favour. To our best knowledge, this is the first attempt to analyse which destination tools contribute to development of accommodations in terms of booking channels management and revenue. These two elements reflect the sustainable development perspective for

accommodation facilities for the following reasons. Appropriate channels management – i.e. direct bookings over intermediated ones – means greater presence and control towards the final consumer, strengthening of the relationships with tourists and co-creation of contextualized offers based on their needs and less dependence on third parties that apply high commissions. Money saved could be used for further investments to create new sources of revenue (e.g. potentiating marketing strategy) and/or to improve internally (e.g. technological equipment) to reduce costs in the long period. Revenue growth is equally important as it is the primary driver for company profitability: higher levels of revenues are likely to generate higher profits, if costs rise at a lower rate, to be reinvested in the business. Moreover, a positive growth rate is a good indicator of company future stability in case of bank loan request, with the possibility to achieve better financial conditions. Similarly benefits result into employees' engagement and talents' attraction. Finally, a growing business is evidence of the effectiveness in delivering value to customers, which triggers confidence into new potential buyers to obtain same benefits from the service. In addition, in accommodation facilities view, the collaboration with DMOs is also a chance to link their brand to the destination one: it is a potent way to power their image and raise consumer awareness toward their service. In fact, studies demonstrated that tourist destinations touchpoints are one of the most influential factors during inspiration and information gathering phases.

Research results confirm that, from touristic firms' perspective, DMOs who make available digital marketing tools are a good opportunity for disintermediation, reducing an excessive reliance on intermediaries. Money saved from third parties commissions can be internally invested to further develop a long-lasting growing. Although positive results emerged also in revenues analysis, there is still large space for improvements for supporting accommodations to increase their visibility and consequently their sales. Accommodations, however, should be conscious of the new consumer behaviour and adapt consequently. In their routine, people constantly switch from digital and physical activities and therefore they tend to replicate this natural behaviour in every aspect of their life, including when it comes to buy a travel service. Thus, accommodations do not have to consider distinctly offline and online anymore when reasoning about marketing strategy; they are now part of a single process that contribute to create a holistic touristic experience. Strategy should be omnichannel, in which offline and online tools are harmonized with each other.

In summary, it is now clear that collaboration between smart destinations and accommodation facilities is a win-win relationship, on which to leverage for increasing the competitiveness and the attractiveness of the tourism industry in the entire territory.

5.1 Limitation and future research

The main limitation of this study is the lack of absolute values for bookings and revenues.

Future researches could develop along various levels: i. conduct qualitative research – with interviews and focus groups – to deepen knowledge and gain insights on the relationships between accommodation facilities and DMOs located in the same territory;

ii. repeat the analysis on homogeneous groups of accommodations (e.g. hotels, farm holidays) to verify if results change since different accommodation types are targeted to people that may respond differently to marketing inputs; iii. analyse the tourist travel journey in order to provide managerial insight on the multiple touchpoints activated by tourists during the purchasing process.

References

- Aldebert, B., Dang, R. J., Longhi, C. (2011) Innovation in the Tourism Industry: The Case of Tourism@. *Tourism Management*, 32, 5: 1204-1213.
- Angeloni, S. (2015) A Tourist Kit 'Made in Italy': an 'Intelligent' System for Implementing New Generation Destination Cards. *Tourism Management*, 52, 187-209.
- Berné, C., García-González, M., García-Uceda, M. E., Múgica, J. M. (2015) The Effect of ICT on Relationship Enhancement and Performance in Tourism Channels. *Tourism Management*, 48: 188-198.
- Boes, K., Buhalis, D., Inversini, A. (2015). Conceptualising Smart Tourism Destination Dimensions. In Tussyadiah I., Inversini A., *Information and communication technologies in tourism 2015*: 391-403. Springer International Publishing.
- Buhalis, D. (1998) Strategic Use of Information Technologies in the Tourism Industry. *Tourism Management*, 19, 5: 409-421.
- Buhalis, D., Law, R. (2008) Progress in Information Technology and Tourism Management: 20 Years On and 10 Years After the Internet – The State of eTourism Research. *Tourism Management*, 29, 4: 609-623.
- Buhalis, D., Molinaroli, E. (2003) Entrepreneurial Networks and Supply Communities in the Italian e-Tourism. *Information Technology & Tourism*, 5, 175-184.
- Correia, R. F., Brito, C. M. (2014) Mutual Influence between Firms and Tourist Destination: a Case in the Douro Valley. *International Review on Public and Nonprofit Marketing*, 11, 3: 209-228.
- Del Vecchio, P., Mele, G., Ndou, V., Secundo, G. (2018) Creating value from Social Big Data: Implications for Smart Tourism Destinations. *Information Processing and Management*, 54: 847-860.
- Di Cesare, C. (2014) *Trivago e Bookassist: futuro nel metasearch per gli hotel*. TTG Italia. http://www.ttgitalia.com/stories/hotel/98854_trivago_e_bookassist_futuro_nel_metasearch_per_gli_hotel. Accessed 07 January 2019.
- Firoiu, D., Dodu, P. (2010) Black sea: European Tourism and Product Innovation. *Romanian Economic Business Review*, 5, 2: 148-155.
- Grängsjö, Y. F. (2003) Destination Networking: Co-opetition in Peripheral Surroundings. *International Journal of Physical Distribution & Logistics Management*, 33, 5: 427-448.
- Gretzel, U., Yuan, Y. L., Fesenmaier, D. R. (2000) Preparing for the New Economy: Advertising Strategies and Change in Destination Marketing Organizations. *Journal of Travel Research*, 39, 2: 146-156.
- Hojeghan, S. B., Esfangareh, A. N. (2011) Digital Economy and Tourism Impacts, Influences and Challenges. *Procedia – Social and Behavioral Sciences*, 19, 0: 308-316.
- Kotler, P., Bowen, J., Makens, J. (2013) *Marketing and Hospitality for Tourism*. New Jersey: Prentice Hall International.
- Mihălcescu, C., Sion, B. (2011) The Functionality of the Internet as Tourism Marketing Instrument. *Romanian Economic Business Review*, 5, 1: 75-81.
- Milović, B. (2012) Social Media and eCRM as a Prerequisite for Hotel Success. *International Scientific Journal of Management Information Systems*, 7, 3: 26.

- Podu, G. I. (2013) An Insight into m-Tourism. *Revista Economica*, 65, 3: 51-63.
- Ruiz-Molina, M., Gil-Saura, I., Moliner-Velázquez, B. (2011) Does Technology Make a Difference? Evidence from Spanish hotels. *Service Business*, 5, 1: 1-12.
- Zoltan, J., Masiero, L. (2012) The Relation between Push Motivation and Activity Consumption at the Destination within the Framework of a Destination Card. *Journal of Destination Marketing & Management*, 1, 1-2: 84-93.

Predictors of Negative Emotional Content in Online Review in the Hospitality Sector

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Abstract

Hospitality is one of the sectors that are nowadays most heavily characterized by consumers' tendency to share online reviews on dedicated digital platforms. While most past work has focused on understanding the effect of online reviews and ratings on consumers' evaluation and purchase decisions, this research tackles the issue of what drives the sharing of certain types of online content. Specifically, we investigate the sharing of user-generated content characterized by negative emotional valence, and study the effect of two factors on the extent to which user-generated content contains negative emotions. One such factor is reviewer's expertise, while the other is hotel quality. Our analysis of 1,200 TripAdvisor reviews on Italian hotels located in three major Italian cities confirm our hypothesis that expert reviewers might share reviews containing less intense negative emotional content compared to less expert reviewers especially when the hotel is of high quality. To support our hypothesis, we build on the research on psychological antecedents of word-of-mouth behavior suggesting that expert consumers are particularly reluctant to share negative word-of-mouth to avoid projecting a negative image of themselves in social contexts, thus possibly damaging their reputation.

Keywords – Hospitality, Online reviews, Expertise, Word-of-mouth, TripAdvisor

Paper type – Academic Research Paper

1 Introduction

In almost every sector, today's managers face the issue of how to fully get useful insights from the huge amount of data generated everyday by consumers, especially through digital and social media platforms. Marketing scholars have long investigated the role of User Generated Content (hereafter, UGC), which refers to media content created or produced by the general public rather than by paid professionals and primarily distributed on the Internet (Daugherty, Eastin, and Bright, 2008, p. 16).

UGC has a particularly crucial role in "information-intensive" sectors, such as tourism (Law, Buhalis, and Cobanoglu, 2014; Neirotti, Raguseo, and Paolucci, 2016; Pino et al., 2018; Vargo and Akaka, 2009), in which being able to take data-driven managerial decisions is crucial for companies that want to improve their market performance through the enhancement of the customer experience they deliver (Jackson, 2016; Phillips, Barnes, Zigan, and Schegg, 2017). Consequently, scholarly research has been dedicating a good deal of attention to understanding how contents shared by consumers online may create value in the hospitality industry, engage users and influence destination image, companies' image or tourist behavior (Gössling, Hall, and Andersson, 2018; Kim and Stepchenkova, 2015; Litvin and Dowling, 2018; Marine-Roig, Martin-Fuentes, and Daries-Ramon, 2017; Neirotti, Raguseo, and Paolucci, 2016; Ukpabi and Karjaluoto, 2018).

In this research, we focus on a more specific, though large and relevant, tourism sector such as hospitality, which certainly represents one of the sectors that has been most heavily influenced by digital media and UGC (Narangajavana, Fiol, Tena, Artola, and García, 2017; Varkaris and Neuhofer, 2017). Indeed scholars have mostly concentrated on examining the effect of UGC on outcome variables such as reputation (Dijkmans, Kerkhof, and Beukeboom, 2015), hotel room sales (Ye, Law, and Gu, 2009) and trust towards online consumer reviews (Filiari, Alguezaui, and McLeay, 2015). Scant attention, instead, has been devoted to studying the drivers of UGC, which could allow to detect predictors of reviewers' tendency to share certain types of UGC.

We investigate the effect of two UGC drivers that represent two of the most relevant elements of UGC, namely the *UGC sharer* and the *service* he/she reviews. Specifically, to capture the UGC sharer we examine the effect of reviewers' expertise, while to capture the service the UGC is about we examine the effect of the quality of the hotel reviewed. Moreover, as far as the UGC shared is concerned, we focus on UGC having emotional valence. Indeed, while it is widely known that the content shared by users often has an emotional valence (e.g. Berger and Milkman, 2012; Cervellon and Galipienzo, 2015; Munar and Jacobsen, 2014), there is, to the best of authors' knowledge, a dearth of studies examining the factors that may affect hospitality consumers' tendency to share emotional content. Therefore, we examine the effect of reviewers' expertise (measured using TripAdvisor's reviewer classification system) and hotel quality (measured through the number of "stars" the hotel has) on the extent to which UGC contains negative emotions. Operationally, we used the *Linguistic Inquiry and Word Count* software (LIWC; Pennebaker, Booth, and Francis, 2007; Pennebaker and Francis, 1996), commonly

employed for content analysis, to analyze the text of 1,200 comments posted on TripAdvisor about hotels (either 2-star or 5-star hotels) located in some of the main Italian cities in terms of international awareness and tourism (i.e., Rome, Florence, and Milan). Indeed, according to the “Top 100 City Destinations Ranking” research report published by the Euromonitor International (2017). Our analysis has been carried out through a regression model in which we used as independent variables our two focal variables, that is reviewer expertise and hotel quality, both treated as dichotomous, and as dependent variable an index of negative affect obtained from our content analysis. The reviewer expertise was considered a dichotomous variable in order to more easily study the interaction effect and to simplify the presentation of results (Farrington and Loeber, 2000).

Overall, this research sheds light on the role that one relevant UGC sharer’s characteristic (i.e., her expertise) and one relevant hotel’s characteristic (i.e., its quality) may have on the negative emotional content of comments shared online in the hospitality sector. Three are the main contributions this work makes to advancing extant knowledge. First, we contribute to the literature on tourism marketing and on the analysis of UGC in tourism and hospitality, while most previous work on UGC in tourism and hospitality has focused on the effect of UGC shared on recipients, our core focus in this research is on the determinants of UGC sharing. Second, our results contribute to the literature on social media data management in hospitality by proposing a novel conceptual framework that may help researchers and companies analyze data generated on online networks dedicated to hospitality. Third, we contribute to the UGC literature concerning hotels by analyzing the joint effect of a factor related to the online reviewer, such as her expertise, and a factor related to the product reviewed, such as the hotel quality, on the negative emotional intensity of the content shared.

2 Theoretical background

Our literature review has been the result of a systematic review process that has been conducted according to recent contributions proposed in the literature, in line with the well-established systematic literature review (SLR) approach (e.g., Centobelli et al., 2016; Denyer and Neely, 2004; Pittaway and Cope, 2007). Specifically, our systematic review started with a disciplinary stance to explore journals listed within “tourism” journal rankings. Thus, these journals citation indexes were searched systematically for papers that included the terms “hospitality,” “UGC,” “digital and social media,” “emotions” and/or “WOM” in the citation information, keywords and abstracts. All selected articles were included in a database created ad hoc for the purposes of the current research and, on the basis of the review of the abstracts of the papers selected, divided into three groups depending of their core topic (digital platforms and tourism, UGC and hospitality, emotions and WOM). Within each group, papers were then classified into three categories (A, B, C) according to their possible impact on the above-mentioned core topic. Finally, we started entirely analyzing each single article starting from the “A” papers and then moving to the “B” and “C” ones. This analysis has been firstly carried out for the “digital

platforms and tourism” group, then for the “UGC and hospitality” group and finally for the “emotions and WOM” group (please see Figure 1 for a flowchart of the methodological steps we followed and Figure 2 for a literature map that summarizes the main unit of analysis and contributions on the research topics relevant for this paper).

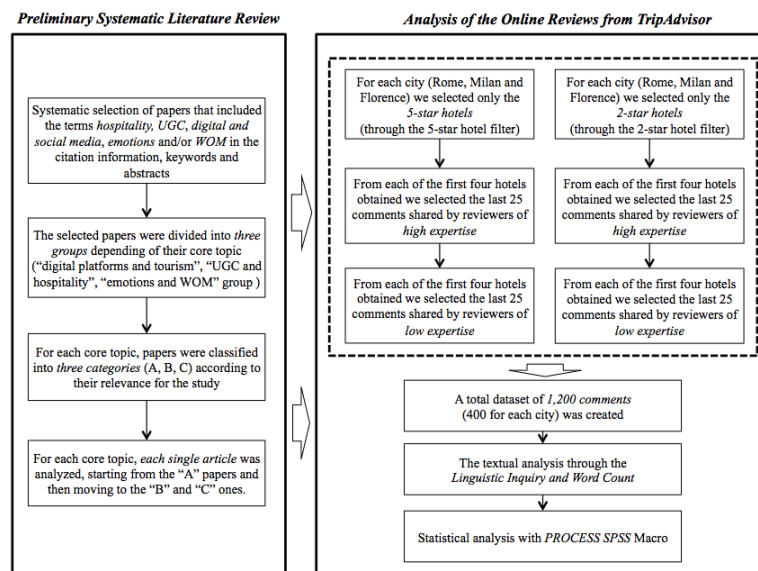


Figure 1. Flowchart summarizing the methodological procedure.

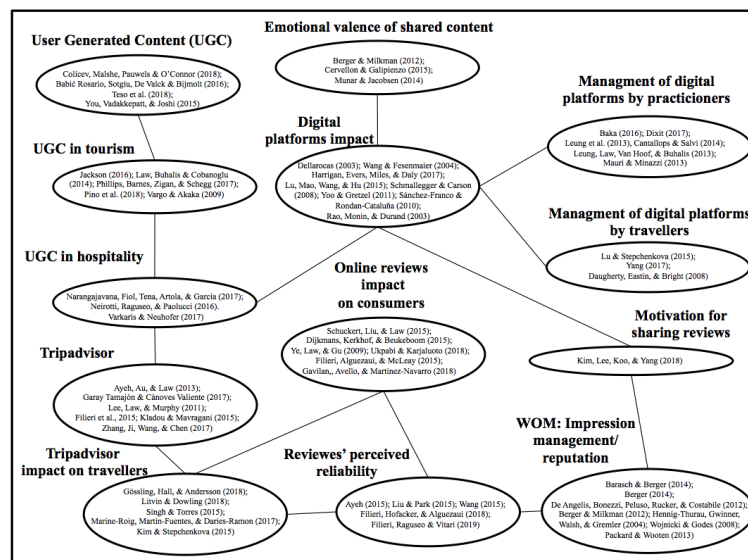


Figure 2. Literature map summarizing the main topics considered for this study.

2.1 Digital platforms in tourism

Information Technology (IT) innovations have driven the rise of digital media, which since the beginning of the new millennium have been unanimously considered as platforms of great importance for businesses in order to understand customers and respond effectively to their needs and preferences (Dellarocas, 2003), with obvious benefits for their relationship with customers (Wang and Fesenmaier, 2004). Such an influence of digital platforms on the way businesses manage their relationship with customers is particularly central in the hospitality sector (Harrigan, Evers, Miles, and Daly, 2017). Indeed, researchers have long underlined that digital media are more effective than other information sources in providing information to travelers regarding a destination (Lu, Mao, Wang, and Hu, 2015; Schmallegger and Carson, 2008; Yoo and Gretzel, 2011).

Acknowledging the importance of digital platforms in tourism and hospitality, scholars have started investigating the role of such platforms in this context and have long recognized that digital media represent one of the “mega trends” that has significantly impacted the hospitality system (Daugherty et al., 2008). In support of this belief, recent research suggests that online ratings as well as the numbers and accuracy of reviews on TripAdvisor positively influence booking transaction values (Gössling et al., 2018; Litvin and Dowling, 2018; Singh and Torres, 2015). Indeed, about 70 percent of independent travel-related bookings happen online and about 35 percent of all package tours are booked online (Schuckert, Liu, and Law, 2015).

However, even if digital platforms’ fundamental importance is nowadays well recognized by hospitality companies, many hotels are still missing a clear strategy for how to effectively respond to online reviews, thereby protecting and sustaining their reputation (Baka, 2016). This issue is particularly sensitive if we consider that reputation plays a highly central role in affecting consumers’ preferences and choices in the hospitality sectors (e.g., Rao, Monin, and Durand, 2003).

Certainly, digital platforms have changed not only the way hospitality businesses analyze the market but also the way travelers assess different alternatives. Indeed, the growth of digital platforms contribute to the dissemination of information on products and services and have become the most important source of information for travelers (Lu and Stepchenkova, 2015; Yang, 2017). Indeed, as highlighted by Daugherty et al. (2008), social media such as blogs (e.g. Twitter), UGC platforms (e.g. TripAdvisor), media sharing sites (e.g. Flickr and YouTube) or social knowledge sharing sites (e.g. Wikitravel) are today largely used by travelers to search, organize, and share their travel experiences.

In the light of this, the appropriate analysis and management of digital platforms represents today not only an opportunity to improve customers’ experience and increase their engagement with the hospitality company, but also a prerequisite for hotels’ long-term survival, especially in their facing the competition of new players born in the digital-based sharing economy (e.g., Airbnb).

2.2 Literature review on UGC in hospitality

Literature on UGC in hospitality sector has mostly focused on understanding the relationship between online reviews and consumers' purchase decisions and satisfaction judgments, on motivations to post online reviews (Schuckert et al., 2015; Kim, Lee, Koo, and Yang, 2018), on how reviews' contents could impact reputation (Dijkmans et al., 2015) and on what hospitality practitioners should do to effectively respond to online comments (Cantalops and Salvi, 2014; Leung, Law, Van Hoof, and Buhalis, 2013; Mauri and Minazzi, 2013). To illustrate, Ye et al. (2009) have showed the existence of a significant relationship between online reviews and hotel room sales, which is the most relevant business performance indicator for a hotel. Filieri et al. (2015) have investigated how factors such as quality of the information provided in the review, quality and reputation of the website in which the review is shared and customer satisfaction judgments contribute to build consumers' trust towards online consumer reviews. Gavilan, Avello, and Martinez-Navarro (2018) have investigated the influence of online reviews on hotel booking intentions by shedding light on the role that the number and the valence of reviews may have on the level of trustworthiness of the ratings. Other scholars have paid attention to motivations for sharing reviews in hospitality such as making new friends, reciprocity, feeling enjoyment in helping, desire to share narratives (Kim et al., 2018). Other motivational elements identified by the literature are represented by benefits associated to the community and personal factors, furthermore motivations seem to vary across different tipology of content creators (Munar and Jacobsen, 2014). It is interesting the study by Hennig-Thurau, Gwinner, Walsh, and Gremler (2004) investigating how motivations as social interaction and self-worth enhancing reside behind sharing and lead to WOM behavior. Even the study by Hu and Kim (2018) recognized the extremely important role of eWOM motivations in the hospitality context, identifying positive and negative motivations determining positive and negative eWOM behaviors, in this study also the role of reviewer's personality traits was explored as moderating the relation between eWOM motivations and posting behaviors. Another important work exploring motivations leading to review sharing, specifically in the context of online travels, is the one by Yoo and Gretzel (2008) that identified important underlying motivations, such as helping other travelers and need for enjoyment and self-enhancement.

Focusing instead on the perspective of travelers' adoption of UGC a very recent work of Ukpabi and Karjaluoto (2018) comprehended that the adoption may be determined by different factors related to the user, such as its profile, involvement, and enjoyment, and the content itself through its novelty, valence, and aesthetics. Even the work developed by Filieri, Raguseo, and Vitari (2019) focuses on reviews' adoption, exploring how the helpfulness of extremely negative reviews is moderated by their length, clarity and reviewer's expertise. Other scholars had pointed out that in the tourism sector users' perception of usefulness of a review is based on various factors, such as, for instance, reviewer's characteristics (e.g. her expertise), accuracy of the message and review readability (Ayeh, 2015; Liu and Park, 2015). Another key driver of travelers' tendency to rely on UGC is their perception about the credibility of the content shared (e.g. Wang, 2015).

While previous studies have certainly contributed to our understanding of the effect of UGC in hospitality much less investigated has been the issue of what might drive hospitality consumers to share UGC on digital platforms. In particular, largely uninvestigated has been the identification of conditions under which hospitality consumers might be likely to share some types of content. We tackle this issue trying to fill this literature gap by exploring how the valence of online shared content can be determined not only by reviewer characteristics but even by factors related to the object of the review.

3 Conceptualization and hypothesis development

Unlike previous work on UGC that has considered a reviewer's perceived expertise as a multidimensional construct composed of different factors such as the name of the reviewer, the number of comments she had shared online in the past and the number of replies a review has generated (Chung, Han, and Koo, 2015), in this research we employ a more objective, and perhaps simpler, definition of reviewer expertise built on the classification scheme used by well-known online platforms (namely, TripAdvisor in our case, which identifies 6 levels of reviewers' expertise) on the basis of reviewer's track records of reviews. In building our theorizing about whether and under what conditions reviewers' expertise affects the sharing of negative emotional content, we expect that an expert reviewer, compared to a less expert one, might be more concerned about potential self-image risks deriving from publishing negative comments online. WOM studies suggest that people generally tend to avoid sharing negative comments in order not to project a negative image of themselves, either as persons sharing negative things (e.g. Berger and Milkman, 2012) or as bad choosers (e.g. Hennig-Thurau, Gwinner, Walsh, and Gremler, 2004).

Importantly, moreover, we do not investigate the simple effect of reviewers' expertise, but we investigate how reviewers' expertise interacts with a product-related factor, such as the quality of the hotel reviewed. We hypothesize that expert reviewers, compared to less expert reviewers, will share online content of lower negative emotional intensity particularly when the hotel is of high (rather than low) quality. Such a hypothesis builds off past WOM research suggesting that consumers' expertise in a domain is often used as an impression management tool, whereby consumers tend either to boost their image by showing off their expertise or to protect it by avoiding sharing content that might harm their reputation as expert (e.g. Packard and Wooten, 2013). We argue such a reviewers' tendency to protect their image in a social context is stronger the higher the quality of the product or service reviewed. Indeed, grounding on the idea that high quality hotels can be considered higher-involvement goods than low quality hotels (e.g. Walls, Okumus, Wang, and Kwun, 2011), we argue that high quality hotels elicit a higher potential risk for a consumer to harm her image if she shares negative comments about her experiences.

Formally:

***Hypothesis:** UGC shared by highly expert reviewers has lower negative emotional intensity than UGC shared by lowly expert reviewers when the hotel*

reviewed is of high quality, while such a difference is less likely to be observed when the hotel reviewed is of low quality.

4 Methodology

To test our research hypothesis, we conducted our empirical analysis through the very well-known hospitality online network TripAdvisor, claiming to be the world's largest travel community, with 455 million monthly visitors, 96 million members and 600 million reviews and opinions (TripAdvisor.com, 2017).

This study focuses on TripAdvisor's reviews concerning hotels located in Italy, which represents a highly relevant country for tourism on a global basis (Guizzardi and Mazzocchi, 2010). Our dataset is composed of 1,200 comments posted on TripAdvisor regarding hotels situated in three major and highly visited Italian cities, such as Rome, Milan, and Florence. In accordance with our theorizing, we varied the quality of hotels by selecting comments regarding either 2-star (i.e. low-quality condition) or 5-star (i.e. high-quality condition) hotels. As regards the manipulation of reviewers' expertise, reviewers have been categorized on the basis of their status assigned by the TripCollective program, which recognizes users each time they contribute to TripAdvisor and classifies them.

Users' TripAdvisor level has been considered a proxy of users' expertise, whereby we identified lowly expert reviewers as level-2 reviewers and highly expert reviewers as level-5 reviewers. We collected a total of 1,200 comments (400 for each city) through an approach assuring an equal number of comments representing all four conditions emerging from crossing the two levels of reviewer expertise (high vs. low expertise) and the two levels of hotel quality level (high vs. low quality) (see Table 1 and 2 for details).

Table 1. Distribution of the selected comments on the basis of the hotel category and the level of expertise of the reviewers across the three cities considered.

Hotel category (number of stars)	Number of hotels considered	Expertise of the reviewers	Number of comments selected
<i>Rome</i>			
5	4	6	100
5	4	2	100
2	4	6	100
2	4	2	100
<i>Milan</i>			
5	4	6	100
5	4	2	100
2	4	6	100
2	4	2	100
<i>Florence</i>			
5	4	6	100
5	4	2	100
2	4	6	100
2	4	2	100
<i>Only 5- and 2-star hotels</i>	<i>48</i>	<i>Only reviewers with 6 and 2 TripCollective level</i>	<i>1,200</i>

Table 2. Name, role, operationalization and references of each of the variable used in the study.

Variables	Operationalization	References
Reviewers' expertise (Independent variable)	TripCollective program (considering the 6 levels introduced by TripAdvisor we operationalized the reviewers' expertise by using the level 2 and the level 6 as a proxy of respectively low and high expertise).	https://www.tripadvisor.com/TripCollective .
Hotel quality (Moderator)	TripAdvisor classification (we operationalized the quality of the hotel by using the number of stars reported on TripAdvisor and using 2-star hotels and 5-star hotels, located in Rome, Milan and Florence, as a proxy of respectively low and high quality level).	https://www.tripadvisor.com
Negative affect (Dependent variable)	This variable was assessed through the use of the LIWC (<i>Linguistic Inquiry and Word Count</i>) software that categorizes words related to negative emotions.	Pennebaker and Francis (1996). http://www.liwc.net .

All collected comments were put in a dataset and analyzed through a textual analysis with the purpose of determining their valence. The textual analysis was run using the LIWC software, which allows getting quantitative insights about textual comments.

In our analysis, we focused on the emotional valence of comments by using as dependent variable LIWC's measure of negative affect included in each comment.

5 Results

We employed the PROCESS SPSS Macro to analyze the data (Hayes, 2013). Specifically, we used Model 1 to test our moderation model ($R^2 = .008$), in line with the research hypothesis. Hotel quality level manipulation served as the moderator in the relationship between reviewer expertise and negative affect. The results showed a marginally significant and positive main effect of reviewer expertise (coded as 0 = low and 1 = high) on negative affect ($b = .19$, $t(1199) = 1.82$, $p = .06$) and a significant main effect of hotel quality level (coded as 0 = low and 1 = high) on negative affect ($b = .06$, $t(1199) = 2.95$, $p < .01$). Of greater importance, the interaction between the reviewer expertise and the hotel quality level resulted to be significant ($b = -.06$, $t(1199) = -2.26$, $p < .05$; see Figure 3).

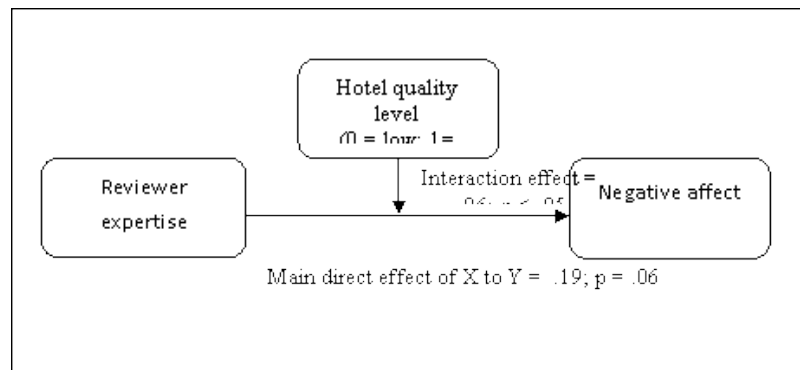


Figure 3. Conceptual model and findings

After analyzing the interaction effect of our two focal variables on negative affect, we inspected more closely such an interaction by looking at the conditional effects. Results revealed that the effect of reviewer expertise on negative affect is significant (and negative) when the review is about high-quality hotels ($b = -.12$, 95% CI: $-.24, -.00$), suggesting that in the case of luxury hotels the higher the expertise of the reviewer the lower the negative affect contained in the comment. Importantly, however, the effect of reviewer expertise on negative affect is not significant when the review is about low-quality hotels ($b = .07$, 95% CI: $-.05, .18$), suggesting that no difference in terms of negative affect contained in the UGC shared by highly versus lowly expert reviewers exists (see Figure 4). Tables 3 and 4 provide a summary of our results.

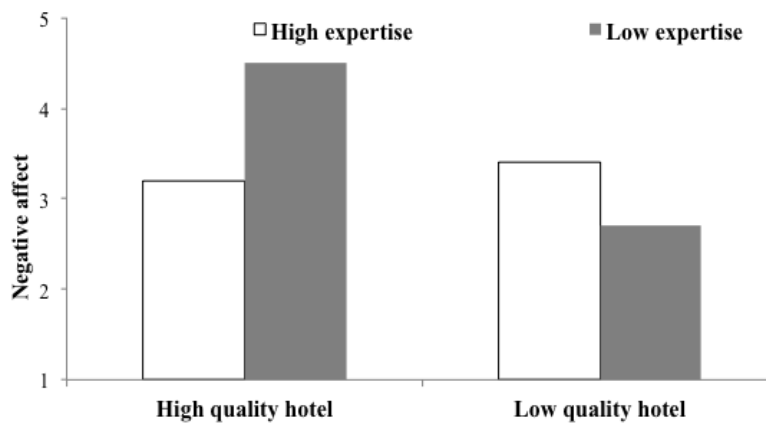


Figure 4. Negative affect as a function of the level of expertise of the reviewer and the level of quality of the hotel

Table 3. Summary of results.

Variables	Main Effects	Interaction Effect
Independent Variable (IV): reviewers' expertise (0 = low; 1 = high)	Effect of the IV on the DV: $b = .19, p = .06$	Direct effect of the interaction (IV x moderator) on the DV $b = -.06, p < .05$
Moderator: hotel quality (0 = low; 1 = high)	Effect of the moderator on the DV: $b =$.05, $p < .01$	
Dependent Variable (DV): negative affect		

Table 4. Conditional effects of reviewers' expertise on negative affect at low and high levels of hotel quality.

Hotel quality	B	S.E.	t	p
Low	.07	.06	1.14	.25
High	-.12	.06	-2.05	< .04

Note: S.E. = Standard Error

Overall, our findings provide full support to our hypothesis about the joint effect of reviewer expertise and hotel quality level on the extent to which UGC contains negative emotions. Indeed our findings indicate that the higher the expertise of the reviewer the lower the intensity of the negative emotional content shared when the hotel reviewed is of high quality. Such a tendency, moreover, seems to be particularly pronounced when the hotel the UGC shared is about is of high (versus low) quality, as hotel's high quality might enhance a reviewer's self-image concerns.

6 Conclusions and implications

The present research shows that the source of online reviews has a central role in determining the emotional content of the comments shared by reviewers on online networks dedicated to the hospitality sector. Therefore, it has potentially relevant implications for both scientific research and managerial practice. As regards theoretical implications, the present research has the merit to shed light on important, though overlooked, drivers of UGC in tourism and hospitality, related to both the UGC sharer (i.e., reviewer expertise) and the service he/she shares the review about (i.e., hotel quality). In doing so, we extend extant literature in this field by differentiating from previous studies that have mostly investigated the effects of UGC on recipients' judgments and behavior. The present study offers valuable contributions to extremely relevant domains of research as tourism marketing, social media management in the hospitality sector, and UGC concerning hotels.

As regards managerial implications, our findings can be potentially helpful to hospitality managers interested in improving their reputation on the market. For instance, they could benefit from our study by learning a methodological approach that might be useful to analyze the emotional content of online comments regarding their company

and/or their main competitors. Second, and more important, our findings suggest that expertise in online reviewing activity is a variable that could be potentially useful to target hotels' customer base.

The present research also presents some limitations that could be addressed by future studies. Indeed, our paper focuses on comments shared on TripAdvisor that is not the only one that travelers commonly use. Therefore, future research may replicate our studies considering different online platforms (e.g., hotels.com or booking.com) in order to make our findings more robust and generalizable. Moreover, our study focuses on Italy and some differences might be found through data collected in other countries. Future studies, moreover, could consider a bigger number of comments compared to our 1,200 comments. Finally, this study is based on a single hypothesis but future research may identify further hypotheses investigating potential mediators of the tested relationship, by also considering the opportunity to assess control variables that were not included in our model.

References

- Ayeh, J. K., (2015) "Travellers' acceptance of consumer-generated media: An integrated model of technology acceptance and source credibility theories", *Computers in Human Behavior*, 48, 173-180.
- Baka, V., (2016) "The becoming of user-generated reviews: Looking at the past to understand the future of managing reputation in the travel sector", *Tourism Management*, 53, 148-162.
- Berger, J., and Milkman, K. L., (2012) "What makes online content viral?", *Journal of Marketing Research*, 49(2), 192-205.
- Cantalalops, A. S., and Salvi, F., (2014) "New consumer behavior: A review of research on eWOM and hotels", *International Journal of Hospitality Management*, 36, 41-51.
- Centobelli, P., Cerchione, R., Esposito, E., and Raffa, M., (2016) "The revolution of crowdfunding in social knowledge economy: literature review and identification of business models", *Advanced Science Letters*, 22(5-6), 1666-1669.
- Cervellon, M. C., and Galipienzo, D., (2015) "Facebook pages content, does it really matter? Consumers' responses to luxury hotel posts with emotional and informational content", *Journal of Travel & Tourism Marketing*, 32(4), 428-437.
- Chung, N., Han, H., and Koo, C., (2015) Adoption of travel information in user-generated content on social media: the moderating effect of social presence. *Behaviour & Information Technology*, 34(9), 902-919.
- Daugherty, T., Eastin, M. S., and Bright, L., (2008) "Exploring consumer motivations for creating user-generated content", *Journal of Interactive Advertising*, 8(2), 16-25.
- Dellarocas, C., (2003) "The digitization of word of mouth: Promise and challenges of online feedback mechanisms", *Management Science*, 29(10), 1407-1424.
- Denyer, D., and Neely, A., (2004) "Introduction to Special Issue: Innovation and Productivity Performance in the UK", *International Journal of Management Reviews*, 5(3/4), 131-135.
- Dijkmans, C., Kerkhof, P., and Beukeboom, C. J., (2015) "A stage to engage: Social media use and corporate reputation", *Tourism Management*, 47, 58-67.
- Euromonitor. International (2017). Top 100 City Destinations Ranking. Available at http://blueswandaily.com/wp-content/uploads/2017/11/Euromonitor-International_WTM-London-2017_Top-100-City-Destinations.pdf.

- Farrington, D. P., and Loeber, R., (2000) "Some benefits of dichotomization in psychiatric and criminological research", *Criminal Behaviour and Mental Health*, 10(2), 100-122.
- Filieri, R., Alguezaui, S., and McLeay, F., (2015) "Why do travelers trust TripAdvisor? Antecedents of trust towards consumer-generated media and its influence on recommendation adoption and word of mouth", *Tourism Management*, 51, 174-185.
- Filieri, R., Raguseo, E., and Vitari, C., (2019) "What moderates the influence of extremely negative ratings? The role of review and reviewer characteristics", *International Journal of Hospitality Management*, 77 (2019) 333-341.
- Gavilan, D., Avello, M., and Martinez-Navarro, G., (2018) "The influence of online ratings and reviews on hotel booking consideration", *Tourism Management*, 66, 53-61.
- Gössling, S., Hall, C. M., and Andersson, A. C., (2018) "The manager's dilemma: a conceptualization of online review manipulation strategies", *Current Issues in Tourism*, 21(5), 484-503.
- Guizzardi, A., and Mazzocchi, M., (2010) "Tourism demand for Italy and the business cycle", *Tourism Management*, 31(3), 367-377.
- Harrigan, P., Evers, U., Miles, M., and Daly, T., (2017) "Customer engagement with tourism social media brands", *Tourism Management*, 59, 597-609.
- Hayes, A. F., (2013) "Introduction to mediation, moderation, and conditional process analysis: A regression-based approach", New York: The Guilford Press.
- Hennig-Thurau, T., Gwinner, K. P., Walsh, G., and Gremler, D. D., (2004). "Electronic word-of-mouth via consumer-opinion platforms: What motivates consumers to articulate themselves on the Internet?", *Journal of Interactive Marketing*, 18(1), 38-52.
- Hu, Y., and Kim, H. J., (2018) "Positive and negative eWOM motivations and hotel customers' eWOM behavior: Does personality matter?", *International Journal of Hospitality Management*, 75, 27-37.
- Jackson, S., (2016) "Prediction, explanation and big(ger) data: a middle way to measuring and modelling the perceived success of a volunteer tourism sustainability campaign based on 'nudging'", *Current Issues in Tourism*, 19(7), 643-658.
- Kim, H., and Stepchenkova, S., (2015) "Effect of tourist photographs on attitudes towards destination: Manifest and latent content", *Tourism Management*, 49, 29-41.
- Kim, S., Lee, K. Y., Koo, C., and Yang, S. B., (2018) "Examining the influencing factors of intention to share accommodations in online hospitality exchange networks", *Journal of Travel & Tourism Marketing*, 35(1), 16-31.
- Law, R., Buhalis, D., and Cobanoglu, C., (2014) "Progress on information and communication technologies in hospitality and tourism", *International Journal of Contemporary Hospitality Management*, 26(5), 727-750.
- Leung, D., Law, R., Van Hoof, H., and Buhalis, D., (2013) "Social media in tourism and hospitality: A literature review", *Journal of Travel & Tourism Marketing*, 30(1-2), 3-22.
- Litvin, S. W., and Dowling, K. M., (2018) "TripAdvisor and hotel consumer brand loyalty", *Current Issues in Tourism*, 21(8), 842-846.
- Liu, Z., and Park, S., (2015) "What makes a useful online review? Implication for travel product websites", *Tourism Management*, 47, 140-151.
- Lu, J., Mao, Z., Wang, M., and Hu, L., (2015) "Goodbye maps, hello apps? Exploring the influential determinants of travel app adoption", *Current Issues in Tourism*, 18(11), 1059-1079.
- Lu, W., and Stepchenkova, S., (2015) "User-generated content as a research mode in tourism and hospitality applications: Topics, methods, and software", *Journal of Hospitality Marketing & Management*, 24(2), 119-154.
- Marine-Roig, E., Martin-Fuentes, E., and Daries-Ramon, N., (2017) "User-generated social media events in tourism", *Sustainability*, 9(12), 2250.

- Mauri, A. G., and Minazzi, R., (2013) "Web reviews influence on expectations and purchasing intentions of hotel potential customers", *International Journal of Hospitality Management*, 34, 99-107.
- Munar, A. M., and Jacobsen, J. K. S., (2014) "Motivations for sharing tourism experiences through social media", *Tourism Management*, 43, 46-54.
- Narangajavana, Y., Fiol, L. J. C., Tena, M. Á. M., Artola, R. M. R., and García, J. S., (2017). "The influence of social media in creating expectations. An empirical study for a tourist destination", *Annals of Tourism Research*, 65, 60-70.
- Neirotti, P., Raguseo, E., and Paolucci, E., (2016) "Are customers' reviews creating value in the hospitality industry? Exploring the moderating effects of market positioning", *International Journal of Information Management*, 36(6), 1133-1143.
- Packard, G., and Wooten, D. B., (2013) "Compensatory knowledge signaling in consumer word-of-mouth", *Journal of Consumer Psychology*, 23(4), 434-450.
- Pennebaker, J. W., and Francis, M. E., (1996) "Cognitive, emotional, and language processes in disclosure", *Cognition & Emotion*, 10(6), 601-626.
- Pennebaker, J. W., Booth, R. J. and Francis, M. E., (2007) "Linguistic Inquiry and Word Count: LIWC2007", Available at <http://www.liwc.net>.
- Phillips, P., Barnes, S., Zigan, K., and Schegg, R., (2017) "Understanding the impact of online reviews on hotel performance: an empirical analysis", *Journal of Travel Research*, 56(2), 235-249.
- Pino, G., Peluso, A. M., Del Vecchio, P., Ndou, V., Passiante, G., and Guido, G., (2018) "A methodological framework to assess social media strategies of event and destination management organizations", *Journal of Hospitality Marketing & Management*, 1-28.
- Pittaway, L., and Cope, J., (2007) "Entrepreneurship education: A systematic review of the evidence", *International small business journal*, 25(5), 479-510.
- Rao, H., Monin, P., and Durand, R., (2003) "Institutional change in Toque Ville: Nouvelle cuisine as an identity movement in French gastronomy", *American Journal of Sociology*, 108(4), 795-843.
- Schmallegger, D., and Carson, D. (2008) "Blogs in tourism: Changing approaches to information exchange", *Journal of Vacation Marketing*, 14(2), 99-110.
- Schuckert, M., Liu, X., and Law, R. (2015) "Hospitality and tourism online reviews: Recent trends and future directions", *Journal of Travel & Tourism Marketing*, 32(5), 608-621.
- Singh, D., and Torres, E. (2015) "Hotel online reviews and their impact on booking transaction value", In XVI Annual Conference Proceedings (pp. 992-999).
- Ukpabi, D. C., and Karjaluoto, H., (2018) "What drives travelers' adoption of user-generated content? A literature review", *Tourism Management Perspectives*.
- Vargo, S. L., and Akaka, M. A., (2009) "Service-dominant logic as a foundation for service science: clarifications", *Service Science*, 1(1), 32-41.
- Varkaris, E., and Neuhofer, B., (2017) "The influence of social media on the consumers' hotel decision journey", *Journal of Hospitality and Tourism Technology*, 8(1), 101-118.
- Veil, S. R., Petrun, E. L., and Roberts, H. A., (2012) "Issue management gone awry: When not to respond to an online reputation threat", *Corporate Reputation Review*, 15(4), 319-332.
- Walls, A., Okumus, F., Wang, Y., and Kwun, D. J. W., (2011) "Understanding the consumer experience: An exploratory study of luxury hotels", *Journal of Hospitality Marketing & Management*, 20(2), 166-197.
- Wang, P., (2015) "Exploring the influence of electronic word-of-mouth on tourists' visit intention: A dual process approach", *Journal of Systems and Information Technology*, 17(4), 381-395.
- Wang, Y., and Fesenmaier, D. R., (2004) "Modelling participation in an online travel community", *Journal of Travel Research*, 42(3), 261-270.

- Wojnicki, A. C., and Godes, D., (2008) "Word of Mouth as Self-enhancement", HBS Marketing Research, Paper No. 06-01, Harvard Business School Marketing Unit, Boston, MA.
- Yang, F. X., (2017) "Effects of restaurant satisfaction and knowledge sharing motivation on eWOM intentions: the moderating role of technology acceptance factors", *Journal of Hospitality & Tourism Research*, 41(1), 93-127.
- Ye, Q., Law, R., and Gu, B., (2009) "The impact of online user reviews on hotel room sales. International", *Journal of Hospitality Management*, 28(1), 180-182.
- Yoo, K. H., and Gretzel, U., (2011) "Influence of personality on travel-related consumer-generated media creation", *Computers in Human Behavior*, 27(2), 609–621.

A Methodological Framework for Measuring the Smartness of Tourism Destinations

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Abstract

During the last years, economies and societies have seen a continuous change inside all their aspects. In this scenario, tourism has always played an increasing crucial role in the growth of many countries and the adoption of Information Communication Technologies (ICTs) has led to several transformations in the core of this sector. Specifically, tourism has registered a tremendous growth in the diffusion of technologies which tourists interact with for searching information, communicating, generating content, transaction, and has seen the use of tools like mobile apps, social media platforms, virtual tourism communities, able to transform the tourist's travel experiences and to support tourists in discovering new attractive destinations, scheduling activities, personalizing their travel, and, more in general, making smart decisions.

Moreover, the use of ICTs has culminated with the notion of Smart Tourism Destinations (STDs), where ICT is a driver for a smart growth and for the competitiveness of a destination. Further studies have enlarged this idea, highlighting that the fundamental constructs of a STD are human capital and social capital constructs, supported and enabled by advanced ICT infrastructures.

In order to work toward the development of a smart and sustainable tourism destination, it is necessary to assess the “state of the art” of a tourism destination under different perspectives and evaluate its promptness to adopt a smart configuration. In literature several authors have considered many aspects of smart tourism and STD. Nevertheless, there is the need of investigative and holistic frameworks able to integrate all the perspectives of a STD.

Accordingly, the aim of this paper is setting up a conceptual methodological framework that integrates different levels of analysis using several dimensions characterizing a tourism destination. Such framework attempts to assess and evaluate the state of the art of a tourism destination in terms of smartness, to provide hints among the tourist actors toward the development of a sustainable tourism destination and to improve the customer perception of a destination.

Keywords – Smart Tourism, Smart Tourism Destination, Methodological framework, Smartness (*max 5 words*)

Paper type – Academic Research Paper

1 Introduction

Over the last two decades, economies and societies have seen a continuous change inside all their aspects. The daily challenge of each sector is to recognize the changes, adapt to these forces of change and exploit them as their own advantages. In particular, the expansion of the Internet and the adoption of Information Communication Technologies (ICTs), such as social media, mobile applications, recommender system and so on, have changed the global industry structure (Sigala 2018; Gretzel et al., 2015). Tourism has always played an increasing crucial role in the growth of many countries (WTTC, 2019) and the adoption of ICTs in this sector leads tourism companies and, in general, destinations to gain competitive advantage by differentiating their products and services or the fruition of their natural resources (Buhalis et al, 2019; Boes et al., 2015). In particular, the embracing of this cutting-edge technologies have led to the birth of the concept of Smart Tourism Destinations (STD), considered as a strategic way for tourism development (Jovicic , 2019; Femenia-Serra and Ivars-Baidal, 2018; Gretzel et al., 2015).

In the recent years, governments, recognizing the potential of smartness and the importance to adapt to this rapid changes, has adopted political strategies aimed at enhancing sustainable development and economic growth (Meijer and Bolívar, 2016; Cocchia, 2014; Nam and Pardo, 2011) among all the stakeholders in the tourism ecosystem.

Moreover, in the destination management new approaches are needed in order to conform to the structural changes, together with the employment of new technologies, with the aim of interacting within the stakeholders (Gretzel et al., 2015), making destinations more competitive (Wang et al., 2013; Gretzel et al., 2015), offering more personalised services to tourists and generating an enhancing tourism experience and create value (Del Vecchio et al., 2018; Weissenberg, 2017; Boes et al., 2015; Buhalis and Amaranggana, 2014; Lamsfus and Alzua-Sorzabal, 2013).

In this scenario, the definition of the “state of the art” of a destination and its promptness to shift toward a smart configuration required the definition of a methodological framework that integrate different level of desk and field analysis on the different dimensions characterizing a tourism destination.

Here it is proposed a conceptual methodological framework that integrates different levels of analysis on several features characterizing a tourism destination and delineating its promptness to adopt a smart configuration, through a focus on the major trends, challenges and opportunities, the physical and technological infrastructure, the level of cooperation culture and attitude, the level of skills and competencies of the tourism workforce and the level of institutional support.

This framework has been adopting in the NEST (Networking for Smart Tourism Development) Project. NEST is a cross-border project between Albania, Italy (Molise and Apulia) and Montenegro, aimed to sustain the competitiveness of the Ionic-Adriatic destination by empowering Tourism Enterprises (small and medium ones, SMTEs) with innovative approaches, tools and strategies that leverage on the potentialities of digital technologies, networking and collaboration.

This paper is organised as it follows. In Section 2 it is reported a brief literature review. In Section 3 the methodological framework is described. In Section 4 the results from a preliminary analysis are shown. Finally, Section 5 concludes the paper describing the implication of this study.

2 Literature review

In the recent years, Smart Tourism has become a hot topic of growing actuality among both researchers and destinations' managers (Jovicic, 2019; Del Vecchio et al., 2018; Weissenberg, 2017). This concept has been applied to describe the increasing reliance of Tourism Destinations, their industries and their tourists on emerging forms of ICT that allow for massive amounts of data to be transformed into value propositions (Xiang & Fesenmaier, 2017; Gretzel et al., 2015).

A Tourism Destination can be compared as a cluster of interrelated stakeholders embedded in a social network that interact, jointly meeting visitor needs and producing the tourism experience (Baggio et al., 2010). Recently, tourism sector registered a tremendous growth of the diffusion of search engines, new distribution channels, virtual tourism communities and numerous social media platforms that support tourists to make smart decisions (Buhalis et al., 2019; Sigala, 2018). The diffusion of mobile technology and wearable devices has further transformed the tourism experience enhancing the tourists' empowerment by bringing together information search, communication, entertainment, social networking and mobility-related functionalities (Doric et al., 2019; Tussyadiah and Zach, 2018). Moreover, tourists are shifting the competition toward the co-creation experience as a basis of value and as the future of innovation (Marasco et al., 2018; Neuhofer et al., 2015; Prahalad and Ramaswamy, 2004).

These advancement of technology in tourism has culminated with the notion of STDs, where ICT is a driver for a smart growth and for the competitiveness of a destination (Femenia-Serra and Ivars-Baidal, 2018). The STD is understood as a local tourism system characterized by advanced services, high degree of innovation and the presence of open, integrated and shared processes for enhancing the quality of life for both residents and tourists (Micera et al., 2013; Wang et al. 2013; Caragliu et al., 2009).

One of the most relevant definition of STD available in the literature is the one provided by Gretzel et al., (2015), that defines it as:

*“integrated efforts at a destination to **collect and aggregate/harness data** derived from **physical infrastructure**, social connections, **government/ organizational sources and human bodies /minds** in combination with the use of **advanced technologies** to transform that data into **on-site experiences and business value-propositions** with a clear focus on efficiency, sustainability and experience enrichment”.*

From the previous definition, it has been highlighted some of the most important key elements characterizing a Smart Destination, that have the final aim of sustainability, efficiency and experience enrichment. Moreover, all these feature can be found in the conceptual layers developed by Gretzel (2017), shown in Fig. 1, and which the analysis of the smartness of destination should be focused on.

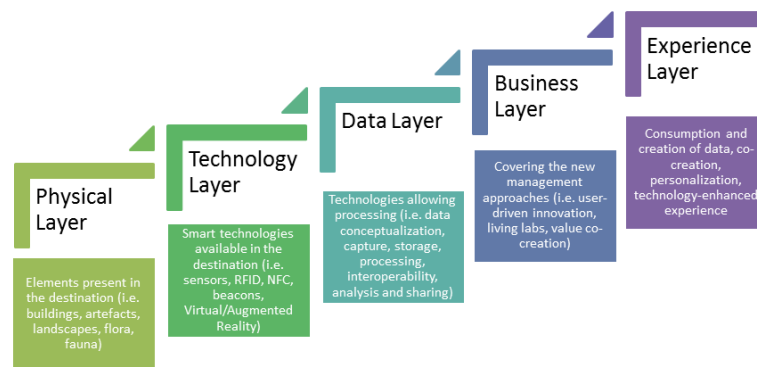


Fig. 1 Conceptual Layers of Smart Tourism (adapted from Gretzel, 2017).

Therefore, STDs can be perceived as places utilising the available technological tools and techniques are considered a means to deliver services to consumer (Helkkula et al., 2018) that enables demand and supply to co-create value, pleasure, and experiences for the tourist and wealth, profit, and benefits for the organisations and the destination (Buhalis et al., 2019; Boes et al., 2015). While many researches primarily has focused on the implementation of technology for the smartness of a tourism destination (Guo et al., 2014) and in its incorporation within the development and production of tourism processes (Wang et al., 2013), Buhalis and Amaranggana (2014) have enlarged this idea, dealing with the building of STDs as a generic framework of inherited concepts that incorporate competitiveness, sustainability, and inclusiveness bases. Boes et al. (2015) have argued that the fundamental constructs of a STD are first of all human capital, which forms the base for the leadership, entrepreneurship and innovation, and social capital constructs, and that these are supported and enabled by advanced ICT infrastructures. Moreover, ICT, people (intended as human capital, social capital and knowledge management) and leadership (meant as participatory government, policies and

regulations, change management), if intertwined and interconnected within the smart ecosystem process, can become contributors to the smartness concept and should therefore be enhanced and developed to co-create innovation (Femenia-Serra and Ivars-Baidal, 2018; Boes et al., 2016; Ndou and Petti, 2005).

Therefore, to create a STD means to have a participatory government that ensure political strategies and policies aimed at enhancing sustainable development and economic growth in the tourism sector, to have available advanced ICT infrastructure, to have access to real-time information (coming from sensors or citizens and visitors as digital footprint from their social media activities), to digitalize the core of business processes, the tourism structure to adopt technologies and improve their services, to engage both the community and the tourist participation for co-creating tourism experience, and so on.

For all these reasons, in order to work toward the development of a smart and sustainable tourism destination, it is necessary to assess the “state of the art” of a tourism destination under different perspectives and evaluate its promptness to adopt a smart configuration.

In literature several authors has considered many aspects of smart tourism and STD, in order to examine how important smart tourism technologies’ characteristics, such as information quality, interactivity, and accessibility, influence travellers’ decision making process and thus lead to their travel decision support satisfaction (Yoo et al., 2017); to investigate tourists’ preferences of smart tourism quantitatively in a tourist attraction context and give useful directions for the diagnosis of strengths and weaknesses of smart tourist attraction construction (Wang et al., 2016); to identify and clarify the employability skills deficits in rural hospitality and tourism destinations (Adeyinka-Ojo, 2018); to understand how smart cities may foster collaboration ecosystems that may improve both the standards of living and the competitiveness of urban spaces (Appio et al., 2019; Hutchison et al., 2011; Giffinger et al., 2007). Nevertheless, any studies show how to evaluate the degree of smartness of a destination.

Due to the dearth of literature in this important aspect, the aim of this paper is to set up a conceptual methodological framework that integrates different levels of analysis on the different dimensions characterizing a tourism destination and that could be used for assessing and evaluating the state of the art of a tourism destination, in terms of smartness.

3 Methodological Framework

As aforementioned, the methodological framework here proposed aims at giving support to the tourism stakeholders in order to highlight strengths and weakness and providing hints, by taking in consideration several parameters that characterize a destination, such as the presence of attractions, physical and technology infrastructures, business companies, the adoption of political tourism strategies, and tourists that contribute to the definition of tourism experiences.

In particular, for assessing the smartness of a tourism destination, it is necessary to analyse tourism destinations from two main perspectives: the *macro-environment* and the

micro-environment. Regarding the macro-environment, the investigation aims to inspect all the characteristics of a destination, the economic impacts of the sector, the main opportunities for tourism, and so on. On the other hand, in relation to the micro-environment, the attention has been focused on both business and customer perspectives, so on one hand on the tourism firms' competitiveness, their technological promptness, the diffusion/adoption of ICT tools and, simultaneously, on those tools, methodologies and approaches useful to define customers profiles, to understand and anticipate their needs, to personalize tourism offers, to co-create tourism experience and evaluate customer satisfactions.

In Fig. 2 it is portrayed the methodological framework proposed. As it can be seen, the framework is made up of three phases: the macro-environment analysis, the micro-environment analysis and, finally, the customer experience analysis. As aforementioned, the framework is based on the conceptual layers that defined a STD, as reported by Gretzel (2017), and embraces the idea that the intertwining and the interconnection between leaderships, people and ICT contribute all together to the development and growing of a STD. Moreover, the presented framework specifies what are the crucial elements for the analysis and how to perform it, pointing also out some global indicators available from different sources.

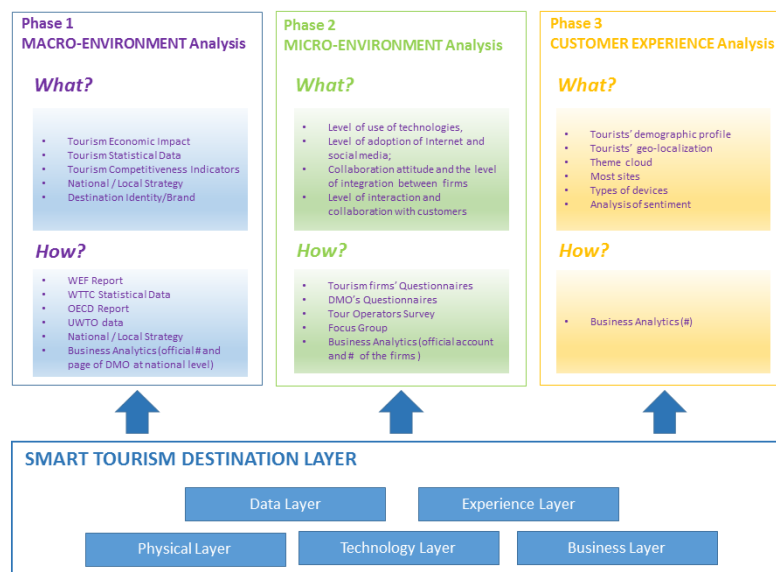


Fig. 2 Methodological Framework.

Both the macro- and micro- dimension of a tourism destination involves different layers, from the physical to the business one, passing through the adopted technologies and data layers, and are strictly related to the final destination image.

3.1 Macro-perspective analysis

The macro-dimension analysis of a destination starts from the study of the impact of the tourism sector within the economy of a country, by taking into consideration some key indicators, such as the tourism direct / indirect contribution to GDP, to employment, investment and visitors exports. Additionally, the economic impact of tourism sector is integrated with statistical information, such as the touristic flows (in terms of domestic, inbound or outbound tourism), the tourism receipts and expenditure, and other useful information about tourism enterprises, in order to describe trends and opportunities for the development of a STD.

The definition of the state of the art of tourism destination also needs to study the competitiveness of tourism destination, where destination competitiveness refers to the ability of destinations to deliver better tourist experiences and to create a better living environment for local residents and other destinations.

Understanding country competitiveness in tourism is a major consideration for policy makers and a major challenge for professionals in providing evidence to inform decision making. During the last years, various indicators have been developed by different organizations to address particular aspects of competitiveness, such as the T&T Competitiveness Index, defined by the World Travel & Tourism Council (WTTC), which is considered to adopt the most complete and modern set of indicators globally available to measure it.

Besides all these indicators, the study of destination brand or identity, which can be performed through the use of business analytics on the social media platforms, assumes an important function in this analysis, as well as the political and regional tourism strategies, which play an important role for the development of tourism destination and its competitiveness. Thus, the study of tourism strategic plan at both national and regional level, its objectives and approaches can offer useful information related to the destination at a macro-level perspective. In fact, the central argument is to see how and to what extent institutional capacity for coordination, collaboration and cooperation can be efficiently used as a governance practice (the efficiency of governance) to improve tourism destination competitiveness, helping to transform tourists needs into solutions and opportunities for a smart, inclusive and sustainable growth.

3.2 Micro-perspective analysis

In order to ameliorate the final destination image and to establish a relationship of loyalty with tourists, the different players of a touristic location have to act in an interconnected way, making available highly innovative services at the aim of making unique their experience. In this scenario, smart technologies play a crucial role in the development of STD and of the final destination image, arising from the convergence of ICTs with the tourism experience and its enhancement through personalization, context-awareness and real-time monitoring. Therefore, the micro-dimension analysis of a destination is based upon the study of the dynamic interconnection among different stakeholders for service co-creation, service exchange and value co-creation and both

social media and internet tools are instrumental in enabling firms to develop such dynamic connections, as technologies enable them to network.

To this aim, for grasping the detailed performance of the emergent features of a STD from a micro-dimension perspective, a field research methodology could be appropriate. This field research consists on gathering data regarding the promptness of the location to adopt a smart destination approach through the definition of surveys to be administered to different typologies of tourism players, such as hospitality firms (hotels, B&B, agritourist, and so on), intermediary (travel agencies, tourist guides, and so on) and Destination Management Organizations (DMO), and so on. Each question has the objective to define the level of smartness of the tourism in a specific territory in terms of its readiness and promptness for the adoption of digital technologies, creation of digital local experiences, the capacity to network and collaborate, and, mostly, to evaluate the following indicators:

- The level of use of technologies, internet and social media;
- The collaboration attitude and the level of integration with the other actors of the tourism system for creating new innovative opportunities;
- The level of interaction and collaboration with customers for experience and service co-creation.

3.3 Customer-perspective analysis

As aforementioned, one of the most fundamental layers in the touristic field is the experiential component. This layer focuses on the affective and emotional component of the consumption process. The concept of experience is strictly connected with the entertainment aspect and implies the consumer participation and interaction during the product/service creation. In other words, the contemporary tourists want to live a unique experience and are not interested anymore in purchasing a standardized product/service. So, in order to meet the new needs of the demand, the tourist destinations must give top priority to the achievement of tourist satisfaction.

Moreover, the importance of the experiential layer and the consumer satisfaction is crucial because of its great impact on future consumer intentions, loyalty and word-of-mouth communications, especially in the touristic sector.

In fact, in the era of Internet-based social media technologies, information is accessed and shared differently from the traditional way. Social networking sites have changed the way in which people plan their travels (Sigala, 2018; Gretzel et al., 2015; Hudson and Thal, 2013) and plays a key role in word-of-mouth communications and decision making processes, especially in a travel and tourism context, where tourists, sharing information on platform like TripAdvisor, Booking, Yelp and so on, help other tourists in their travel planning and influence potential travelers' decision making (Zeng and Gerritsen, 2014, Filieri and McLeay, 2014, Sparks and Browning, 2011).

The use of this data can facilitate touristic firms in knowing the needs of tourist and in planning some processes, such as advertising, sharing just in time information about attractions, catering facilities and transportation alternatives, and so on. Using the insights gained from large and complex data is important to uncover new opportunities for the business, to make decisions on the basis of numbers and analysis rather than anecdotes,

guesswork, intuition, or past experience. From the point of view of the tourists and in terms of mobile technology, having reliable real-time information always available is crucial in terms of enabling them to find their way.

In this way, Big Data Analytics strategy is also indispensable to ascertain consumer trends, travel patterns, threats, and opportunities. In particular, some of the enhancements that Big Data Analytics could bring for customer experience and business efficiency improvement are: personalizing the customer experience, helping travel companies in creating a better pricing strategy, customer analytics and improvement of services, marketing and sales optimization.

4 Preliminary Results

In the previous section it has been designed the conceptual methodological framework that has been developed in order to evaluate the state of the art of a tourism destination in terms of smartness under different perspectives, i.e. from a macro-, micro- and customer-perspective.

This framework has been adopted in the NEST Project. Primarily, in this specific context the methodological framework aims to understand in depth the level of smartness of the tourism in the context of the involved, giving an answer to the following issue:

- How to measure the impact of the tourism sector for the economy of each country covered by the project;
- How to measure the degree of e-readiness of Hospitality Firms, Intermediaries, Destination Management Organizations, through the use of questionnaires;
- How to quantify the perception of the final tourism destinations from the customer point of view.

Therefore, the adoption of this framework allows to enhance what are the major trends in each country of the context analysis, the main opportunities, the diffusion and the efficiency of both physical and technological infrastructures, if the cooperation between different tourism's actors exists and how profitable it is, if each country has different kind of support from institutions, and so on.

A preliminary analysis has been conducting under both a macro- and customer-perspective, with the aim of building the basis of a deeper analysis and of sketching out a first answer to the previously mentioned issues.

In particular, it has been investigating what is the role of travel and tourism in the economy of a country and how it contributes to the economic growth, in terms of GDP, created jobs, visitor exports (international tourism spend), domestic spending and capital investment.

Besides this macro considerations, the use of the Global Innovation Index (GII) has allowed to assess the presence of the ICT Infrastructure. The GII is an index that aims to capture the multi-dimensional facets of innovation and provide the tools that can assist in tailoring policies to promote long-term output growth, improved productivity, and job

growth¹. One of the pillar of the GII is Infrastructure, whose measure is the arithmetic mean between Information and communication technologies (ICTs), General Infrastructure and Ecological sustainability. To the aim of this analysis, it has been considered the evaluation in the field of ICTs, that is made up of four indexes: ICT access, ICT use, Government's online service, Online e-participation.

While in Fig. 3 it has been reported the trend of the ICT Infrastructure values of Albania, Italy and Montenegro in the years, from 2013 to 2018, in Fig. 4 it can be seen the details of the ICT Infrastructure pillar, as it has been reported the evaluations of the four indexes whose this pillar is made up.

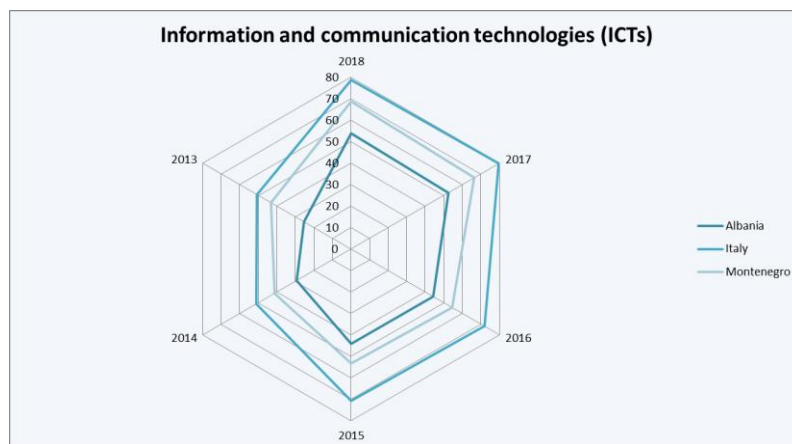


Fig. 3 ICT Infrastructure values: from 2013 to 2018. Elaboration from GII 2018.

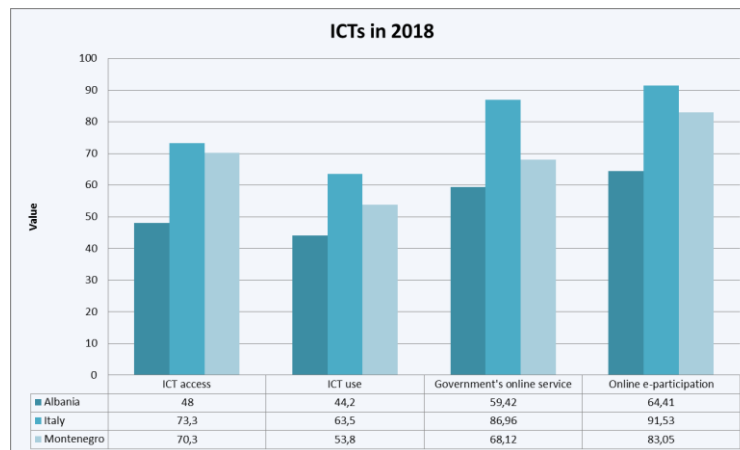


Fig. 4 ICT Infrastructure indexes for Albania, Italy and Montenegro in 2018. Elaboration from GII 2018.

¹ <https://www.globalinnovationindex.org/about-gii>

It is noticeable that the higher values are present in the Online e-participation and Government's online services. This tendency is almost justifiable by the latest European policies, aimed at simplifying procedures and bureaucracy and for this purpose adopting technological infrastructures. In general, all the indexes shows strong values and this implies that in all these countries the ICT Infrastructures are efficient, consequently it is possible to take advantages of the presence of these infrastructures and implement new services for citizens and tourists, to the aim of making "innovative" and "smart" a destination.

Behind this exploratory analysis from a macro point of view, with the help of business analytics, it has been gathered various data from social media platforms in order to analyse them and to explore the perception of the final destinations and the customer satisfaction.

After an introductory analysis on TripAdvisor, consisted in the discovery of the different activities proposed to the tourists for all the different regions and whose snapshot is shown in Fig. 5, analysing social media data from other online platforms has allowed to understand how much and how it is talked about a region, if the experience of the tourist is positive or negative, the effectiveness of the communication through the social network used.

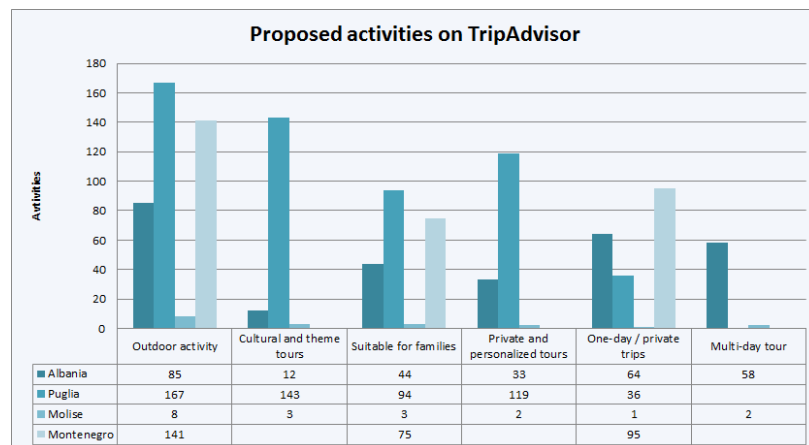


Fig. 5 Proposed activities on TripAdvisor.

To this aim, four hashtags have been chosen in order to extract and analyse the social media data: *#Albania* for Albania, *#weareinpuglia* for Apulia, *#molise* for Molise, *#Montenegro* for Montenegro, all combined with *#tourism*. In this way, a first simple selection has been done. The tool used for the analysis is Brand24¹.

While in Fig. 6 it is reported the discussion intensity chart for the four countries, i.e. the graphic that shows the trend of the number of mentions of each related hashtag, combined with *#tourism*, in Fig. 7 it is shown the sentiment chart, that shows the trend of

¹ <https://brand24.com/>

the social sentiment analysis related to the contents. It is easy to note that the vast majority of the comments are positive for all the regions.

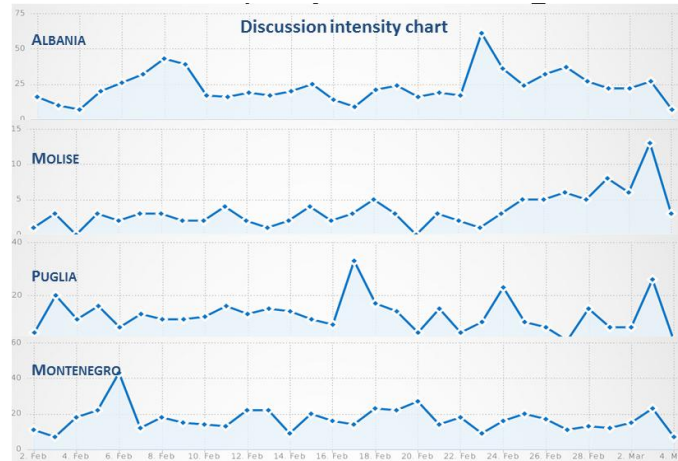


Fig. 6 Discussion Intensity Chart for #Albania, #molise, #weareinpuglia and #montenegro. Data elaborated with Brand24.



Fig. 7 Sentiment Chart for #Albania, #molise, #weareinpuglia and #montenegro. Data elaborated with Brand24.

This preliminary investigation through the adoption of the methodological framework here proposed has given the possibility to collect different kind of data gathered from several sources and to build the basis of a solid analysis from which it has been emerging both the strengths and weakness of each studied country, providing hints among the

tourist actors toward the development of a smart and sustainable tourism destination and the improvement of the customer perception of a destination.

5 Discussions and conclusions

In this paper it has been introduced a conceptual methodological framework that integrates different levels of analysis at a macro-, micro- and customer- level on different features that characterize a tourism destination and delineate its promptness to adopt a smart configuration.

In particular, in order to well characterize a tourism destination under the three different perspectives, several parameters, such as the presence of physical and technological infrastructures, of business companies and tourism attractions, and so on, have been included.

This framework has been adopted in the NEST (Networking for Smart Tourism Development) Project. A preliminary analysis under a macro- and customer- perspectives has allowed to highlight the efficiency of the ICT infrastructures and both the strengths and weakness of each studied country.

So this methodological framework reflects the possibility of implementing new services for citizens and tourists and attempts to provide hints among the tourist actors toward the development of a sustainable tourism destination and the improvement of the customer perception of a destination.

Finally, the ultimate perspective is to understand if the tourism destination has an ecosystem conception, by studying how much all the stakeholders are integrated within the development of the STD and the absorption of smartness by all the actors, being the country competitiveness in tourism a major consideration for policy makers and a major challenge for professionals in providing evidence to inform decision making.

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References

- Adeyinka-Ojo, S. (2018), “A strategic framework for analysing employability skills deficits in rural hospitality and tourism destinations”, *Tourism Management Perspectives*, Vol. 27, pp.47-54.
- Appio, F.P., Lima, M., Paroutis, S. (2019), “Understanding Smart Cities: Innovation ecosystems, technological advancements, and societal challenges”, *Technological Forecasting and Social Change*, Vol. 142, pp. 1-14.
- Baggio, R., Scott, N., Cooper, C. (2010), “Improving tourism destination governance: a complexity science approach”, *Tourism Review*, Vol. 65, No. 4, pp. 51-60.

- Boes, K., Buhalis, D., and Inversini, A. (2015), "Conceptualising Smart Tourism Destination Dimensions", in I. Tussyadiah & A. Inversini (Eds.), *Information and Communication Technologies in Tourism 2015*, pp. 391–403. Heidelberg: Springer.
- Boes, K., Buhalis, D. and Inversini, A. (2016), "Smart tourism destinations: ecosystems for tourism destination competitiveness", *International Journal of Tourism Cities*, Vol. 2, No.2, pp. 108–124.
- Buhalis, D. (2000), "Marketing the competitive destination of the future", *Tourism management*, Vol. 21, pp.97–116.
- Buhalis, D., and Amaranggana, A. (2014), "Smart tourism destinations", in Z. Xiang & I. Tussyadiah (Eds.), *Information and communication technologies in tourism 2014*, pp. 553–564, Dublin: Springer.
- Buhalis, D., and Amaranggana, A. (2015) "Smart Tourism Destinations: Enhancing Tourism Experience Through Personalisation of Services", in I. Tussyadiah & A. Inversini (Eds.), *Information and Communication Technologies in Tourism 2015*, pp. 377–389, Heidelberg: Springer.
- Buhalis, D., Harwood, T., Bogicevic, V., Viglia, G., Beldona, S., & Hofhacker, C. (2019) "Technological disruptions in Services: lessons from Tourism and Hospitality", *Journal of Service Management*, Forthcoming. <http://tinyurl.com/ITDisruptioninServices> .
- Caragliu, A., Del Bo, C. and Nijkamp, P. (2009) "Smart Cities in Europe", *Proceedings of the 3rd Central European Conference in Regional Science—CERS 2009, Kosice*, pp. 49-59.
- Cocchia, A. (2014), "Smart and Digital City: A Systematic Literature Review", R. P. Dameri & C. Rosenthal-Sabroux (Eds.), *Smart City: How to Create Public and Economic Value with High Technology in Urban Space*, pp. 13-43.
- Del Vecchio, P., Mele, G., Ndou, V., and Secundo, G. (2018), "Creating value from social big data: implications for smart tourism destinations", *Information Processing & Management*, Vol. 54, Issue 5, pp. 847-860.
- Della Corte, V., Sciarelli, M., Cascella, C., Del Gaudio, G. (2015) "Customer Satisfaction in Tourist Destination: The Case of Tourism Offer in the City of Naples", *Journal of Investment and Management*. Special Issue: Attractiveness and Governance of Tourist Destinations, Vol. 4, No. 1-1, pp. 39-50.
- Doric, J., Komsic, J., Markovic, S., (2019) "Mobile technologies and applications towards smart tourism – state of the art", *Tourism Review*, Vol. 74, Issue: 1, pp.82-103.
- Femenia-Serra, F. & Ivars-Baidal, J.A. (2018) "Do Smart Tourism Destinations Really Work? The Case of Benidorm", *Asia Pacific Journal of Tourism Research*(forthcoming), <http://dx.doi.org/10.1080/10941665.2018.1561478>.
- Filieri, R. and McLeay, F. (2014) "E-WOM and Accommodation an Analysis of the Factors That Influence Travelers' Adoption of Information from Online Reviews", *Journal of Travel Research*, Vol. 53, pp. 44 – 57.
- Giffinger, R. , Fertner, C., Kramar, H. , Kalasek, R., Pichler-Milanović, N., Meijers, E. (2007), "Smart Cities: Ranking of European medium-sized Cities", Centre of Regional Science (SRF), Vienna University of Technology, Vienna, Austria.
- Gretzel, U., Yoo, K. (2008), "Use and impact of online travel reviews", *Information and communication technologies in tourism 2008*, Springer-Verlag Wien, Vienna, Austria, pp. 35-46.
- Gretzel, U., Sigala, M., Xiang, Z., and Koo, C. (2015) "Smart tourism: foundations and developments", *Electronic Markets*, Vol. 25, Issue 3, pp. 179-188.
- Gretzel, U. (2017), "Smart Destination Research: State of the Art", *Conference: Smart Tourism Destinations: New Horizons in Tourism Research and Management STDRM2017*, <https://doi.org/10.13140/RG.2.2.22062.41289> .

- Guo, Y., Liu, H., and Chai, Y. (2014), "The embedding convergence of smart cities and tourism internet of things in China: An advance perspective", *Advances in Hospitality and Tourism Research*, Vol. 2, No. 1, pp.54–69.
- Jovicic, D. Z. (2019) "From the traditional understanding of tourism destination to the smart tourism destination", *Current Issues in Tourism*, Vol. 22, No. 3, p 276-282.
- Helkkula, A., Kowalkowski, C. and Tronvill, B. (2018) "Archetypes of service innovation: implications for value cocreation", *Journal of Service Research*, Vol. 21 No. 3, pp. 284-301.
- Hudson, S., Thal, K. (2013), "The impact of social media on the consumer decision process: Implications for tourism marketing", *Journal of Travel & Tourism Marketing*, Vol. 30, pp. 156-160.
- Hutchison, W. , Bedford, N. , Bedford , S. (2011), "Ukraine's global strategy in the post-crisis economy: developing an intelligent nation to achieve a competitive advantage", *Innov. Market.*, Vol. 7 , pp. 46-53.
- Kuo, Y. F., Wu, C. M., Deng, W. J. (2009), "The relationships among service quality, perceived value, customer satisfaction, and post-purchase intention in mobile value-added services," in *Computers in human behavior*, Vol. 25, pp. 887-896.
- Lamsfus, C., and Alzua-Sorzabal, A. (2013), "The theoretical framework for a tourism internet of things: Smart destinations", *TourGUNE Journal of tourism and human mobility*, Issue 0, pp. 15-21.
- Marasco, A., De Martino, M., Magnotti, F., Morvillo, A. (2018) "Collaborative innovation in tourism and hospitality: a systematic review of the literature", *International Journal of Contemporary Hospitality Management*, Vol. 30 Issue: 6, pp.2364-2395.
- Meijer, A., and Bolivar, M. P. R. (2016), "Governing the smart city: a review of the literature on smart urban governance", *International Review of Administrative Sciences*, Vol. 82, Issue 2, pp. 392-408.
- Micera, R., Presenza, A., Del Chiappa, G., and Splendiani, S. (2013), "Smart Destinations: new strategies to manage tourism industry", *Ifkad 2013 – International Forum on Knowledge Asset Dynamics*, Zagreb (Croatia).
- Morgeson III, F. V., Mithas, S., Keiningham, T. L., Aksoy, L. (2011), "An investigate on of the cross-national determinants of customer satisfaction," in *Journal of the Academy of Marketing Science*, Vol. 39, pp.198-215.
- Nam, T., and Pardo, T. A. (2011), "Conceptualizing smart city with dimensions of technology, people, and institutions", paper presented at the Proceedings of the 12th Annual International Digital Government Research Conference on Digital Government Innovation in Challenging Times - dg.o '11, New York, pp. 282-291.
- Neuhofer, B., Buhalis, D., & Ladkin, A. (2015)" Smart technologies for personalized experiences: a case study in the hospitality domain", *Electronic Markets*, 25, 243–254. <http://doi.org/10.1007/s12525-015-0182-1>.
- Prahalad, C.K., and Ramaswamy, V. (2004), "Co-creating unique value with customers", *Strategy & Leadership*, Vol. 32, Issue: 3, pp.4-9.
- Qi, J. Y. , Zhou, J. P., Chen, W. J., Qu, Q. X. (2012), "Are customer satisfaction and customer loyalty drivers of customer lifetime value in mobile data services: a comparative cross-country study," in *Information Technology and Management*, Vol. 13, pp. 281-296.
- Sigala, M. (2018) "New technologies in tourism: From multi-disciplinary to anti-disciplinary advances and trajectories", *Tourism management perspectives*, Vol. 25, p. 151-155.
- Sparks, B. A., and Browning, V. (2011). The impact of online reviews on hotel booking intentions and perception of trust. *Tourism Management*, Vol. 32, Issue 6, pp. 1310 – 1323.
- Tussyadiah, I.P., Jung, T.H., tom Dieck, M.C. (2018), "Embodiment of Wearable Augmented Reality Technology in Tourism Experiences", *Journal of Travel Research*, Vol.57, Issue 5, pp. 597-611.

- UNWTO (2015), "Understanding Tourism: Basic Glossary", accessed online (May 25, 2015) at <http://media.unwto.org/en/content/understanding-tourism-basic-glossary>.
- Wang, D., Li, X. (. R.), and Li, Y. (2013), "China's "smart tourism destination" initiative: A taste of the service-dominant logic", *Journal of Destination Marketing & Management*, Vol. 2, No. 2, pp.59–61.
- Wang , X., Li, X.R., Zhen, F., Zhang, J.H. (2016), "How smart is your tourist attraction?: Measuring tourist preferences of smart tourism attractions via a FCEM-AHP and IPA approach", *Tourism Management*, Vol.54, pp. 309 – 320.
- Weissenberg, A. (2017) "Trends defining the global travel industry in 2017", *Global Economic Impact and Issue 2017*, available at: <https://www.wttc.org/-/media/files/reports/economic-impact-research/2017-documents/global-economic-impact-and-issues-2017.pdf>.
- WTTC (2019), "Travel & Tourism Economic Impact 2019 - World", accessed online at <https://www.wttc.org/-/media/files/reports/economic-impact-research/regions-2019/world2019.pdf>.
- Xiang, Z., & Fesenmaier, D. R. (2017) Big Data Analytics, Tourism Design and Smart Tourism. In Z. Xiang & D. R. Fesenmaier (Eds.), *Analytics in Smart Tourism Design* (pp. 299–307). Switzerland: Springer.
- Yoo, C.W., Goo, J., Huang, C.D., Nam, K., Woo, M. (2017), "Improving travel decision support satisfaction with smart tourism technologies: A framework of tourist elaboration likelihood and self-efficacy", *Technological Forecasting and Social Change*, Vol. 123, pp. 330-341.
- Zeng, B., and Gerritsen, R., "What do we know about social media in tourism? A review", *Tourism Management Perspectives*, Vol. 10, pp. 27 – 36.

Digital Transformation of Museums: a Framework

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Abstract

This paper aims to shed light on the link between digitization processes and market strategies in Italian museums. It is also addressed to understand how digital skills, held or accessible by the museum, do affect the organization's capability to match technological innovation and strategy.

We have adopted the multi-case study approach. A sample of Italian museums has been investigated through semi-structured interviews addressed to their managers.

Cases show how digitization processes are mainly driven by museums' accessibility to technical skills, as well as mimetic and normative isomorphism processes seem having a non-secondary role. This often brings to underestimate the required alignment between digital contents, digital skills held by the cultural organizations, and types of users.

Some early managerial implications may derive from this study. In fact, managers' awareness about the positioning of the museum can raise, as they reflect on the consistency between implemented market strategies, technologies in use, and digital skills held or accessible by the museum itself.

Keywords - Museums, digital transformation, digital skills, alignment strategy-technology-skills

Paper type - Academic Research Paper

1 Introduction

The fruition of the cultural heritage has always represented, for Italy, one of the most relevant items for the purposes of tourism development in individual cities or territories. Digitization processes can play a key-role in developing museums' ability to attract audiences and, consequently, boosting tourist flows, especially where the single museum or the local museum system represent a reference point for a tourism destination.

There is a widespread awareness that cultural organizations can benefit in many ways from the adoption of digital technologies. Collection, conservation and access to the cultural heritage in novel, accessible and attractive ways demand for digitizing museums, as well as for designing methodologies to represent, manage and exploit cultural heritage data at different levels. In Italy, as well as in many other countries, heritage organizations are currently engaged in choices regarding the adoption of digital technologies. However, either the literature or the empirical evidence suggests that not always these choices are the result of a clear perception and of a careful reflection about opportunities and limitations linked with the adoption of digital artefacts and devices.

Our paper aims to shed light on the link between digitization processes and market strategies in Italian museums housed in historical sites. Consistently with the exploratory nature of research, we adopted a qualitative approach; this has been carried out through the multi-case method. We wonder how digital skills, held or accessible by the cultural organizations, do affect the organization's capability to align technological innovation and strategy in Italian museums.

In the following paragraph we briefly illustrate the theoretical background; in section 3 we outline the research objectives and methodology; in section 4 we present the results of our analysis; and lastly, in section 5 we debate about such findings; finally, section 6 outlines the limits and the perspectives of the research.

2 Theoretical background

The general framework of reference is constituted by the relationships that exist between the firm's strategic choices, the digitization processes, and the development of digital skills. The literature review has been circumscribed to the analysis of these relationships in museums, as well as to the identification of some possible classifications and taxonomies, related to competitive strategies, technologies, as well as to the so-called "digital skills" within cultural organizations.

Research on the processes of digitization of cultural heritage, and in particular of the museums' collections, has initially privileged the analysis of technologies for the preservation of works of art, and for their remote fruition (through the Internet), and then moved on the role and the impact of digital technologies for on-site fruition. To date, two themes still seem to us insufficiently investigated in the literature: that of the relationship between choices relating to technology and the market orientation of museum institutions; as well as the question of the adequacy of digital skills and the connected degree of technology acceptance.

As regards the first issue, references to the necessary alignment between the choices of technology adoption and the market strategies of the museums are sporadic (Bertacchini & Morando, 2013; Kane, Palmer, Phillips, Kiron & Buckley, 2015; Solima & Minguzzi, 2015). Much of the research considers the introduction of digital technologies in museums as an independent variable, from which implications on organizational strategy, as well as on roles and skills, may arise. In other studies, the

analysis of the digitization process leads to the identification of alternative digital approaches (Gombault, Allal-Chérif & Décamps, 2016; Dewdney, 2018).

The topic of digital skills, on the contrary, is much more debated, but issues concerning technology acceptance are often neglected. Studies on this topic are mainly concerned with the identification of some possible classification criteria; otherwise they focus on the opportunities associated with the emergence of new roles and the evolution of existing roles within cultural organizations (Parry, Eikhof., Barnes & Kispeter, 2018).

In short, in our opinion the main gaps in the literature can be traced a) in the almost total absence of a debate about the relationship between the role of digital technologies and market strategies; b) in the lack of attention to the question of technology acceptance, both on the side of museum employees and on the users' side. A deepening in these two fields of research seems really desirable, in order to support museum organizations to pursue adequate levels of efficiency and effectiveness in the digitization processes underway.

3 Research objectives, methodology, and data collection

The first aim of our research was to assess the coherence between digital technologies in use and the competitive strategy pursued by museums. Besides, we wanted to understand how digital skills, held by the museum, do affect the organization's capability to match technological innovation and strategy.

We adopted a qualitative research design, that we carried out through the multi-case study approach. Indeed, the multi-case method makes it possible to highlight a variety of situations, even diverging from one another, with the ultimate aim of contributing to the elaboration of an explanatory theory (Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Yin, 2009).

The sample has been built according to the following criteria: a) combination of historical and artistic importance of the site and relevance of the collections housed in it; b) variety of the sample, according to the logic of multi-case method. The choice to select a sample consisting of art collections hosted in ancient palaces, castles, or villas is linked to the belief that this combination extolls the opportunities inherent in the digital technologies for on-site fruition (e.g. virtual/augmented reality devices). A significant variety of the sample was obtained by considering the following characters: ownership, year of foundation, annual number of visitors, characteristics of the collections hosted.

The main data relating to each museum are summed up in Table 1, below.

Table 1: The sample investigated

	<i>Museum</i>	<i>Place</i>	<i>Opening</i>	<i>Ownership</i>	<i>Visitors (2017)</i>	<i>Type of heritage</i>
1	National Gallery of the Marche at Palazzo Ducale	Urbino	1912	Public (government)	164.000	Renaissance painting
2	Museums at	Mantova	1881	Public	323.000	Thematic exhibitions

	Palazzo Ducale			(government)		
3	Museum at La Venaria Reale	Torino	2008	Public-private network	1.049.000	Paintings and sculptures from the 15 th to the 17 th century. Thematic exhibitions
4	Museums at Castello Sforzesco	Milano	late 1800s	Public (Municipality)	450.000	Museums of archaeological finds, wooden sculptures, ancient art, decorative arts, musical instruments. Renaissance sculptures and paintings
5	San Domenico & Palazzo Romagnoli Museums	Forlì	2005	Public (Municipality)	20.000	Frescoes and paintings from the Middle Ages. Archaeological museum (forthcoming opening)
6	Pontifical Museum Santa Casa	Loreto (AN)	late 1800s	Public (government)	20.000	Paintings and tapestries from the 15 th to the 19 th century.
7	Museums at Castello Scaligero	Malcesine (VR)	1960	Public (Municipality)	150.000	Natural history museum & museum of the Venetian galleys
8	Bali Museum	Colli al Metauro (PU)	2004	Private	50.000	Science museum

Data was collected through semi-structured interviews addressed to the managers of the museums, with the aim of drawing up deeper insight into the features of digitizing processes. Interviews were performed in the period november 2018-april 2019, either at the office of the manager or by telephone. They have lasted from thirty minutes to an hour and followed a precompiled track. However, we left managers free to investigate further points. Three main questions were posed about the following issues: type of market strategy pursued by the museum; type of digital technologies/devices in use and reasons that has pushed museums to their adoption; range of digital skills held by managers or employees in the museum, or externally accessible (at universities, museum networks, consultants,...). The data collected through the interviews were integrated with those obtained from the analysis of the museums' website. This with the aim of analyzing the main features of the museum offer, the types of services offered, and the methods of communication and interaction with the relevant public.

As regards market strategies, our reference model was that by Bakhshi & Throsby (2012, built on McCarthy & Jinnett, 2001). They distinguish between audience broadening, diversifying, or deepening; where the first refers to the "capturing a larger share of the population already known to be audiences", the second to the attraction of "new groups of consumers that do not currently attend", and the third to the "increasing and/or intensifying the engagement of audiences" (Bakhshi & Throsby, 2012: 209).

As regards digital technologies, the taxonomy proposed in Styliani, Fotis, Kostas & Petros (2009) and the distinction by Bonacini (2011) between remote fruition technologies (e.g.: website, social networks, multimedia, database) and on-site fruition technologies (e.g.: info-points, touch-screens, VR/AR devices) was used.

Lastly, we distinguished between *technical* digital skills (technological skills on solutions, platforms, programming languages, which characterize ICT roles) and *applied* digital skills (ability to use software and devices by the decision makers and the employees involved in routine tasks), following the distinction proposed by AICA & Assintel (2017).

4 Findings

The analysis of the sample of museums has led to a significant wealth of information, related on the one hand to the market strategies pursued, on the other to the digitization processes, and to the methods in which digital skills are developed or accessed.

Evidence gathered allow us to identify some common traits: among these a sufficient awareness of the potential of digital technologies in the development of the attraction capacity of the museums themselves, and the common recognition of the scarcity of financial means to support the digitization processes. Moreover, the fear that the technologies allowing remote access to collections are at the expense of the decision to visit the museum are resized from the analysis.

Below, we illustrate the results of the analysis following the outline of the interviews conducted. We will first analyze the strategic behavior of museums, then the choices of introducing digital technologies; finally, the substance of the digital skills that support the processes in place.

4.1 Market strategies

The market strategies of the museums being analyzed are mainly oriented towards increasing the number of visitors (audience broadening). This trend is present in the different types of museums, but especially in the state museums, evidently pressured by the need to reach targets concerning the number of visitors. The strategy of expanding the public is absent in the museums that have already a high number of visitors and who believe that the time has come to deepen the relation with the existing public or to approach segments of the population that are traditionally not inclined to visit museums.

The strategy is rarely clear and unambiguous. On the contrary, in most cases the will to pursue multiple strategic objectives is declared. The strategy of audience broadening is combined with others, aimed now at audience deepening, now at audience diversifying. Finally, in a couple of cases, strategies of audience deepening and diversifying are combined.

In terms of alignment between strategies and technologies, we can hypothesize that both the multiplicity of strategic objectives and the choice to focus on widening the audience with an undifferentiated approach, represent situations in which it is not easy to discern which technologies are most consistent with what strategies. On the contrary, the strategies aimed at audience deepening or diversifying may offer more precise indications about the digitization path to go.

4.2 Digital technologies

The analyzed museums highlight different combinations of remote and on-site fruition technologies; however, if we also consider the digital devices to be installed in the short term, apart from a couple of extreme situations, differences appear to be fairly limited, in relation to the high variety of the sample. At the moment, we can say that none of the analyzed museums have reached the "digital transformation" stage; however, as at least in one case (Museums at Castello Sforzesco) this goal seems to be really at hand.

As regards remote access technologies, the use of websites and social networks is almost generalized, even if their contents vary considerably; in particular, the choice of making a virtual tour possible is an exception (Museums at Castello Sforzesco), and is openly opposed in other cases. The construction of digital archives is also quite widespread, but it follows different approaches and logics from case to case.

With regard to on-site fruition technologies, touchscreen applications are the most widespread, while there is a certain hesitancy with the adoption of VR / AR instruments, that is presumably due to the challenging management of these tools. On-site fruition technologies is the category in which a more pronounced dynamic is expected in the coming years; however, this dynamic appears to be conditioned by the future availability of resources.

As for the reasons factors that have influenced the decision to adopt digital technologies, it is quite evident as the example of other museums has played an important role, together with the proposals formulated by IT consultants. These two modes often occur, regardless of the nature of ownership or the size of the museums that have been studied. It can be said with some certainty that these two factors weighed much more than the analysis of the preferences of the audience. Hence, it seems possible to state that mimetic and normative isomorphism processes constitute a powerful driver of ongoing digital transformation processes.

4.3 Digital skills

With reference to digital skills, the survey has allowed us to gather information regarding both the competences currently held, and those that are expected to be developed in the coming years. At the moment, none of the sample museums can be said to be completely self-sufficient in terms of digital skills. However, the differences from one museum to another are considerable, with regard not only to the stock of skills currently held, but also the intention to develop them in the coming years.

At one extreme we find museums that, while having at their disposal only some applied skills, that are concentrated in a few roles, do not feel the need to rebalance a situation of marked dependence on the outside (universities, software companies and digital consultancy, etc.). At the other extreme, there are museums that, despite being already in possession of some technical skills, other than the applied ones, show a clear orientation to further develop them and to make them widespread among all the roles. This in order to reduce their dependence on the outside, which does not give sufficient guarantees with regard to the development of the systems and their maintenance. Even the

simple availability of widespread applied skills seems to constitute a good result, because it is believed that an adequate level of digital literacy can favor the development of ideas and proposals to make the digital equipment of the museum more in line with the current and potential audience.

The analysis suggests that the proprietary nature of the museum can be a relevant factor for the possibility of developing a wide range of digital skills internally. From this point of view, private museums and civic museums that are part of an integrated circuit seem to be favored: in fact, for the latter, there is the possibility of developing at central level (e.g., municipality) some technical skills, without the need to develop them internally in each museum.

Table 2: Market strategy, technologies in use, and digital skills

	<i>Museum</i>	<i>Market strategy</i>	<i>Digital technologies</i>		<i>Digital skills</i>	
			<i>Off-site</i>	<i>On-site</i>	<i>Currently</i>	<i>To be developed</i>
1	National Gallery of the Marche at Palazzo Ducale (Urbino)	Audience broadening Audience deepening	Website Social networks Digital archives (under construction)	Virtual reality, Augmented reality, eye tracking technology (to be installed)	Internal, concentrated (applied) External (technical)	No change
2	Museums at Palazzo Ducale (Mantova)	Audience broadening	Website Social networks	Touchscreen station (out of order) Digital info-point	Internal, concentrated (applied) External (technical)	Development of internal skills (technical), if financial resources are available
3	Museum at La Venaria Reale (Torino)	Audience deepening	Website Social networks Digital archives Chatbots technology (to be installed)	Multimedia device	Internal, widespread (applied) External (technical)	Digital Manager to coordinate digital strategy
4	Museums at Castello Sforzesco (Milano)	Audience deepening Audience diversifying	Website Newsletter Social networks Digital archives Virtual Tour	QR code Touchscreen stations Multimedia device Virtual Reality	Internal, widespread (applied) Internal, concentrated, and external (technical)	Less use of external skills
5	San Domenico & Palazzo Romagnoli Museums (Forlì)	Audience deepening Audience broadening	Website Newsletter Social networks PatER Portal	Touchscreen stations Smartphone e tablet apps QR code (to be installed)	Internal, widespread (applied) Internal, concentrated (technical)	Deepening of internal skills (technical)
6	Pontifical Museum Santa Casa (Loreto, AN)	Audience broadening	Website Social networks (to be installed)	Touchscreen stations (to be installed)	External (applied and technical)	Deepening of internal skills (applied)

7	Museums at Castello Scaligero (Malcesine, VR)	Audience broadening Audience diversifying	Website (municipality) Digital archives	Touchscreen stations Multimedia device	Internal, widespread (applied) External (technical)	Internal development (applied), if financial resources are available
8	Bali Museum (Colli al Meatu, PU)	Audience deepening Audience diversifying	Website Newsletter Social networks Online use of astronomical observatory	QR code Multimedia device <i>(to be installed)</i>	Internal, widespread (applied) Internal, concentrated, and external (technical)	Deepening of internal skills (technical)

5 Discussion

Museums that adopt digital technologies aimed at facilitate the off-site fruition of the heritage are those in which, generally, applied skills prevail or are exclusive. These organizations focus on activation of new channels to reach the audience. To achieve this goal, they just adopt platforms (e.g. social media or websites) with a low barrier to enter, but which simply "tell" about the activities carried out in the museum (e.g. events, news, etc.). This approach can be defined as "storytellers". When the museum integrates applied skills with technical skills it can offer online access to the collections, going beyond a mere narration of the heritage (for example, through online access to the archive or virtual tours). This is an approach to the use of technology that we could call "wikipedian", because it aims to facilitate the accessibility of the heritage even to people (physically) far from the museum.

In turn, museums that choose to use technology as a tool to improve the on-site experience seem to be guided by two main options, which are linked to the type of skills (technical or applied) to which they have access.

The first option tends to use technology to spectacularize the visiting experience. Usually hardware devices (e.g. augmented reality devices) are implemented to allow visitors to access specific contents that integrate physical accessibility. Since these museums add a multimedia component to the on-site experience, this approach defines them as "entertainers". This option assumes that the museum has access to all the (technical) skills needed to implement this type of solution within the museum.

The second option, on the other hand, sees technology as a tool to facilitate the orientation of visitors within the museum, while improving the interpretation of the exposed heritage, through touchscreens or other devices that can provide those information that can improve the accessibility from a visitor perspective. Museums that adopt this approach can therefore be defined as "navigators", and they choose it when the set of accessible skills is mainly applied.

6 Conclusion

This paper represents a first attempt in understanding the phenomenon of digital transformation in the Italian museums. The variety of the analyzed sample allowed us to identify different approaches to digitization processes. Moreover, our research provided new insight in order to understand how held or accessible digital skills drives decision-making process regarding the deployment of technologies. Finally, our findings enforces our initial assumption and outlines the need of a better alignment between the choices concerning the adoption of fruition technologies, and the market orientation.

Our findings have some managerial and theoretical implications. As for the first ones, we believe that the reflections developed in the paper can help managers to choose in a more conscious way the adoption of digital technologies, evaluating in particular their sustainability over time, based on possessed and accessible skills.. Instead, as far as theoretical implications are concerned, our study contributes to strengthen the research concerning the processes of digital transformation in museums, by emphasizing the need to jointly consider the choices relating to strategy, technology and key-competences.

Among the limitations of the research we underline the fact that we have carried out only one interview for each museum. A further limitation concerns the fact that we have simply obtained a “snapshot” of the progress of digitization processes, whereas the ongoing process of digitization should benefit for a prolonged observation, in the logic of a longitudinal research.

Based on these limitations, it is possible to identify two lines of research development. On the one hand, it will be interesting to monitor how the analyzed museums proceed on the digitalisation path they have taken; on the other hand, it will be equally useful to test the conceptual model proposed through a quantitative survey on a large-sized sample, so as to identify possible correlations between some features of museums and ways of digital transformation.

References

- AICA & Assintel (2017). Osservatorio delle competenze digitali. https://www.agid.gov.it/sites/default/files/repository_files/osservatorio_competenze_digitali_2017.pdf.
- Bakhshi, H. & Throsby, D. (2012). “New technologies in cultural institutions: theory, evidence and policy implications”, *International Journal of Cultural Policy*, Vol. 18, No. 2, pp. 205-222.
- Bertacchini, E., & Morando, F. (2013). “The future of museums in the digital age: New models for access to and use of digital collections”. *International Journal of Arts Management*, Vol. 15, No. 2, pp. 60-72.
- Bonacini, E. (2011). “Nuove tecnologie per la fruizione e valorizzazione del patrimonio culturale”. Roma, Aracne.
- Dewdney, A. (2018). “What Is the current fascination with VR on the part of museums and art galleries?” *Contemporary Art Society Annual Conference: The Virtual in Museums: Hot Medium?*
- Eisenhardt, K.M. (1989). “Building theories from case study research”, *Academy of Management Review*, Vol. 14, No.4, pp. 532-550.

- Eisenhardt, K.M., & Graebner, M.E. (2007). "Theory Building from Cases: Opportunities and Challenges", *Academy of Management Journal*, Vol. 50, No. 1, pp. 25-32.
- Gombault, A., Allal-Chérif, O., & Décamps, A. (2016). "ICT adoption in heritage organizations: Crossing the chasm". *Journal of Business Research*, Vol. 69, No. 11, pp. 5135-5140.
- Kane, G.C., Palmer, D., Phillips, A.N., Kiron, D., & Buckley, N. (2015). "Strategy, not technology, drives digital transformation". *MIT Sloan Management Review and Deloitte University Press*, Vol. 14, pp. 1-25.
- McCarthy, K. & Jinnett, K., (2001). "A new framework for building participation in the arts". *Rand Corporation*.
- Parry, R., Eikhof, D.R., Barnes, S.A., & Kispeter, E. (2018). "Development, supply, deployment, demand: Balancing the museum digital skills ecosystem". First findings of the 'One by One' national digital literacy project. *Museums and the Web*. <https://mw18.mwconf.org/paper/development-supply-deployment-demand-balancing-the-museum-digital-skills-ecosystem-first-findings-of-the-one-by-one-national-digital-literacy-project/>.
- Solima, L., & Minguzzi, A. (2015). "Innovare il rapporto tra musei, visitatori ed utenti attraverso le relazioni digitali". *Economia e diritto del terziario*, No. 1, pp. 41-61.
- Styliani, S., Fotis, L., Kostas, K., & Petros, P. (2009). "Virtual museums, a survey and some issues for consideration". *Journal of cultural Heritage*, Vol. 10, No. 4, pp. 520-528.
- Yin, R.K. (2009). "Case Study Research. Design and Methods", Second Edition, Thousand Oaks, CA: Sage Publications.

The Role of Digital Technology in Food Retailing Ecosystem

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Abstract

Nowadays the retail industry is changing so fast by means of digitalization processes. Digital and interactive technologies are mediating relationships and strategies among actors and modifying the way through retailers manage their value propositions. This paper applies an ecosystem perspective and represents a preliminary study about the contribution of technology to the workability, management, and survival of retail ecosystem. In particular the work compares service ecosystem features with retail industry dynamics focusing on the role of technology. A qualitative methodology has been adopted emphasizing specific focus useful to further academic research and to practitioners in order to consider retail sector as an ecosystem. Specifically, findings achieved are threefold. Firstly, this paper presents the technology as a key actor able to give a 'soul' to the ecosystem multiplying the relationships and improving the resource integration. Secondly, the work considers the relationship management as a key feature to deal with complexity and to help the retail ecosystem to survive during the time. Finally, considers the retailer as the actor able to balance the equilibrium among actors in a retail ecosystem, due to the multiplicity of actors involved and directly connected and the mutual influence they play.

Keywords – Digital technology, ecosystem, food, retailing

1 Introduction

Nowadays the digitalization process affecting people daily life is also broadly transforming many elements of the retailing industry (Hagberg *et al.*, 2017; Hagberg *et al.*, 2016) in general, and in food retail industry in particular. Digital technologies – considered in a wide sense and including interactive technologies (Huang, 2019; Poushneh, 2018) such as: Augmented Reality, Virtual Reality, Internet of Things, and so on – are mediating relationships among actors. Indeed, these technologies are modifying the way through retailers have to manage their relationships (both upstream and downstream), strategies, and their value propositions (Balaji and Roy, 2017). The widening of scholars' debate and of supply chain impact is mirrored even in the attention paid to food supply chain is growing, since they are considered as a driver of sustainability for several actors and in various perspective.

Retail sector today has a key role as sensitive and connective actor in the network of interacting actors; the cooperative retailers, retail chains, large scale distribution represent the organisations able to sense and feel the market transformation and in specific sectors, retailers are able to influence the market changing (Sansone *et al.*, 2017). Within the last years around the world, within the private labels evolution, retail sector has become an influencer (Briggs *et al.*, 2018) about customer decisions and in some cases, lifestyle and habits. This contributed in determining actors evolution and competition in this industry that involve supply chain and, in general, supply network, in particular the influences involve relationships between producers, retailers and customers.

Activities based on resource integration could be represented as belonging to systems of value founded over SMART concepts (Spohrer and Maglio, 2010a) and research streams about Service Systems in a hypothetical SMART planet (Spohrer and Maglio, 2010b) present the relevant role of technology in providing value. Each action, relation and interaction between supply networks (retail industry included) is (and it will be) managed and optimized by technology. So, technology is the main entity able to improve the opportunity of interaction between direct and indirect involved actors in systems.

Interactive technologies (Huang, 2019; Poushneh, 2018) contribute to shed the light on retail evolution direction and its use could represent elements of differentiation between chains, a relevant asset in gaining competitive advantage and a powerful tool to get realistic retail ecosystem.

2 Theoretical Background

2.1 Retail development in complex markets

Economy and world's relationships are affected by complexity due to a multiplicity of forces that act on organizations, people, politics and markets. The technology, nowadays, it is affecting the everyday life from company and customer side and it represents a key point in increasing (or reducing) complexity in relationships. Focusing on retail industry, many actors are involved in the value proposition activity. In this context value chains

and supply networks assume a role that go beyond the classic supply optimization and they become resource integrators able to contribute in generating benefits for every actor involved in the system, customer included (Groves, 2001). The traditional retail industry goals identified in providing goods, services and giving an impulse to the economy (Ilbery and Maye, 2006; Paddison and Calderwood, 2007) is aggravated by emerging roles. In particular retail sector has to stimulate and provide innovation (Pantano, 2014), integrate its knowledge within the supply network with key strategic factors such as service and technology (Kandampully, 2012) and with supply customisation looking at changes in consumption and lifestyle (De Kervenoael *et al.*, 2006; Woodliffe, 2004).

Particularly, large scale retail trade reacts to the environment stimuli adapting formats, concepts, marketing, and management approaches (Sansone *et al.*, 2017; Bruni, 2014) generating effects for industrial companies, logistics and change in consumer behaviour. The complex scenario that is affecting retail industry, customers and production needs to be studied eventually thinking to new paradigms and frameworks able to obtain more integrated perspectives and points of view. The ecosystem approach seems to be useful to the goal.

2.2 Ecosystems: a brief theoretical background in business and management

Complexity, fast communication, technologies, networks and relationships characterized this era are going to define new paradigms where could be useful to represent the actors interaction scenario in every field of interest. Considering the different outlooks in social science literature, the ecosystem seems to be a useful framework to study and interpret the actors relationships in social contexts (Moore, 1993; 2013). Different authors are working around this topic (Aarikka-Stenroos and Ritala, 2017) by multiple perspectives with a focus on business context. Literature (Aarikka-Stenroos and Ritala, 2017) is interested in describing the characteristics of interdependence and co-evolution of the business and innovation activities using ecosystem paradigm. The interdependence is represented by systemic characteristics of ecosystem and mutual dependence and continuous change of perspectives by events and activities within the ecosystem and the co-evolution is studied as ecosystem characteristic based on collaborative forces between the actors directly and indirectly involved in the ecosystem survival.

The ecosystem research branch is complex and relatively new in business marketing and management. Holmqvist and Diaz Ruiz (2017) present a contribution selecting scientific manuscripts that present three principal perspectives able to represent the same resources integration but explained by names and different points of view: a) markets (Araujo and Kjellberg, 2009); b) business networks (Cantù *et al.*, 2012); c) service ecosystems (Vargo and Akaka, 2012). They found contact points but differences in interpretation and definitions respect to these aggregations (spontaneous or finalized). Long-lasting relationships and interdependencies are identified as similar characteristics but at the same time, only the service ecosystem approach includes the customer as part of the business context management. In particular service ecosystems include the

customers as part of ecosystems and present the customer satisfaction as final purpose (Wieland *et al.*, 2015). As per (Aarikka-Stenroos *et al.*, 2017) 4 groups of researches express the ecosystem characteristics: a) competition and evolution; b) emergence and disruption; c) stable business exchange; d) value co-creation.

2.3 Ecosystem and retail

Diffusely the concept of ecosystem is applied in retail sector identifying, theoretically and practically, the wide relationships between retailers and suppliers in market contexts. Widely authors refer to retail in practical and theoretical works around ecosystems particularly following business approach (Moore, 1993; 2013) and service approaches (Aarikka-Stenroos and Ritala, 2017). Further Barile and Saviano (2014) state that a change in perspective and a new approach to retail service marketing using a service view is necessary.

Following a systemic and service approach, Sansone *et al.*, (2018) state that the ecosystem paradigm could be used to explain the latent and modern concept of retail and to express the process of interaction among a multiplicity and variety of emerging institutions through resource integrations in the retail market. Food supply chain and retailing set of actors as an ecosystem (Macfadyen *et al.*, 2015) is based on the need to consider the multiple roles and activities played to complete food retailing, moving, for instance, from the field to the table. Practitioners are aligned to scholars in defining the retail context as an ecosystem and in identifying the role of technologies as pivotal in shaping the ecosystem through changing relationships (IDC, 2016).

The retail context (food and no-food) should search for new paradigms to deep the pivots of the next steps in a future characterized by resource integration with the manufacture industry and with customers and related customer associations.

Anyway, it is still needed to understand how these actors negotiate and – when needed – counterbalance their interests when diverging. In food retail industry for instance, local farmers, big players of the food retailing industry, consumers, and all the actors surrounding the triads among the actors mentioned before (Frishammar *et al.*, 2018), should be considered in order to describe the interplay they have as a win-win game or a ‘zero-sum’ strategy. Aiming at understanding the dynamics describing how this clash takes place, a depiction of the retail ecosystem is needed and the role technology has in shaping it is the first step to be done. Technology has been considered in relation to retail ecosystem as a way to shape interactions with customers (Balaji and Roy, 2017), in different ways from a country to another (Child *et al.*, 2015), leading to industry transformation (Hänninen *et al.*, 2018).

2.4 Ecosystem and technology

Following a B2C perspective, this research is framing retail as an ecosystem, as in the pioneering consideration by Demirkan and Spohrer (2014), as they identified technology as a factor modifying society and retailing contexts, offering new solutions, and enhancing customer involvement and experiences.

The relevance in using ecosystem framework in explaining retail dynamics and the relevance of technological studies within retail evolution and customer relationships is strictly related to the fact that retail is always been an integral part of society. In retail evolution technology has always played a role as the first author of change. In particular, nowadays, the digital transformation affecting society and retail digitalization (Hagberg *et al.*, 2016; 2017) are modifying retail sector and shopping experience helping retailers to survive (Berman, 2019) and satisfy consumers needs'. On the same way, technology gained the a relevant role in customer life, stimulating customer expectations and needs (Hopping, 2000). This era is considered as the "fast era" with several example in retail context such as fast food, fast fashion, fast live in general, and in the same way the consumer is now changing faster. Nowadays, a growing number of smart consumer, digitally-connected and price-conscious are exploiting various retail channels (online and offline) to find products at the price they want (Aubrey and Judge, 2012). Fundamentally digital technologies mean as interactive technologies (Huang, 2019; Javornik, 2016; Poushneh, 2018) in the past few decades shown a significant implication for a traditional form of retail by emphasising the engagement of customers involved in the shopping process (Yadav and Pavlou 2014).

In digital technology connectivity and interactivity represent the principal features (Huang, 2019; Berman, 2019; Yim and Park, 2019) able and useful to increase the willingness to buy of customers (Poncin and Mimoun, 2014). By considering on one side the main characteristics of digital technologies such as high connectivity, interactivity, fast usage, and on the other side the expertise of consumers such as greater awareness in the use of technologies, greater shopping skills and increasingly demanding needs, emerges the necessity to consider the technology as the principal enabler of retail ecosystem.

Studies showing benefits of immersive technologies such as virtual and augmented reality are becoming numerous, specially to define main feature for the creation of innovative and efficient stores (Pantano and Servidio, 2012). The retailers awareness in the use of technology is translated in the application of a variety of systems, such as self-service technologies equipped with interactive touch screen displays, 3D virtual reality systems, mobile apps, and so on (Demirkan and Spohrer, 2014; Dennis et al., 2014; Rese et al., 2014; Pantano, 2016). Benefits come from these technologies are related with more realistic interactions, customized virtual products, augmented products and environments in order to catch the consumer's attention (Lee and Chung, 2008) both online and offline. By considering as an example an online store based on 3D virtual environments, users can explore and experience products and service directly through Internet in a more immersive and interactive manner (Lee and Chung, 2008; Liu, 2010). In the same way with the support of Augmented Reality in a physical store, for example, consumers can perform several activities such as interacting with the products, visualizing details, requesting and findings customized information able and useful to influence their final purchasing decision (Liu, 2010).

This broad overview on the relevance of technology in retailing considered as an ecosystem, is further highlighted by Finsterwalder (2018) to stress the ties linkages

among engagement, value, and actors' ties and to call for further research in order to clarify how technologies affect customers engagement in services industries. Similarly, technology can affect consumer behaviour in their decision-making process in food stores (Pantano and Priporas, 2016). Finally, in this optic the technology could be defined and also considered as the engine able to create a new vision of retail industry.

Resources integration, actors interaction and company-customer relationships are guaranteed by technology. The power balance between the role of actors within the network of relationships is regulated by technology evolution and application. The ecosystem paradigm contribute in explaining this process

3 Research Aim

The research focus is to grasp more meanings on the arising definition of retail ecosystem. In line with the theoretical background performed above, authors will compare the main features of service ecosystems with the ones of retail industry. Moreover, attention will be paid to technology in defining and identifying these key elements, since it has emerged as a relevant element in creating and steering the multiple set of interactions.

Due to the novelty of the debate on what a retail ecosystem, the attention has been drawn to how a retail ecosystem is shaped and which are the key issues framing the ongoing debate. Additionally, these key issues shaping the notions of retail ecosystem have been further investigated through the lens of new technologies to understand if and how they can support the continuous framing and reframing of ecosystems as emerged from the literature.

The literature considered in this research stems from the concept of ecosystems and moves towards the retail ecosystems. Recent contributions described ecosystems as contexts featured by the following key issues:

- complexity
- dynamicity and change
- interactions
- mutual dependence
- long-term perspective

As a consequence, the next section will be based on the parallel analysis of ecosystem literature and retail studies on the five issues above, in order to propose a path towards the understanding of retail ecosystems.

4 Findings

The overview on retail ecosystems - and more generally on the retailing operators along the supply chain - seems to mirror the same features than service ecosystem. The cross-fertilization between the two literature led us to highlight key insights in describing what retail ecosystem is.

Table 1. Ecosystem key elements' and retail studies

Key issues	Ecosystem literature	Retail studies
Complexity	The ecosystem approach is considered as suitable to analyse ecosystems, both as a feature and as a way to analyse the multiple context of interactions (Aarikka-Stenroos and Ritala, 2017)	Retail is an industry in continuous evolution causing (and getting affected by) consumption modification (Pantano and Priporas, 2016)
Dynamicity and change	The dynamicity of interactions and subsequent changes occurring in an ecosystem lead to disruption as a continuous process leading an ecosystem to be shaped and re-shaped (Aarikka-Stenroos <i>et al.</i> 2017)	The digitalization process is broadly transforming many elements of the retailing industry increasing the level of dynamicity and change approach (Hagberg <i>et al.</i> , 2016; Hagberg <i>et al.</i> , 2017)
Interactions	Multiple actors in an ecosystem are linked one another because of an intricacy of relationships with mutual influence. In such a web of relationships, technology is offering an opportunity to both manage and further advance them. (Balaji and Roy, 2017)	Retail sector has to stimulate and provide innovation (Pantano, 2014), integrate its knowledge within the supply network with key strategic factors such as service and technology (Kandampully, 2012) and with supply customisation looking at changes in consumption and lifestyle (Woodliffe, 2004; De Kervenoael <i>et al.</i> , 2006).
Mutual dependence	The interactions among actors lead to continuous change in the workability of an ecosystem and since connectivity takes place with no time and space boundaries, the influence actors can play one another is constant. (Huang, 2019)	Large scale retail trade reacts to the environment stimuli adapting formats, concepts, marketing, and management approaches (Bruni, 2014; Sansone <i>et al.</i> , 2017) generating effects for industrial companies, logistics and change in consumer behaviour
Long-term perspective	An ecosystem is evolving over time and this is due to the need to sustain the survival of the ecosystem itself and the actors shaping it. This is mirroring some more the mutual influence of actors. (Moore, 2006; Aarikka-Stenroos and Ritala, 2017)	Traditionally retail industry goal is in providing goods, services and giving an impulse to the economy during the time having a social and economic role (Ilbery and Maye, 2006; Paddison and Calderwood, 2007)

Source: Authors data elaboration

Based on the contributions highlighted in the table above (Table 1) and the key elements identified as determinants of an ecosystem, we derived the following research propositions.

RPI: Complexity describes retail ecosystems as continuously evolving, even through technological innovation

The debate on complexity derives from well-established studies on supply chain and mirrors the multiple mechanisms affecting operations in retail. An ecosystem approach deals with such a feature, since complexity is an inner feature of an ecosystem and makes actor aware of the need to consider a wide range of elements in their decision-making processes in a retail ecosystem. Technology can support these processes and the management of complexity.

RP2: Dynamicity and change depict the transformation of a retail ecosystem and digitalization supports this dynamics

In line with the previous proposition, change is constantly taking place in retail ecosystems, due to the features of all actors and the constant involvement of new ones; this is an innate feature of an open context as an ecosystem is. Thus, technologies can be helpful in tracking these changes and dealing with them, together with offering the opportunity to make this change profitable.

RP3: Multiple interactions lead to constantly rearrange a retail ecosystem; consumer behaviour, innovation and their interplay affect the set of interactions.

A wide set of interactions is the essence of a retail ecosystem, in order to favour its workability and as a way to describe what happens in such a dynamic context the intricacy of interaction makes strategies and consumption styles as constantly changing elements, leading retail ecosystems to instability. Technology can represent a way to deal with this feature and support the ecosystem's reaction to new interactions.

RP4: Actors are mutually influencing through stimuli, thus the influence in a retail ecosystem is mutual and evolving.

The above-mentioned emerging of changes due to new actors and behaviours lead a retail ecosystem to be affected because of the effects the actors can play one another. It is not a one-way process, due to the action-reaction effect. Thus, all actors are changing and adapting their behaviour because of the dependence on other actors in the ecosystem. Technology can represent a way to negotiate diverging goals and make dependence a lever to the further development of the retail ecosystem.

RP5: Time and intensity of interactions affect the perspective of a retail ecosystem, since survival is a pivotal aim for every actor and for the entire ecosystem.

Survival is a key goal for a retail ecosystem as for all ecosystems; while this is an easy to be understood feature, it is hard to deal with this goal in such a changing environment, because evolution, shaping and reshaping and new needs are affecting the inner mechanisms of a retail ecosystem. At the same time the concentration of interactions intensity automatically switches the relevance of focal nodes within the retail ecosystem. Improvements in this domain can be achieved by implementing technology and favouring social and economic results of a retail ecosystem.

5 Conclusion

This work represents a preliminary study about retail ecosystem, through the consideration of the advances in ecosystem literature and the contribution of technology to the workability, management, and survival of ecosystem.

In this first focus, the work presents the technology as a key actor able to give a 'soul' to the ecosystem and, in particular, able to keep strong relationships between the involved

actors; the management of relationships and changes is a key feature to deal with complexity - as in RP1 - and to aim at keeping alive the retail ecosystem in a long-time perspective - as in RP5 - to ensure the achievement of fruitful conditions in complex conditions depending on evolution and change. The retail ecosystem should be searching for a condition of equilibrium between actors relationships and this path stimulates continuous change in actors interactions. Interactions and their intensity affect change, thus the time perspective is something not-to-be-missed when debating and considering a retail ecosystem.

Technology works at first as a 'tool of links' but in a second level of interpretation, in particular applying the advanced technology, every device, software and technological tool gives meanings, contents and multiple connections increasing the opportunity of interaction (knowledge) between the involved actors. Each actor in the retail ecosystem has the opportunity to participate influencing the trends, the ecosystem interpretation and, of course, the ecosystem survival. The relevant role of technology emerges in retail ecosystem because it permits the emerging of ecosystem's key features through stimuli of actors dynamicity. The role of retailer is not only the simple distribution of good but it represents an intelligent actor able to manage its own activity and intervention within the ecosystem, considering that the source of ideas, insights and innovation could come from each actor directly or indirectly involved within the ecosystem (suppliers, manufacturers, customers, others). It is possible to assume that retail ecosystem should contain high number of involved actors (customer included), high levels of innovative technology, shared knowledge and low level of hierarchy between actors involved .

The 'relational weight' of each actor in the ecosystem. In some situations within the actual and modern market relationships, retailer emerges as a relevant actor in ecosystem able to influence the whole trend in terms of production, distribution, times, needs and customer knowledge. The future seems to be strongly characterized by the increasing role of retailer as an actor able to sense, feel and manage the relationship between offering and demand (Sansone *et al.* 2017) and, at the same time, the retailer should be the actor able to balance the equilibrium among actors in a retail ecosystem, due to the multiplicity of actors involved and directly connected - as in RP3 - and the mutual influence they play - as in RP4. Of course this relationship is at the base of cooperation between retailers and their partners in manufacture for private label projects but is even increasing in relationships between retailers and industrial manufacturers.

Although in traditional marketing approach the customer has always the power on the production and distribution network because the customer is the last in the chain able to choose, in technological and digital retail ecosystem it is impossible to understand 'a priori' which hands hold the power in influencing the future of consumption; the customer is always a relevant actor but in the ecosystem environment the influences in purchasing could come from retailers strategy (private label for instance in some markets has gaining over 40% in market share for sales in food retailers market) and, of course, by manufacturers; this is due to the dynamicity of the retail ecosystem - as in RP2 - and the wide set of interaction among actors, innovation, and technology - as in RP3. Digital technology represents a tool to optimize, control, diffuse knowledge and, of course to

make influence, stimulating and involving customer to co-create the value that he/she will choose. Of course the retailers have the opportunity to influence the market but the trend in value co-creation and the use of social network sites could switch parts of the influence power on the hands of other actors involved. It depends on the recognized role and awareness in the value co-creation process; this process is emerging as depending on several actors and it shapes a complex decision-making process - as in RP1 - due to the continuous changes - as in RP2 - taking place in the retail ecosystem.

Further questions should be solved in next works. For example, in terms of relationships between customers, manufacturers and retailers in terms of industrial, private label and local products. The same ecosystem is able to generate different effects for different offerings because the success in terms of sales of the different offerings (industrial products, private label products and local products) it depends by the efforts of the ecosystem's actors in generating awareness and relevance of the offerings with the interested customers. For this reason, for industrial goods the awareness is mainly generated by the industrial company and supported by the retailer in the final phase; for private label products the efforts in awareness and relevance is mainly generated by the retailer efforts in terms of strategic role of private label. Local productions, not included in private label projects and strategies are in the middle. The local productions have no strong support by the manufacturers (because often the manufacturers are small and medium enterprises not really able to manage relationships with retail ecosystem), no strong support by retailers (because at least retailer prefers to support local products in private label offerings) and a limited customer awareness. For this reason, the relevance of local productions and the representation of these offerings within the retailers assortments depends by the ecosystem's efforts in considering the integrated activity of each actor and the cooperation toward the survival of the ecosystem. Each actor should contribute in supporting the local production giving benefits to the local manufacturers (preserving the specializations and cultural identity), to the customers (that increase opportunity to choose within retail assortment) and to the retailers (they differentiate the assortments going beyond the dichotomy represented by the industrial and private label goods). That approach could represent a further set of activities that could be studied in next researches.

References

- Aarikka-Stenroos, L., and Ritala, P. (2017) "Network management in the era of ecosystem: systematic review and management framework", *Industrial Marketing Management*, 67, 23-36.
- Araujo, L. and Kjellberg, H. (2009), "Shaping exchanges, performing markets: the study of marketing practices", in Maclaran, P., Saren, M., Stern, B.B. and Tadajewski, M. (Eds), Sage, London, pp. 195-218.
- Aubrey, C., and Judge, D. (2012). Re-imagine retail: Why store innovation is key to a brand's growth in the 'new normal', digitally-connected and transparent world. *Journal of Brand Strategy*, 1(1), 31-39.
- Balaji, M. S., and Roy, S. K. (2017). Value co-creation with Internet of things technology in the retail industry. *Journal of Marketing Management*, 33(1-2), 7-31.

- Berman, B. (2019), "Flatlined: Combatting the death of retail stores", *Business Horizons*, Vol 62 No.1, 75-82.
- Briggs, E., Deretti, S., & Kato, H. T. (2018). Linking organizational service orientation to retailer profitability: Insights from the service-profit chain. *Journal of Business Research*.
- Bruni R. (2014), *Dinamiche impresa-contesto-cliente e retail di prossimità*, Aracne, Roma.
- Caboni F., Bruni R., Colamattéo A., (2018) "Augmented reality (AR) in expressing place through food" Tomorrow's Food Travel (TFT) Conference, University of Gothenburg, Book of Abstract Conference.
- Cantù, C., Corsaro, D. and Snehota, I. (2012), "Roles of actors in combining resources into complex solutions", *Journal of Business Research*, Vol. 65 No. 2, pp. 139-150.
- Child, P., Kilroy, T., and Naylor, J. (2015). Modern grocery and the emerging-market consumer: A complicated courtship. *McKinsey Quarterly*.
- De Kervenoael R., Hallsworth A. Clarke I. (2006), "Macro-level change and micro level effects: a twenty-year perspective on changing grocery shopping behaviour in Britain", *Journal of Retailing and Consumer Services*, vol. 13, n. 6, pp. 381-92.
- Dennis, C., Brakus, J., Gupta, S., Alamanos, E., 2014. The effect of digital signage on shoppers' behavior: the role of evoked experience. *J. Bus. Res.* 67 (11), 2250–2257.
- Demirkan, H., and Spohrer, J. (2014) "Developing a framework to improve virtual shopping in digital malls with intelligent self-service systems", *Journal of Retailing and Consumer Services*, 21(5), 860-868.
- FAO (2015) Innovative Short Food Supply Chain management Retrieved from: <http://www.fao.org/family-farming/detail/es/c/410251/>
- Finsterwalder, J. (2018) "A 360-degree view of actor engagement in service co-creation", *Journal of Retailing and Consumer Services*, 40, 276-278.
- Frishammar, J., Cenamor, J., Cavalli-Björkman, H., Hernell, E., and Carlsson, J. (2018). Digital strategies for two-sided markets: A case study of shopping malls. *Decision Support Systems*, 108, 34-44.
- Groves A.M. (2001), "Authentic British food products: a review of consumer perceptions", *International Journal of Consumer Studies*, vol. 25, n. 3, pp. 246-54.
- Hagberg, J., Sundstrom, M., and Egels-Zandén, N. (2016) "The digitalization of retailing: an exploratory framework", *International Journal of Retail & Distribution Management*, 44(7), 694-712.
- Hagberg, J., Jonsson, A. and Egels-Zandén, N. (2017), "Retail digitalization: Implications for physical stores", *Journal of Retailing and Consumer Services*, Vol. 39, pp.264-269.
- Hänninen, M., Smedlund, A., & Mitronen, L. (2018). Digitalization in retailing: multi-sided platforms as drivers of industry transformation. *Baltic Journal of Management*, 13(2), 152-168.
- Huang, T. L. (2019), "Psychological mechanisms of brand love and information technology identity in virtual retail environments", *Journal of Retailing and Consumer Services*, Vol. 47, pp. 251-264.
- Holmqvist, J., and Diaz Ruiz, C. (2017). Service ecosystems, markets and business networks: What is the difference? A horizontal literature review. *The TQM Journal*, 29(6), 800-810.
- Hopping, D. (2000). Technology in retail. *Technology in Society*, 22(1), 63-74.
- Javornik A. (2016), "It's an illusion, but it looks real! Consumer affective, cognitive and behavioural responses to augmented reality applications", *Journal of Marketing Management*, Vol.32, pp.987–1011.
- IDC (2016), IoT White Paper, available at http://www.digitalistmag.com/files/2016/03/IDC_IoT_white_paper_Mar2016.pdf
- Ilbery B., Maye D. (2006), "Retailing local food in the Scottish-English borders: a supply chain

- perspective”, *Geoforum*, vol. 37, n. 3, pp. 352-367.
- Kandampully, J. (2012). *Service as the new paradigm in retailing*, *Service Management*, Springer, New York, NY, pp.1-6
- Lee, H., Chung, N., Jung, T., 2015. Examining the cultural differences in acceptance of mobile augmented reality: comparison of South Korea and Ireland. In *Proceedings of Information and Communication Technologies in Tourism 2015*. Springer International Publishing, Wien, Austria, pp. 477–491.
- Liu, C.-L., 2010. The impact of goods-classification and landmarks for spatial knowledge and goods-finding in the elderly within a 3D virtual store. *Computers in Human Behavior*, 26 (6), 1777–1786.
- Long, T. B., Looijen, A., and Blok, V. (2018). Critical success factors for the transition to business models for sustainability in the food and beverage industry in the Netherlands. *Journal of cleaner production*, 175, 82-95.
- Macfadyen, S., Tylianakis, J. M., Letourneau, D. K., Benton, T. G., Tittone, P., Perring, M. P., ... and Okabe, K. (2015). The role of food retailers in improving resilience in global food supply. *Global Food Security*, 7, 1-8.
- Moore, J. F. (1993) “Predators and prey: a new ecology of competition”, *Harvard business review*, 71(3), 75-86.
- Moore, J. F. (2013). Shared purpose: A thousand business ecosystems, a worldwide connected community, and the future. Retrieved from https://www.arm.com/files/pdf/Shared_Purpose.pdf.
- Moore, J. F. (1996) The death of competition: leadership and strategy in the age of business ecosystems (p. 297). New York: HarperBusiness.
- Moore, J. F. (1998) “The rise of a new corporate form”, *Washington Quarterly*, 21(1), 167-181.
- Moore, J. F. (2006) “Business ecosystems and the view from the firm”, *The antitrust bulletin*, 51(1), 31-75.
- Paddison A. and Calderwood E. (2007), “Rural retailing: a sector in decline?”, *International Journal of Retail and Distribution Management*, vol. 35, n. 2, pp. 136-55.
- Pantano, E., and Priporas, C. V. (2016). The effect of mobile retailing on consumers' purchasing experiences: A dynamic perspective. *Computers in human behavior*, 61, 548-555.
- Pantano, E. and Servidio, R. (2012). Modeling innovative points of sales through virtual and immersive technologies. *J. Retail. Consum. Serv.* 19 (3), 279–286.
- Pantano E. (2014), “Innovation drivers in retail industry”, *International Journal of Information Management*, vol. 34, n. 3, pp. 344-350.
- Pantano, E., (2016). Benefits and risks associated with time choice of innovating in retail settings. *Int. J. Retail Distrib. Manag.* 44 (1), 58–70.
- Poncin, I. and Mimoun, M. S. B. (2014), “The impact of “e-atmospherics” on physical stores”, *Journal of Retailing and Consumer Services*, Vol.21 No.5, pp.851-859.
- Poushneh, A. (2018), “Augmented reality in retail: A trade-off between user’s control of access to personal information and augmentation quality”, *Journal of Retailing and Consumer Services*, Vol.41, pp.169–176.
- Rese, A., Schreiber, S., Baier, D. (2014). Technology acceptance modelling of augmented reality at the point of sale: can surveys be replaced by an analysis of online reviews? *J. Retail. Consum. Serv.* 21 (5), 869–876.
- Sansone M., Bruni R., Colamatteo A., Pagnanelli M.A. (2017). “Dynamic capabilities in retailers’ marketing strategies: defining an analysis model”, *Mercati and Competitività*, vol. 2, pp. 17-42.
- Sansone M., Bruni R., Colamatteo A., Pagnanelli M.A., (2018) Service ecosystem perspective in the retail industry, *Sinergie - Italian Journal of Management*, Vol. 36, N. 107, ISSN 0393-5108, pp. 49-64, DOI 10.7433/s107.2018.03

- Sharif, M. S. M., Zahari, M. S. M., Nor, N. M., Muhammad, R. (2016) "The Importance of Knowledge Transmission and its Relation towards the Malay Traditional Food Practice Continuity", *Procedia-Social and Behavioral Sciences*, Vol.222, pp.567-577.
- Spohrer, J. and Maglio, P. P. (2010a). Service science: Toward a smarter planet. Introduction to service engineering, 3-30.
- Spohrer, J. C. and Maglio, P. P. (2010b). Toward a science of service systems. In *Handbook of service science* (pp. 157-194). Springer, Boston, MA.
- Wieland, H., Koskela-Huotari, K. and Vargo, S. (2015), "Extending actor participation in value creation: an institutional view", *Journal of Strategic Marketing*, Vol. 24 Nos 3/4, pp. 210-226.
- Woodliffe L. (2004). Rethinking consumer disadvantage: the importance of qualitative research. *International Journal of Retail and Distribution Management*, vol. 32 n.11, pp. 523-531.
- Yadav, M. S., and Pavlou, P. A. (2014), "Marketing in computer-mediated environments: Research synthesis and new directions", *Journal of Marketing*, Vol.78 No.1, pp.20-40.
- Yim, M. Y. C. and Park, S. Y. (2019), "I am not satisfied with my body, so I like augmented reality (AR)": Consumer responses to AR-based product presentations. *Journal of Business Research*. Article in Press.
- Yulia, C., Hasbullah, H., Nikmawati, E. E., Mubaroq, S. R., Abdullah, C. U., Widiaty, I. (2018) Augmented reality of traditional food for nutrition education, "In *MATEC Web of Conferences*, EDP Sciences, Vol. 197 p. 16001.
- Vargo, S. L. and Akaka, M. A. (2012). Value co-creation and service systems (re) formation: A service ecosystems view. *Service Science*, 4(3), 207-217.

Ecosystem Approach in Retail Industry and Customer Role: a Service Perspective

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Abstract

The evolution of the modern retail concept involves many actors and stimulates several dynamics in markets that cannot be represented only by traditional economic sectors. Retail industry is emerging as a meta-sector where production companies, agriculture, logistics, and retail are integrating their strategies and resources to have fast reaction to markets complexity and variability. Retailers stimulate the integration of many actors in the market from the production of raw material to services. Innovation in retail industry involves companies in production, distribution channels and stimulates change and evolution in consumption and demand.

Actors in retail industry are influencing, generating and using rules, languages, cultural norms, values, codes - institutions - that cause effects on the same actors involved, on markets and on the complex emerging system. Within this entangled context of actors' interaction, sharing of institutions and behaviours, following a service perspective, retail industry seems to configure a service ecosystem - retail ecosystem -.

The work contributes in explaining the emerging of retail ecosystem, the relevant institutions involved and the contribution of the customer as influencer of institutions dynamics within retail context. The relevance of ecosystem approach emerges and, although the customer represents a relevant actor, the success of the wide system comes by co-evolution of involved actors and institutions dynamics. The survival – final purpose - of the whole retail ecosystem is generated by the resource integration and mutual dependence of every involved actor.

Keywords – retail industry, survival, retail ecosystem, institutions, customer

Paper type – Academic Research Paper

1 Introduction

The economic impact of the retail industry on countries' economy is currently measured and included in the tertiary sector, with reference to the traditional division of economic activity into three main sectors: primary - extraction of raw materials and agriculture, secondary - manufacturing, - and tertiary – services (Fisher, 1939; Fourastié,

1951; Wolfe, 1955). While this distinction may be useful in terms of the real economy's organization - for instance classifying the position of companies in the market and identifying them in terms of specific functions, investments, and tax system - sometimes it is not really applicable to marketing and management regarding to understanding actors' interactions in markets, especially in times characterized by complexity, fast communication, network relationships, and interactions.

Generally retail industry is characterized by supply chains with different levels of complexity and interaction; the evolution of consumptions, markets, and actors relationships is encouraging the network and system approach (Gummesson, 2006; Espejo and Harnden, 1989; Barile, 2009) to understand the actors dynamics, interactions and the co-evolution of the multiple interactive actors involved in the process of value creation. Each marketing and management activity of companies – retail industry included - is involved in this variable market and fusion of roles, information and activities in which value is co-created by resource integration (Vargo and Lusch 2004; 2016). In this scenario the role of customer in retail industry is relevant but it is contextualised in a system of relationships and influences coming by actions and reactions of a multiplicity of integrated actors that form the retail system – farms, industrial production companies, suppliers, logistics companies, retailers, intermediaries, communication companies -.

New marketing and management paradigms are contributing to explain complex dynamics in markets, the actors' interaction and value co-creation; in fact adopting a service logic (Vargo and Lusch, 2004, 2008, 2016) the value is co-created by a wide actors interaction and resource integration, customer included. Complex markets and businesses – retail industry included – could be analysed using the ecosystem approach (Aarikka-Stenroos et al., 2017) even following a service perspective (Vargo, Wieland and Akaka, 2015). Some authors are approaching to the retail industry using the ecosystem framework (Barile and Saviano, 2014; Sansone et al. 2018) and that is generating questions around the role of actors in resource integration and around the institutions dynamics in shaping the retail ecosystem.

This work contributes in the debate explaining the emerging of retail ecosystem, the relevant institutions involved and the contribution of the customer as influencer of institutions dynamics within retail context.

2 Theoretical background

The ecosystem framework is not a novelty in literature. Moore (1993; 2013) sustains that ecosystem could be a useful framework to study and interpret the actors' relationships in social contexts. With a focus on business context, many authors are working around ecosystem framework approaching with multiple perspectives (Aarikka-Stenroos and Ritala), highlighting the ecosystem's key issues identified in complexity, interactions, dynamicity, mutual dependence. Aarikka-Stenroos *et al.* (2017) identified 4 groups of research streams expressing the ecosystem characteristics: a) competition and evolution; b) emergence and disruption; c) stable business exchange; d) value co-creation.

In particular, systemic characteristics of ecosystem stimulate the emersion of interaction and mutual dependence, change of perspectives and co-evolution between actors involved. Within the ecosystem actors resource integration is based on collaborative forces directly and indirectly involved in the ecosystem survival.

In business marketing and management studies the ecosystem research stream is relatively new; Holmqvist and Diaz Ruiz (2017) published a contribution selecting scientific manuscripts that present three principal perspectives with different points of view: a) markets (Araujo and Kjellberg, 2009); b) business networks (Cantù et al., 2012); c) service ecosystems (Vargo and Akaka, 2012). They found contact points but differences in interpretation and definitions respect to these aggregations (spontaneous or finalized). Long-lasting relationships and interdependencies are identified as similar characteristics. Between the approaches, the service ecosystem (Wieland et al., 2015) includes the customer as part of the business context management and consider value co-creation and actors' interaction at the base of actors' relationships.

Diffusely the concept of ecosystem is applied in retail sector identifying, theoretically and practically, the wide relationships between retailers and suppliers in market contexts. Widely authors refer to retail in practical and theoretical works around ecosystems particularly following business approach (Moore, 1993; 2013) and service approaches. Further Barile and Saviano (2014) state that it is necessary a change in perspective and new research in retail service marketing.

Sansone et al., (2018) present the retail concept using the ecosystem paradigm building on service and system approaches. The authors assert that through a configuration of emerging institutions the ecosystem framework contributes in explaining the multiple and variable interactions of actors within the modern retail system. Other authors (Macfadyen et al., 2015) sustain that an ecosystem emerges when a multiplicity of actors interact in food supply chain with direct or indirect relationships, sharing knowledge and protocols, bringing food from production field/plant to the customer direct consumption.

The retail context (food and no-food) should search for new paradigms to deep the pivotalsof resource integration with the manufacture industry and with customers. Anyway, it is still needed to understand how these actors negotiate and – when needed – counterbalance their interests when diverging. In food retail industry for instance, local farmers, big players of the food retailing industry, consumers, and all the actors surrounding the triads among the actors mentioned before (Frishammar et al., 2018), should be considered in order to describe the interplay they have and the real value generated by their interaction strategy. A focus on the role of customer in generating influences on retail ecosystem could contribute to the actual research debate.

3 Research aim

The work presents the institutions able to stimulate the emersion of retail ecosystem and the role of customer in generating influences in institutions dynamics and actors'

resources integration. The service perspective is adopted in identifying the retail ecosystem roots and the role of actors' interaction and institutions dynamics.

Each actor influences the retail ecosystem characterized by institutions, complexity, dynamicity, interaction and mutual dependence. Within this scenario, every actor in service ecosystem has a role and characterizes the ecosystem features; in fact in retail sector the role of customer always has been considered relevant in marketing and management strategies and it has conditioned and shaped the market approach for retailers. The retailer activities aims at satisfying the customer because he assumes a relevant role within the retail industry; in fact practitioners and researchers are focused on retailer-customer relationship searching for customer satisfaction. In contrast, within the ecosystem logic, the customer should not only represent an actor to satisfy but someone that, at the same time, gets and gives influence to institutions and to actors' activity with different levels of pressure and results. Of course the customer remains a pivotal in retail ecosystem but the ecosystem survival depends by co-evolution, integrated activity and influence of the whole system of actors involved.

The next section will present the institutions that stimulate the emerging of retail ecosystem and specific insights about the role of customer in influencing institutions dynamics and the actors' involvement in resource integration and in retail ecosystem survival.

4 Findings

Observing the relevance of consumption, the market's complexity, the development of the interactions between producers and retailers, the increasing role of the technology and the origin of relationships and interactions, it is possible to select specific institutions able to generate effects in the actors' relationships dynamic in retail ecosystem (Sansone et al. 2018). The retail ecosystem emerges as a system of actors in co-evolution that directly or indirectly interact integrating resources and co-creating value. Following a service perspective (Vargo and Lusch, 2004; 2008) every actor is influenced by other actors in the ecosystem and, within retail ecosystem, the emerging set of institutions is the result of innovation and evolution of the modern retail concept. The need to answer to market needs by actors in retail industry – from production till the retail activity – and the complex relationships between supply network players generate shared institutions between actors – customer included –.

In Table below it is possible to find the selection of institutions in retail ecosystem and for each of them, the customer influencing role of institutions dynamics is indicated.

Tab. 1: The customer's role in institutions dynamics in retail ecosystem

<i>Institutions in Retail ecosystem</i>	<i>Meaning of institutions</i>	<i>The role of customer in institutions dynamics in retail ecosystem</i>
In store value proposition management	Although this activity represents the retailer's mission, the managerial approach to the retail value	Customer benefits and, at the same time, influences the retail value proposition management in terms of purchases, requests,

	proposition could be considered an institution.	suggestions, feedbacks (demand).
Mobile applications supporting production, retail network and customer	The diffusion of use of mobile devices affects each actor and contributes in co-evolution that are working day-by-day in distribution. The institution of mobile applications affects both supply and demand.	Customer contributes to the spread of mobile applications through the frequency of applications use. The diffusion of the mobile applications increase the relevance of the customer role in increasing of institution relevance.
Relationships between manufacturer and retailer	Languages, agreements and managers that interacts each other – e.g. the trade marketing manager, buyer relationship between retailers and manufacturers – represent a shared institution that support interaction within ecosystem.	Customer is a data producer online and offline. The participation of the customer to retailers initiative for promotions and communication - for e.g. the contribution of customers in social network activity and the participation in loyalty projects – contributes in generating information that co-create value to each actor in retail ecosystem.
Private label as strategic asset	The private label assumes a strategic role that goes beyond the single use as a tool to increase margins and profit. Today the private label is a shared language and code that affects supply (retailers), production, and demand (customers).	Informed customer gives trust and a relevant role to the private label. For this reason, the private label is competing in the retail market at the same level of famous and industrial brands. That behavior encourages the retail ecosystem to make efforts in improving and developing private label strategies involving each actor in ecosystem in long term projects.
Accepted logistics practices	The logistics practices represent the core activity in retail ecosystem. The trend is to extend the sharing of solutions and information between the interacting actors. That encourages the actors co-evolution reducing complexity in actors interaction.	Every logistics practice affects the customer indirectly for retail ecosystem efficiency. Any case the last mile logistics practice – included the home delivery – have a relevant role. E-commerce encouraged the diffusion of home delivery making the customer more available to that practice. For this reason the customer is asking for new and integrated logistics practices in online and offline purchases.
Mobile communication and data exchange	Demand and supply share the habits regarding mobile communication. Rules and limits of mobile communication allow the increase in opportunities to connect the value network.	The use of mobile communication is increasing constantly and the data creation and use through mobile has overcome the traditional one. That generates strong influences in retail ecosystem in terms of communication and offerings. Every actor is affected by this evolution toward the mobile approach - from agricultural and industrial production till retailers.
E-commerce and rating systems	E-commerce and rating systems represent shared languages that involve the whole retail ecosystem. Every actor in retail ecosystem is able to use the e-commerce system and the diffusion of this practice supports the traditional retailing. From B2B to B2C - and C2C - relationships every actor finds opportunities in sharing e-commerce language. The e-commerce is linked with the rating system of reviews and comments that represent shared	The customer uses e-commerce not only as a residual choice and considers the omnichannel activity; the fast increasing of e-commerce and rating system adoption by customer increases the influence of customer on the institution and, of course, on retail ecosystem.

	codes able to give trust - or not- to the digital world.	
Sharing solutions	Sharing solutions attend to the opportunity to go beyond the single actor's activity. It is increasing the opportunity to share ideas and projects between actors in different sectors but belonging to the same ecosystem. Of course, it is possible to have different retailers belonging to the same distribution center and, at the same time, agricultural producers working with a retailer projects or a logistics provider.	Quality protocols, circular economy and shared practice in management of healthy food and practices involve the whole retail ecosystem. That creates necessity to sharing solutions, activities, tools and protocols. The customer interest in previous logics and practices is increasing and that causes an influence on this institution
Dynamic and hybrid formats and concepts	The concept of continue adaptation leads retailers to diversify the retailers value proposition integrating new and different services. The dynamic innovation is an accepted logic that is shared by the retail ecosystem.	A sophisticated customer has multiple needs for service and he is asking for continue innovation and new stimuli in value offerings. Customer induces the retailer to continuous adaptation and that dynamicity of requests generates effects to the whole retail ecosystem.

Source: Author's elaboration

The previous table presents the relevant institutions that permit to configure the retail ecosystem considering the most common and relevant practices and retail management strategies as source of information and trends. The modern retail is going beyond the mission of distribution and it is involving every economic sector in its activity, sometimes, controlling directly the process across the sectors involved – for e.g. some private label projects represent specific strategies where retailer is able to influence the production process, the logistics and the final destination of goods involving customer in loyalty relationships.

The ecosystem framework seems to efficaciously represent the dynamics of relationship in modern retail industry that are going toward smoother and soft distinctions between the actors - production, logistics, intermediaries, others - involved in different sectors within the retail industry. Every actor can integrate production activities and market strategies with retailers, starting by the sharing of rules, codes, activities – institutions - and finishing with practical projects that go beyond the classic production and distribution activities. In that way the retail ecosystem has not only the goal to distribute goods and services but it is configured as a system of value providers - co-creators - that identify and co-create lifestyles, behaviours, research projects for innovation in production and distribution and satisfaction for customers. In this relationship, customer gets and gives influence to institutions and to actors' activity with different levels of pressure and results. As explained before, the influence of the customer is sustained from one hand by technology that helps the customer to become active and influent actor in the ecosystem and from the other hand by the customer evolution in terms of knowledge and awareness about its role in the retail ecosystem. The awareness to be part of the ecosystem permits to react and participate, even searching for better opportunities achieving own satisfaction.

5 Conclusions

Ecosystem appears an alternative framework to describe the retail industry dynamics and to try to forecast trends and development of actors' interactions. Studying the retail industry relationships following an ecosystem approach gives the opportunity to shed the light on vertical and horizontal relationships between the system of actors directly and indirectly involved. Giving the ecosystem definition to the retail industry permit to consider the retail concept as something that goes beyond the mission stated in goods and service distribution. In the ecosystem approach the retail industry expresses the power of value co-creation involving actors included, otherwise, in other sectors – industrial production, agriculture, services, logistics, others -. Further, recognizing the retail ecosystem it is possible to consider the relevance of specific institutions that explain how the actors are integrating their resources and what kind of rules and languages they are using or, sometimes, creating.

Although the relevant mission for retailers remain the same – to deliver goods and services to the customer -, more specialized and sophisticated strategies contribute in giving and getting insights to customers, manufactures, logistics, data management companies and other actors involved directly or indirectly within the retail ecosystem. In this complex system of interactions actors share fundamental meanings and key issues – interaction, dynamicity, mutual dependence – and each actor in a long perspective should cooperates for ecosystem survival. The involvement of each actor in ecosystem logic is generated by the results obtainable by the cooperation and resource integration and co-evolution. The complexity of markets induces the actors in retail ecosystem to cooperate going beyond the activity within their specific sector and switching the approach toward a more inclusive and shared strategy. They should pass from the exclusive focus on own specific market/sector toward a more ecosystemic view - the retail ecosystem -, characterized by actions and reactions coming from a multiplicity of actors interconnected across the sectors.

Analysing the institutions and the role of customer in influencing the institutions evolution and dynamics a relevant role of technology emerges. In general technology affects the service ecosystems (Maglio and Spohrer, 2008) but the actors' integration in retail ecosystem seems really characterized by technology adoption and evolution from communication to efficiency management. The same retail ecosystem is strongly characterized by the role of technology because the mentioned smoother distances between the involved actors (and sectors) are reduced thanks to the diffusion of technology in projects design, implementation and, of course, in communication and data management. More technology permits more opportunity to reduce the distances between the actors coming from different, complex and multiple sectors.

Within this context the customer can't be only considered as a subject that waits for a value offering. Customer influences the actors' interactions, ideas, projects, value propositions, times and innovation and at the same time, he is influenced by the innovation and value proposition of actors included in retail ecosystem. Although the retail ecosystem is characterized by mutual dependence and value co-creation between the

actors, the customer contributes in stimulating actions and reactions of involved actors and generates influences on institutions and institutional arrangements. Further research need understanding how to involve customer in ecosystem development and survival. Customer could better be involved in private label projects, in developing of new logistics activities, in retail formats design, in communication activities and in projects increasing efficiency and customer satisfaction.

References

- Aarikka-Stenroos, L., & Ritala, P. (2017). Network management in the era of ecosystems: Systematic review and management framework. *Industrial Marketing Management*, 67, 23-36.
- Barile S. (2009), *Management sistemico vitale* (Vol. 1), Giappichelli, Torino.
- Barile, S., & Saviano, M. (2014). A New Systems Perspective in Retail Service Marketing. In *Handbook of Research on Retailer-Consumer Relationship Development* (pp. 197-218). IGI Global.
- Espejo R., Harnden, R. (1989), *The viable system model: interpretations and applications of Stafford Beer's VSM*, Wiley.
- Fisher A.G. (1939), "Production, primary, secondary and tertiary", *Economic Record*, vol. 15, n. 1, pp. 24-38.
- Frishammar, J., Cenamor, J., Cavalli-Björkman, H., Hernell, E., & Carlsson, J. (2018). Digital strategies for two-sided markets: A case study of shopping malls. *Decision Support Systems*, 108, 34-44.
- Fourastié J. (1951), "Productivity and Economics", *Political Science Quarterly*, vol. 66, n. 2, pp. 216-225
- Gummesson, E. (2006). Many-to-many marketing as grand theory. The service-dominant logic of marketing: Dialog, debate, and directions, 339-353.
- Holmqvist, J., & Diaz Ruiz, C. (2017). Service ecosystems, markets and business networks: What is the difference? A horizontal literature review. *The TQM Journal*, 29(6), 800-810.
- Maglio, P.P. & Spohrer, J. (2008a). Fundamentals of service science. *Journal of the Academy of Marketing Science*, 36(1):18-20.
- Macfadyen, S., Tylianakis, J. M., Letourneau, D. K., Benton, T. G., Tiltonell, P., Perring, M. P., ... and Okabe, K. (2015). The role of food retailers in improving resilience in global food supply. *Global Food Security*, 7, 1-8.
- Moore, J. F. (1993). Predators and prey: a new ecology of competition. *Harvard business review*, 71(3), 75-86.
- Sansone M., Bruni R., Colamatteo A., Pagnanelli M.A. (2017). "Dynamic capabilities in retailers' marketing strategies: defining an analysis model", *Mercati and Competitività*, vol. 2, pp. 17-42.
- Vargo S.L., Lusch R. F. (2004), "Evolving to a new dominant logic for marketing", *Journal of Marketing*, vol. 68, n. 1, pp. 1-17.
- Vargo S.L., Lusch R.F. (2008), "Service-dominant logic: continuing the evolution", *Journal of the Academy of Marketing Science*, vol. 36, n. 1, pp. 1-10.

- Vargo S.L., Lusch R.F. (2016), "Institutions and axioms: an extension and update of service-dominant logic", *Journal of the Academy of Marketing Science*, vol. 44, n. 5, pp. 5-23.
- Vargo, S. L., Wieland, H., & Akaka, M. A. (2015). Innovation through institutionalization: A service ecosystems perspective. *Industrial Marketing Management*, 44, 63-72.
- Wolfe M. (1955), "The concept of economic sectors", *The Quarterly Journal of Economics*, vol. 69, n. 3, pp. 402-420.

Emerging Retail as Ecosystem by Private Label “DNA”

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Abstract

Starting from the theoretical framework of ecosystem in Service-Dominant Logic (S-D Logic) perspective, this conceptual study aims to understand the role of private label in the modern retail. The assumption of the work is that the literature about service ecosystem could support the analysis of retail dynamics helping to explain the relationships and interactions between manufacturer companies, copackers, retail companies, logistics, and customers; in this sense, it is possible to explain how actors' relationships in the retail ecosystem are affected by specific institutions that define actors behaviour.

The role of the private label in modern retail is analysed as institution of the retail ecosystem, in order to understand if the private label actually represents a shared language and code that affects production, retailers, customers and other actors who should recognize the growing value of private labels and could contribute to value co-creation.

The main managerial implications of the paper concern the marketing and management competences and knowledge necessary for retailers to manage an institution of increasing importance for the entire retail ecosystem, which generates economic, social and environmental value.

Keywords – retail, ecosystem, private label, institution, service ecosystem.

Paper type: Academic Research Paper

1 Introduction

The difficulty in defining the modern retail sector and in describing relationships between actors has led to the emerging of new models/ frameworks aimed at studying these topics. Among these, network and systems theories (Håkansson and Snehota, 1995; Gummesson, 2004; Espejo and Harnden, 1989; Barile, 2009) are giving specific answers to interpret the evolution of the relationships and value co-creation generation in retail industry.

Some researches (Sansone et. al, 2018) are using the Service-Dominant (S-D) Logic (Vargo and Lusch, 2004; 2008; 2016) to define the retail concept as meta-sector and to identify shared rules, languages, cultural norms, values, codes; interpreting therefore the retail as an ecosystem. This approach underlines how retail emerges as a service ecosystem, through the evolution and integration of specific institutions that affect the retail industry and the involved actors.

One of the most relevant institutions that seems to affect the retail ecosystem is the private label. Private label today plays a relevant role among the sources of competitive advantages of retailers and within the exchange economy. This trend is confirmed by the growing interest shown by scholars: they debate the strategic role of private label beyond its mere use as a tool to increase margins and profit: the definition of private labels and their evolution over time (Cristini, 1992; Fornari, 2007; Pastore et al., 2007; Castaldo et al., 2013), the determinants of success and market share (Lamey et al., 2007; Rubio, Yague, 2009; Sethuraman, Gielens, 2014), the role of the private label in retailer management policies and in the levers of the retail marketing mix (Ailawadi, Keller, 2004; Lugli, 2009; Fornari, 2009), consumer behaviour, purchase preferences and factors that influence consumer choices (Ailawadi et al., 2001; Dalli and Romani, 2003; Sprott and Shimp, 2004; De Wulf et al., 2005; Dolekoglu et al., 2008).

Based on these premises, this conceptual paper aims at analysing the role of private label in the emerging process of retail as an ecosystem; the study deeps the characteristics of the private label as an institution. It seems to summarize shared languages of interaction, codes, projects and shared strategies between actors, deeply contributing in emerging of retail ecosystem.

The paper is organized as follows: first the evolution of the private label concept in the main reference literature is discussed, then the theoretical background on ecosystems from the perspective of S-D Logic is presented, with the aim of understanding the concept of retail as ecosystem and the main institutions that characterize it.

2 Private label evolution

Over the last few years, the private label subject has attracted increasing interest from reference literature, as shown by a significant increase in research contributions; this interest is mainly aimed at justifying the growth of the private label's market share (+4% on average in Europe – with a market share in value of 39.4% across major western

markets UK, France, Germany, Greece, Italy, Spain, Netherlands) and the impact on relations upstream and downstream of the supply chain (IRI, 2018).

One of the main objectives of the research, over time, has been to define the private label concept and its role assumed within the assortment, first of all in order to understand what dynamics have given rise to the private label and the specific characteristics of each variant, as well as to understand how the objectives of retailers have changed over time (Cristini, 1992; Fornari, 2007; Pellegrini, 2008; Castaldo, et al., 2013).

In 2002, Sayman, Hoch and Raju analysed the ideal positioning of private label products, arguing that the optimal strategy for retailers is to position private label products as close as possible to the strongest of national brands; in 2004, the same authors proposed research on how the characteristics of the category affect the number and types of private labels introduced by the retailer; in 2006 Choi and Coughlan proposed reflections on private label positioning strategies in relation to the positioning of industrial brands; in 2010 Geyskens, Gielens, Gijsbrechts analysed the different positions of private labels within the range of retailers and the combined effect of the introduction of a premium, first price or mainstream line on the others.

With reference to market shares and emerging divergences in the various countries, numerous studies have been carried out in order to understand future growth prospects and developments in relation to industrial brands (Quelch, Harding, 1996) or to study the price elasticity of private label and national brand products and their consequent effects on market shares (Cotterill, Putsis, 2000). In 2007, a study looked at the success of the private label in relation to the economic situation of the reference market, empirically confirming a positive correlation between market share and economic recession (Lamey, Deleersnyder, Dekimpe, Steenkamp, 2007). In 2008, Ailawadi, Pauwels and Steenkamp proposed an econometric model aimed at understanding the relationship between the private label's market share and store loyalty, demonstrating the positive effect of all the components of behavioural trust in the store on the private label's market share.

Again, in 2012 Lamey *et al.* analyse how private label market shares vary in relation to the economic situation and the various elements of the marketing mix managed by retailer. In the same year, Gielens analyzed the effects of the introduction of private label and national brand products on their respective and reciprocal market shares and on category sales.

In this regard, Rubio and Yague (2009), compiling the previous contributions, proposed a model that summarized the determinants of the store brand's market share, outlining the market structure, demand characteristics, economic and financial objectives as well as the competitive strategy among the macro-class variables. This contribution has therefore highlighted how in recent years the choice of the retail is increasingly characterized by strategic reasons and not merely by tactics, generating the growing need for marketing skills of retailers themselves.

An important area of research is about the role of the private label in retailer management policies and in the levers of the retail marketing mix, whose contributions have focused on many aspects: the role of brand image building by retailers, focusing attention on relationships with manufacturers and the assortment of private label products

in this process (Ailawadi, Keller, 2004); on assessing the value of the private label brand with respect to the brand in general, proposing that the income differential generated by a brand with respect to that of a private brand product be a simple and objective measure of brand equity (Ailawadi, Lehmann, Neslin, 2003); in 2004, Sudhir, Talukdar analyzed the relationships between brand loyalty and store brand loyalty as well as the impact of these implications on horizontal differentiation.

The evolution of the concept and the role of the private label has had an impact on the vertical level on the supply chain, on the bargaining power that for a long time was held exclusively by industrial brands (Lugli, 2009; Fornari, 2009) and on the cross-cutting challenges that the expansion to extra-core categories opens up (Martinelli, 2012).

Private label allows brands to differentiate themselves from competitors (Spratt, Shimp, 2004 and Sudhir, Talukdar, 2004) and to enjoy greater flexibility in defining promotional policies (Nogales and Suarez, 2005). It also provides other strategic benefits, such as increasing customer traffic (Dick et al., 1995), increasing store loyalty (Cortjens and Lal, 2000; Dekimpe et al., 1997), achieving higher margins and increasing bargaining power with suppliers (Lugli, 2009; Fornari, 2009; Ailawadi et al., 2008).

3 Service ecosystem in SD-Logic perspective

At the base of S-D logic perspective there is the concept that service, as the application of one actor's resources (e.g., knowledge and skills) for the benefit of another, is the foundation of all economic and social exchange (Vargo & Lusch, 2004, 2008). More recently, Vargo and Lusch (2011) introduced within S-D logic the service-ecosystems view, conceptualizing ecosystem as *"relatively self-contained, self-adjusting system[s] of resource-integrating actors connected by shared institutional logics and mutual value creation through service exchange"* (Lusch & Vargo, 2014, p. 161), focusing on the integration of resources for connecting social and technological aspects of markets (Vargo & Akaka, 2012).

The ecosystem framework seems to be a useful to study and interpret the actors' relationships in social contexts, analysing interactions between actors within a scenario characterized by fast changes and complexity. In the ecosystem perspective, interdependence is represented by mutual dependence and co-evolution is based on collaborative forces between the actors directly and indirectly involved in the survival of the ecosystem. Moreover, the service ecosystem approach includes customers as part of ecosystems and present customer satisfaction as an end goal (Wieland et al., 2015).

In S-D Logic perspective the value creation is driven by the integration, exchange and application of resources among actors (Vargo & Lusch, 2008), so value is always co-created. Therefore, the ecosystem perspective exceeds the dualistic approach of interaction between firms and customers (Vargo & Lusch, 2011), focusing on beneficially knowledge application and overcoming a view of markets as relatively static, external entities in which value flows sequentially from value-creating firms to consumers. S-D logic extends the concept of value co-creation, emphasizing the importance of institutions (Vargo & Lusch, 2011), because for service exchange, actors depend on rules.

The S-D Logic approach supports the necessity to consider the institutions – formalized rules “such as laws, more informal norms including social expectations, values and moral codes that define appropriate behaviour, and cultural meanings including cognitive frames and schemas that encapsulate the assumptions and beliefs fundamental to make life comprehensible” (Siltalo et al., 2016) – and the institutional arrangements – set of interrelated institutions; the role and process of institutionalisation are the keys to understanding structure and functioning of the service ecosystem – as contributions to the emergence of the ecosystem.

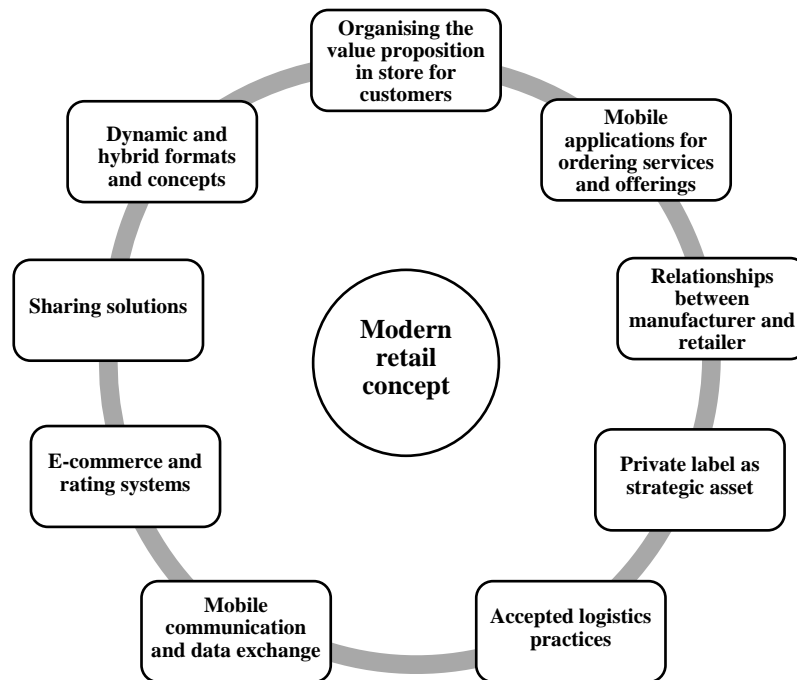
Some of these institutions are formalized (e.g. laws) and thus appear to be externally given, while others exist informally and endogenously emerge (Fujita et al., 2019). Furthermore, institutions influence the interactions among multiple actors.

In general, it is possible to assume that context is composed by networks of actors and institutional arrangement that guide actions and interactions (Vargo & Akaka, 2015).

Resource integration and service exchange among actors generate the value co-creation, involving various views on value (institutional arrangements), which determine what works and what does not work (Lusch, Vargo, & O'Brien, 2007). Therefore, the value co-creation process involves companies (manufactures or retailers), customers, influencers and it is driven by institutionalization of integrative, normative, and representational practices.

4 Retail as service ecosystem

The ecosystem framework has been applied to the retail industry with different approaches. In general, ecosystem theory has been used to analyze the relationships between retailers and suppliers following a business approach, through conceptual and empirical research (Moore, 1993; 2013). Some authors have suggested the need to study the retail system with new approaches related to service science (Barile & Saviano, 2014). Therefore, new paradigms have been proposed to analyse retail systems based on the S-D Logic perspective (Aarikka-Stenroos & Ritala, 2017; Sansone et al., 2018). In particular, Sansone et al., (2018) argue that the ecosystem framework could be useful to analyze the modern concept of retail, to understand the entangled relationships between industrial companies, agriculture, logistics, distribution and consumptions that integrate resources and exchange value belonging to the same retail system. Therefore, considering the characteristics of the modern retail concept, it is possible to define a system of institutions that affect the relationships among actors in the retail system. The relevance of consumption, the turbulence of the market, the evolution of the relationships between manufacturers and retailers, the evolution of technology, and the possible roots of relationships and interactions – knowledge, business and society, technology and culture – (Barile, 2016), give the possibility to configure some institutions that affect the dynamic of relationships between actors in the retail system (Sansone et al., 2018), as shown in Fig. 1.



Source: Sansone et al., 2018.

Fig. 1: Institutions in retail ecosystem

The interrelation of the institutions – institutional arrangements – will contribute to defining the structure and functioning of retail as service ecosystem and could be useful to interpret trends and roles of every actor in the ecosystem.

5 Private label as institution

Considering the literature contribution and the recent research, private label represents a relevant source of competitive advantage for retail companies.

In order to have an overview of the impact of private label projects in Italy, it is possible to consider the "Four Capitals" model of The European House - Ambrosetti. The model represents an integrated and multidimensional analysis system that measures the contribution generated by the private label for the country, also evaluating the structural and comparative implications, including 4 capitals: economic capital, social capital, cognitive capital, environmental capital (The European House – Ambrosetti, 2019).

The *economic capital* of the private label highlights the generation of economic value: a turnover of 10.1 billion euros, with growth in 2017 that represents about 30% in Italian food industry turnover.

Private label has impact of 10.2 billion euros on extended supply chain and that represents 0.6% of Italian GDP; in long product chain that indirectly involves 50 production and distribution sectors. In fact, the private label economic multiplier is 2.6, compared to the 2.5 of Information and Communication Technology and the 1.8 of tourism.

In Italy, the private label involves around 1,500 copacker companies, represented by Italian companies for 92%. It is interesting to highlight the long-term relationships that link retailers and copackers. Retailers prefer to establish strategic cooperation with manufacturers/copackers and for this reason 98% of contracts are more than 2 years and 47.5% go over 8 years of duration.

The *social capital* in private label economy is represented by employment aspects: 205,000 employed in the supply chain - 3% of employed in manufacturing industry and commerce in Italy; 90% of them have a permanent contract -. The private label projects stimulate employment between youngers (18%) and women employment (62%).

Furthermore, the private label social value is connected to Corporate Social Responsibility policies in modern retail, in terms of fair trade products and support for companies about social interest, in terms of supporting health, well-being, donations for charity purposes and collaborations with schools and universities.

The third aspect is *cognitive capital*, which can essentially be represented by 3 aspects: private label product *innovation*, that aims at responding to new consumption styles and to the principles of well-being and health, (private label has introduced some organic products on the market or health before the National Brands); *industrial efficiency*, through innovation and sharing of know-how; *training activities* offered by modern retailers to their employees (96%).

The last aspect is related to *environmental capital*. That is essentially represented by environmental impact of modern retail in term of energy efficiency policies and the consumption reduction for retail activities and, specifically, in private label productions: for instance, the use of sustainable raw materials for private label products (75%), the selection of copackers based on their environment respect policy (85%) and the confidence with standards of quality (95%).

This model summarizes economic, social and sustainable value of the private label and highlights that private label as institution must not be traced back only to formal or contractual relationships or to tactics of mutual interest between actors, but it seems to represent a shared code, language and way to interpret the modern retail in every step of production and distribution of goods.

The formal and contractual aspects between producers, copacker companies and retailer companies are relevant but not enough to explain the relationships and dynamics of interactions behind private label strategies.

Private label represents a project that permits the connection between numerous actors (producer of raw materials, copackers, consumers, stakeholders) who recognize the growing value of private labels, co-creating value and generating mutual benefits. Therefore, the contribution of private label in retail ecosystem seems to be relevant in

terms of influence and stimuli generated by the involved actors in ecosystem relationships.

6 Conclusions

This conceptual work aims at analysing the role of private label as institution in retail service ecosystem .

The literature about service ecosystem could support the analysis about modern retail dynamics helping to explain the relationships configuration and interactions between manufacturer companies, copackers, retail companies, logistics, and customers. Furthermore, through service ecosystem framework it is possible to explain how actors' relationships in the retail system are conditioned by specific institutions that define actors' behaviour. The interrelation of the institutions – institutional arrangements – will contribute to define the structure of retail service ecosystem and it is used to interpret trends and roles of every actor in the ecosystem. The nature of private label in modern retail context has been analysed in terms of institution and the analysis has generated opportunities to underline the role of private label in retail industry.

The value generated by private label in terms of economic capital, social capital, cognitive capital, environmental capital highlights its strategic role in the retail ecosystem. The private label seems to be a shared language and code that affects supply (retailers), production, and demand (customers) and numerous actors are starting to recognize the growing value of private labels, contributing to co-create value because they are convinced of mutual and reciprocal benefits. In particular, from the analysis it emerges that the private label could be elected as a relevant institution and involve every actor in retail ecosystem from production till final customer. Private label has a multiple role: from one hand it represents a strategic asset for retailers and by the other hand, it represents a recognized element of trust by customer side. Every actor in modern retail ecosystem seems to share the private label rules, customer included.

These results underline the implications of the strategic role of private label on knowledge management of retail companies: the preparation, organization and management of private label strategy poses organisational and management challenges and requires a marketing planning effort that involves the entire company management. The strong link between the brand and company requires full integration of marketing skills and activities in the retailing process and the need to establish supply relationships with highly qualified, more stable and long-lasting producers.

The originality of the work consists in the application of the ecosystem framework in the perspective of the S-D Logic to the modern retail, in order to study a topic of growing interest for research and companies. The main limitation is due to the conceptual nature of the paper, which therefore does not include empirical research that could be useful to better understand the relationships between actors, perhaps through in-depth interviews with the main stakeholders.

References

- Aarikka-Stenroos, L., & Ritala, P. (2017). Network management in the era of ecosystems: Systematic review and management framework. *Industrial Marketing Management*, 67, 23-36.
- Ailawadi K.L., Neslin S.A., Gedenk G. (2001), "Pursuing the value-conscious consumer: store brands versus national brand promotions", *Journal of Marketing*, vol. 65, n. 1, pp. 71-89.
- Ailawadi, K. L., Lehmann, D. R., & Neslin, S. A. (2003). Revenue premium as an outcome measure of brand equity. *Journal of marketing*, 67(4), 1-17.
- Ailawadi, K. L., & Keller, K. L. (2004). Understanding retail branding: conceptual insights and research priorities. *Journal of retailing*, 80(4), 331-342.
- Ailawadi, K. L., Pauwels, K., & Steenkamp, J. B. E. (2008). Private-Label Use and Store [http://refhub.elsevier.com/S0022-4359\(16\)30002-1](http://refhub.elsevier.com/S0022-4359(16)30002-1).
- Barile S. (2009), *Management sistemico vitale* (Vol. 1), Giappichelli, Torino.
- Barile, S., & Saviano, M. (2014). A New Systems Perspective in Retail Service Marketing. In *Handbook of Research on Retailer-Consumer Relationship Development* (pp. 197-218). IGI Global.
- Barile S., Lusch R., Reynoso J., Saviano M., Spohrer J. (2016), "Systems, networks, and ecosystems in service research", *Journal of Service Management*, vol. 2, n. 4, pp. 652-674.
- Castaldo S., Premazzi K., Grosso M. (2013). *Retail and channel Marketing*. Cheltenham, UK: Edward Elgar.
- Choi, S. C., & Coughlan, A. T. (2006). Private label positioning: Quality versus feature differentiation from the national brand. *Journal of retailing*, 82(2), 79-93.
- Corstjens, M., & Lal, R. (2000). Building store loyalty through store brands. *Journal of Marketing Research*, 37(3), 281-291.
- Cotterill, R. W., Putsis, Jr, W. P., & Dhar, R. (2000). Assessing the competitive interaction between private labels and national brands. *The Journal of Business*, 73(1), 109-137.
- Cristini G., (1992) *Le strategie di marca del distributore: Differenziazione dell'offerta e vantaggio competitivo*, Egea.
- Dalli D., Romani S. (2003) "Acquirenti e processi di acquisto dei prodotti di marcacommerciale", in LUGLI G. (a cura di), "Branding Distributivo", Egea, Milano.
- Dekimpe, M. G., Steenkamp, J. B. E., Mellens, M., & Abeele, P. V. (1997). Decline and variability in brand loyalty. *international Journal of Research in Marketing*, 14(5), 405-420.
- De Wulf K., Odekerken-Schroder G., Goedertier F., Van Ossel G., (2005) "Consumer perceptions of store brands versus national brands", *Journal of Consumer Marketing*, Vol. 22 Iss: 4.
- Dick, A., Jain, A., & Richardson, P. (1995). Correlates of store brand proneness: some empirical observations. *Journal of Product & Brand Management*, 4(4), 15-22.
- Dolekoglu, C. O., Albayrak, M., Kara, A., Keskin, G. (2008). Analysis Of Consumer Perceptions And Preferences Of Store Brands Versus National Brands: An Exploratory Study In An Emerging Market. *Journal Of Euromarketing*, 17(2), 109-125
- Espejo R., Harnden, R. (1989), *The viable system model: interpretations and applications of Stafford Beer's VSM*, Wiley.
- Fornari E. (2007), *Economia della marca commerciale*, Egea.
- Fornari D. (2009). *Trade Marketing*. Milano, Egea.
- Fujita, S., Vaughan, C., & Vargo, S. L. (2019, January). Service Ecosystems Emergence and Interaction: A Simulation Study. In *Proceedings of the 52nd Hawaii International Conference on System Sciences*.

- Geyskens, I., Gielens, K., & Gijsbrechts, E. (2010). Proliferating private-label portfolios: how introducing economy and premium private labels influences brand choice. *Journal of Marketing Research*, 47(5), 791-807.
- Gielens, K. (2012). New products: The antidote to private label growth?. *Journal of Marketing Research*, 49(3), 408-423.
- Gummesson, E. (2004). Return on relationships (ROR): the value of relationship marketing and CRM in business-to-business contexts. *Journal of business & industrial marketing*, 19(2), 136-148.
- Håkansson, H., & Snehota, I. (1995). The burden of relationships or who's next. In *IMP Conference (11th) (Vol. 11)*. IMP.
- IRI Special report on private label (2018)
- Lamey, L., Deleersnyder, B., Steenkamp, J. B. E., & Dekimpe, M. G. (2012). The effect of business-cycle fluctuations on private-label share: what has marketing conduct got to do with it?. *Journal of Marketing*, 76(1), 1-19.
- Lamey, L., Deleersnyder, B., Dekimpe, M. G., & Steenkamp, J. B. E. (2007). How business cycles contribute to private-label success: Evidence from the United States and Europe. *Journal of Marketing*, 71(1), 1-15.
- Lugli, G. (2009), Il ruolo della politica assortimentale nella crisi e rilancio dell'ipermercato, «Mercati e Competitività», n. 3, pp. 11-32.
- Lusch, R. F., Vargo, S. L., & O'Brien, M. (2007). Competing through service: Insights from service-dominant logic. *Journal of retailing*, 83(1), 5-18.
- Lusch, R. F., & Vargo, S. L. (2014). Evolving to a new dominant logic for marketing. In *The Service-Dominant Logic of Marketing* (pp. 21-46). Routledge.
- Martinelli, E. (2012). *Distributori grocery in convergenza. Esperienze a confronto*, Franco Angeli, Milano.
- Moore, J. F. (1993). Predators and prey: a new ecology of competition. *Harvard business review*, 71(3), 75-86.
- Nogales, A. F., & Suarez, M. G. (2005). Shelf space management of private labels: a case study in Spanish retailing. *Journal of retailing and consumer services*, 12(3), 205-216.
- Pastore A., Fornari E., Cecconi V. (2007). Sviluppo e riposizionamento delle marche commerciali. *Finanza, Marketing e Produzione*, pp. 61-86.
- Pellegrini, L. (2008). *I rapporti industria-distribuzione: modelli integrati e ricerca di cooperazione*. Economia e politica industriale.
- Quelch, J. A., & Harding, D. (1996). Brands versus Private labels-Fighting to win".
- Rubio N., Jague M.J. (2009). The determinants of store brand market share. A temporal and cross-sectional analysis. *International Journal of market research*, 51.
- Sayman, S., Hoch, S. J., & Raju, J. S. (2002). Positioning of store brands. *Marketing Science*, 21(4), 378-397.
- Sayman, S., & Raju, J. S. (2004). How category characteristics affect the number of store brands offered by the retailer: a model and empirical analysis. *Journal of Retailing*, 80(4), 279-287.
- Sansone M., Bruni R., Colamatteo A., Pagnanelli M.A. (2017). "Dynamic capabilities in retailers' marketing strategies: defining an analysis model", *Mercati and Competitività*, vol. 2, pp. 17-42.
- Siltaloppi, J., Koskela-Huotari, K., & Vargo, S. L. (2016). Institutional complexity as a driver for innovation in service ecosystems. *Service Science*, 8(3), 333-343.
- Sethuraman, R., & Gielens, K. (2014). Determinants of store brand share. *Journal of Retailing*, 90(2), 141-153.
- Sprott, D. E., & Shimp, T. A. (2004). Using product sampling to augment the perceived quality of store brands. *Journal of Retailing*, 80(4), 305-315.

- Sudhir, K., & Talukdar, D. (2004). Does store brand patronage improve store patronage?. *Review of Industrial organization*, 24(2), 143-160.
- Vargo, S. L., & Akaka, M. A. (2012). Value cocreation and service systems (re) formation: A service ecosystems view. *Service Science*, 4(3), 207-217.
- Vargo S.L., Lusch R. F. (2004), "Evolving to a new dominant logic for marketing", *Journal of Marketing*, vol. 68, n. 1, pp. 1-17.
- Vargo S.L., Lusch R.F. (2008), "Service-dominant logic: continuing the evolution", *Journal of the Academy of Marketing Science*, vol. 36, n. 1, pp. 1-10.
- Lusch, R. F., & Vargo, S. L. (2011). Service-dominant logic: a necessary step. *European Journal of Marketing*, 45(7/8), 1298-1309.
- Vargo S.L., Lusch R.F. (2016), "Institutions and axioms: an extension and update of service-dominant logic", *Journal of the Academy of Marketing Science*, vol. 44, n. 5, pp. 5-23.
- Wieland, H., Koskela-Huotari, K. and Vargo, S. (2015), "Extending actor participation in value creation: an institutional view", *Journal of Strategic Marketing*, Vol. 24 Nos 3/4, pp. 210-226.

Retail Ecosystem Emerges or Can Be Built through B2B Relational Factors Encouraged by Legal Rules? An Empirical Analysis

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Abstract

Over the last decade, the retail sector had trouble due to the economic crisis and the growing complexity of the environment. In this context, the banking system becomes a relevant actor for accessing a critical resource such as credit. The objective of this work is to investigate the role of the legality rating, introduced by the Italian Law 62/2012 as an award-winning instrument for "virtuous" companies, in managing the relationships with bank. With this aim, this paper benefits of the systems theories and the literature on ecosystems. Primary data have been collected from 123 retailers and analysed using a qualitative approach based on the frequency distributions of the variables. Results show the main benefits provided by the legality rating that retailers claim they have had in the relationship with the banks. This paper offers an original contribution for the study of legality ratings by the business perspective and for the understanding of the retail ecosystems emersion.

Keywords: legality rating, ecosystem, retail, bank credit

1 Introduction

Since the economic/financial crisis of 2008, the need for regulatory interventions on potential illegal activities and behaviors able to affect the performance and competitiveness of companies emerged (Caputo, Pizzi, 2019). With this objective, the Italian Government introduced the legality rating aimed at stimulating the voluntary adoption of ethical, socially responsible and sustainable behaviors by enterprises. The primary purpose of this certificate is to favor enterprises, which possess it, in accessing bank credit and public financing offering a concrete opportunity for the "virtuous" enterprises to improve their reputation in relations with stakeholders. To date, this legislation has generated positive effects since the number of enterprises requesting this certificate has grown exponentially showing a great interest for the legality rating.

According to systems theories like the Viable Systems Approach (Golinelli, 2000; 2005; 2010; Barile, 2008; 2009), the General System Theory (Von Bertalanffy, 1956; 1968; Beer, 1972; Maturana and Varela, 1975; Lazlo, 1996; Meadows, 2008; Ng et al., 2012) and the Theory of Open Systems (Boulding, 1956), a system emerges because it has a governing body that relates to and interacts with supra-systems and sub-systems in order to survive over time co-creating value. This objective is reached if the relational dynamics between complex actors, albeit on the basis of constraints deriving from the relevant supra-systems, are consonant (Prahalad, Ramaswamy 2004; Vargo, Lusch, 2004; 2009; Lusch et al., 2010).

To generate effective value propositions, the relationships between interacting systems should be collaborative, communicative and conscious (Nikoomaran et al., 2013; Saren et al., 2013). During interactions the different systems should support each other and co-create value according to a shared vision defined by an entity that assumes the role of hub of this economic community, called ecosystem (Moore, 1996). Particularly, according to an ecosystems perspective, the institutional supra-system through the introduction of legal norms that regulate the interactions between systems, may favor the emergence of value co-creation paths (Vargo, Lusch, 2011). An ecosystem can emerge if certain conditions exist. These conditions could also be determined by legal rules set by an institutional supra-system (eg. the Government) with the aim of codifying the interactions between the entities that make up the ecosystem to improve and strengthen it. In this case, the dyadic relationship between the ecosystem components is enhanced by an innovative initiative developed outside the boundaries of a single organization and it is aimed at defining specific behaviors among the actors for the exchange of resources; in this context the institutional system acts as a coordination mechanism (Thornton, et al., 2012; Vargo, Akaka, 2012; Edvardsson et al., 2014; Koskela-Huotari et al., 2016; Vargo, Lusch, 2016). However, it may happen that the objective set by the legislative is not achieved compromising the emergence of the ecosystem. The study of these issues is of particular interest for the retail industry that, during the last decade, has been affected by the increasing complexity of the external environment, which compromised the effectivity of forecasting activities, and by the economic crisis, which created a reduction in consumption (Moretta Tartaglione et al., 2018). In this context, it becomes fundamental to

analyze how retailers can interact and share resources with other components of the ecosystem to which they belong in order to survive. Among the various actors, the bank is a very relevant entity as it possesses critical resources for the surviving. On the bases of these considerations, it becomes important a better understanding of the relationships between retailers and banks; with this aim we formulated the following research question: Are the relationships between retailers and banks based on an independent relational process or are they influenced by a relevant supra-system? In order to answer to this research question, this paper investigates the conditions for the emergence of the retail ecosystem, analyzing whether it is a spontaneous process or it can be determined by external factors such as norms and certifications aimed at regulating B2B relations for the valorization of the reputational equity. To achieve the objective set, this paper uses a survey administered to all the retailers possessing the legality rating in Italy to examine the opinions about the benefits in the relationships with banks generated by this award-winning instrument, issued by the Italian Competition Authority in accordance with the Law 62/2012. The primary data collected have been analyzed using a qualitative approach based on the frequency distributions of the variables.

This paper is structured as follows: after a review of the literature on the emergence of ecosystems and their role in favoring intersystemic interactions, the method used for the analysis is described; the descriptive statistics and the qualitative analysis follow. The work concludes with final considerations, managerial implications and suggestions for future research.

2 Scientific background

According to the systems theories, companies cannot be considered as “isolated” entities but they are open systems that interact with their environment in which relevant stakeholders possess the critical resources to survive (Saraceno, 1973; Golinelli, 2005). From these interactions, a complex system emerges consisting of “many independent entities and agents that behave in accordance with their objectives, and perform mutual interactions” (Fabac, 2010).

Therefore, embracing a systems perspective of the business reality, it emerges that it is able to influence the choices and behaviors of other systems as well as to be influenced in turn. As highlighted by Barile et al. (2015), a system emerges following “a process of formation of new collective entities established by the coherent behavior of interacting elements. The system is made up of many components, subject to a common plan, deliberated by a decision-maker, which allows the pursuit of specific objectives converging towards a single purpose: the survival of the system itself within the context in which it operates”. The different components support each other and co-create value according to a shared vision defined by an entity that assumes the role of hub of this constantly evolving economic community, called ecosystem (Moore, 1996). The co-evolutionary logic is also shared by Mitleton-Kelly (2003) who states that “each organisation is a fully participating agent which both influences and is influenced by the social ecosystem made up of all related businesses, consumers, and suppliers, as well as

economic, cultural, and legal institutions”. Consequently, functioning like a social ecosystem is a critical success factor for any organisation. When firms and institutions cease to function like a community or social ecosystem, they may break down (Mitleton-Kelly, 2003).

For the emergence of an ecosystem strategies and synergies are required to maximize the satisfaction of the needs and expectations of the different interacting components (Vargo, Akaka, 2012; Stam, Spigel, 2016; Taillard et al., 2016; Brown, Mason, 2017; Sansone et al., 2018) supported by the management of a culture and of advanced operating models (Davidson et al., 2015). Moreover Jacobides et al. (2018) have highlighted that ecosystems do not always "emerge" spontaneously but they can be the result of a deliberate activity by external entities.

Several authors consider the ecosystem a complex system designed by rules and regulations deriving from supra systems belonging to the external environment (Moore, 1993; Vargo, Lusch, 2011; Davidson et al., 2015; Rong et al., 2018), taking into consideration that decisions and behaviors of a single system can influence the decisions and the behaviors of the other systems also of different sectors (Gummesson, Polese, 2009; Akaka et al., 2012; Zahra, Nambisan, 2012; Barile et al., 2016). This creates mutual influences also implemented through visible and / or invisible resource flows, contracts, trusts, and vision sharing, which can lead to the expansion or decline of the ecosystem (Tsujimoto et al., 2018). For Tsujimoto et al. (2018), “within an ecosystem, each actor has different attributes, experiences, and beliefs. This path dependency creates inertia. The differences in decision principles can cause unintended results at the ecosystem level, even though each actor's decision-making and behavior is rational at a given point in time”. By sharing a positivist vision, ecosystems are considered as “a complex web of interdependent enterprises and relationships which both create and allocate business value. Business ecosystems add mutual value – the whole is greater than the sum of the individual parts. If this were not the case, there would be no incentive for organizations or individuals to participate in the system” (Davidson et al., 2015).

In an ecosystem, on the other hand, by creating a reticular situation, a co-evolutionary process is implemented in function of an innovation aimed at supporting also services to meet the expectations and needs of the customers in a way that is advantageous for the various concerned party (Moore, 1993; 2006; Iansiti, Levien, 2004; Ozcan, Eisenhardt, 2009; Adner, Kapoor, 2010; Rong, Shi, 2014; Vargo et al., 2015; Hannah, Bremner, Eisenhardt, 2016; Vargo, Lusch, 2016; Aarikka-Stenroos, Ritala, 2017; Hannah, Eisenhardt, 2018; Rong et al., 2018).

On this basis an ecosystem strategy can be implemented, according to which, each system must align with the expectations of the other systems that are part of the ecosystem itself. This must take place on the basis of the aptitude of a focused system which, having the role of a hub with respect to a network of intersystem relations, must have the capability, through the definition of specific methods of access, incentives and control, to make them converge towards a set purpose (Adner, 2016).

This need derives from the multiplicity of entities that are part of the ecosystem, from the activities that revolve around the constraints, to the rules and criteria to be able to adhere to them and which can influence the stability of the ecosystem itself (Gulati et al., 2012). Thus, according to Stam and Spigel (2016), systemic conditions are created which represent “the heart of the ecosystem and include networks of entrepreneurs, leadership, finance, talent, knowledge, and support services”.

Among these systemic conditions that interact as determinants for the success of the ecosystem, for the purposes of the present study, two decisive factors emerge: the financial capital, which represents a critical resource for the survival of many systemic entities and the state supra-system which issues also juridical norms finalized to support the economy and the relationships between the different organizations that operate in the reference territory.

On the other hand, the possibility of accessing financial resources provided by banks favors the growth of entrepreneurship in enterprises of any kind (Kerr, Nanda, 2009; Lerner, 2010; North et al., 2013; Bruton et al., 2015; Clarysse et al., 2015; Jahanmir, 2016; Stam, Spigel, 2016; Brown, Mason, 2017).

From the analysis of previous studies, some gaps of the literatures emerged:

- there are no studies that analyze the internal dynamics and the existing relationships in the ecosystem area (McGrath, 2010; Winter et al., 2017; Jacobides et al., 2018; Rong et al., 2018);
- the role of the state supra-system was analyzed only in relation to direct interventions as risk capital (Grilli, Murtinu, 2014; Harrison, 2018);
- the role of the ecosystem as a hub has been attributed to a defined private enterprise, as a leader, "platform leader", orchestrator or focal, which promotes the alignment of objectives and alliances with a large number of other partner companies, mostly sub-suppliers or suppliers of complementary products / services, aimed at maximizing its growth and development (Williamson, De Meyer, 2012; Gawer, Cusumano, 2014; Pellikka, Ali-Vehmas, 2016; Adner, 2017).

Moreover, as far as we know, there are no studies in the literature tending to analyze the existence of actual benefits generated by the legality rating on the companies that hold this certificate.

3 Method

This paper is based on a qualitative approach. To collect primary data, a semi-structured questionnaire was administered through a link to Google form to 226 retailers with a legality rating in September 19th 2017. The questionnaire includes 5 questions aimed at detecting: eventual facilities after the legality rating for the access to bank credit; the type of benefits found; the type of bank with which each retail has financial relations; the opinion about the use of the legality rating by the bank as a tool for the enterprises rewarding or simply for assessing the creditworthiness.

A total of 123 retail enterprises filled out the questionnaire, 30 of which with the legal form of a partnership and 93 of a **company**.

Table 1 – Foundation year of respondents (%)

Foundation year	Companies	Partnership
<1980	15,4	8,9
1981-2000	35,7	13
2001-2010	17,1	1,6
2011-2015 ¹	7,32	0,81
Total	75,6	24,4

Respondents have on average 201 employees, with minimum values of 1 and a maximum of 5077 units; the median value corresponds to 44 employees.

Table 2 – Turnover of respondents in million euros, year 2016 (%)

2-10	62,6
11-50	28,4
>50	9

Analyzing the type of bank with which retailers have relationships, it emerges that companies have relationships mainly with banking groups while partnership with banking groups, people's banks and co-operative banks (Tab. 3).

Table 3 – Type of banks with which respondents have relationships (%)

Type of bank	Companies	Partnership
Banking groups, people's banks, co-operative banks and other banks	2,4	1,6
Banking groups, people's banks e co-operative banks	11,3	6,5
Banking groups, people's banks e other banks	1,6	-
Banking groups, co-operative banks e other banks	0,8	-
Banking groups e people's banks	14,6	3,2
Banking groups e co-operative banks	5,7	3,2
Banking groups e other banks	1,6	-
People's banks e co-operative banks	2,4	2,4
People's banks e other banks	1,6	-
Co-operative banks e other banks	2,4	0,8
Only with banking groups	22,8	5,7
Only with people's banks	4,1	-
Only with co-operative banks	1,6	0,8
Other banks	0,8	-
Do not relate to any type of bank	1,6	-
Total	75,6	24,4

¹ According to the provisions of the legislation, the enterprises that request the rating of legality must be registered in the "Registro delle Imprese" since at least two years.

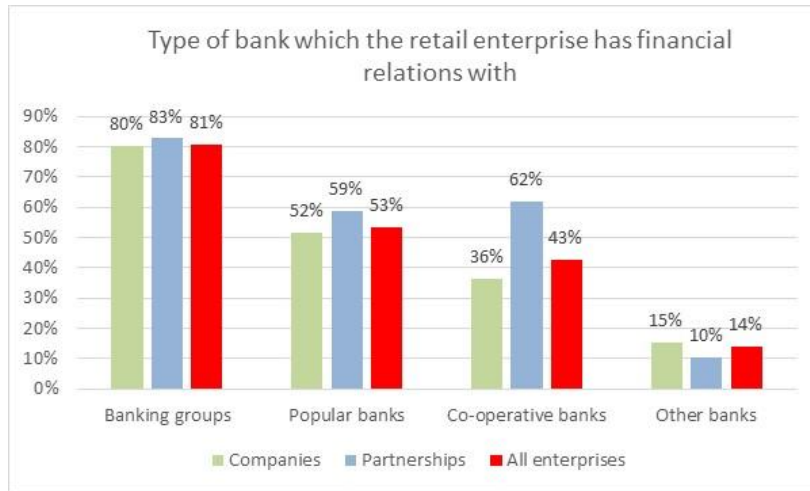


Figure 1. shows the frequency distribution of the type of banks with which retailers have relationships

The number of banks with which retailers have financial relationships is shown in Table 4.

Table 4 - Number of banks with which respondents have financial relationships

Banks	Frequency	%
0	2	1.6%
1	44	35.8%
2	47	38.2%
3	25	20.3%
4	5	4.1%
	123	100%

4 Findings and discussion

The answers show that only 30 of the 123 respondents said they have obtained benefits from the legality rating in terms of access to bank credit (Table 5).

Table 5 – Characteristics of retailers that claim to have had benefits in accessing credit

	Companies	Partnerships
Foundation year		
<1980	6	5
1981-2000	4	5
2001-2010	7	1
2011-2015	1	1
N. employees		
<10	3	1
10-49	7	2

50-249	6	2
>250	2	7
Turnover in 2016 (million euros)		
2-10	10	4
11-50	8	6
>50	-	2

According to the provisions of the law on legality ratings, enterprises, which stand out for compliance with high standards of legality, have the opportunity, with regard to the credit access, to be able to obtain benefits in relation to the preliminary investigation costs of the case, to the times and economic conditions of disbursement applied by the bank.

Table 6 shows the benefits that respondents claim to have obtained from the legality rating with the characteristics of retailers. Only one respondent declared that the legality rating has maximized all the benefits provided by the law. It is an enterprise established between 1981 and 2000, with a number of employees under 10 and a turnover between 2 and 10 million euros.

Table 6. Characteristics of respondents declaring to have obtained benefits by the legality rating

Benefit	Type	Number	Foundation year	Employees	Turnover (million euro)
<i>Favourable economic conditions and reduced time for the preliminary investigation</i>	Company	1	<1980	50-249	10-50
	Company	2	2001-2010	10-49	2-10
	Partnership	1	1081-2000	>249	10-50
<i>Favourable economic conditions applied to the loan and reduced preliminary investigation costs</i>	Partnership	2	<1980	10-49	2-10
<i>Reduction of the time required to complete the loan</i>	Company	1	<1980	<10	2-10
	Company	1	<1980	10-49	10-50
	Company	1	<1980	>249	2-10
	Company	1	1981-2000	10-49	2-10
	Company	1	2001-2010	<10	2-10
	Company	1	2001-2010	10-49	2-10
	Company	2	2001-2010	50-249	10-50
	Company	1	2011-2015	50-249	10-50
	Partnership	1	<1980	>240	10-50
	Partnership	1	1981-2000	>249	>50
	Partnership	1	2001-2010	50-249	2-10
	Partnership	1	2011-2015	<10	10-50
<i>Favourable economic conditions applied to the loan</i>	Company	2	<1980	10-49	2-10
	Company	1	1981-2000	>249	10-50
	Partnership	1	<1980	>249	10-50
	Partnership	1	1981-2000	50-249	10-50
	Partnership	1	1981-2000	>240	2-10
	Partnership	1	2011-2015	<10	10-50
<i>A better general assessment of the company by the intermediary</i>	Company	2	1981-2000	50-249	10-50
	Partnership	1	>249	<1980	10-50
	Partnership	1	>249	1981-2000	>50

Figure 2 shows the frequency distributions of the variables regarding the benefits retailers received by the legality rating in terms of costs of granting loans, time for

processing of loan applications, costs for processing of loan applications, general assessment.

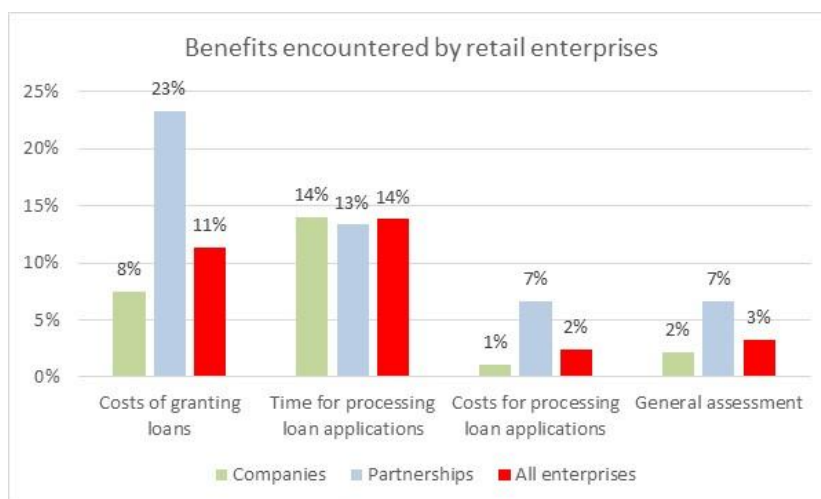


Figure 2. Frequency distributions of the benefits received by the legality rating

48 respondents claimed that, according to their perception, the banks which they relate with concretely reward commercial enterprises with a legality rating (Tab. 7).

Table 7. Characteristics of respondents claiming that banks reward commercial enterprises with a legality rating

	Companies	Partnerships
Foundation year		
<1980	5	6
1981-2000	17	4
2001-2010	11	1
2011-2015	3	1
N. employees		
<10	6	2
10-49	16	2
50-249	10	3
>250	4	5
Turnover in 2016 (million euros)		
2-10	22	6
11-50	11	5
>50	3	1

Finally, 59 respondents claimed that the banks which they relates with use the legality rating as one of the variables for the assessment of credit access (Tab. 8).

Table 8. Characteristics of respondents claiming that banks use legality rating for the assessment of credit access

	Companies	Partnerships
Foundation year		
<1980	8	6
1981-2000	21	7
2001-2010	13	-
2011-2015	3	1
N. employees		
<10	6	2
10-49	21	3
50-249	14	3
>250	4	6
Turnover in 2016 (million euros)		
2-10	30	5
11-50	12	7
>50	3	2

Figure 3 shows the frequency distributions of the variables related to the benefits obtained by retailers in terms of attribution of reward advantages and attribution of higher corporate rating.

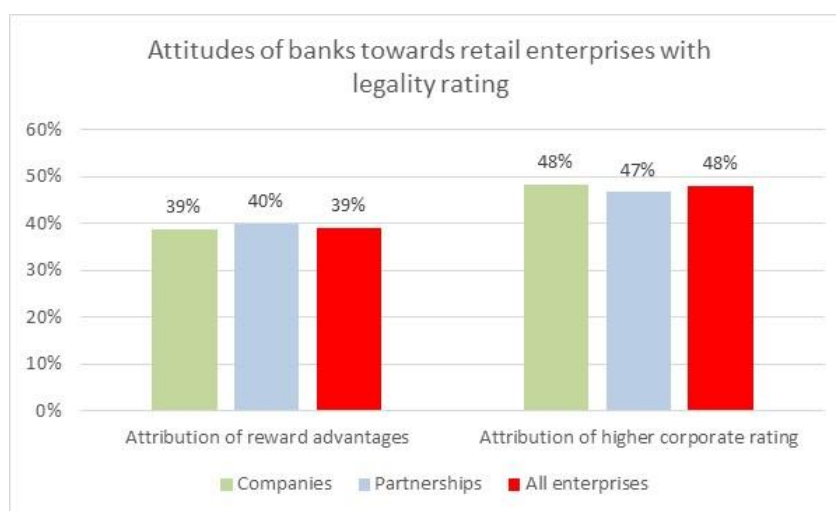


Figure 3. Frequency distributions of the attitudes of banks towards retailers with the legality rating

From the results it emerges that only 24% of retailers interviewed found effective benefits by having obtained the legality rating when accessing bank credit, among which there are several Small and Medium Enterprises. However, only one retail company has maximized the benefits obtainable, while in the majority of cases, advantages were found only in terms of a reduced time for processing the loan procedure. However, this did not affect the confidence that retailers place on the legality rating. In fact, it is possible to highlight clearly positive perceptions in this sense, because around 40% acknowledge that the banks with which they relate concretely reward retail enterprises with a legality rating and 48% believe that the banks use this certification as one of the variables used for the

assessment of credit access. Finally, it should be noted that the companies are more inclined in this regard than the partnerships.

5 Conclusions, practical implications, limitations and future research

By introducing and regulating the legality rating, the Italian legislator has created a reward instrument that aims both to enhance the ethical and socially responsible behaviors implemented by "virtuous" companies in the long term, and to encourage a general cultural evolution in this sense. Although the rule provides that the legality rating can also be used when granting public loans and participating in tenders for the awarding of supplies / services / public works, this work focuses on access to the bank credit, which, in accordance with the provisions of the sector legislation, is in any case subject to a positive assessment of creditworthiness also for the company with a legality rating. Although there are several studies that analyze the issue of legality ratings according to the view of banks, which are required to publish data in this sense annually, this study presents significant elements of originality. On the basis of the information collected, in fact, it represents the first scientific contribution in which the business perspective is analyzed and in particular that of the retail enterprises. Moreover, this work contributes to enriching the literature on the retail ecosystem as it shows the existence of an ecosystem that emerges even if it is not always possible to design it, because relations and interactions that are difficult to hypothesize and can be schematized within specific binding regulations for the counterparts, develop.

Certainly the legal rules and therefore the constraints imposed by a relevant supra-system can support the strengthening of relationships aimed at creating shared value; however, it is undeniable that, in many cases, relations and interaction, between banks and retail companies, are governed by a relational capability dictated by a system of elements, of a different nature, that emerge: consonance between business and territory, in-depth knowledge, long term personal and trust relationships.

In conclusion, this research consolidates the thesis according to which a retail ecosystem within a B2B relational context between banks and retail companies, is not something that can be built a priori, but is something that must emerge. In this scenario, the relational elements can certainly be encouraged by certifications and rules, even if the latter are not decisive. In fact, especially in some contexts, relations between people are still fundamental, to the point that the rule is outdated by so-called institutions, in practice those rules also not written, those consolidated relationships, those customs that guarantee more than norms and certifications.

With regard to the research limitations, it is undeniable that, in order to generalize the results obtained, it would be appropriate to extend the study to include companies operating also in other economic sectors and analyze the same perceptions in relation to the possibility of accessing public funding.

With regard to future research, it is planned to deepen the analysis by repeating the administration of the questionnaire after a few years, to assess whether the data will undergo a positive or negative evolution and if the legality rating will be able to achieve

the objectives set by the legislation, while taking into account that over the years the number of companies in possession of this certificate has grown considerably. Furthermore, we intend to verify a possible correlation between the benefits obtained by retail companies with a legality rating and the level of the rating held, which increases in relation to the possession of certain requisites required by law.

References

- Adner, R. (2017). Ecosystem as structure: an actionable construct for strategy. *Journal of Management*, 43(1), 39-58.
- Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations. *Strategic Management Journal*, 31(3), 306-333.
- Aarikka-Stenroos, L., & Ritala, P. (2017). Network management in the era of ecosystems: Systematic review and management framework. *Industrial Marketing Management*, 67, 23-36.
- Barile, S. (2008) *L'impresa come Sistema – Contributi sull'Approccio Sistemico Vitale* (2nd ed.). Torino: Giappichelli.
- Barile, S. (2009) *Management Sistemico Vitale*. Turin: Giappichelli.
- Barile, S., Sancetta, G., & Saviano, M. (2015). *Management. Il modello sistemico e le decisioni manageriali* (Vol. 1). Torino: Giappichelli.
- Barile, S., Lusch, R., Reynoso, J., Saviano, M., & Spohrer, J. (2016). Systems, networks, and ecosystems in service research. *Journal of Service Management*, 27(4), 652-674.
- Beer, Stafford (1972), *Brain of the Firm*. London: The Penguin Press.
- Boulding, K. (1956). General systems theory – The skeleton of science. *Management Science*, 2(3), 197-208.
- Brown, R., Mason, C. (2017). Looking inside the spiky bits: a critical review and conceptualisation of entrepreneurial ecosystems. *Small Business Economics*, 49(1), 11-30.
- Bruton, G., Khavul, S., Siegel, D., & Wright, M. (2015). New financial alternatives in seeding entrepreneurship: microfinance, crowdfunding, and peer-to-peer innovations. *Entrepreneurship Theory and Practice*, 39(1), 9-26.
- Caputo, F., Pizzi, S. (2019). Ethical firms and web reporting: Empirical evidence about the voluntary adoption of the Italian “legality rating”. *International Journal of Business and Management*, 14(1), 36-45.
- Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A. (2014). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research policy*, 43(7), 1164-1176.
- Davidson, S., Harmer, M., & Marshall, A. (2015). Strategies for creating and capturing value in the emerging ecosystem economy. *Strategy & Leadership*, 43(2), 2-10.
- Edvardsson, B., Kleinaltenkamp, M., Tronvoll, B., McHugh, P., & Windahl, C. (2014). Institutional logics matter when coordinating resource integration. *Marketing Theory*, 14(3), 291-309.
- Fabac, R. (2010). Complexity in organizations and environment-adaptive changes and adaptive decision-making. *Interdisciplinary Description of Complex Systems: INDECS*, 8(1), 34-48.
- Formisano, V., Fedele, M., Pietrovito, F., Le caratteristiche bancarie che influiscono sull'accesso al credito delle imprese con rating di legalità, *Sinergie Italian Journal of Management*, 36(107), 213-281.
- Gawer, A., & Cusumano, M. A. (2014). Industry platforms and ecosystem innovation. *Journal of Product Innovation Management*, 31(3), 417-433.

- Ginesti, G., Caldarelli, A., & Zampella, A. (2018). Exploring the impact of intellectual capital on company reputation and performance. *Journal of Intellectual Capital*, 19(5), 915-934.
- Golinelli G.M. (2000), *L'approccio Sistemico al Governo dell'Impresa. L'Impresa Sistema Vitale*, I ed. Padova: Cedam.
- Golinelli G.M. (2005), *L'approccio sistemico al governo dell'impresa. L'impresa sistema vitale*, CEDAM, Padova.
- Golinelli G.M. (2010), *Viable Systems Approach (VSA). Governing Business Dynamics*. Padova: Kluwer Cedam.
- Grilli, L., & Murtinu, S. (2014). New technology-based firms in Europe: market penetration, public venture capital, and timing of investment. *Industrial and Corporate Change*, 24(5), 1109-1148.
- Gummeson, E., & Polese, F. (2009). B2B is not an island! *Journal of Business and Industrial Marketing*, 24(5-6), 337-350.
- Hannah, D. P., Eisenhardt, K. M. (2018). How firms navigate cooperation and competition in nascent ecosystems. *Strategic Management Journal*, 39(12), 3163-3192.
- Hannah, D., Bremner, R., & Eisenhardt, K. (2016). Resource redeployment in business ecosystems. In T. Folta, C. Helfat, & S. Karim (Eds.), *Resource redeployment and corporate strategy* (advances in strategic management, Vol. 35, pp. 19-48). London, England: Emerald Group Publishing Limited.
- Hardy, C., & Maguire, S. 2010. Discourse, field-configuring events, and change in organizations and institutional fields: Narratives of DDT and the Stockholm Convention. *Academy of Management Journal*, 53(6): 1365-1392.
- Harrison, R. (2018). Crossing the chasm: the role of co-investment funds in strengthening the regional business angel ecosystem. *Small Enterprise Research*, 25(1), 3-22.
- Gulati, R., Puranam, P., & Tushman, M. L. 2012. Meta-organization design: Rethinking design in interorganizational and community contexts. *Strategic Management Journal*, 33(6): 571-586.
- Iansiti, M., Levien, R. 2004. *The keystone advantage: What the new dynamics of business ecosystems mean for strategy, innovation, and sustainability*. Boston, MA: Harvard Business Press.
- Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal*, 39(8), 2255-2276.
- Jahanmir, S. F. (2016). Paradoxes or trade-offs of entrepreneurship: Exploratory insights from the Cambridge eco-system. *Journal of Business Research*, 69, 5101-5105.
- Kerr, W.R., & Nanda, R. (2009) Democratizing entry: Banking deregulations, financing constraints, and entrepreneurship. *Journal of Financial Economics* 94(1): 124-149.
- Koskela-Huotari, K., Edvardsson, B., Jonas, J. M., Sörhammar, D., & Witell, L. (2016). Innovation in service ecosystems—Breaking, making, and maintaining institutionalized rules of resource integration. *Journal of Business Research*, 69(8), 2964-2971.
- Laszlo, E., 1996. *The Systems View of the World: A Holistic Vision for Our Time*. New Jersey: Hampton Press.
- Lerner, J. (2010). The future of public efforts to boost entrepreneurship and venture capital. *Small Business Economics*, 35(3), 255-264.
- Lusch, RF, Vargo, S. and Tanniru, M. (2010) 'Service, Value Networks and Learning', *Journal of the Academy of Marketing Science* 38: 19-31.
- Maturana H.R., Varela F.J. (1975), *Autopoietic systems*, BLC Report 9, University of Illinois.
- McGrath, Rita Gunther. 2010. Business Models: A Discovery Driven Approach. *Business Models* 43 (2): 247-261.
- Meadows, D.H. 2008. *Thinking in Systems: A Primer*, Chelsea Green Publishing, December.

- Mitleton-Kelly, E. 2003. Ten Principles of Complexity and Enabling Infrastructures. In Mitleton-Kelly, E. (eds.) *Complex Systems and Evolutionary Perspectives on Organizations: The Application of Complexity Theory to Organizations*. Pergamon, Amsterdam. pp. 23-50.
- Moore, J. F. (1993). Predators and prey: A new ecology of competition. *Harvard Business Review*, 71(3), 75–83.
- Moore, J. F. (1996). The death of competition: Leadership and strategy in the age of business ecosystem. *NY: HarperCollins*.
- Moore, J. F. (2006). Business ecosystems and the view from the firm. *The antitrust bulletin*, 51(1), 31-75.
- Moretta Tartaglione A., Bruni R., Bozic M., Cavacece Y. (2018), “How the environmental complexity affects forecasting in retail? Actual research trends”, *Journal of Marketing Trends*, 5(2), 71-90.
- Ng, I., Badinelli, R., Polese, F., Nauta, P. D., Löbner, H., & Halliday, S. (2012). SD logic research directions and opportunities: The perspective of systems, complexity and engineering. *Marketing Theory*, 12(2), 213-217.
- Nikoomaran, H., Roodposhti, F.R., Ashlaghi, A.T., Lotfi, F.H. and Taghipourian, Y. (2013), “The effects of age, gender, education level and work experience of accountant on ethical decision making by using a fuzzy logic”, *International Research Journal of Applied and Basic Sciences*, Vol. 4 No. 6, pp. 1559-1571.
- North, D., Baldock, R., & Ullah, F. (2013). Funding the growth of UK technology-based small firms since the financial crash: are there breakages in the finance escalator? *Venture Capital*, 15(3), 237–260.
- Ozcan, P., & Eisenhardt, K. M. (2009). Origin of alliance portfolios: Entrepreneurs, network strategies, and firm performance. *Academy of Management Journal*, 52(2), 246–279.
- Pellikka, J., & Ali-Vehmas, T. (2016). Managing Innovation Ecosystems to Create and Capture Value in ICT Industries. *Technology Innovation Management Review*, 6(10), 17-24.
- Prahalad, C.K. and Ramaswamy, V. (2004), “The future of competition: co-creating unique value with customers”, *Strategy and Leadership*, Vol. 32 No. 3, pp. 4-9.
- Rong, K., Shi, Y. (2014). *Business ecosystems: Constructs, configurations, and the nurturing process*. Springer, London.
- Rong, K., Lin, Y., Li, B., Burström, T., Butel, L., & Yu, J. (2018). Business ecosystem research agenda: More dynamic, more embedded and more internationalized. *Asian Business & Management*, 17(3), 167-182.
- Sansone, M., Bruni, R., Colamatteo, A., Pagnanelli, M.A., Service ecosystem perspective in retail industry, *Sinergie Italian Journal of Management*, 36(107), 49-64.
- Saraceno P. (1973), *Il governo delle aziende*, Libreria Editrice Universitaria, Venezia.
- Saren, M., Díaz-Méndez, M. and Gummesson, E. (2013), “Treating advertising agencies clients as value creation partners: difficulties and implications”, in Giannini Editore (Ed.), *The 2013 Naples Forum on Service proceedings*, Ischia, Giannini Editore, Naples, pp. 1-19.
- Stam, F. C., & Spigel, B. (2016). Entrepreneurial ecosystems. *USE Discussion paper series*, 16(13).
- Taillard, M., Peters, L. D., Pels, J., & Mele, C. (2016). The role of shared intentions in the emergence of service ecosystems. *Journal of Business Research*, 69(8), 2972-2980.
- Thornton, P. H., Ocasio, W., & Lounsbury, M. (2012). *The institutional logics perspective: A new approach to culture, structure and process*. Oxford: Oxford University Press.
- Tsujimoto, M., Kajikawa, Y., Tomita, J., & Matsumoto, Y. (2018). A review of the ecosystem concept—Towards coherent ecosystem design. *Technological Forecasting and Social Change*, 136, 49-58.
- Vargo, S., & Akaka, M. (2012). Value co-creation and service systems (re)formation: A service ecosystems view. *Inform Service Science*, 4(3), 207–217.

- Vargo, S.L. and Lusch, R.F. (2004), "Evolving to a new dominant logic for marketing", *Journal of Marketing*, Vol. 68 No. 1, pp. 1-17.
- Vargo, S.L. and Lusch, R.F. (2009), *A Service-Dominant Logic for Marketing*, The SAGE handbook of marketing theory, New York, NY.
- Vargo, S. L., & Lusch, R. F. (2011). It's all B2B... and beyond: Toward a systems perspective of the market. *Industrial Marketing Management*, 40(2), 181–187.
- Vargo, S. L., Wieland, H., & Akaka, M. A. (2015). Innovation through institutionalization: A service ecosystems perspective. *Industrial Marketing Management*, 44, 63–72.
- Vargo, S. L., & Lusch, R. F. (2016). Institutions and axioms: An extension and update of service-dominant logic. *Journal of the Academy of Marketing Science*, 44(1), 5–23.
- Von Bertalanffy L. (1956), "General System Theory", in Emery F.E. (a cura di), *General System (Yearbook of the Society for the Advancement of General System Theory)*,
- Von Bertalanffy L. (1968), *General System theory: Foundations, Development, Applications*, George Braziller, New York.
- Williamson, P. J., & De Meyer, A. 2012. Ecosystem Advantage: How to Successfully Harness the Power of Partners. *California Management Review*, 55(1): 24–46.
- Winter, J., Battisti, S., Burström, T., & Luukkainen, S. (2018). Exploring the success factors of mobile business ecosystems. *International Journal of Innovation and Technology Management*, 15(03), 1850026-1-1850026-23.
- Zahra, S. A., & Nambisan, S. (2012). Entrepreneurship and strategic thinking in business ecosystems. *Business Horizons*, 55(3), 219-229.

Ethical Branding in the Modern Retail: a Comparison of Italy and UK Ethical Coffee Branding Strategies in 2014 and 2018

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Abstract

Modern Modern markets can be seen as a complex system embedding the various stakeholders in a mutually influencing network of relationship that is able to influence their decision-making processes and their value creation processes. As a consequence, modern businesses have been called to adopt a broader perspective in order to not focus their actions only on trying to maximize their economic performance, but to design them taking into account even the social and environmental impacts they have on the system as a whole; according to Zimmerman and Zeitz (2002) firms have to respond to the expectations of the various social actors operating in the same systems they are embedded into as a way to obtain the legitimacy needed to create a beneficial environment that will help them in creating a positive effect out of the system of relations the companies are part of without violating the social contract tying together all the actors in a given system (Donaldson and Dunfee, 2002). It follows that, when companies can effectively communicate to their systems' actors how they are following the principles of sustainability and somehow prove that their actions are Socially Responsible, they can get several advantages. One of the way companies have to accomplish this feat is to ask third parties to certify their actions in order to be able to print on their products one of the various Ethical Labels. Using these labels to mark their products can be used as a tool to influence the consumer in buying the company's over the competitors' one leveraging on a higher legitimacy.

In this paper, we have studied the evolution of the practice of non-financial disclosure through ethical labels that 14 coffee brands, both in Italy and in England, as a way to understand how, in different markets they have changed over a 5 year time span.

Keywords – Ethical Branding; Social Responsibility Disclosure; Legitimacy; Coffee; Modern Retailing.

Paper type – Academic Research Paper

1 Introduction

Today firms are seen as social actors in a complex systems (Boardman and Sauser, 2008). These system's actors are linked in a web of relationship, driving enterprises to take into account their activities effects on the system as a whole, not only focusing only on those actors they are in a direct relationship with but factoring in even the effects they will have on the other actors. Moreover the network structure will limit the freedom of the companies as it will propagate, and amplify, both the positive and the negative perceptions of the various actors in the system (Ekeh, 1974; Harrison and Wicks, 2013) and the companies will have to follow the social contract (Donaldson and Dunfee, 2002) they have with all the system's actors. It follows that modern companies cannot focus only on the economic performance but they have to adopt a broader vision, encompassing the social and environmental perspectives (Elkington, 1994; Passet, 1996; Sciarelli, 2012); moreover, they are more and more driven to adopt *social responsibility disclosure* (SRD) (Chauvey, *et al.*, 2015) practices to influence their stakeholders and their buying behavior (Auger *et al.*, 2008).

Several marketing scholars (Bone and Corey, 2000; Rokka and Uusitalo, 2008) have found that modern consumers prefer to consume those products they sharing values with. The product packaging, its design and its gestalt, is one of the ways companies have to communicate with their customers and to show them the values they are adopting (Wansink, Sonka, and Hasler, 2004; Silayoi and Speece, 2007).

In this paper, we report the first results of our study on how firms non financial disclosure practices using ethical labels in their products, have changed over the last 5 years. In particular, we have looked into the different approach to ethical labeling by 13 coffee brands, 10 in Italy, and 3 in the UK, both in the 2014 and in the 2018, as a way to understand how companies look at the evolution of the market.

2 Corporate Social Responsibilities, Stakeholder management, and Sustainability

As highlighted by Freeman in 1984, modern companies live in a complex world requiring them to interact with many different stakeholders not only to get access to the resources they need to carry on their activities (Pfeffer and Salancik, 1978; Frooman,

1999), but even to get a competitive advantage (Harrison, et al. 2010). Acknowledging the existence and the nature of these ties with the organization's stakeholders (Freeman, 1984; 96) is needed to define actions that can reduce the negative effects of stakeholder pressures on the company while maximizing the positive ones (Mohr, et al., 2001) as responding to these pressures in the right way is one of the keys for the companies to get the legitimacy needed to reap the maximum benefits out of the system of relations they are part of (Zimmerman and Zeitz, 2002).

Chauvey (et al. 2015) show that adopting standard SRD practices is one of the way companies can effectively obtain this legitimacy; at the same time Maak (2007) showed that the higher legitimacy is linked to the company ability to create a set of relationship with their interlocutors not only mutually beneficial but even consistent, stable over time.

It follows that companies should go beyond focusing their activities only on the economic performance but they should create value for their stakeholders, taking into account the various social and environmental constraints in order to contribute to society's advancement (Elkington, 1994; Passet, 1996; Sciarelli, 2012). Moreover the focus on sustainability should not be limited to the organization itself, but it should encompass all its value systems (Markley and Davis, 2007; Matos and Hall, 2007).

According to several authors (Hoeffler and Keller 2002; Sen and Bhattacharya, 2004, Barnett, 2007) CSR benefits are linked to the consistent responsible behavior over time as it create a set of positive perceptions that, in future, will be able to balance the eventually socially irresponsible activities (Brown and Dacin, 1997; Godfrey, 2005) with a positive corporate association.

Moreover, several authors (De Pelsmacker, et al., 2005; Lamberti and Lettieri; 2009) have found that there is a niche of consumers willing to pay a higher price to buy an asset that had been produced in a socially responsible manner; Line et al. (2002) got a similar result for ethical behavior. As a consequence, when companies are able to effectively behave in a responsible way they are able to implement a differentiation strategy, even if only for some of their product lines (Auger et al., 2003; Porter and Kramer, 2006; Carroll and Shabana, 2010).

3 Social responsibility disclosure via packaging and ethical brands

SRD activities, the various practices a company can use to disclose to the market their activities toward a sustainable society. Moreover, in the last 20 years, the SRD practices have been strongly developed (Deegan 2002; Kolk, 2003).

SRD can focus on various topics and it is usually difficult to draw a general criteria on SRD as it mostly depends on the business area the company operates (Ingram, 1978); but Branco and Rodrigues (2008) show that they usually focus on four issues: environment, human resources, products and consumers, community engagement. On a similar page, Hanss and Böhm (2012) have found that corporations have been driven by stakeholders' requests towards environmental sustainability and other issues related to social sustainability.

Even Dawkins and Lewis (2003) highlighted that market actors have an interest in getting access to this information, although other authors (Folkes and Kamins, 1999) point out that the SRD positive effects are coupled with more negative ones when the company adopts an unethical behavior.

Several authors (Nilsson, *et al.* 2004; De Pelsmacker and Janssens, 2007) have shown that insufficient transparency is one of the main SRD limitations, undermining their credibility. This risk is stronger when companies try to use SRD as a tool of brand reputation management (Neu *et al.*, 1998; Hooghiemstra, 2000) rather than as a way to help external stakeholders in understanding their social performance (Berthelot, *et al.* 2003; Dubbink, *et al.* 2008).

Even if today, companies have access to multiple media to use in their own SRD activities (Jenkins and Yakovleva, 2006), product packaging is one of the main tools company have in SRD as it does not only have a logistic and functional use (containment, protection, fragmentation, transportation, storage), but also for its role in communication process (Prendergast and Pitt, 1996). In our modern self-service economy (McDaniel and Baker, 1977), the role of packaging is becoming more and more crucial, since it is the last things consumers see before making the decision purchase (Ampuero and Vila, 2006). Pearce (1999) acknowledges that packaging becomes more relevant when the consumer has only a limited knowledge of the products and, companies can use brands, symbols or logos (Azad and Hamdavi pour, 2012) in order to communicate personal and social values (Underwood, 2003). It follows that packaging becomes more relevant in consumer relationships and some companies invest more on the design of the packaging of the product than on its advertising (Dickson, 1994).

Ethical brands, logos that companies can use to signal to stakeholders, mainly consumers, the respect of some basic principles (Font and Harris, 2004), can be used to prove if the company compliance with a given disciplinary (Teisl, *et al.* 2008).

Ethical labels, when known, help consumers in identifying more sustainable products, and, therefore, it may influence their purchasing behavior (Gallaraga Gallastegui, 2002; Hanss and Böhm, 2012). Other authors, however, stressed that the use of ethical brands faces also some critical issues, both related to their content and to the ability of consumers to fully understand their meaning. Van Amstel, *et al.* (2008) have criticized these labels as they are voluntary ones and their rules are often not enough rigid; on the same page, Gallaraga Gallastegui (2002) points out that a general lack of objective measures. On the other side, the perception of consumers of an ethical label brand is rooted on their limited knowledge of the mark's real meaning (Codron, *et al.* 2006), and on the risks of information overload when there are too many labels (Thøgersen, 2000).

4 Research Objectives and Design

The literature review highlights that a social responsible behavior can be used in corporate communication processes to influence its stakeholders and get better reactions to the firm's activities (Brown and Dacin, 1997; Godfrey, 2005). In particular, the literature review on SRD has highlighted how the packaging (Underwood, 2003) is

widely used to convey these informations as a consequence of the modern GDO self-service approach (McDaniel and Baker, 1977 Rettie and Brewer, 2000). Moreover, since the packaging communication process is implemented through trademarks, symbols and logos (Azad and Hamdavipour, 2012), it is especially suited to show off ethical labels the corporation has been certified with as a way to enable them to show consumers, and other stakeholders, that their commitment to sustainability issues is not a façade, but underlies a set of shared values (Font and Harris, 2004).

In this paper we present the preliminary results from a single sector in order to reduce the variability (Yin, 2003): ground coffee. We have chosen to focus on ground coffee as it is a commodity that is produced abroad (Catturani, et al., 2008) and it has been previously studied (De Pelsmacker, *et al.* 2005; Arnot, *et al.* 2006) have shown how, in this specific market, socially responsible business behavior actually result in a competitive advantage, a factor encouraging companies towards SRD (Mackey, *et al.* 2007).

Moreover there are several ethical certifications aimed at analyzing the sustainability of production processes and supply chains (Perna, 1998). In addition, as with all food and agricultural products, companies have the opportunity to also adopt organic farming, to further emphasize their responsible behavior towards the natural environment.

In this sector there are only few brands, helping consumers to know them and to understand them more easily (Hanss and Böhm, 2012), limiting the information overload risk (Thøgersen, 2000). The following table 1 shows the main sustainability certifications used by coffee importers on their packaging.

Table 1 – Most Used Ethical Standards in Coffee

Labels	Institution			Transparency		
	International	Private?	Coop?	Verification	Independent certified	Traceability
<i>Ecolabel</i>	YES	NO	NO	YES	YES	YES
<i>Fair Trade Label Organization</i>	YES	YES	YES	YES	NO	YES
<i>Rain Forest Alliance* **</i>	YES	YES	NO	YES	NO	NO
<i>UTZ **</i>	YES	YES	NO	YES	YES	NO

Labels	Subject			
	Supply Chain	Firm	Product	100% labeled
<i>Ecolabel</i>	YES	NO	YES	NO
<i>Fair Trade Label Organization</i>	YES	NO	YES	YES
<i>Rain Forest Alliance* **</i>	NO	YES	NO	NO
<i>UTZ **</i>	YES	YES	YES	NO

Labels	Social Performance				
	Child Labour	Freedom of union	Subcontractors	Social Development	Land Rights
<i>Ecolabel</i>	N/A	N/A	N/A	N/A	N/A
<i>Fair Trade Label Organization</i>	YES	YES	YES	YES	NO
<i>Rain Forest Alliance* **</i>	YES	YES	YES	NO	YES
<i>UTZ **</i>	NO	NO	NO	NO	NO

Labels	Environmental performance				
	Pesticides and Fertilizers	GMO	Waste Management	Rainforest Usage	Wildlife
<i>Ecolabel</i>	YES	NO	YES	N/A	NO
<i>Fair Trade Label Organization</i>	NO	NO	YES	NO	NO
<i>Rain Forest Alliance* **</i>	NO	NO	YES	NO	YES
<i>UTZ **</i>	YES	YES	NO	NO	NO

* A company has to follow more than 80% of the standards criteria to be certified

** Merged from december 2018, no common standard

Our analysis has been focused on two geographically distinct markets: the Italian and the English one. We looked into UK-based companies as it is an advanced market as, according to FLO data (2012), fair trade coffee has grown by about 13 times from 2001 to 2010, reaching almost 25% of the entire national market. The cases we have selected have been shown in the following Table 2. As the table shows we have analyzed 10 Italian brands (3 private labels, 3 responsible brands, and 4 traditional ones) and 3 main UK-based brands (1 responsible label and 2 private labels). Even if the number of producers is different, as shown in table 2 the number of different product label in the 2014 was similar (54 in Italy, and 47 in Uk).

Table 2 – The Cases

Mkt	Company	Brand	Abbr.	2014		2018	
				Products	Certified	Products	Certified
Italia	Alice Nero	Alcenero	AN	2	2	3	3
		Altromercato	AMA	5	5	5	5
	Altromercato	BioCaffè	AMB	2	3	4	4
		Monorigine	AMM	5	5	3	3
	Cafè do Brazil	Kimbo	KMB	6	0	10	1
		Kosè	KOSE'	2	0	2	0
	Carrefour	Normal / Classic	CRFN	5	0	5	0
		Selection	CRFS	2	2	2	2
		Bio	CRFB	-	-	1	1
	CONAD	Conad	CONAD	3	2	7	0
		Conad "Il Biologico"	CONBIO	1	1	1	1
	Coop	Coop	COOP	2	0	5	0
		FiorFiore	COOPF	1	1	1	0
		Solidal Coop	COOPS	2	2	2	2
	Ecor	Ecor	ECOR	1	1	2	2
		Natura Si	NATS	1	1	-	-
	Illy Caffè	Illy	ILLY	3	0	7	0
	Lavazza	Lavazza	LVZZ	7	0	7	0
		!Tierra!	!T!	-	-	5	5
	Passalacqua	Passalacqua	PSSL	4	0	4	0
Inghilterra	Cafedirect	Monorigine	CDM	4	4	5	5
		Organic	CDO	-	-	4	4
		Blends	CDB	6	6	5	5
	Sainsbury	Fair Trade	SBFT	11	11	7	7
		Taste the difference	SBTTF	10	10	9	9
	Tesco	Local	TSCLC	6	6	6	1
		Finest	TSCFIN	10	9	7	7

For each of these products we have looked if they were used as a media for SRD, and, as the various certification are really different, we have looked into which one they used. The factors we have studied have been reported in table 3.

Table 3 – The factors investigated

Indicator	Description	Values	
EP	Organic Product or RFA Certified	NO	YES
SP	FLO or UTZ	NO	YES
Country of Origin	Explicit definition of the Coffee Beans	NO	YES
Blend or Taste	% of Arabica Coffee Beans or a Description of Taste	NO	YES

We have not looked in the companies Social Report as many of them (mostly the Modern Distributors) even if they have a social report do not disclose their activities at the product level so the data would have been dishomogeneous with those of the packaging.

5 Discussion of Results

In the following tables 4, and 5 we report the main findings in the two years.

Table 4 – Results in the 2014

Mkt	Company	Brand	Abbr.	2014				
				Products	EP	SP	CoO	Blend or Taste
Italy	Alce Nero	Alcenero	AN	2	2	2	2	2
		Altromercato	AMA	5	0	5	0	5
	Altromercato	BioCaffè	AMB	2	2	2	0	2
		Monorigine	AMM	5	5	5	5	5
	Cafè do Brazil	Kimbo	KMB	6	0	0	0	6
		Kosè	KOSE'	2	0	0	0	2
	Carrefour	Normal / Classic	CRFN	5	0	0	0	5
		Selection	CRFS	2	0	0	2	2
		Bio	CRFB	-	-	-	-	-
	CONAD	Conad	CONAD	3	0	0	0	2
		Conad "Il Biologico"	CONBIO	1	1	1	0	1
	Coop	Coop	COOP	2	0	0	0	0
		FiorFiore	COOPF	1	0	0	1	1
		Solidal Coop	COOPS	2	2	2	1	2
	Ecor	Ecor	ECOR	1	1	1	0	1
		Natura Si	NATS	1	1	1	0	1
	Illy Caffè	Illy	ILLY	3	0	0	0	3
	Lavazza	Lavazza	LVZZ	7	0	0	0	7
		!Tierra!	ITI	-	-	-	-	-
	Passalacqua	Passalacqua	PSSL	4	0	0	0	3
UK	Cafedirect	Monorigine	CDM	4	0	4	4	4
		Organic	CDO	-	-	-	-	-
		Blends	CDB	6	0	6	0	6
	Sainsbury	Fair Trade	SBFT	11	1	11	1	11
		Taste the difference	SBTTF	10	0	10	9	10
	Tesco	Local	TSCLC	6	6	0	1	6
		Finest	TSCFIN	10	1	9	9	10

The results have been displayed graphically in the following figure 1 where we show the percentage of products disclosing the environmental and the social activities by brands.

The picture highlights the presence of four main clusters: Traditional Producers; Partially Responsible Producers; Fair-trade Producers; Ethical Producers.

The first cluster is composed by the Italian traditional producers that do not do any kind of social disclosure through the packaging, while focusing their communication on their brand. The second cluster is composed by the Italian Coop and by Tesco in UK. These big players have created specific lines to disclose their socially responsible activities overseas.

The third cluster is composed by the Fair-trade producers mostly focused on Social Performance and with a limited focus on the Environmental one.

In the last cluster (Ecor and Alce Nero in Italy) we have the two producers that are fully leveraging their CSR related activities. AltroMercato, in Italy, is in the middle ground between these last two clusters.

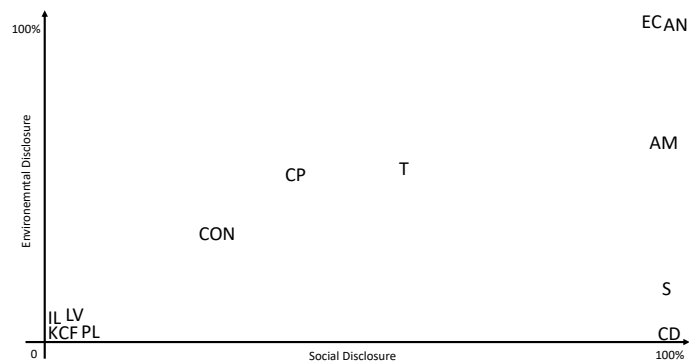


Figure 1 – SRD by coffee Brands in the 2014

The results in the 2018 investigation have been reported in table 5.

Table 5. – Results in the 2018

Mkt	Company	Brand	Abbr.	2018				
				Products	Env.	Social	CoO	Blend or Taste
Italy	Alce Nero	Alcenero	AN	3	3	3	3	3
		Altromercato	AMA	5	0	5	0	5
	Altromercato	BioCaffè	AMB	4	4	4	0	4
		Monorigine	AMM	3	3	3	3	3
	Cafè do Brazil	Kimbo	KMB	10	1	1	0	10
		Kosè	KOSE'	2	0	0	0	2
	Carrefour	Normal / Classic	CRFN	5	0	0	0	5
		Selection	CRFS	2	0	0	2	2
		Bio	CRFB	1	1	1	1	0
	CONAD	Conad	CONAD	7	0	0	0	7
		Conad "Il Biologico"	CONBIO	1	1	1	1	1
	Coop	Coop	COOP	5	0	0	0	5
		FiorFiore	COOPF	1	0	0	1	1
		Solidal Coop	COOPS	2	2	2	1	0
	Ecor	Ecor	ECOR	2	2	2	0	0
		Natura Si	NATS	-	-	-	-	-
	Illy Caffè	Illy	ILLY	7	0	0	4	7
	Lavazza	Lavazza	LVZZ	7	0	0	0	7
		!Tierra!	!T!	5	5	5	5	5
	Passalacqua	Passalacqua	PSSL	4	0	0	0	4
UK	Cafedirect	Monorigine	CDM	5	1	5	5	5
		Organic	CDO	4	4	2	2	4
		Blends	CDB	5	1	5	5	7
	Sainsbury	Fair Trade	SBFT	7	1	7	1	7
		Taste the difference	SBTTF	9	0	9	9	9
	Tesco	Local	TSCLC	6	6	0	1	6
		Finest	TSCFIN	7	0	7	7	7

As before, we have represented the brands SRD in a figure (figure 2).

After 5 years the cluster of the traditional players have reacted to the market need of SRD and Cafè do Brasil, with the Italian Private label have created a different cluster with around the 20% of certified product lines.

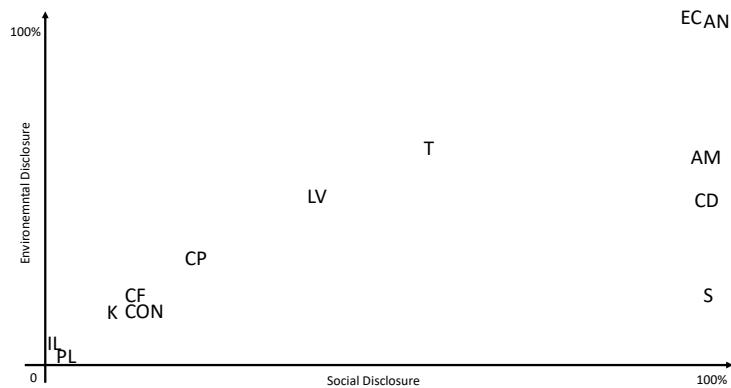


Figure 2 - SRD by coffee brands in the 2018

Lavazza has strongly pushed toward sustainability (40% in both EP and SP). Cafédirect in Uk has joined Altrmercato to highlight a common strategy of these two fully fair-trade producers. The changes have been represented in the following table 6, and in figure 3.

Tables 6 – the change in the 5 years

		2014		2018		GAP	
		Env SRD	Social SRD	Env SRD	Social SRD	Env SRD	Social SRD
Alce Nero	AN	100%	100%	100%	100%	0%	0%
Altrmercato	AM	58%	100%	58%	100%	0%	0%
Cafè do Brasil	K	0%	0%	8%	8%	8%	8%
Carrefour	CF	0%	0%	13%	13%	13%	13%
CONAD	CON	25%	25%	13%	13%	-13%	-13%
Coop	CP	40%	40%	25%	25%	-15%	-15%
Ecor	EC	100%	100%	100%	100%	0%	0%
Illy Caffè	IL	0%	0%	0%	0%	0%	0%
Lavazza	LV	0%	0%	42%	42%	42%	42%
Passalacqua	PL	0%	0%	0%	0%	0%	0%
Cafedirect	CD	0%	100%	43%	100%	43%	0%
Sainsbury	S	5%	100%	6%	100%	1%	0%
Tesco	T	44%	56%	46%	54%	2%	-2%

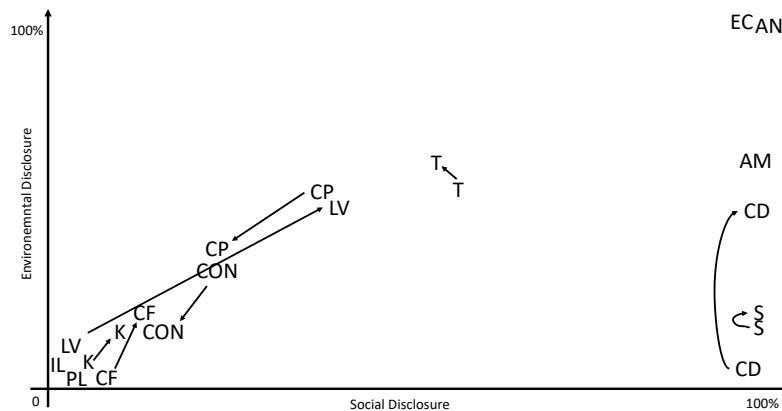


Figure 2 - SRD by coffee brands in the 2018

6 Conclusions

Our preliminary findings show that Companies in the Coffee Industry are reacting to the consumers' requests of a Behavior not only by the company but by their whole supply chain.

In particular we have found that in the 2014 there was a clear division between the two markets as in the UK there was a stronger adoption of the fair-trade label that. This label is mostly focused on the social aspects of sustainable development even if it asks companies to act for limiting the damages to the environment.

In Italy, we have found a stronger pressure towards the environmental side of CSR even if the players adopting the Ecolabel have even adopted the Fair-trade label in order to attest their behavior in the Social dimension of sustainability.

During the last years, the pressure towards sustainability have driven some of the traditional companies to create specific product lines to attract the more sensitive part of the market, with the exceptional growth of Lavazza that has decided to create a specific line so it now certifies the 40% of their product lines (not sales). Using this strategy these players have been able to play in several different segments, as shown by the increased number of product lines (from 54 to 76 in Italy).

The data show that the difference between the two market has slowly been reducing as the companies in both markets are starting to leverage SRD in both dimensions.

Our paper is just the preliminary findings to these topics, and they highlight several new directions for further analysis.

On one side, focusing on the Italian market we should focus on the effect that the new coffee caps have had toward SRD. As these products are usually sold for higher prices, they create the resources to buy more certification and to source in a more responsible way.

On the other side, we should factor in the real market effects linked to these new more sustainable product lines gathering data on the consumer perception of these labels in

order to understand if they know the differences among them or, at the very least, if they are able to discern among them.

References

- Ampuero, O., & Vila N. (2006). Consumer perceptions of product packaging, *Journal of Consumer Marketing*, 23(2), 100 – 112.
- Arnot, C., Boxall, P. C., & Cash, S. B. (2006). Do ethical consumers care about price? A revealed preference analysis of fair trade coffee purchases. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*, 54(4), 555-565.
- Auger, P., Burke, P., Devinney, T. M., & Louviere, J. J. (2003). What will consumers pay for social product features?. *Journal of Business Ethics*, 42(3), 281-304.
- Auger, P., Devinney, T. M., Louviere, J. J., & Burke, P. F. (2008). Do social product features have value to consumers?. *International Journal of Research in Marketing*, 25(3), 183-191.
- Azad, N., & Hamdavi pour, L. (2012). A study on effects of packaging characteristics on consumer's purchasing confidence. *Management Science Letters*, 2(1), 397-402.
- Berthelot, S., Cormier, D., & Magnan, M. (2003). Environmental disclosure research: review and synthesis. *Journal of Accounting Literature*, 22, 1-44.
- Boardman, J., & Sauser, B. (2008). *Systems thinking: Coping with 21st century problems*. CRC Press.
- Bone, P. F., & Corey, R. J. (2000). Packaging ethics: Perceptual differences among packaging professionals, brand managers and ethically-interested consumers. *Journal of Business Ethics*, 24(3), 199-213.
- Branco, M. C., & Rodrigues, L. L. (2008). Factors influencing social responsibility disclosure by Portuguese companies. *Journal of Business Ethics*, 83(4), 685-701.
- Brown, T. J., & Dacin, P. A. (1997). The company and the product: Corporate associations and consumer product responses. *Journal of marketing*, 61(1), 68-84.
- Carroll, A. B., & Shabana, K. M. (2010). The business case for corporate social responsibility: a review of concepts, research and practice. *International Journal of Management Reviews*, 12(1), 85-105.
- Porter, M. E., & Kramer, M. R. (2006). The link between competitive advantage and corporate social responsibility. *Harvard business review*, 84(12), 78-92.
- Catturani, I., Nocella, G., Romano, D., & Stefani, G. (2008). Segmenting the Italian coffee market: marketing opportunities for economic agents working along the international coffee chain. In 12th Congress of the European Association of Agricultural Economists, Ghent, Belgium.
- Chauvey, J. N., Giordano-Spring, S., Cho, C. H., & Patten, D. M. (2015). The normativity and legitimacy of CSR disclosure: Evidence from France. *Journal of Business Ethics*, 130(4), 789-803.
- Codron, J. M., Siriex, L., & Reardon, T. (2006). Social and environmental attributes of food products in an emerging mass market: Challenges of signaling and consumer perception, with European illustrations. *Agriculture and Human Values*, 23(3), 283-297.
- Dawkins, J., & Lewis, S. (2003). CSR in Stakeholder Expectations: And Their Implication for Company Strategy. *Journal of Business Ethics*, 44(2-3), 185-193.
- De Pelsmacker, P., & Janssens, W. (2007). A model for fair trade buying behaviour: The role of perceived quantity and quality of information and of product-specific attitudes. *Journal of Business Ethics*, 75(4), 361-380.
- De Pelsmacker, P., Driesen, L., & Rayp, G. (2005). Do consumers care about ethics? Willingness to pay for fair-trade coffee. *Journal of consumer affairs*, 39(2), 363-385.
- Deegan, C. (2002). The Legitimising Effect of Social and Environmental Disclosures - A Theoretical Foundation, *Accounting, Auditing & Accountability Journal* 15(3), 282-311.

- Donaldson, T., & Dunfee, T. W. (2002). Ties that bind in business ethics: Social contracts and why they matter. *Journal of Banking & Finance*, 26(9), 1853-1865.
- Dubbink, W., Graafland, J., & Van Liedekerke, L. (2008). CSR, transparency and the role of intermediate organisations. *Journal of Business Ethics*, 82(2), 391-406.
- Ekeh, P. P. (1974). *Social Exchange Theory: The Two Traditions*, Harvard University Press.
- Elkington, J. (1994). Towards the sustainable corporation: Win-win-win business strategies for sustainable development. *California management review*, 36(2), 90-100.
- Folkes, V. S., & Kamins, M. A. (1999). Effects of information about firms' ethical and unethical actions on consumers' attitudes. *Journal of Consumer Psychology*, 8(3), 243-259.
- Font, X., & Harris, C. (2004). Rethinking standards from green to sustainable. *Annals of tourism Research*, 31(4), 986-1007.
- Freeman, R. E. (2010). *Strategic management: A stakeholder approach*. Cambridge university press.
- Frooman, J. (1999). Stakeholder influence strategies. *Academy of management review*, 24(2), 191-205.
- Galarraga Gallastegui, I. (2002). The use of eco-labels: a review of the literature. *European Environment*, 12(6), 316-331.
- Godfrey, P. C. (2005). The relationship between corporate philanthropy and shareholder wealth: A risk management perspective. *Academy of management review*, 30(4), 777-798.
- Hanss, D., & Böhm, G. (2012). Sustainability seen from the perspective of consumers. *International Journal of Consumer Studies*, 36(6), 678-687.
- Harrison, J. S., & Wicks, A. C. (2013). Stakeholder theory, value, and firm performance. *Business ethics quarterly*, 23(1), 97-124.
- Harrison, J. S., Bosse, D. A., & Phillips, R. A. (2010). Managing for stakeholders, stakeholder utility functions, and competitive advantage. *Strategic management journal*, 31(1), 58-74.
- Hooghiemstra, R. (2000). Corporate Communication and Impression Management: New Perspectives Why Companies Engage in Corporate Social Reporting. *Journal of Business Ethics*, 27(1/2), 55-68.
- Ingram, R. W. (1978). An investigation of the information content of (certain) social responsibility disclosures. *Journal of accounting research*, 270-285.
- Jenkins, H., & Yakovleva, N. (2006). Corporate social responsibility in the mining industry: Exploring trends in social and environmental disclosure. *Journal of cleaner production*, 14(3), 271-284.
- Kolk, A. (2003). Trends in Sustainability Reporting by the Fortune Global 250'. *Business Strategy and the Environment*, 12(5), 279-291.
- Lamberti, L., & Lettieri, E. (2009). CSR practices and corporate strategy: Evidence from a longitudinal case study. *Journal of Business Ethics*, 87(2), 153-168.
- Maak, T. (2007). Responsible leadership, stakeholder engagement, and the emergence of social capital. *Journal of Business Ethics*, 74(4), 329-343.
- Mackey, A., Mackey, T. B., & Barney, J. B. (2007). Corporate social responsibility and firm performance: Investor preferences and corporate strategies. *Academy of management review*, 32(3), 817-835.
- Markley, M. J., & Davis, L. (2007). Exploring future competitive advantage through sustainable supply chains. *International Journal of Physical Distribution & Logistics Management*, 37(9), 763-774.
- Matos, S., & Hall, J. (2007). Integrating sustainable development in the supply chain: The case of life cycle assessment in oil and gas and agricultural biotechnology. *Journal of Operations Management*, 25(6), 1083-1102.
- McDaniel, C. & Baker, R.C. (1977). Convenience food packaging and the perception of product quality", *Journal of Marketing*, October, pp. 57-8.

- Mohr, L. A., Webb, D. J., & Harris, K. E. (2001). Do consumers expect companies to be socially responsible? The impact of corporate social responsibility on buying behavior. *Journal of Consumer affairs*, 35(1), 45-72.
- Neu, D., Warsame, H., & Pedwell, K. (1998). Managing public impressions: environmental disclosures in annual reports. *Accounting, organizations and society*, 23(3), 265-282.
- Nilsson, H., Tunçer, B., & Thidell, Å. (2004). The use of eco-labeling like initiatives on food products to promote quality assurance—is there enough credibility?. *Journal of Cleaner production*, 12(5), 517-526.
- Passet, R. (1996). *L'économie et le vivant*, Paris. Economica, 2.
- Pearce, R. (1999). Social responsibility in the marketplace: asymmetric information in food labelling. *Business Ethics: A European Review*, 8(1), 26-36.
- Perna, T. (1998). *Fair Trade: la sfida etica al mercato mondiale*. Bollati Boringhieri.
- Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. Harper & Row.
- Prendergast, P.G. & Pitt, L. (1996). Packaging, marketing, logistics and the environment: are there trade-offs?, *International Journal of Physical Distribution & Logistics Management*, 26(6), 60-72.
- Rettie, R. & Brewer, C. (2000). The verbal and visual components of package design, *Journal of Product & Brand Management*, 9(1), 56-70.
- Rokka, J., & Uusitalo, L. (2008). Preference for green packaging in consumer product choices—do consumers care?. *International Journal of Consumer Studies*, 32(5), 516-525.
- Sciarelli, M. (2012). *Corporate social performance: il valore allargato nella prospettiva degli stakeholder*. Cedam
- Silayoi, P., & Speece, M. (2007). The importance of packaging attributes: a conjoint analysis approach. *European journal of marketing*, 41(11/12), 1495-1517.
- Teisl, M. F., Rubin, J., & Noblet, C. L. (2008). Non-dirty dancing? Interactions between eco-labels and consumers. *Journal of Economic Psychology*, 29(2), 140-159.
- Thøgersen, J. (2000). Psychological determinants of paying attention to eco-labels in purchase decisions: Model development and multinational validation. *Journal of Consumer Policy*, 23(3), 285-313.
- Underwood, R.L. (2003), The communicative power of product packaging: creating brand identity via lived and mediated experience, *Journal of Marketing Theory and Practice*, Winter, pp. 62-76.
- Van Amstel, M., Driessen, P., & Glasbergen, P. (2008). Eco-labeling and information asymmetry: a comparison of five eco-labels in the Netherlands. *Journal of Cleaner Production*, 16(3), 263-276.
- Wansink, B., Sonka, S. T., & Hasler, C. M. (2004). Front-label health claims: when less is more. *Food Policy*, 29(6), 659-667.
- Yin, R. K. (2003). *Case Study Research: Design and Methods*. SAGE.
- Zimmerman, M. A., & Zeitz, G. J. (2002). Beyond survival: Achieving new venture growth by building legitimacy. *Academy of management review*, 27(3), 414-431.

Developing a Big Picture View on Research through Visualization Techniques

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Abstract

Purpose – The paper presents an approach helping to create a big picture view of the different information pieces involved into research. The approach is based on the use of modern visual knowledge mapping techniques. The focus of this paper is on applying systems thinking and visual metaphors for generalization of the selected research domain of management research. The visualization techniques serve not only to present the results of research analysis and to illustrate generative/analytical techniques representing the data. They are providing insight and communicative tools forming the context essential for the understanding and implementation of the research results and further discussions. Our aim is to give advice on how we can improve general understanding by using visual metaphors for different data, knowledge category and purposes. Examples for the use of this classification system for a big picture view of management research are presented. Specific examples are illustrated by concept maps, mind maps and Ishikawa diagrams.

Design/methodology/approach - This paper is considering the design science research approach and systems thinking. It is focused on the differentiated question-based aspects depending on knowledge type and the visualization techniques. We split the research knowledge domain into seven main categories of knowledge: what, what for, how to, who, where, when, and why. Each of these categories could be better presented by a different visual knowledge codification technique, enabling to create a set of diagrams for the development a big picture view of management research.

Originality/value – This research puts in evidence on the issue of big picture thinking with the use of visualization technique for the knowledge domain of management research. Different stages of research work are exploiting various complex cognitive processes. Research is a collective work and joint understanding and knowledge sharing are essential for the success. Decomposing research tasks ranging from writing a paper

to creating a grant application often results in a comprehensive set of subtasks that have complex dependencies on each other. Visual approach simplifies all the above-mentioned difficulties by creating the illustrations and simplifications of the pieces.

Practical implications – Described big picture visual approach may help young researchers and knowledge analysts to accomplish, to present and to share their results in the research community. This will also help other researchers to interpret the meanings of the concepts correctly, avoiding the cases of semantic ambiguity.

Keywords – knowledge management, visualization technique, big picture research, domain-specific KM, case study.

Paper type – Academic Research Paper

1 Introduction

In recent years, visual metaphors and images have not only become an important communication tool in academia and education to generate and uphold understanding and audience interest but also a rich resource for systems thinking and deep modelling. In this paper we discuss how well-known diagrams gathered from different business domains may be used to rethink and reconsider research in order to present which abstract concepts and objects matter to researchers to identify their ideas and to illustrate their main findings. By using mind maps and other diagrams, we explore how these visual schemes can provide deep contextual presentation of a research big picture for understanding the main ideas, principles, concepts and their relations. To facilitate analysis of the research approach we introduce visual knowledge codification tools and use them to analyze the main elements related to the study. In total, we collected some popular diagrams and used them for the research description and illustration.

However, even the simplest diagrams may cause frustration for the researchers unfamiliar with visual approach. Very few studies exist on what people do to overcome problems they encounter on the way to knowledge mapping, or how diagrams can be designed to aid people when these problems occur. In this paper, we analyze several popular diagrams (like mind maps, concept maps and Ishikawa diagram) on how researchers can implement them in order to present their current research. In particular, we identify the main categories and types of diagrams for the researchers. We analyzed the patterns of how different diagram forms and metaphors are used. We suggest some practical rather than universal solutions that may help both business school students and young researchers in their communications.

2 Research methodology

The use of graphical images, figures and maps is growing in popularity in research publications. In this paper identification and systematization of visual knowledge codification (diagramming) techniques for different management research categories and

purposes was done on the basis of the systemic literature review and interviews. A broader definition of visualization states that it is in general “a graphic representation that depicts information in a way that is conducive to acquiring insights, developing an elaborate understanding, or communicating experiences” (Lengler & Eppler, 2007). As noted by many researchers (Luther, Fiesler & Bruckman, 2013; Hahn, Chang, Kim & Kittur, 2016), decomposing tasks ranging from writing an article to creating an animated film often results in pieces that have complex dependencies on each other. Management research, as well as research in general, develops through small contributions of individuals, each of whom sees only a part of the whole big picture view. Supporting and developing management research requires a big picture view of different pieces at different scales and ensuring they all fit together. Accomplishing big picture thinking through small tasks is challenging because it means that each person can only have a limited view of the bigger picture.

Diagramming techniques were chosen to develop a big picture or visionary view of management research as they “occupy that hinterland between written text and the purely graphical. That is their strength, enabling, often through the use of graphic metaphor, the visual representation of the otherwise invisible” (Richards, 2002). A diagram serves to provide insights, develop an understanding on a specific data or topic (Iliinsky, 2010; Lengler & Eppler, 2007; Yin, 2011).

3 Tool to develop a big picture view on management research

Different stages of research work require various complex cognitive processes. The use of visual knowledge codification techniques simplifies to solve all the subtasks in decomposing research tasks in management. The suggested specification of knowledge types and diagramming techniques in management research is based on previous research and presented in Figure 1 (Kudryavtsev, Gavrilova, 2017).

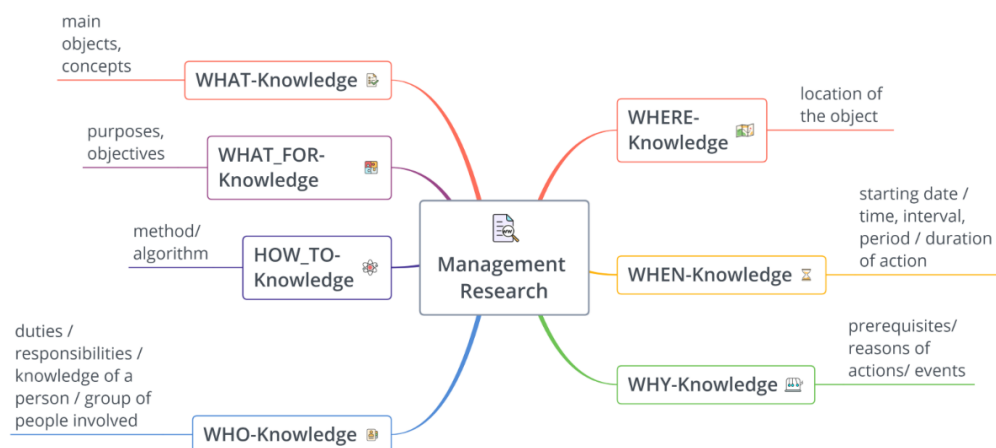


Figure 1 Description of knowledge types in management research developed from (Kudryavtsev, Gavrilova, 2017).

Specification of knowledge types described in Figure 1 helps a lot to create the set of diagrams for the big picture of management research depending on the question under consideration. This helps young researchers and knowledge analysts to find the most appropriate diagram for the presentation of the particular task; the more tasks they visualize this way – the bigger picture they get!

Visual knowledge codification techniques displayed in Figure 2 are universal techniques that can be applied to different knowledge types, but are more frequently used for “what”-knowledge. The visual approach help to inspire the researcher’s creativity and to summarise the heterogeneous pieces of information into more abstract categories.

To capture a big picture of management research, concept maps and mind maps were chosen as commonly used diagrams in scholarly research (Wheeldon & Ahlberg, 2012).

Mind maps are more flexible that concept maps in which a central governing construct is explored using groupings and/or branches (Tattersall & Vernon, 2007; Wheeldon & Ahlberg, 2012). Mind maps presented in Figure 1, 2 help to illustrate the idea of knowledge types and classification of visual knowledge codification techniques in management research, with the most important concepts of knowledge types that radiate from the central idea of management research.

Concept maps represent a technique to describe principles in management research and to represent their perceived relationships between various concepts, usually enclosed in circles or boxes (Novak & Gowin, 1984). In order to explain the conceptual structure of thesis that corresponds to WHAT-Knowledge, concept map was chosen. Linking words in the concept map help to present clear propositions on the structure of thesis described in Figure 2.

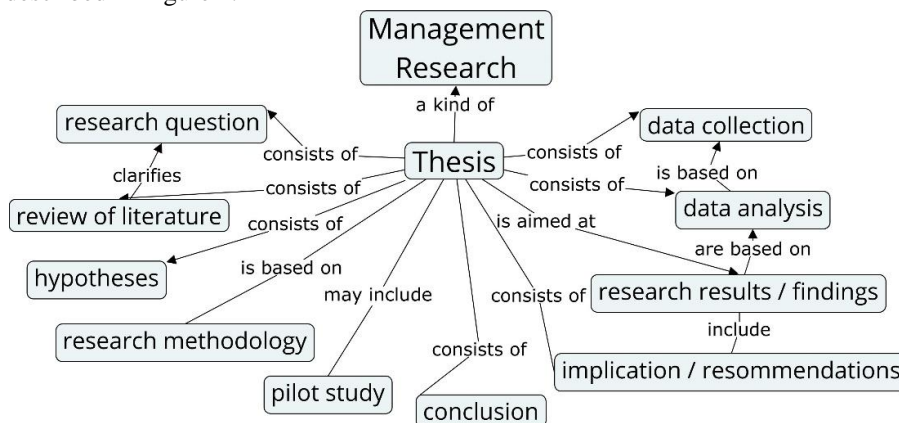


Figure 2 Concept map describing possible structure of the thesis (WHAT-knowledge example).

Cause-and-effect, or fishbone, or an Ishikawa diagram (Ishikawa, 1963; Kenett, 2007) is recommended to present WHY-knowledge, and this was chosen and created for the representation of structured literature review on visual knowledge mapping techniques (see Figure 3 for the part of it). A fishbone diagram is a graphical tool for categorizing the potential causes of a problem in order to identify its root causes. Dr. Kaoru Ishikawa, a Japanese quality control expert, introduced it to help his colleagues avoid solutions that

merely address the symptoms of a much larger problem. The design of the diagram resembles a skeleton of a fish. Fishbone diagrams are typically worked right to left, with each large “bone” of the fish branching out to include smaller bones containing more detail.

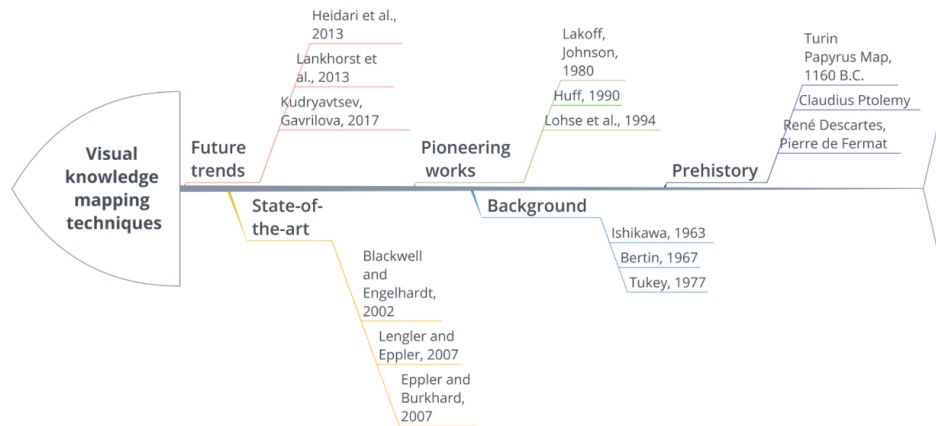


Figure 3 Fragment of Ishikawa diagram for structured literature review (WHY-knowledge example).

Sometimes such diagrams may be used for the historical view. Then the central line of Ishikawa diagram is the metaphor for time, dating back to the prehistoric period and coming to the present time, reflecting the future trends as well. Earlier works caused further development of visual knowledge mapping techniques, so structured literature review refers to WHY-Knowledge.

Usually research tasks require not only a single diagram as they depict various knowledge types; but also a set of diagrams to represent big picture, supporting the concepts presented in each of them. Supporting such work requires having a well-trained generalizing and analyzing abilities for developing the systemic view of different research aspects at different scales and ensuring they all fit together. The diagrams chosen to present research development aim at creating a big picture view of a single research or general research issues and help to avoid semantic interoperability. However, the relationships between different types of research knowledge may be presented by matrix (positioning and decision matrices, generic grid, generic scored profile, generic table) or state-space solutions, tables, profiles, checklists, taxonomy, software, and combinations thereof.

Nowadays there are a number of digital tools to support e-doodling of these diagrams. The authors use some free software to create the presented figures. But in our educational practice we use Microsoft Visio, Mind Manager, IHMC Cmap Tool, Gliffy, Trello, etc. (Capterra, 2019).

4 Conclusions

Visual knowledge codification (diagramming) techniques are widely used in research in general as well as in the management domain for collecting, organizing and summarizing different data. The paper puts in evidence on the issue of a big picture view of the different interdependent information pieces involved into research. Modern visual knowledge codification (diagramming) techniques help to capture a big picture view developing the context for the perception and realization of the research results and discussions. The paper focuses on the graphic representation of experience in the domain of management research. Especially such approach is useful in business schools and universities where students are more focused on the practical goals and underestimate the research activity. They are also unfamiliar with the business research methodology.

The study identified a visual approach that can help to create a big picture methodological view of the different information pieces (data, definitions, cases, documents, video- and audio-content, etc.) involved into research. Described diagramming techniques may help young researchers and knowledge analysts to accomplish, to present and to highlight their results either for a particular research project or for general research issues.

Concept maps provide a more structured approach to present connections to the management research concepts, with linking words depicting clear propositions. On the other hand, mind maps are more flexible tools in which a central concept is represented using groupings and/or branches. Besides, Ishikawa diagram serves a tool to explore cause and effect of a problem. The relationships between different knowledge types of management research may be presented by matrix or state-space solutions, tables, profiles, checklists, taxonomy, software, and combinations thereof.

Well-facilitated by technology media visual representation of a big picture view on management research provides additional data representation, serves an attempt towards better communication between all the stakeholders and contributes to the growing interest to the use of visual methods for business and academic purposes.

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References

- Alavi, M., & Leidner, D. (2001). "Knowledge management and knowledge management systems: conceptual foundations and research issues", *MIS Quarterly*, Vol. 25, No.1, pp. 107–136.
- Banks, M. (2001). *Visual methods in social research*. London: Sage.
- Bosch, O. J. H., King, C. A., Herbohn, J. L., Russell, I. W., & Smith, C. S. (2007). "Getting the Big Picture in Natural Resource Management—Systems Thinking as 'Method' for Scientists, Policy Makers and Other Stakeholders", *Systems Research and Behavioral Science Syst. Res.* Vol. 24, pp. 217-232.

- Hahn, N., Chang, J., Kim, J.E., & Kittur, A. (2016). "The Knowledge Accelerator: Big Picture Thinking in Small Pieces", CHI'16, May 07 - 12, 2016, San Jose, CA, USA, <http://dx.doi.org/10.1145/2858036.2858364>
- Iliinsky, N. (2010). On beauty. In J. Steele & N. Iliinsky (Eds.), *Beautiful visualization: Looking at data through the eyes of experts* (pp. 1–13). Sebastopol, CA: O'Reilly Media.
- Kudryavtsev, D., & Gavrilova, T. (2017). "From anarchy to system: A novel classification of visual knowledge codification techniques", *Knowledge and Process Management*, Vol. 24, No. 1, pp. 3-13.
- Lengler, R., & Eppler, M. (2007). Towards a periodic table of visualization methods for management. IASTED Proceedings of the Conference on Graphics and Visualization in Engineering, Clearwater, FL, USA, http://www.visual-literacy.org/periodic_table/periodic_table.pdf
- Luther, K., Fiesler, C., & Bruckman, A. (2013). "Redistributing Leadership in Online Creative Collaboration", Proceedings of the 2013 Conference on Computer Supported Cooperative Work (CSCW '13). ACM, New York, NY, USA, 1007–1022. DOI: <http://dx.doi.org/10.1145/2441776.2441891>
- Novak, J. D., & Gowin, D. B. (1984). *Learning how to learn*. Cambridge, UK: Cambridge University Press.
- Richards, C. (2002). The fundamental design variables of diagramming. In M. Anderson, B. Meye, & P. Olivier (Eds.), *Diagrammatic representation and reasoning* (pp. 85-102). London: Springer-Verlag London Limited.
- Tattersall, C., & Vernon, S. (2007). Mind mapping as a tool in qualitative research. *Nursing Times.Net*, 103, 32-33.
- Umoquit, M., Tso, P., Varga-Atkins, T., O'Brien, M., & Wheeldon, J. (2013). "Diagrammatic elicitation: Defining the use of diagrams in data collection", *The Qualitative Report*, Vol. 18, No.60, pp. 1-12.
- Wheeldon, J., & Ahlberg, M. (2012). *Visualizing social science research: Maps, methods, and meaning*. Thousand Oaks, CA: Sage Publications.
- Yin, R. K. (2011). *Qualitative research from start to finish*. New York, NY: Guilford Press.
- Captterra (2019). *Mind Mapping Software*. USA. <https://www.captterra.com/mind-mapping-software/>

Solving Internal Environmental Barriers with KM Practices

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Abstract

In relation to SMEs (small and medium sized enterprises), there is a lack of managerial mechanisms to overcome environmental knowledge barriers. Some of these barriers are related to resource shortages or outdated knowledge, which can impede the utilization of Knowledge. In the following paper, we consider that if environmental knowledge barriers are present then specific knowledge management practices are required to stimulate the utilization of knowledge and, hence, provide for the assimilation of knowledge. Thus, in this paper, we focus on socializations practices as a method to counteract the problem of environmental knowledge barriers. We have analysed the relationships between environmental knowledge barriers and the SECI model using an empirical study of 87 Spanish Knowledge Intensive Business Services (commonly known as KIBS) (are services and business operations heavily reliant on professional knowledge) in SMEs, in order to identify whether the impact of environmental knowledge barriers on knowledge utilization can be mitigated through socializations practices. Our results confirm that when environmental knowledge barriers take place, the relationship between socializations practices and the utilization of Knowledge is weaker than it otherwise would be.

Keywords – Environmental knowledge barriers, Utilization of knowledge, Socializations practices.

Paper type – Academic Research Paper

1 Introduction

In recent years, small KIBS enterprises have been under pressure to innovate in order to meet modern world customers' requirements. Whilst many researchers investigated into open innovation in KIBS organisations, the main focus has been on large organisations. SMEs normally face more resource constraints than large organisations, and this could potentially influence the adoption of open innovation in SMEs. In order to create a more enabling environment for open innovation in KIBS SMEs, it is necessary to gain further insights into this domain.

The great challenge of our days is the care of the environment because the natural resource are in rapid decline (Cegarra-Navarro & Martinez, 2010; Mardani et al., 2017). Increasingly, several previous research have analysed the role of environmental sustainability in different areas such as; waste management, green product or service, climate, energy, tourism and tourist behaviour, information and communication technology, decision making, business performance and practices (Mardani et al., 2017) and other topics. In environmental issues, the principles, rules and methods are constantly questioned because rapid changes require it.

Companies are increasingly challenged to include environmental concerns in their activities. While in the past companies were considered to be mainly the source of the environmental problems, more recently they are increasingly seen as a possible solution largely thanks to their eco-innovative activity (Cainelli, De Marchi, & Grandinetti, 2015). Although, a growing number of businesses and researchers have recognised economic advantages in environmental practices, however, some companies are not implementing sustainable practices (Darnall, Henriques, & Sadorsky, 2010). The companies find barriers to applied and use environmental knowledge (Martínez-Martínez & Cegarra-Navarro, 2018; Murillo-Luna, Garcés-Ayerbe, & Rivera-Torres, 2011; Pinget, Bocquet, & Mothe, 2015; Yang & Zhang, 2017).

It should be also noted that previous studies have implicitly identified barriers to use the environmental knowledge into internal and external barriers (Chan, Okumus, & Chan, 2015; Murillo-Luna et al., 2011). The external barriers cannot always be controlled by firms (for example, legislation) however, in the internal barriers the firms could decide and act on them to modify, it seems interesting to investigate about the second type. For example, as Darnall et al., (2010) said, while smaller firms are less likely to undertake as many environmental practices as larger firms, extant literature suggests that smaller firms may be more responsive to the pressures to owners, managers or worker, in addition other stakeholder, to implement them.

In order to move towards adopting more sustainable measures, the elimination of barriers to environmental knowledge is necessary (Connell, 2010). One way people can overcome environmental knowledge barriers is by knowledge socialization practices, such practices help increase interaction between managers and organizational members that entrust them to share diverse interpretations of problems and solutions (Martínez-Martínez & Cegarra-Navarro, 2018), which serves to foster the utilization and promote the integration of heterogeneous knowledge (Cainelli et al., 2015). This study investigates

how socialization practices can mitigate or even counteract the presence of environmental knowledge barriers, along with investigating how such a process can, in turn, result in successful knowledge utilization.

This research contributes to the relevant literature in several ways. Firstly, it focus on the knowledge-intensive business services (hereafter KIBS) which makes this research unique when compared to previous studies, which have examined this problem in industrial contexts. Secondly, in the literature there are many researches on the need to use environmental knowledge but we are finding a gap between barriers to use environmental knowledge in KIBS SMEs (Castaldi, Faber, & Kishna, 2013; Pinget et al., 2015). We are focus on internal barriers of environmental knowledge in KIBS because those firms are facilitators to knowledge, research about the barriers to use environmental knowledge could be a first step to eliminate those barriers and to use environmental knowledge by KIBS. The proposed theoretical framework is presented in the following section. Details of the survey that was used to collect appropriate data to test the model are presented in section 3, results in section 4 and the conclusions, managerial implications and limitations are discussed in section 5.

2 The proposed research model

2.1. Knowledge utilization

To define knowledge utilization, we would argue that “knowledge application” is one thing and “applying knowledge” another. While knowledge application is a KM process that entails being good at transferring knowledge from one context to another (Gold, Malhotra, & Segars, 2001), applying knowledge learned to a new context may provide organizations with the incentive to improve efficiency (Senge, 1990). Put another way, while knowledge application is the capability for effective action, applying knowledge is the effective action in the business, which may involve many complex issues. This paper will therefore focus on our consideration that “knowledge utilization” is one way to apply learned knowledge to new understandings and situations to create the perception among customers that the company’s version of its product or service is somehow different and thus has added value that is not available from its competitors (Khamseh, Jolly, & Morel, 2017; Kim & Kim, 2017; Martelo-Landroguéz & Cegarra-Navarro, 2014).

2.2. Environmental knowledge utilization

As shown in Table 1, environmental knowledge (EK) has been defined in different ways. While there are authors who identify the key enablers of EK, there are others who point out the key outputs. At this point, it is also important to differentiate between reflective and formative constructs. Based on the presence of enablers versus outputs, we can find an interesting perspective about formative and reflective measurements (Rigdon, 2016). While the presence of a composite reflective EK-construct may show a high level of correlation between EK utilization issues (Cepeda-Carrion, Cegarra-Navarro, & Cillo,

2019), a composite formative EK construct may show that its EK-enablers are the ingredients to be combined to shape the construct itself (Cepeda-Carrion et al., 2019). In this study, environmental knowledge utilization is specified as a composite reflective construct given that there is a high level of correlation between indicators (Dijkstra & Henseler, 2015; Henseler, Hubona, & Ray, 2016).

Table 1. Key definitions of environmental knowledge

Definition	Source
'refers to the understanding and retention of information on ecological problems and connexions' (pp. 2)	Martínez-Martínez, Zumel-Jiménez and Cegarra-Navarro (2018)
'is a stronger predictor of private pro-environmental behavior than professional environmental knowledge' (pp. 289)	Duan and Sheng (2018)
'two constructs based on the amount of "real" (objective) and "perceived" (subjective) knowledge with regards to environmental problems and solutions' (pp. 4)	Kim, Kim and Thapa (2018)
'is technology transfer and spillovers' (pp. 382)	Ning and Wang (2018)
'is a significant predictor of environmental behaviour' (pp.86)	Myung (2017)
'shapes environmentally friendly attitudes and more responsible behaviours in relation to the surrounding environment' (pp. 385)	Paço and Lavrador (2017)
'is closer to a wide range of resources for effective action (i.e. procedural knowledge)' (pp. 283)	Martínez-Martínez, Cegarra-Navarro and García-Pérez (2015)
is a process that entails being good at transferring knowledge from one context to another (pp. 225)	Nieves and Haller, (2014)
'embedded explanatory, instrumental and evaluative knowledge, offering the "why" and "how" for the internal organisational agents (i.e. shareholders, management, and employees)' (pp. 343)	Cegarra-Navarro <i>et al.</i> (2013)
'how different approaches can work together to better steward and manage the environment and natural resources' (pp. 2)	Whyte (2013)
'as the knowledge on what people know about the environment, key relationships leading to environmental impacts, an appreciation of the 'whole systems', and collective responsibilities necessary for sustainable development' (pp. 148)	Aman, Haru and Hussein (2012)
'it relies upon the recipient actors involved (e.g. farmers, residents or visitors' (pp. 7)	Raymond <i>et al.</i> (2010)
'a key factor in the successful marketing of a product is the identification of what is important to the decision-making process' (pp.2)	Barber, Taylor and Strick (2009)
'involves what is common knowledge for society about the environment, key relationships leading to environmental aspects or impacts, and an appreciation of systems, and collective responsibilities necessary for sustainable development' (pp. 37)	Po-Shin and Li-Hsing (2009)
'are attitudes, which in turn motivate ecologically or environmentally responsible consumer behaviour' (pp. 428)	Haron, Paim and Yahaya (2005)
'a general knowledge of facts, concepts, and relationships concerning the natural environment and its major ecosystems' (pp. 48)	Fryxell and Lo (2003)
as a system that connects data, analysis and people and presents an opportunity to formalise developed ecology in a business environment (pp. 8)	Wernick (2003)
'know-how of all employees and the continuous improvements made in the company's daily practices' (pp. 292)	Boiral (2002)
'can be defined as the degree to which one express concern about ecological issues' (pp.342)	Amyx <i>et al.</i> (1994)

Adapted from: Martínez-Martínez, Cegarra-Navarro, García-Pérez, & Moreno-Ponce, (2019)

2.3. Internal and external barriers to use environmental knowledge

From a KM perspective, external barriers play an important role, but more important are internal barriers and the way they are overcome (Connell, 2010). According to the resource capacity theory (Wang & Byrd, 2017), while the way companies face external barriers can be a source of threats and opportunities (as shown in Table 2), the way an organization faces high innovation costs or intellectual property issues to deal with the environmental impact of the company is increasingly important in creating market value and sustainable competitive advantages. Because of this issue, we wanted to provide evidence that a socialization can play a part in overcoming some of the internal obstacles to the utilization of environmental knowledge.

Table 2. Barriers that hinder EK utilization

Internal barriers	External barriers
Financial barriers high innovation costs Shortage of qualified personnel Limited internal know-how to manage the innovation process Missing market access knowledge- to meet customer's needs- to enter foreign markets Lack of Information and knowledge about technologies Lack of intellectual property rights	Lack of efficient government support Bureaucratic hurdles- long administrative procedures- restrictive laws and regulations Lack of external partners and networking possibilities

Adapted from: (Sánchez-Polo; Cegarra-Navarro; Cillo; Wensley, 2019)

2.4. Linking environmental barriers with the effective utilization of environmental knowledge

The idea of environmental knowledge refers to the way in which companies align their strategic goals to sustainable development (Wernick, 2003). Research by Fryxell and Lo (2015) defined environmental knowledge as a general knowledge of facts, concepts, and relationships concerning the natural environment and its major ecosystems. In their research, Martínez-Martínez, Cegarra-Navarro and García-Pérez, (2015) found that the conservation of the environment becomes a key factor to be considered in the management of services business. In this regard, environmental knowledge involves what people or agents know about the environment, key relationships leading to environmental aspects or their impact, and an appreciation of systems and collective responsibilities necessary for sustainable development (Frick, Kaiser, & Wilson, 2004).

The sector of the knowledge-intensive business services (KIBS) consists mostly of SMEs (Savic, 2016). SME generate a great deal of the environmental contamination (Del Brío & Junquera, 2003). In this vein, SME tend to focus less on environmental questions than larger companies, even though they account for approximately 64% of all industrial pollution (Calogirou, Sørensen, Bjørn Larsen, & Alexopoulou, 2010). Under this framework, normative instruments for SME should be put on the nature and magnitude of the environmental contamination and that efforts should rather be directed towards the effective use of environmental knowledge (Del Brío & Junquera, 2003).

This study has selected KIBS companies since knowledge and knowledge management are the core activities of these organizations (Bettiol, Di Maria, & Grandinetti, 2012). The core of KIBS is comprised by knowledge related activities such as innovative and electronic services (Figueiredo, Neto, Quelhas, & Ferreira, 2017), or eco-innovative products and services (Cainelli et al., 2015; Marchi & Grandinetti, 2013). Although a significant majority of KIBS companies have adopted eco-innovative products and services as a way of improving customer relations (Figueiredo et al., 2017; Muller & Zenker, 2001; Scarso & Bolisani, 2012), many struggle with great challenges and barriers to implement such measures (Pinget et al., 2015).

Based on the work of (Chan et al., 2015; Connell, 2010; Murillo-Luna et al., 2011), in order to understand what hinders the utilization of environmental knowledge, the barriers may be divided into two sub-components (i.e. internal and external barriers). This study focus on internal barriers because the KIBS could decide and act on them to identify solutions (Murillo-Luna et al., 2011). Among the most common internal barriers to the effective use of technologies encompass, we might encounter the following internal barriers:

- Lack of financial resources or access to financing, they are signalled as an important environmental knowledge barriers (Azzone & Noci, 1998; Connell, 2010; Del Brío & Junquera, 2003; Delgado-Ceballos, Aragón-Correa, Ortiz-de-Mandojana, & Rueda-Manzanares, 2012; Pinget et al., 2015; Walker, Janice, Lynnaire, Calvin, & Ute, 2008). Pinget et al., (2015) said that financial barriers significantly affect companies' decisions to abandon, slow down, or not start innovative projects. In spite of, it is shows the positive relationship of environmental knowledge and business performance (Dangelico & Pontrandolfo, 2015; González-Benito & González-Benito, 2005).
- Limited human resources. It would be a barrier if they did not get involved, since the environmental knowledge is intensive in human resources (Connell, 2010; Del Brío & Junquera, 2003; Delgado-Ceballos et al., 2012; Murillo-Luna et al., 2011; Valero-Gil, Rivera-Torres, & Garcés-Ayerbe, 2017; Zaragoza-Sáez, Claver-Cortés, Marco-Lajara, & Úbeda-García, 2016), and it depends on the ability, involvement and motivation of the employees to achieve their effective application (Zilahy, 2004).
- Resistance from the organizational members. The resistance to changes or organizational inertia are less obvious barriers than financial ones, but they will be more difficult to overcome (Aquilani, Abbate, & Codini, 2017; Delgado-Ceballos et al., 2012; Gray, 2002; Kollmuss & Agyeman, 2002; Peattie & Ring, 1993; Valero-Gil et al., 2017). Besides, barrier that limits the socialization practices and acquisition of environmental knowledge (Connell, 2010; Del Brío & Junquera, 2003) .

Bearing in mind the above, it seems logical to think that the presence of environmental knowledge barriers may hinder the effective utilization of environmental knowledge (Walker et al., 2008). An example of this negative impact on the effective utilization of environmental knowledge is when internal barriers such as resistance to change or lack

financial resources make many KIBS wary of incorporating eco-effective practices into their daily routines. Therefore, this led the authors to hypothesise that:

Hypothesis 1: The presence of environmental knowledge barriers has a negative effect on knowledge utilization.

2.5. Overcoming environmental barriers by socialization

Environmental knowledge involved in environmental activities can be tacit or codified and it can be generated within the KIBS companies or be acquired from external sources such as network partners (Dominguez Gonzalez & Martins, 2017). However, explicit knowledge is not the exclusive dimension involved in environmental knowledge (Boiral, 2002). The companies need all type of environmental knowledge explicit and encoded (for example, environmental management systems as such as, ISO 14000) but the companies should not ignore or unacknowledged the implicit, subjective and tacit environmental knowledge (for example, environmental knowledge of the worker who implemented ISO 14000). The main characteristics of tacit knowledge are implicit, inarticulate or personal knowledge (Polanyi, 1962). Some companies taken their workers' environmental knowledge and turned them into the main thrust of their environmental actions (Boiral, 2002).

Environmental knowledge is not of a rigid nature. In fact, it can be acquired, distributed and utilized. Viewing the companies as a knowledge-creating entity, (Nonaka, 1994; Nonaka, Toyama, & Konno, 2000) illustrate the knowledge transformation processes that might occur within companies and develop a knowledge-use function that indicates knowledge-use capabilities of the company. In this respect, these authors try to demonstrate that the knowledge conversion process involves tacit knowledge (Nonaka et al., 2000). One of the most difficult and most interesting steps in the knowledge management process is capturing tacit knowledge (Dominguez Gonzalez & Martins, 2017). In this context it is appropriate to note that previous studies show how transactive memory systems (i.e. tacit knowledge of knowledge agents) support initiatives to increase efficiency and effectiveness in the use of environmental practices (Lewis, 2004; Martinez-Martinez, Cegarra-Navarro, Garcia-Perez, & Wensley, 2019).

So far, it may be observed that knowledge workers potentially allow end users of KIBS to gain much deeper insight into environmental issues and make more informed decisions (Figueiredo et al., 2017). Although workers often work autonomously, they also collaborate between team members, observing the team members, each team member try to analyse the other workers to bring out personal environmental knowledge (Cegarra-Navarro & Martinez, 2010; Po-Shin & Li-Hsing, 2009).

As noted above, the presence of socialization practices between company's members acquired environmental knowledge to learning from each other. They have capacity to react to and use environmental knowledge how response to external factors and by changing the ways individuals interactor come to interpreter day-to-day events related to the environment (Martínez-Martínez, Cegarra-Navarro, García-Pérez, & Moreno-Ponce, 2019).

This study recognizes “socialization” as a particularly knowledge structure through which a collaborative work of eco-innovation can be explored. Indeed, it produces emotional investment and intimate attachment among organizational members by creating social bonds and bringing a deep emotional holding power (Murillo-Luna et al., 2011; Pinget et al., 2015; Po-Shin & Li-Hsing, 2009), and it gives detailed hints how internal barriers can be overcome (Boiral, 2002; Lee & Choi, 2003; Martínez-Martínez, Cegarra-Navarro, & García-Pérez, 2017; Po-Shin & Li-Hsing, 2009). For example, the desire towards the implementation of an environmental policy forms the basis for a sense of belonging and mutual recognition, so that a high degree of trust is likely to emerge among internal and external stakeholders, which is perceived as a prerequisite for overcoming environmental barriers (Boiral, 2002). On these bases, the following hypotheses have been formulated:

Hypothesis 2: Socialization is negatively associated with the existence of environmental knowledge barriers.

Hypothesis 3: Socialization is positively associated with the utilization of knowledge.

Taking into account all of the above, this study proposes the structural model shown in Figure 1. The lower path suggests that socialization has a positive impact on the effective utilization of environmental knowledge by removing the barriers that restrict the use of environmental knowledge.

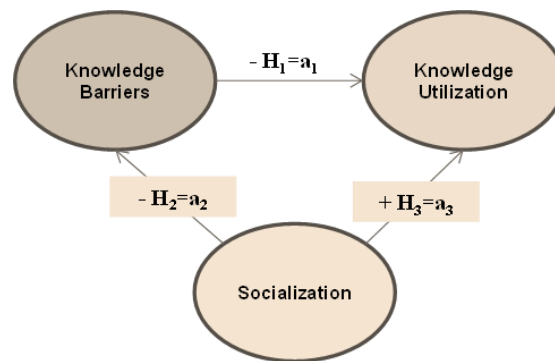


Figure 1. Theoretical model

3 Method

This research uses data from a sample of SME of KIBS. Small companies make up the vast majority of businesses in Europa (Hillary, 2004) and Spain. In 2015, on average around 99 % of European business were classified as small and medium-sized enterprises (European Commission, 2003) and the SMEs in Spain are 99,9% of the total number of companies, those are 2.3 million companies in Spain, with 10.9 million of person employed (Eurostat, 2015). The EU defines SMEs based on employee numbers, turnover

or balance sheet total and ownership. SMEs has less than 250 employees and either an annual turnover not exceeding EUR 50 million, or an annual balance sheet total not exceeding EUR 43 million, and is an independent enterprise (European Commission, 2003).

3.1 Data analysis

The proposed hypotheses were tested simultaneously using partial least squares (PLS-SEM) due to all constructs have been considered as composites (Richter, Cepeda, Roldán, & Ringle, 2016). Therefore, the total variance of all constructs is used to estimate model parameters (Hair, Hult, Ringle, Sarstedt, & Thiele, 2017; Henseler et al., 2014). The utilization of knowledge, socialization and knowledge barriers were specified as reflective indicators given that there is a high level of correlation between them (Dijkstra & Henseler, 2015; Henseler et al., 2016). Based on recent advances of PLS-SEM reporting, the first step was to examine the measures' reliability and validity.

As shown in Table 3, the fit statistics for the model indicate a reasonable data fit. The standardized root mean square residual (SRMR) value of the measurement model was 0.060 and all discrepancies were below the 95%-quantile of the bootstrap discrepancies (HI95), which suggests very good measurement model fit (Henseler et al., 2014).

Table 3. Results of the Confirmatory Composite Analysis

Overall saturated model fit evaluation	Value	Hi ₉₅	Hi ₉₉
SRMR	0.060	0.090	0.119
d _{ULS}	0.1632	0.365	0.640
d _G	0.1588	0.251	0.367

Note:

Global goodness of fit and bootstrap-based 95% and 99% quantiles (saturated model)

SRMR→ Standardized Root Mean Square Residual; d_{ULS}→ Unweighted Least Squares Discrepancy; d_G→ Geodesic Discrepancy

As shown in Table 4, all standardized loadings are greater than 0.7 and each indicator's loading has a greater loading with its constructs than with other constructs. Hence, individual items are reliable (Henseler et al., 2016).

Table 4 Factor Loadings of reflective constructs

	BAR	SOC	UK
BAR_1: Limited financial resources.	0.867	-0.259	-0.309
BAR_2: Limited human resources.	0.859	-0.253	-0.290
BAR_3: Resistance from the organizational members.	0.767	-0.177	-0.207
SOC_1: Our company stresses gathering information from suppliers and customers.	-0.314	0.863	0.514
SOC_2: Our company stresses building databases on products and service.	-0.243	0.847	0.364
SOC_3: Our company stresses planning strategies by using published literature.	-0.136	0.873	0.395

UK_1: The company (hotel) uses less polluting industrial processes and products.	-0.282	0.446	0.887
UK_2: The company (hotel) has developed a green program (waste management, control of effluents, inventory of pollution sources).	-0.317	0.402	0.858
UK_3: The company (hotel) has developed a drafting of environmental emergency plans and measures.	-0.250	0.453	0.831

Notes:

BAR= knowledge barriers. SOC = Socialization. UK = utilization of knowledge.

Discriminant validity was determined by comparing the square root of the AVE (i.e. the diagonals in Table 6) with the correlations among constructs (i.e. the lower triangle of the matrix in Table 6). On average, each construct related more strongly to its own measures than to others' (Fornell & Larcker, 1981). In addition, all the variables attain discriminant validity, since all HTMT are below the value of 0.90. The constructs correlation matrix, shared variances, means and standard deviations are shown in Table 5. As a result of this analysis, evidence of content validity, reliability and convergent validity, and discriminant validity for the constructs of the example was found.

Table 5 Descriptive Statistics

	Mean	S.D	HTMT	AVE	CA	Correlation matrix		
						1	2	3
1. Knowledge barriers	4.169	1.341				0.743		
3. Socialization	2.413	1.444	0.570	0.552	0.780	0.337	0.786	
2. Utilization of knowledge	2.907	1.474	0.779	0.619	0.830	0.405	0.600	0.778

Notes:

S.D→Standard Deviation; CA→Cronbach's Alpha; Inter correlations are presented in the lower and shady triangle of the matrix. The bold numbers on the diagonal are the square root of the Average Variance Extracted. Maximum HTMT→Heterotrait-Monotrait Ratio of Correlations.

4 Results

The PLS-SEM analysis was operationalized by two models (Hair et al., 2017; Henseler et al., 2016): (1) a measurement/*outer* model relating the manifest variables to their own latent variable; and (2), a structural/*inner* model relating some endogenous latent variables to other latent variables.

The results in Table 6 show the validity of the *outer model*. The fit statistics for the model indicate a reasonable data fit. With regard to the reliability of *knowledge barriers*, *socialization* and *the utilization of knowledge* constructs, the Dijkstra and Henseler's rho (pA) and the average variance extracted are above the common standards of 0.7 and 0.5 respectively (Dijkstra & Henseler, 2015; Henseler et al., 2016). In addition, all factor loadings from knowledge barriers, socialization and the utilization of knowledge constructs are statistically significant and greater than 0.7, with the lowest value for the item measuring "Barriers3" being "0.751".

Table 6 Measurement Outer Model Evaluation

Construct		VIF	Weight	loading	Reliability (ρ _A .. AVE ^b)
Knowledge barriers					
	Barriers1	1.692	0.453 ^{***}	0.861 ^{***}	ρ _A = 0.806 AVE=0.552
	Barriers2	1.691	0.433 ^{***}	0.853 ^{***}	
	Barriers3	1.514	0.306 ^{***}	0.751 ^{***}	
Socialization					
	Soc1	1.590	0.482 ^{***}	0.860 ^{***}	ρ _A = 0.860 AVE=0.619
	Soc2	2.244	0.350 ^{**}	0.834 ^{***}	
	Soc3	2.501	0.330 ^{***}	0.864 ^{***}	
Utilization of knowledge					
	Util1	2.173	0.396 ^{***}	0.875 ^{***}	ρ _A = 0.822 AVE=0.606
	Util2	1.965	0.377 ^{***}	0.851 ^{***}	
	Util3	1.636	0.391 ^{***}	0.832 ^{***}	

Notes:

*** <0.01

VIF → variance inflation factor; ^a Dijkstra-Henseler's rho → (ρ_A); ^b Average variance extracted → (AVE);

The results of the structural model after the PLS analysis are collected in Table 7. According to Streukens & Leroi-Werelds (2016), the use of bootstrapping (5,000 resamples) produces bootstrap confidence intervals of standardized regression coefficients. Bootstrap confidence intervals constitute a good approach for detecting path coefficients (Hayes & Scharkow, 2013). The results demonstrate that the inner model has satisfactory predictive relevance for knowledge utilization ($Q^2=0.196$) because that value is higher than 0. As Table 4 shows, the proposed model also explains the 27.7 percent of the variance in knowledge utilization (adjusted R^2). Based on Preacher and Hayes (2008), a post-hoc indirect effect analysis was carried out to test the indirect effect of independent variables on the dependent variable by way of the mediator. In doing so, a two-step procedure for testing mediation in PLS was followed: (1) we used the specific model in question with both direct and indirect paths included to perform 5000 bootstrap resampling and explicitly calculate the product of the direct paths that form the indirect path being assessed; and (2) we estimated the significance using percentile bootstrap. This generated 95% confidence intervals (CI) for the indirect relationships under study. As Table 7 shows, as the interval determined through bootstrapping does not contain the zero value, the indirect effect of socialization on the utilization of knowledge via knowledge barriers is statistically significant at a level of 0.05. Consequently, the results provided full support for both hypotheses H1, H2 and H3.

Table 7 Structural Model statistics

Direct relationship	Path coefficients	T value	Lower 5%	Upper 95%	Adjusted R^2	Significance of effect
H1: $BAR \rightarrow UK(a_1)$	-0.207***	2.354	-0.343	-0.058	0.393	Yes
H2: $SOC \rightarrow BAR(a_2)$	-0.285***	2.487	-0.451	-0.095	0.104	Yes
H3: $SOC \rightarrow UK(a_3)$	0.461***	5.014	0.320	0.622	0.393	Yes
Indirect relationship						
$SOC \rightarrow Barriers \rightarrow UK(a_1 * a_2)$	0.057**	1.781	0.009	0.115	0.393	Yes

Notes:

*** <0.01; ** <0.05

BAR= knowledge barriers. SOC = Socialization. UK = utilization of knowledge.

5 Conclusions

There is lack of research into environmental knowledge barriers and use of environmental knowledge (Cainelli et al., 2015). This research focuses on KIBS because they base their competitive advantages on the production and diffusion of knowledge. Consequently, attention is paid to solve the environmental knowledge barriers as well as to the socialization role in the use of environmental knowledge. Considering this and based on a detailed analysis, socialization practices have been found to mitigate internal barriers by informing people about the way problems can be solved.

These results support the extant literature which argues that as a result of social interaction internal and external stakeholders can help each other to use environmental knowledge (Miles, Miles, Perrone, & Edvinson, 1998), especially, in solving problems (Lundh-Snis, 2001; Tanriverdi & Iacono, 1999), which will in turn help them overcome mutual barriers (Connell, 2010; Pinget et al., 2015), and misunderstandings resulting from new environmental concerns (Cainelli et al., 2015; Gadenne & Mckeiver, 2009; Haron et al., 2005; Kabongo & Boiral, 2017). A possible explanation for this finding would be the fact that socialization mechanisms among the members of the company are necessary because produce intensively new or improved environmental knowledge, both fundamental and applied, to transform effectively the necessary part of this knowledge in productive economic or social, such as, products and services.

From a practical point of view, the overcoming environmental knowledge barriers and using environmental knowledge could mean taking a step closer to achieving eco-innovation (Cainelli et al., 2015; Marchi & Grandinetti, 2013; Zieba, Bolisani, Paiola, & Scarso, 2017). This means that KIBS managers should focus on facilitating socialization practices as a measure to environmental knowledge utilization in their companies (Muller & Zenker, 2001). In doing so, they could plan worker training or awards for workers' environmental initiatives. Furthermore, they should prepare an organizational structure that includes environmental measures.

Despite its valuable insights, the research is limited because it only analyses the KIBS companies and we know that this sector is directly affected by its action with the environment (for example, use of product or component highly environmental impacts). Other limitation is that we are research about internal barriers; future research could also be an opportunity to include external barriers. Finally, in future research the business performance and environmental behaviour should be included.

References

- Aman, A. H., Haru, A., & Hussein, Z. (2012). The influence of environmental knowledge and concern on green purchase intention: The role of attitude as mediating variable. *British Journal of Arts and Social Sciences*, 7(2), 145167. <https://doi.org/10.1108/07363769910297506>
- Amyx, D. A. ., DeJong, P. F. ., Lin, Chakraborty, G., & Wiener, J. L. (1994). Influencers of purchase intentions for ecologically safe products: an exploratory study. In *AMAWinter Educators'Conference Proceedings* (pp. 1093–1099). Chicago: IL: American Marketing Association.

- Aquilani, B., Abbate, T., & Codini, A. (2017). Overcoming cultural barriers in open innovation processes through intermediaries: a theoretical framework. *Knowledge Management Research & Practice*, 15(3), 447–459. <https://doi.org/10.1057/s41275-017-0067-5>
- Azzone, G., & Noci, G. (1998). Seeing ecology and “green” innovations as a source of change. *Journal of Organizational Change Management*, 11(2), 94–111. <https://doi.org/10.1108/09534819810212106>
- Barber, N., Taylor, D. C., & Strick, S. (2009). Environmental Knowledge and Attitudes: Influencing the Purchase Decisions of Wine Consumers. *CHRIE Conference-Refereed Track*.
- Bettiol, M., Di Maria, E., & Grandinetti, R. (2012). Codification and creativity: knowledge management strategies in KIBS. *Journal of Knowledge Management*, 16(4), 550–562. <https://doi.org/10.1108/13673271211246130>
- Boiral, O. (2002). Tacit Knowledge and Environmental management. *Long Range Plann*, 35(3), 291–317.
- Cainelli, G., De Marchi, V., & Grandinetti, R. (2015). Does the development of environmental innovation require different resources? Evidence from Spanish manufacturing firms. *Journal of Cleaner Production*, 94, 211–220. <https://doi.org/10.1016/j.jclepro.2015.02.008>
- Calogirou, C., Sørensen, S. Y., Bjørn Larsen, P., & Alexopoulou, S. (2010). *SMEs and the Environment in the European Union. PLANET SA and Danish Technological Institute*. European Commission, DG Enterprise and Industry.
- Castaldi, C., Faber, J., & Kishna, M. J. (2013). Co-Innovation By Kibs in Environmental Services — a Knowledge-Based Perspective. *International Journal of Innovation Management*, 17(05), 1350017–1350020. <https://doi.org/10.1142/S1363919613500205>
- Cegarra-Navarro, J. G., Martínez-Martínez, A., Gutiérrez, J. O., & Rodríguez, A. L. L. (2013). Environmental knowledge, unlearning, and performance in hospitality companies. *Management Decision*, 51(2), 341–360. <https://doi.org/10.1108/00251741311301858>
- Cegarra-Navarro, J. G., & Martínez, A. M. (2010). Managing environmental knowledge through learning processes in spanish hospitality companies. *Spanish Journal of Psychology*, 13(2), 827–840. <https://doi.org/10.1017/S1138741600002481>
- Cepeda-Carrion, G., Cegarra-Navarro, J. G., & Cillo, V. (2019). Tips to use partial least squares structural equation modelling (PLS-SEM) in knowledge management. *Journal of Knowledge Management*. <https://doi.org/10.1108/JKM-05-2018-0322>
- Chan, E. S. W., Okumus, F., & Chan, W. (2015). Barriers to Environmental Technology Adoption in Hotels. *Journal of Hospitality & Tourism Research*, 42(5), 829–852. <https://doi.org/10.1177/1096348015614959>
- Connell, K. Y. H. (2010). Internal and external barriers to eco-conscious apparel acquisition. *International Journal of Consumer Studies*, 34(3), 279–286. <https://doi.org/10.1111/j.1470-6431.2010.00865.x>
- Dangelico, R. M., & Pontrandolfo, P. (2015). Being “Green and Competitive”: The Impact of Environmental Actions and Collaborations on Firm Performance. *Business Strategy and the Environment*, 24(6), 413–430. <https://doi.org/10.1002/bse.1828>
- Darnall, N., Henriques, I., & Sadowsky, P. (2010). Adopting proactive environmental strategy: The influence of stakeholders and firm size. *Journal of Management Studies*, 47(6), 1072–1094. <https://doi.org/10.1111/j.1467-6486.2009.00873.x>
- Del Brío, J. Á., & Junquera, B. (2003). A review of the literature on environmental innovation management in SMEs: Implications for public policies. *Technovation*. [https://doi.org/10.1016/S0166-4972\(02\)00036-6](https://doi.org/10.1016/S0166-4972(02)00036-6)
- Delgado-Ceballos, J., Aragón-Correa, J. A., Ortiz-de-Mandojana, N., & Rueda-Manzanares, A. (2012). The Effect of Internal Barriers on the Connection Between Stakeholder Integration and Proactive Environmental Strategies. *Journal of Business Ethics*, 107(3), 281–293. <https://doi.org/10.1007/s10551-011-1039-y>

- Dijkstra, T. K., & Henseler, J. (2015). Consistent and asymptotically normal PLS estimators for linear structural equations. *Computational Statistics and Data Analysis*, 81, 10–23. <https://doi.org/10.1016/j.csda.2014.07.008>
- Dominguez Gonzalez, R. V. ., & Martins, M. F. (2017). Knowledge Management Process : a theoretical-conceptual research. *Gestão & Produção*, 24(2), 248–265. <https://doi.org/https://dx.doi.org/10.1590/0104-530x0893-15>
- Duan, W., & Sheng, J. (2018). How can environmental knowledge transfer into pro-environmental behavior among Chinese individuals? Environmental pollution perception matters. *Journal of Public Health*, 26(3), 289–300. <https://doi.org/10.1007/s10389-017-0873-5>
- European Commission. (2003). What is an SME? *Concerning the Definition of Micro, Small and Medium-Sized Enterprises*. Retrieved from http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_es
- Eurostat. (2015). Statistics on small and medium-sized enterprises. *Dependent and Independent SMEs and Large Enterprises*. Retrieved from http://ec.europa.eu/eurostat/statistics-explained/index.php/Statistics_on_small_and_medium-sized_enterprises
- Figueiredo, R., Neto, J. V., Quelhas, O. L. G., & Ferreira, J. J. de M. (2017). Knowledge Intensive Business Services (KIBS): bibliometric analysis and their different behaviors in the scientific literature. *RAI Revista de Administração e Inovação*, 14(3), 216–225. <https://doi.org/10.1016/j.rai.2017.05.004>
- Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39–50.
- Frick, J., Kaiser, F. G., & Wilson, M. (2004). Environmental knowledge and conservation behavior: Exploring prevalence and structure in a representative sample. *Personality and Individual Differences*, 37(8), 1597–1613. <https://doi.org/10.1016/j.paid.2004.02.015>
- Fryxell, G. E., & Lo, C. W. H. (2003). The influence of environmental knowledge and values on managerial behavior in China: a comparison of managers in Guangzhou and Beijing. *Journal of Business Ethics*, (46), 45–69.
- Gadenne, D. L., & McKeiver, C. (2009). An Empirical Study of Environmental Awareness and Practices in SMEs. *Journal of Business Ethics*, 84(1), 45–63. <https://doi.org/10.1007/s10551-008-9672-9>
- Gold, A. H., Malhotra, A., & Segars, A. (2001). Knowledge Management: An Organizational Capabilities Perspective. *Journal of Management Information Systems*, 18(1), 185–214. <https://doi.org/10.1080/07421222.2001.11045669>
- González-Benito, J., & González-Benito, Ó. (2005). Environmental proactivity and business performance: An empirical analysis. *Omega*, 33(1), 1–15. <https://doi.org/10.1016/j.omega.2004.03.002>
- Gray, C. (2002). Entrepreneurship, resistance to change and growth in small firms. *Journal of Small Business and Enterprise Development*, 9(1), 61–72. <https://doi.org/10.1108/14626000210419491>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., & Thiele, K. O. (2017). Mirror, mirror on the wall: a comparative evaluation of composite-based structural equation modeling methods. *Journal of the Academy of Marketing Science*, 45(5), 616–632. <https://doi.org/10.1007/s11747-017-0517-x>
- Haron, S. A., Paim, L., & Yahaya, N. (2005). Towards sustainable consumption: an examination of environmental knowledge among Malaysians. *International Journal of Consumer Studies*, 29(5), 426–436. <https://doi.org/10.1111/j.1470-6431.2005.00460.x>
- Hayes, A. F., & Scharkow, M. (2013). The relative trustworthiness of inferential tests of the indirect effect in statistical mediation analysis: does method really matter? *Psychological Science*, 24(10), 1918–1927. <https://doi.org/10.1177/0956797613480187>
- Henseler, J., Dijkstra, T. K., Sarstedt, M., Ringle, C. M., Diamantopoulos, A., Straub, D. W., ... Calantone, R. J. (2014). Common Beliefs and Reality About PLS. *Organizational Research*

- Methods*, 17(2), 182–209. <https://doi.org/10.1177/1094428114526928>
- Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial Management & Data Systems*, 116(1), 2–20. <https://doi.org/10.1108/IMDS-09-2015-0382>
- Hillary, R. (2004). Environmental management systems and the smaller enterprise. *Journal of Cleaner Production*, 12, 561–569. <https://doi.org/10.1016/j.jclepro.2003.08.006>
- Kabongo, J. D., & Boiral, O. (2017). Doing More with Less: Building Dynamic Capabilities for Eco-Efficiency. *Business Strategy and the Environment*. <https://doi.org/10.1002/bse.1958>
- Khamseh, H. M., Jolly, D., & Morel, L. (2017). The effect of learning approaches on the utilization of external knowledge in strategic alliances. *Industrial Marketing Management*, 63, 92–104. <https://doi.org/https://doi.org/10.1016/j.indmarman.2016.12.004>
- Kim, M. S., Kim, J., & Thapa, B. (2018). Influence of environmental knowledge on affect, nature affiliation and pro-environmental behaviors among tourists. *Sustainability*, 10(9). <https://doi.org/10.3390/su10093109>
- Kim, S. S., & Kim, Y. J. (2017). The effect of compliance knowledge and compliance support systems on information security compliance behavior. *Journal of Knowledge Management*, 21(4), 986–1010. <https://doi.org/10.1108/JKM-08-2016-0353>
- Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239–260. <https://doi.org/10.1080/13504620220145401>
- Lee, H., & Choi, B. (2003). Knowledge Management Enablers, Processes, and Organizational Performance: An Integrative View and Empirical Examination. *Journal of Management Information Systems*, 20(1), 179–228. <https://doi.org/10.1080/07421222.2003.11045756>
- Lewis, K. (2004). Knowledge and Performance in Knowledge-Worker Teams: A Longitudinal Study of Transactive Memory Systems. *Management Science*, 50(11), 1519–1533. <https://doi.org/10.1287/mnsc.1040.0257>
- Lundh-Snis, U. (2001). Innovation through knowledge codification. *Journal of Information Technology*, 16(2), 83–97. <https://doi.org/10.1080/026839600110054771>
- Marchi, V. De, & Grandinetti, R. (2013). Knowledge strategies for environmental innovations : the case of Italian manufacturing firms. <https://doi.org/10.1108/JKM-03-2013-0121>
- Mardani, A., Streimikiene, D., Zavadskas, E., Cavalaro, F., Nilashi, M., Jusoh, A., & Zare, H. (2017). Application of Structural Equation Modeling (SEM) to Solve Environmental Sustainability Problems: A Comprehensive Review and Meta-Analysis. *Sustainability*, 9(10), 1814. <https://doi.org/10.3390/su9101814>
- Martelo-Landroguez, S., & Cegarra-Navarro, J.-G. (2014). Linking knowledge corridors to customer value through knowledge processes. *Journal of Knowledge Management*, 18(2), 342–365. <https://doi.org/10.1108/JKM-07-2013-0284>
- Martínez-Martínez, A., Cegarra-Navarro, J. G., García-Pérez, A., & Wensley, A. (2019). Knowledge agents as drivers of environmental sustainability and business performance in the hospitality sector. *Tourism Management*, 70, 381–389. <https://doi.org/10.1016/j.tourman.2018.08.030>
- Martínez-Martínez, A., & Cegarra-Navarro, J. G. (2018). *Gestión del conocimiento ambiental*. Madrid: Ediciones Pirámide.
- Martínez-Martínez, Aurora, Cegarra-Navarro, J. G., & García-Pérez, A. (2015). Environmental knowledge management: A long-term enabler of tourism development. *Tourism Management*, 50, 281–291. <https://doi.org/10.1016/j.tourman.2015.03.006>
- Martínez-Martínez, Aurora, Cegarra-Navarro, J. G., & García-Pérez, A. (2017). Improving Environmental Management Systems by ISO 9001 in the Spanish Hospitality Sector. In *Sustainability in Innovation and Entrepreneurship* (pp. 87–101). https://doi.org/10.1007/978-3-319-57318-2_6

- Martínez-Martínez, Aurora, Cegarra-Navarro, J. G., García-Pérez, A., & Moreno-Ponce, A. (2019). Environmental knowledge strategy: driving success of the hospitality industry. *Management Research Review*, MRR--02--2018--0091. <https://doi.org/10.1108/MRR-02-2018-0091>
- Martínez-Martínez, Aurora, Zumel-Jiménez, C., & Cegarra-Navarro, J.-G. (2018). A theoretical framework for key processes on environmental knowledge management. *Anatolia*, 0(0), 1–9. <https://doi.org/10.1080/13032917.2018.1519180>
- Miles, G., Miles, E. R., Perrone, V., & Edvinson, L. (1998). Some Conceptual and Research Barriers to the Utilization of Knowledge. *California Management Review*, 40(3), 281–288.
- Muller, E., & Zenker, A. (2001). Business services as actors of knowledge transformation : the role of KIBS in regional and national innovation systems. *Research Policy*, 30, 1501–1516. [https://doi.org/10.1016/S0048-7333\(01\)00164-0](https://doi.org/10.1016/S0048-7333(01)00164-0)
- Murillo-Luna, L., Garcés-Ayerbe, C., & Rivera-Torres, P. (2011). Barriers to the adoption of proactive environmental strategies, 19. <https://doi.org/10.1016/j.jclepro.2011.05.005>
- Myung, E. (2017). An Exploratory Study of Attendee Willingness to Pay for Environmentally Friendly Meetings. *International Journal of Hospitality and Tourism Administration*, 18(3), 272–287. <https://doi.org/10.1080/15256480.2016.1276002>
- Nieves, J., & Haller, S. (2014). Building dynamic capabilities through knowledge resources. *Tourism Management*, 40, 224–232. <https://doi.org/https://doi.org/10.1016/j.tourman.2013.06.010>
- Ning, L., & Wang, F. (2018). Does FDI Bring Environmental Knowledge Spillovers to Developing Countries? The Role of the Local Industrial Structure. *Environmental and Resource Economics*, 71(2), 381–405. <https://doi.org/10.1007/s10640-017-0159-y>
- Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, 5(1), 14–37. <https://doi.org/10.1287/orsc.5.1.14>
- Nonaka, I., Toyama, R., & Konno, N. (2000). SECI , Ba and Leadership : a Unified Model of Dynamic Knowledge Creation. *Leadership*, 33, 5–34. [https://doi.org/10.1016/S0024-6301\(99\)00115-6](https://doi.org/10.1016/S0024-6301(99)00115-6)
- Paço, A., & Lavrador, T. (2017). Environmental knowledge and attitudes and behaviours towards energy consumption. *Journal of Environmental Management*, 197, 384–392. <https://doi.org/10.1016/j.jenvman.2017.03.100>
- Peattie, K., & Ring, T. (1993). Greener Strategies: The Role of the Strategic Planner. *Greener Management International*, 3, 5164.
- Pinget, A., Bocquet, R., & Mothe, C. (2015). Barriers to Environmental Innovation in SMEs : Empirical Evidence from French Firms. *Management*, 18(2), 132–155.
- Po-Shin, H., & Li-Hsing, S. (2009). Effective environmental management through environmental knowledge management. *International Journal of Environmental Science & Technology*, 6(1), 35–50. <https://doi.org/10.1007/BF03326058>
- Polanyi, M. (1962). *Personal Knowledge: Towards a Post- Critical Philosophy*. Chicago: University of Chicago Press.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and Resampling Strategies for Assessing and Comparing Indirect Effects in Multiple Mediator Models, 40(3), 879–891. <https://doi.org/10.3758/BRM.40.3.879>
- Raymond, C. M., Fazey, I., Reed, M. S., Stringer, L. C., Robinson, G. M., & Evely, A. C. (2010). Integrating local and scientific knowledge for environmental management. *Journal of Environmental Management*. <https://doi.org/10.1016/j.jenvman.2010.03.023>
- Richter, N. F., Cepeda, G., Roldán, J. L., & Ringle, C. M. (2016). European management research using partial least squares structural equation modeling (PLS-SEM). *European Management Journal*, 34(6), 589–597. <https://doi.org/https://doi.org/10.1016/j.emj.2016.08.001>
- Rigdon, E. E. (2016). Choosing PLS path modeling as analytical method in European management research: A realist perspective. *European Management Journal*, 34(6), 598–605.

<https://doi.org/10.1016/j.emj.2016.05.006>

- Sánchez-Polo, M. T., Cegarra-Navarro, J. G., Cillo, V., & Wensley, A. (2019). Overcoming knowledge barriers to health care through continuous learning. *Journal of Knowledge Management*, In press. <https://doi.org/10.1108/JKM-10-2018-0636>
- Savic, M. (2016). What role for knowledge-intensive business services (KIBS) in de-industrialized regions? *Regional Studies, Regional Science*, 3(1), 445–454. <https://doi.org/10.1080/21681376.2016.1243455>
- Scarso, E., & Bolisani, E. (2012). Trust in knowledge exchanges between service providers and clients: a multiple case study of KIBS. *Knowledge Management Research & Practice*, 10(1), 16–26. <https://doi.org/10.1057/kmrp.2011.28>
- Senge, P. (1990). *The fifth discipline: the art and practice of the learning organisation* (Doubleday). New York: Currency.
- Streukens, S., & Leroi-Werelds, S. (2016). Bootstrapping and PLS-SEM: A step-by-step guide to get more out of your bootstrap results. *European Management Journal*, 34(6), 618–632. <https://doi.org/10.1016/j.emj.2016.06.003>
- Tanriverdi, H., & Iacono, C. S. (1999). Diffusion of Telemedicine: A Knowledge Barrier Perspective. *Telemedicine Journal*, 5(3), 223–244. <https://doi.org/10.1089/107830299311989>
- Valero-Gil, J., Rivera-Torres, P., & Garcés-Ayerbe, C. (2017). How is environmental proactivity accomplished? Drivers and barriers in firms' pro-environmental change process. *Sustainability (Switzerland)*, 9(8), 1327–1339. <https://doi.org/10.3390/su9081327>
- Walker, B., Janice, R., Lynnaire, S., Calvin, W., & Ute, G. (2008). *Small and medium enterprises and the environment: barriers, drivers, innovation and best practice. A review of the literature*. Edith Cowan University. Perth, Australia.
- Wang, Y., & Byrd, T. A. (2017). Business analytics-enabled decision-making effectiveness through knowledge absorptive capacity in health care. *Journal of Knowledge Management*, 21(3), 517–539. <https://doi.org/10.1108/JKM-08-2015-0301>
- Wernick, I. (2003). Environmental Knowledge Management. *Journal of Industrial Ecology*, 6(2), 7–9. <https://doi.org/10.1162/108819802763471735>
- Whyte, K. P. (2013). On the role of traditional ecological knowledge as a collaborative concept: a philosophical study. *Ecological Processes*, 2(7), 1–12. <https://doi.org/10.1186/2192-1709-2-7>
- Yang, F., & Zhang, Z. (2017). Analysis of the barriers in implementing environmental management system by interpretive structural modeling approach. *Management Research Review*, 40(12), 1316–1335. <https://doi.org/10.1108/MRR-08-2016-0196>
- Zaragoza-Sáez, P., Claver-Cortés, E., Marco-Lajara, B., & Úbeda-García, M. (2016). Influence of intellectual capital upon knowledge creation in Spanish subsidiaries: an empirical study. *Knowledge Management Research & Practice*, 14(4), 489–501. <https://doi.org/10.1057/kmrp.2015.20>
- Zieba, M., Bolisani, E., Paiola, M., & Scarso, E. (2017). Searching for innovation knowledge: insight into KIBS companies. *Knowledge Management Research & Practice*, 15(2), 282–293. <https://doi.org/10.1057/s41275-017-0050-1>
- Zilahy, G. (2004). Organisational factors determining the implementation of cleaner production measures in the corporate sector. *Journal of Cleaner Production*, 12(4), 311–319. [https://doi.org/10.1016/S0959-6526\(03\)00016-7](https://doi.org/10.1016/S0959-6526(03)00016-7)

Knowledge Dynamics and Conformism: Managerial Fads and Financial Herding in Organization Studies and Neuroscience

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Abstract

What pushes an actor, be it an individual or an organization, to imitate the choices of others, is a theme that has fascinated scholars of several disciplines that observed this underlying dynamic in diverse phenomena. This paper provides a review on conformism across diverse research disciplines that are rarely considered altogether when conformism is addressed.

Keywords – conformism, knowledge diffusion, adoption, managerial fads, herding.

Paper type – Academic Research Paper

1 Introduction

What pushes an actor, be it an individual or an organization, to imitate the choices of others, is a theme that has fascinated scholars of several disciplines that observed this underlying dynamic in diverse phenomena. This paper provides a review on conformism across the following research disciplines: organization studies, finance and neuroscience. In relation to these areas, conformism will respectively be addressed in terms of innovation adoption and managerial fads, financial herding and brain activation.

The review will be developed across these literatures with a focus on the issue of agency, intended as the role of intentionality in human behavior and the possibility to control and design behavior and impact on reality (Frigotto, 2018; Stacey et al. 2000). Aldrich and Ruef (2006, p. 18) understand agency in terms of whether (and in what

terms) actors are free to make autonomous decisions or are driven by the context in which they are embedded up to the extreme position that sees the exogenous determination of their behavior and the illusion of control and impact on reality. Namely, by presenting the several studies on conformism, the following research question will be addressed: to what extent do actors conform i.e., display similar behaviors, i) because they rationally decide to do so i.e., as the outcome of an informed decision-making process, or, ii) because they are pushed to do so by the need to adhere to the standards of a group or coalition of other actors? In particular, contributions from neuroscience complement other streams of literature by adding to the observation and the understanding of behaviors in the organizational or financial context, also evidence on brain activation for further and more micro-level theorization of conformism.

The paper is organized as follows. In the next Section, conformism as rational decision is introduced. Then, psychological, sociological and organizational factors playing a role in conformism are presented. In Section four, conformism is addressed in terms of the determinants of financial herding. In Section five, studies on conformism from the area of neuroscience are discussed. A closing Section concludes the paper. The contribution of the paper lies in combining research areas that are rarely considered altogether when conformism is addressed.

2 The rational decision to conform

When conformism is observed in the similar behaviours of agents, researchers have often referred to its manifestation in term of herding or herd behaviour. In English the word 'herd' has three different meanings: 1. a flock of sheep or, more generally, of animals; 2. the act of grouping the animals by the shepherd, 3. the act of proceeding together performed by the animals themselves. Used metaphorically, the term refers to an association of people that adopt the so-called herd behavior or herding. Typically, when behavior is described as herding, it suggests that the observed behavior a set of subjects is not the result of an independent choice of the individuals, but an imitative reaction of the behavior of others, even when this is a harmful one, or at most the individual's response to the same external stimuli. Keynes (1930) contrasted herding with the independent choice of the individual autonomously elaborating on given information. The classical example of herding is given by the movement of the flock, moving together and appearing as a whole. However, conformism is observed everyday in various contexts for instance, in the crowd that, when facing an emergency, escapes towards the busiest, rather than the free exits.

The herd behavior is difficult to explain in the classical decision theory that was grounded in the theory of rational expectations. According to this approach, decisions are the outcome of rational reasoning applied to available information given individual preferences. Although it is recognized that human rationality is limited in different ways and further aspects besides rational ones, such as psychological or emotional ones play a role, the latter found limited room in the classical decision theory. Within a rational decision approach it is possible to explain conformism according to three alternatives:

- the imitation of the behavior of others brings advantages, at least temporarily, to the individual that performs it rationally, and the convenience to copy increases with the number of subjects making the same choice. This is called pure herding. The most famous illustration of pure herding in economics is the Keynes beauty contest organized by a newspaper that assigns a prize to the reader who will be able to guess which among six women, will win the contest. A smart reader will not vote for the most beautiful woman according to him, but he will vote for the one that he thinks will be voted by most readers. Pure herding might take the following forms:
 - i) a strategy aimed to seize positive externalities, for example, castaways on a desert island are more likely to be spotted and saved if they wave all together, so they perform the same behavior;
 - ii) a reputation strategy, for instance, when managers imitate other managers' strategies because they prefer to risk making a mistake like others, rather than being the only one to make an isolated choice (even a correct one). This form concerns a principal-agent problem, occurring when the behavior of a subject, called agent, is evaluated by another subject, known as principal, who cannot observe the information available to the agent, nor his effort.
 - iii) an informative strategy, for instance, when a foreigner in a city needs to choose a restaurant to have dinner, she observes two nearby restaurants, one with many guests and the other empty. As she ignores the quality of the two restaurants and does not want to invest time in researching, she would most likely choose to eat in the busiest restaurant. Whoever observes this decision will probably copy it, and so on. This is because she assumes that the many people who chose previously knew the quality of the restaurants.
- the individual's decision is rationally the best (at least at some point in space and time) and does not depend on the others' choice but on the individual assessment of available information. This is called spurious herding.
- conformism concerns non-rational arguments that are typical not included in the rational arguments of decision.

The problem in discerning between conformism as a rational decision (in the pure and spurious forms) and as a behavior that builds on non-rational aspects, is that it is only possible to observe behaviors and not their motivations. As a matter of fact, it is also difficult to clarify if the phenomenon of conformism is a structural element of human decision, given that it is even not possible to assess the relevance of spurious herding.

3 Psychological, sociological and organizational factors in conformism

Conformism cannot always be traced back to the rational assessment of advantages, but rather to psychological or sociological factors. This would explain why some individuals, some populations or professions are more prone to conformism, while others, in the same situations, are not. For example, in the case of a real emergency at a concert, fear and panic lead many people to the most crowded exits; the same situation during an exercise does not induce the same behavior.

Psychology studies highlighted the role of psychological traits, moods and emotions in conformism. Traits regarding the ability to socialize, such as extraversion, adherence to social norms and risk aversion, are linked to the propensity to conform (Baddeley, 2010). Conversely, Bernardo and Welch (2001) show that self-confidence is linked to the propensity to guide others and not to follow a herd behavior. However, Baddeley points out that not psychological traits but the mood, identified as a generic and superficial emotional state (positive or negative), impacts on behavior, and therefore on conformism. For example, there is evidence that the mood induced by a sunny or rainy day affects the choices of traders (Hirshleifer and Shumway, 2003). If the mood derives from external conditions such as the weather, it is however reinforced or damped by individual traits; in this perspective, herding is spurious, that is, it derives from the same external stimuli and not from imitation.

Evolutionary studies explain choices that hardly fit within a pure rational perspective with innate instincts that are the result of evolution, and that are traceable in our closest ancestors and also in other species. Fish that swim in schools display herding. In fact, such behavior produces advantages both for individuals and for the group: when attacked by a predator, they escape together, decreasing the probability of being captured, and improving their hydrodynamic efficiency.

There is also evidence of sociological factors linked to behavioral conformism that are also found in animals. Some fish, that are removed from their group, show an alteration of vital parameters and behaviors, which is interpreted as a sort of stress due to the separation from the group that plays a reassuring and calming role. Sociological studies have focused on understanding the meaning that the group has for the individual and more generally in society. It is recognized that humans often tends to place themselves in groups that approve their behavior. Important determinants of conformism are: i) the identification of the individual with the group that is, the fact that the individual recognizes himself as similar to the other members and feels he is represented by them (indicated as private acceptance); ii) the social pressure to conform (indicated as public compliance). The first element pushes the individual to operate the same choices of the group. The second pushes the the individual to replicate the choices of the group in order to be part of it.

Moreover, sociological and organizational studies suggest that when an individual belongs to a group, she builds an identity that relates herself to other individuals through a process of social construction of meanings that define what is considered relevant not only from a utilitarian, but also from an emotional perspective. Going back on the tulip bubble case, it seems impossible today that merchants and investors of the time exchanged tulip bulbs for the value of a house. Today, in fact, the value attributed to tulips appears very limited, because the demand for tulips is limited and the supply is adequate or exceeding the demand. The exchange value is very small and what is considered the intrinsic value, simply linked to the joy of enjoying the beauty of a tulip, is recognized as modest. However, in the early Seventeenth century in Holland, instead, interest in tulips became a real craze that led to the intensive search for the rarest specimens and the most amazing colors and streaks. The distance between the value

recognized today to tulips and the value attributed back then, is immense, and more precisely, it is difficult to rationally understand, if not admitting that also the concept of value is the result of a social construction. The role of the social construction of meaning is evident when bubbles burst: what leads to a sudden and unexpected refusal of a construction in which individuals believed or that individuals wanted to ride and exploit? When bubbles burst, conformism suddenly stops because the shared sensemaking collapses.

Social construction also takes place through specific languages, symbolic narratives, metaphors and tools. For example, consider that during the growth of the dotcom bubble, investor-seeking firms legitimized themselves with the number of customers and online contacts, rather than with their ability to turn these into revenues. At the same time, as the dotcom quotations grew, a rhetoric, a language and a series of indicators were developed that supported investors' confidence in the potential of the so-called new economy companies. According to Consob, the Italian national agency for the control of financial markets: "The general euphoria deriving from the concepts of "development", "progress" and "growth", associated with a cutting-edge sector such as the new economy, fueled the expectations on the future and increased the value of companies of this sector, regardless of the information expressed by traditional profitability indicators" (<http://www.consob.it/web/investor-education/la-bolla-delle-c.d.-dotcom>).

Finally, in the literature on innovation adoption, conformism has been viewed as the result of the observation of the benefits of innovation within a community of actors. This literature, mainly from the strategy area, relies on a strong belief in the agency and intentional behaviour of actors that decide according to their (bounded) rationality. In Roger's argument (1962), adopters observe the outcomes of adoption in their network of other actors and then decide whether to adopt the innovation or not. Contrasting this perspective, Abrahamson (1991) argued that innovations such as new techniques for organizing are not adopted because of their observed benefits. Adoption, instead, derives from a fascination with new and promising managerial practices, as well as from the desire to legitimate oneself into the group of reference actors that have already adopted them. They are, in fact, "managerial fads and fashions" and conformism occurs by imitation of what is done by other organizations independently from the assessments of the benefits of innovation (Abrahamson, 2013) through the so-called "bandwagon mechanism". In a similar vein, in the neo-institutional literature, conformity has been understood as a form of compliance with a perspective that is being institutionalized and that displays a logic of legitimation by a group of reference actors that lead change, rather than a logic a cost-benefit analysis (Meyer and Rowan, 1977; Di Maggio and Powell, 1983). It is not been clarified, and this goes beyond the scope that is typical of such studies, whether conformism in those cases is the result of agency, namely of an intentional action aimed at strategically exploit the behavior of a collection of agents that act similarly. The literature on organization studies building on social psychology, refers to the theories of self- and social categorization (Tajfel, 1974; Turner and Reynolds, 2011) or to the theories of similarity and attraction (Byrne, 1971) to understand conformism. In the first case, the individual feels to belong to a group and she tends to

conform to the group's behavior to stress and strengthen its membership; here, conformism is a manifestation of the affiliation to a group of agents. In the similarity-attraction paradigm, the individual is attracted by other individuals with which she shares characteristics or behaviors; here, conformism is a manifestation of the perspective shared among several agents.

4 Financial herding

In the financial literature, financial bubbles have pointed out the issue of conformity that has been debated in terms of herd behaviour. In every financial bubble, market euphoria over a specific asset leads to a boom in sales; the herd behaviour of investors can drive the price of this asset up to absurd level, as it was in the Dutch Tulip Mania of the 16th century, and in the dotcom at the end of the 90s. The financial literature has investigated to what extent a dramatic and persistent deviation of prices is due to the imitation of other investors choices independently from the estimation of the asset value, and whether investors can gain from this trend by exiting the market at the right time. When the investors' choices lead to a persistent deviation of an asset price from its intrinsic value, it is crucial to understand if herding behaviour will produce a bubble, or if such deviations will instead be rebalanced with arbitrage. Investors could identify profitable investment strategies by investigating the following issues:

- when is it profitable to be conform to others' financial choices? When is the optimal timing to make a different financial choice? The answer to these questions would help to understand when a speculative bubble is being created and to what extent it is worth riding;
- how independent from others' financial choices is the estimation of an asset value performed by the fundamental approach? The answer to this question would allow to define best practices in assets' evaluations.

Further, financial literature has investigated herding both in the portfolio composition of institutional investors and in investments' recommendation of financial analysts. Herding can arise because of reputational issues: performance evaluation of institutional investors (hereinafter referred to as manager) and analysts is usually carried out with respect to others' performance and any deviation can therefore severely damage reputation. In the following main studies on financial conformism are discussed.

The seminal model by Scharfstein and Stein (1990) shows how rationally managers mimic other managers and ignore their private information, because of reputation and career concerns. Managers are positively assessed if: 1) they made a profitable investment and 2) their portfolio composition was similar to that of others. When managers achieve the same profit, those mimicking others will be more favourable evaluated than those that behave in an opposing fashion. Unprofitable decisions are therefore not compromising the manager's career and reputation if those wrong decision are shared among others (sharing-the-blame effect): when managers follow others' decisions the market infers that all managers have been exposed to the same information (and are more likely to be smart managers). On the contrary, when a manager differs from others' behaviour, no matter

how good or bad was his investment, he is perceived as unskilled (his profit is simply the result of luck). Herding by pension funds has been tested by Lakonishok et al. (1992) by measuring the disproportionate tendency of managers to buy or sell the same asset at the same time. Results show very little herding over the all sample and more intensive herding in small stocks, possibly due to their more opaque information. Herding among mutual funds is found quite low (Wermers, 1999), but higher among growth-oriented mutual funds and in small stocks. Interestingly, any observed long-term price adjustments of those stock that have been traded by “herds” appear to be permanent, suggesting that mutual fund herding speeds the adjustment-price process and that managers end up with the same investment decisions because of their similar private information about stock’s fundamentals and not due to reputational concerns. Chevalier and Ellison (1999) relate manager’s career concerns to the desire to avoid being fired and examine how behavior differs between younger and older mutual fund’s managers. Findings point out that younger managers are less likely to deviate from others behaviour, because they are more likely to be punished (losing the job) for deviating from the herd.

Herding behavior in institutional investors could also emerge because their investment choices are based on the (same) analysts’ recommendations, which are public for a long time. Herding among financial analysts has been studied with regard to: 1) the release of forecasts of firm’s earnings and 2) the issue of investment newsletters. Trueman (1994) theoretically shows that it is not always valid to assume that earnings’ forecasts by analysts reflect their private information in an unbiased manner. When an analyst releases a forecast that is close to others’ or to his prior forecasts, the investors’ assessment of his forecasting ability increases; this enable higher fees and career progression. In the model, the issuing of an extreme forecast, although justified by private information, could be perceived simply as correction of past inaccurate estimates. As a consequence, herding behavior emerges. Empirical research investigates how herding in forecasts is linked to career opportunities and characteristics of the analysts. Hong et al. (2000) observe that less experienced analysts are more likely to be terminated for inaccurate (or deviating from the consensus) forecasts; accordingly, younger analysts herd more and revise their earnings forecasts more frequently. Clement and Tse (2005) point out the complex relation of herding and (among others) brokerage size and the number of evaluated industries: analysts with big brokerages are more likely to deviate from average forecasts (due to lower career concerns) but as the number of followed industries increases herding emerges, probably due to the analyst’s inability to develop specialized knowledge. Turning to newsletters’ release, Graham (1999) develops a model in which each analyst is tempted to ignore his private information and mimic the previous analyst’s newsletter if he has high reputation to protect and inaccurate private information. This study is the first to evaluate model’s implication by measuring analyst’s herding as the mimicking of a specific newsletter (Value Line Investment Survey, considered the market leader), and not as a statistical tendency of a high number of analysts to conform. Results corroborate the model: herding increases with newsletter reputation and poor quality of private information. Most research measure herding by estimating the deviation of each action from the mean of all actions: such measure could not be able to capture pure herding,

because it is biased by variables that similarly affect everyone's choice. Bernhardt et al. (2006) challenge the prevalent view that analysts systematically herd, by testing a model of herding in earning forecast which is robust to (among others): correlated signals among analysts, common unforecasted shocks to earnings, information arrival, systematic analyst optimism or pessimism. The authors find strong evidence against herding behavior. This stresses that to detect pure herding, empirical research needs to develop robust measures that account for common drivers.

5 Conformism in Neuroscience

Neuroscientific studies on conformism are relatively young and constitute a niche (Wu et al., 2016). While they build a discipline per se, they also provide a promising instrumentation that allows to clarify the role of psychological factors in the decision to conform, and that can thus inform other research areas. Neurosciences shed light on how the decision-making process activates and is represented in neural circuits, and this is made possible by neuroimaging tools and techniques, such as functional magnetic resonance imaging (fMRI). Berns et al. (2005) provide the first biological evidence for alterations in brain activity associated with social conformity. They show that when individuals conform judgment to that of the group specific brain areas related to perception and emotional processes are activated, and not those related to information-aware decision.

Some studies analyze whether conformism is the result of autonomous choices made by several individuals or the outcome of the adaptation to the choice of others. To understand this, they looked at whether the subjects show a different neural representation of the value associated with a stimulus, depending on whether or not they know the value given by the group to the same stimulus. Zaki et al. (2011) asked to participants to judge the attractiveness of 180 female faces by using a 7-point scale. During the first round participants were informed, on most trials, about the evaluation expressed by previous participants; however, this group ratings were generated by a pseudorandom algorithm. In the second round participants expressed a second judgment on the same faces, while they underwent fMRI scanning. Results show that attractiveness ratings were significantly influenced by social norms: participants changed their ratings to conform to those of their peers. Moreover, when the same faces are assessed for the second time, participants show a significant greater brain's response for stimuli ostensibly rated more positively by peers. Those specific brain regions (i.e. orbitofrontal cortex (OFC) and nucleus accumbens (NAcc)) respond generally to reward and when jointly activated constitute a system that learns and encodes the value of events and stimuli. These results suggest that individuals consider social consensus as intrinsically rewarding, and that they are therefore keen to conform to others. Following a similar procedure, Charpentier et al. (2014) investigate whether the response of a brain region to a specific stimulus (peers' rating) can predict subsequent brain activity to the identical stimulus, but under different circumstances (individual choice). Results show the intertemporal relationship between past and

subsequent response of the right OFC, which is observed only when individual first observe a peers' inconsistent choice.

Klucharev et al. (2009) address conformism within the framework of reinforcement learning, meaning that learning is produced through actions and the observed consequences of such actions. They observe that being in conflict with group opinion trigger a neuronal response in the rostral cingulate zone (RCZ) and in the ventral layer (VS), brain areas typically observed in neuroscientific experiments that analyse predictive errors in reinforcement learning models. these findings suggest a new role for the RCZ in social cognition: the dissimilarity of our judgements with social group norms evoke conformity via learning mechanisms.

Izuma and Adolphs (2013) stress that conformism includes a judgement on actors that could be imitated (cognitive balance), so that conformism occurs only when actors are appreciated and not despised. They reveal to participants the preferences of strongly liked or disliked groups and observe first that participants' choices conform to those of the liked people, and second that their dorsomedial prefrontal cortex (dmPFC) was activated, thus suggesting that cognitive imbalance activates the dmPFC because it represents an aversive outcome requiring subsequent adjustment. This association and later preference change remained significant even after months.

Huber et al. (2015) contextualize their neuroscientific study in finance on stocks trade. They ask participants to buy one of two stocks, subject to a different set of private (recommendation of a rating agency for one or the other stock) and social information (decisions of two fictitious stock market traders). The authors aim to explores if specific neural activation is tracked in participants that differently weight social and private information, given that conformism (in the form of informational cascades) can occur when rationally individuals decide independently of their private information. Result show that stronger individual overweighting of private information is positively correlated with activity in the inferior frontal gyrus/anterior insula, areas that have been related to higher risk aversion and risk-aversion mistakes. To avoid mistakes the participants decide to conform.

6 Conclusions

In this paper a review of the topic of conformism was elaborated across different literatures. This work displays that conformism is pervasive in observed human behavior and has been addressed within diverse disciplines. An issue that emerges across disciplines concerns the actual possibility to detect conformism by finding measures and points of reference that can show its distinctiveness with respect to other behaviors that are similar but that are simply triggered by the same set of stimuli.

References

- Abrahamson, E. (1991). "Managerial fads and fashions: The diffusion and rejection of innovations", *Academy of management review*, Vol. 16, No. 3, pp. 586-612.
- Abrahamson, E. (2013). "Innovation Diffusion", in *Encyclopedia of management theory*, ed. E. H. Kessler, Sage Publications, London.
- Bernhardt, D., Campello, M., Kutsoati, E., (2006) "Who herds?", *Journal of Financial Economics*, Vol. 80, pp. 657–675.
- Berns, G.S., Chappelow, J., Zink, C.F., Pagnoni, G., Martin-Skurski, M.E. and Richards, J., (2005) "Neurobiological correlates of social conformity and independence during mental rotation", *Biological Psychiatry*, Vol. 58, pp. 245–253.
- Byrne, D. (1971) *The Attraction Paradigm*. Academic Press, New York.
- Charpentier, C.J., Moutsiana, C., Garrett, N. and Sharot, T., (2014) "The brain's temporal dynamics from a collective decision to individual action", *The Journal of Neuroscience*, Vol. 34, pp. 5816–5823.
- Chevalier, J. and Ellison, G., (1999) "Career concerns of mutual fund managers", *Quarterly Journal of Economics*, Vol. 114, pp. 389–432.
- Clement, M.B. and Tse, S.Y., (2005) "Financial analyst characteristics and herding behavior in forecasting", *Journal of Finance*, Vol. 60, pp. 307–341.
- Di Maggio, P.J. and Powell, W., (1983). "The iron cage revisited: institutional isomorphism and collective rationality in organizational fields", *American Sociological Review*, Vol. 48, pp. 147-160.
- Frigotto, M.L. (2018). *Understanding Novelty in Organizations. A Research Path Across Agency and Consequences*. Palgrave MacMillan, Cham, Switzerland.
- Graham, J. R., (1999) "Herding among investment newsletters: theory and evidence", *Journal of Finance*, Vol. 54, pp. 237–268.
- Hong, H., Kubik, J. D. and Solomon, A., (2000) "Security Analysts' Career Concerns and Herding of Earnings Forecasts", *The RAND Journal of Economics*, Vol. 31, pp. 121–144.
- Huber, R.E., Klucharev, V. and Rieskamp, J., (2015) "Neural correlates of informational cascades: brain mechanisms of social influence on belief updating", *Social Cognitive and Affective Neuroscience*, Vol. 10, pp. 589–597.
- Izuma, K. e Adolphs, R., (2013) "Social manipulation of preference in the human brain", *Neuron*, Vol. 78, pp. 563–573.
- Klucharev, V., Hytonen, K., Rijpkema, M., Smidts, A. and Fernandez, G., (2009) "Reinforcement learning signal predicts social conformity", *Neuron*, Vol. 61, pp. 140–151.
- Lakonishok, J., Shleifer, A. and Vishny, R. W., (1992) "The impact of institutional trading on stock prices", *Journal of Financial Economics*, Vol. 32, pp. 23–44.
- Meyer, J.W. and Rowan, B., (1977) "Institutional organizations: formal structure as myth and ceremony," *American Journal of Sociology*, Vol. 83, pp. 340-63.
- Rogers, E. M. (1962). *Diffusion of innovations* (1st ed.). Free Press of Glencoe, New York.
- Scharfstein, D.S. and Stein, J. C., (1990) "Herd Behavior and Investment", *American Economic Review*, Vol. 80, pp. 465–489.
- Stacey, R.D., Griffin, D. and Shaw, P. (2000) *Complexity and Management: Fad or Radical Challenge to Systems Thinking?*. Routledge, London.
- Tajfel, H. (1974) Social identity and intergroup behaviour. *Social Science Information*, 13, 66–93.
- Trueman, B., (1994) "Analyst forecasts and herding behavior", *Review of Financial Studies*, Vol. 7, pp. 97–124.
- Turner, J.C., and Reynolds, K.J. (2011). Self-categorization theory. *Handbook of theories in social psychology*, eds. P.A.M. Van Lange, A.W. Kruglanski and E.T. Higgins. Sage, London. pp. 399-417.

- Wermers, R., (1999) "Mutual fund herding and the impact on stock prices", *Journal of Finance*, Vol. 54, pp. 581–622.
- Wu, H., Luo Y. and Feng C., (2016) "Neural signatures of social conformity: A coordinate-based activation likelihood estimation meta-analysis of functional brain imaging studies", *Neuroscience & Biobehavioral Reviews*, Vol. 71, pp. 101–111.
- Zaki, J., Schirmer, J. and Mitchell, J.P. (2011) "Social influence modulates the neural computation of value", *Psychological Science*, Vol. 22, pp. 894–900.

Exploring the Antecedents of Knowledge Absorptive Capacity: (How) are Social Integration Mechanisms Useful in Brazilian Firms?

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Abstract

Purpose – This paper explores the role of social integration mechanisms for knowledge absorptive capacity (ACAP) in southern Brazilian firms.

Design/methodology/approach – We followed a positivist approach and we used quantitative methods. Our sample includes 125 firms from Southern Brazil. Hypotheses were tested using structural equation modelling (SEM) supported by the software ADANCO 2.0.1.

Originality/value – Our paper contributes to the knowledge-based view literature by contributing to understand ‘why’ and ‘how’ social integration mechanisms are influencing knowledge absorptive capacity in firms. Our results suggested that social integration mechanisms have a positive effect on ACAP dimensions, and that the use of teams that are cross-functional and composed by people with diverse background, is likely to improve ACAP capabilities in firms. We suggest that further studies may perform a deeper analysis about the moderation effect of social integration mechanisms on ACAP.

Practical implications – By identifying the relevance of social integration mechanisms for improving ACAP, this study brought valuable information to managers of both Brazilian firms and foreign organisations willing to establish their operations in Brazil, for the efficient allocation of firm resources for improving the innovative performance.

Keywords – Social integration mechanisms, Knowledge absorptive capacity, Knowledge management practices, Brazil.

Paper type – Academic Research Paper

1 Introduction

Innovation is an intrinsic characteristic of firms that survive (Cefis & Marsili, 2006; O'Reilly & Tushman, 2016; Schumpeter, 1942). In the last years, the nature of innovation, its antecedents and its effects have received a growing attention from scholars and practitioners (Baregheh, Rowley, & Sambrook, 2009). Several research streams (e.g. Knowledge Management) have been used by scholars to study innovation phenomenon (Crossan & Apaydin, 2010). From the knowledge management (KM) perspective, knowledge absorptive capacity (ACAP) has emerged as a key antecedent of business innovation (Davila, Durst, & Varvakis, 2018; Flatten, Greve, & Brettel, 2011).

ACAP is defined as the firm's ability to exploit external knowledge and apply it for commercial ends (Cohen & Levinthal, 1990). As a premise for ACAP, Cohen and Levinthal (1990) stated that the firm needs to have a prior related knowledge. Firms with larger and more diverse prior knowledge base are more likely to 'make the novel associations and linkages' when a new knowledge arrives, thus, improving the learning process, the innovation capability and ultimately organizational performance. The association between the prior knowledge base and the new knowledge is possible by using some mechanisms that facilitate the sharing and exploitation of knowledge, also called 'social integration mechanisms' (Todorova & Durisin, 2007; Zahra & George, 2002). Later, some scholars have focused their attention on these mechanisms and its role for ACAP (Björkman, Stahl, & Vaara, 2007; Enkel, Groemminger, & Heil, 2018; Todorova & Durisin, 2007). Despite scholars seem to converge when they affirm that a positive relationship between the use of social integration mechanisms and the firm's absorptive capacity exists, there are yet divergences when they attempt explanations about how exactly these mechanisms contribute to enhance (or to decrease) ACAP.

Empirically, the role of social integration mechanisms on ACAP have been investigated by few studies (Armstrong & Lengnick-Hall, 2013; Björkman et al., 2007; Cuervo-Cazurra & Rui, 2017; Enkel et al., 2018; Filenga, Cernas Ortiz, & Machado-da-Silva, 2016; Kallio & Bergenholtz, 2012; Vega-Jurado, Gutiérrez-Gracia, & Fernández-De-Lucio, 2008; Yao & Chang, 2017), with relevant results but not enough for a systematic understanding about how (and in what extent) these mechanisms can enhance ACAP. In one hand some authors posit that social integration mechanisms facilitates organisational process such as ACAP (Chimhanzi, 2004; Zahra & George, 2002). In the other hand, scholars point out that these mechanisms may have either a positive or a negative effect, depending of specific contingencies (Todorova & Durisin, 2007). Yet, there is no enough empirical studies for contrasting the conflicting theoretical propositions (Chimhanzi, 2004). In this context, some questions emerge: are Social

integration mechanisms really contributing to enhance firm ACAP? If that contribution exists, in what extent these mechanisms are improving ACAP? Which roles and dimensions of ACAP are more likely to be improved by the use of social integration mechanisms?

To address these research questions, we chose Brazil as it represents an under-researched context in knowledge management literature, has very distinct characteristics when compared to western countries and it is one emerging market that is becoming more and more prominent in the international arena.

2 What do we know about ACAP?

The knowledge based view of the firm (KBV) approach provides the basis for understanding organisational innovations, by considering the renovation of traditional organisational structures (e.g., empowerment, team-based structures, or strategic alliances), the importance of knowledge-based competences, and the existence of knowledge integration and application processes that leads to value creation. According to KBV, the main role of the firm is to integrate specialised knowledge resident in humans into final goods and services (Grant, 1996). To do so, Grant (1996) posits that one of the pertinent characteristics is named ‘aggregation’ of knowledge, which, in individual or organisational levels, can be explained by ACAP.

ACAP has been analysed from many research streams due to its interdisciplinary nature (Flatten et al., 2011a). Cohen and Levinthal (1990) defined ACAP as the firm’s ability to take advantage of external knowledge, in a process that includes recognising the value of the new information, assimilating, and applying this information for commercial purposes, and even for predicting the nature of future technological advances (Wesley M Cohen & Levinthal, 1994). In line with this approach, Lane et al. (2006) defined ACAP as one of the firm’s learning capabilities, because it contributes to enhance the firm knowledge base (Lane, Koka, & Pathak, 2006).

Based on Cohen and Levinthal (1990), a multidimensional definition of ACAP was proposed by Zahra and George (2002). They defined ACAP as a dynamic capability composed of a set of routines and organisational processes by which firms acquire, assimilate, transform, and explore knowledge to improve organisational skills, and consequently, to sustain and increase competitive advantage. Zahra and George (2002) emphasise the existence of four dimensions that are sequential — acquisition, assimilation, transformation, and exploitation. They also identified two processes inside ACAP: Potential – PACAP (composed by acquisition and assimilation dimensions) and Realized – RACAP (composed by transformation and exploitation dimensions). Acquisition is the ability of the firm to identify and acquire knowledge generated externally and critical to its operation. Knowledge assimilation routines allow the firm to analyse, interpret, and understand process information captured from external sources. ‘Understanding’ is the factor that promotes the assimilation of knowledge. Transformation capability facilitates the identification of opportunities by developing and refining the routines and practices that allow you to combine new knowledge with prior

knowledge base through the addition of knowledge, unlearning, or ‘bissociation,’ which occurs when the same idea is perceived by two self-consistent but incompatible backgrounds. In addition, exploitation is the ability to refine, develop, and/or change existing skills for new ones, by incorporating in the operational routines the new knowledge previously acquired, assimilated, and processed.

The ACAP model of Zahra & George (2002) has been heavily criticized (E.g. Todorova & Durisin, 2007). By using learning theory, Todorova and Durisin (2007) point out that Assimilation (part of PACAP) and Transformation (part of RACAP) are not sequential dimensions. They posit that pieces of organisational knowledge may move not only from

Assimilation to Transformation dimensions but also in the opposite direction, because they both are alternative routes to exploitation. Hence, the separation of PACAP and RACAP proposed by Zahra and George (2002) collapses. RACAP hinges entirely on PACAP, and Cohen and Levinthal (1990) say it explicitly “These abilities collectively constitute what we call a firm’s ‘absorptive capacity.’” (p. 128). Since the deconstruction of a construct that hinges upon its elements acting in an integrated fashion is perhaps not the most fruitful avenue to pursue, our study will follow the ACAP model proposed by Todorova & Durisin (2007).

3 The role of Social Integration Mechanisms for ACAP

Acquisition is recognized by Todorova and Durisin (2007) as a first component of ACAP, related to the intensity, speed and effort to gather knowledge. They cite Cohen and Levinthal (1990) and use cognitive sciences in individual learning for demonstrating that assimilation and transformation phases are alternative process, after knowledge acquisition. When the new knowledge can be slightly altered to fit and to be incorporated into the existing knowledge structures, this new knowledge is ‘assimilated’. When the new knowledge cannot be assimilated, it is transformed. The transformation is an alternative process to assimilation, and it enables firms to perceive new knowledge to some extent incompatible with prior knowledge structures, to build new ones which are capable to receive the new knowledge. Thus, it may be the transformation capability that allows firm to survive in highly competitive environments (Todorova & Durisin, 2007). Based on this, the following hypotheses are going to be tested:

H1. The assimilation of knowledge (ASS) in firms is a function of the acquisition process (ACQ).

H2. The transformation of knowledge (TRF) in firms is a function of the acquisition process (ACQ).

H3. The exploitation of knowledge (EXP) in firms is a function of the assimilation process (ASS).

H4. The exploitation of knowledge (EXP) in firms is a function of the transformation process (TRF).

Social integration mechanisms contribute to build connectedness and shared meanings (Todorova & Durisin, 2007). They favour the efficient circulation of information flows

within the firm (Fosfuri & Tribó, 2008) and they increase the interpersonal networks and make interunit knowledge transfer more intensive (Peltokorpi, 2017). For example, the use of cross-functional teams may increase innovativeness by bringing together people with different skills, backgrounds and complementary information about the same problem or opportunity (Davenport, David, & Beers, 1998; Manhães & Dávila, 2016). Informal meetings, open dialogs between employees and managers may be other forms of social integration mechanisms (Kianto & Andreeva, 2014).

Todorova and Durisin (2007) posit that the social integration mechanisms are likely to influence the four dimensions of ACAP. They posit that, depending of specific circumstances (e.g. type of new knowledge and type of knowledge processes), social integration mechanisms may have either a positive or a negative effect on those dimensions. Even more, according to Todorova and Durisin (2007), social integration mechanism may have a direct or a moderating effect on those dimensions.

The propositions of Todorova and Durisin (2007) regarding the positive or negative effects of SIM on ACAP' dimensions have not properly discussed yet, and this lack of studies is even more visible in regions beyond the boundaries of emerging countries. Thus, due its exploratory nature, this study will analyse the direct and moderations effects of SIM on ACAP' dimensions without the development of hypotheses.

4 Method

This paper follows a positivistic point of view. An analysis of the relationships between the different dimensions of ACAP and the social integration mechanisms implies a definition of a set of causal relationships that can be examined using a quantitative approach.

4.1 Sample

To address this research question, we collected the survey data in Santa Catarina State, Brazil, using scales previously validated in international context. Santa Catarina is located in the South region of Brazil, and it is responsible for 4.8% of Brazilian gross domestic product (GDP), it employs 7.8 % of the Brazilian workforce and it has the fourth highest GDP per capita (IBGE, 2014). Hofstede et al. (2010) defined the South of Brazil as "European and prosperous, is more hierarchical, less formal, more individualist, and more masculine (achievement-oriented)" (p.347).

The target enterprises were selected from a database of Industry Federation of Santa Catarina (FIESC / SC). The data was collected from November 2015 to April 2016 by mailing to companies' managers from top or middle levels in each firm. As a result of collection efforts, we collected 146 responses, representing a response rate of 9.3%. After excluding 21 responses with incomplete data or ungagged responses, we achieved a usable sample of 125 responses for further analysis.

4.2 Measures

ACAP. For measuring Potential and Realised ACAP, we used the scale developed by Flatten, Engelen, Zahra & Brettel (2011), composed by 14 items and that was built considering different research streams and models for ACAP (Todorova & Durisin, 2007; Zahra & George, 2002).

Social integration mechanisms (SIM). We measured this construct using part of the scale developed by Kianto & Andreeva (2014), because this scale contains indicators that may represent the different mechanisms, and it has a wording and structure that are well understood in Brazilian context.

Controls. We use firm size and firm age, represented by the logarithm of the number of employees and the logarithm of the number of year operating.

4.3 Analysis

In line with suggestions from Podsakoff, MacKenzie, & Podsakoff (2012) as well as benchmarking of previous studies (cf. Andreeva et al., 2017), we applied a set of remedies to control and ensure that common method bias (CMB) would not influence our results. Then, we tested our hypotheses using structural equation modelling (SEM) supported by ADANCO software, following suggestions from Henseler, Hubona, & Ray (2016). SEM allows testing causal paths between latent variables and identifying the collective strength of multiple variables (Creswell & Creswell, 2017). First, we analysed the measurement model to ensure construct reliability, convergent validity, and discriminant validity. Second, we assessed the structural model by using the following steps: we analysed the Standardized Root Mean Square Residual (SRMR), proposed by Henseler, Hubona, & Ray (2016) as a model fit assessment criterion. Then, we identified the amount of variance of dependent variables explained by the model (adjusted- R^2 values). After this, the statistical significance and the strength of path estimate between constructs were evaluated, for testing the research hypotheses. Even more, a bootstrapping procedure was performed (using 5000 bootstrap samples) in order to obtain and present confidence intervals about each construct and path in the model.

5 Results

The following section presents the application of remedies for common method bias, the results of analysis of both measurement model and structural model, for testing the developed hypotheses.

5.1 Remedies for Common Method Bias (CMB).

We used some procedural remedies suggested by Podsakoff et al. (2012). The online survey was managed and performed by FIESC, an institution that use to collect data from industries from Santa Catarina. By doing this, we provided to respondents the same data collection standards they use to deal with (e.g. ethics, privacy, communication style and channel), and we increased the probability of honest answers. We chose respondents that

were familiar with innovation and business management issues. In the statistical side, we tested a model that included additional unmeasured latent factor to represent CMB, and as suggested by Liang, Saraf, Hu, & Xue (2007), we confirmed that the loadings on the unmeasured latent factor were lower than the loadings on the construct factors. In addition, we checked that variance inflation factors (VIF) for each construct factor in each latent variable were lower than 3.3 (Kock, 2015). These procedural and statistical procedures taken together decreased the risk of CMB being a serious concern in this research. We also compared the answers of early and late respondents for testing nonresponse bias, by using discriminant analysis (J. S. Armstrong & Overton, 1977) and no significant differences were found.

5.2 Measurement model.

We confirmed good reliability in latent constructs by calculating scores (above 0.7) as recommended by Nunnally & Bernstein (1994) for Cronbach's Alpha, composite reliability, and rho A tests. The AVE scores above 0.5 for all latent variables as suggested by Fornell & Larcker (1981), and the loadings of all indicators above 0.6 (Hair, Black, Babin, Anderson, & Tatham, 2006) evidenced an adequate convergent validity (see table 1)

Table 1. Measurement test results for the variables of the study.

Constructs and Indicators		Loadings	Cronbach's Alpha	rho A	Composite Reliability	AVE
Social Integration Mechanisms (SIM)			0.842	0.854	0.888	0.615
SIM1	People from different parts of our organization interact informally with each other in a frequent manner	0.766				
SIM2	In our organization, open dialogs are common among/between employees and manager	0.781				
SIM3	In our projects, our organization uses teams consisting of people with skills and expertise from diverse fields	0.869				
SIM4	In our organization, we frequently use cross-functional teams and projects	0.820				
SIM5	In our organization, we have purposeful overlap of functional responsibilities	0.673				
Acquisition (ACQ)			0.700	0.714	0.833	0.625
AQ1	The search of relevant information concerning our industry is every-day business in our country	0.758				
AQ2	Our management motivates the employees to use information sources within our industry	0.853				
AQ3	Our management expects that the employees deal with information	0.758				

	beyond our industry					
Assimilation (ASS)			0.781	0.792	0.858	0.602
AS1	In our company ideas and concepts are communicated cross-departmental	0.765				
AS2	Our management emphasizes cross-departmental support to solve problems	0.832				
AS3	In our company there is a quick information flow, e.g., if a business unit obtains important information it communicates this information promptly to all other business units or departments	0.793				
AS4	Our company demands periodical cross-departmental meetings to interchange new developments, problems and achievements	0.709				
Transformation (TRF)			0.888	0.890	0.923	0.749
TR1	Our employees have the ability to structure and to use collected knowledge	0.844				
TR2	Our employees are used to absorb new knowledge as well as to prepare it for further purposes and to make it available.	0.907				
TR3	Our employees successfully link existing knowledge with new insights	0.857				
TR4	Our employees are able to apply new knowledge in their practical work	0.852				
Exploitation (EXP)			0.816	0.845	0.890	0.730
EX1	Our management supports the development of prototypes	0.766				
EX2	Our company regularly reconsiders technologies and adapts them accordant to new knowledge	0.914				
EX3	Our company has the ability to work more effective by adopting new technologies	0.878				

As suggested by Fornell and Larcker (1981), we assessed Discriminant validity by checking that square root of AVE in each latent construct is higher than the correlation between the construct and the other ones (see table 2). Descriptive statistics show that social integration mechanisms are widely used by firms in the sample (mean 3.76), and that acquisition and exploitation are the most representative dimensions of ACAP performed by the firms in our sample (mean 3.91).

Table 2. Descriptive statistics and correlations between variables of the study.

	Mean	ACQ	ASS	TRF	EXP	SIM	FS	FA
ACQ. Acquisition	3.91	0.79						
ASS. Assimilation	3.72	0.60	0.78					
TRF. Transformation	3.41	0.42	0.66	0.87				
EXP. Exploitation	3.91	0.50	0.55	0.46	0.85			
SIM. Social Int. Mechanisms	3.76	0.42	0.65	0.54	0.53	0.78		
FS. Firm Size	2552.58	0.05	0.12	0.05	0.11	0.07	1.00	
FA. Firm Age	35.30	0.22	0.21	0.11	0.24	0.19	0.45	1.00

* Square root of AVE in diagonal

5.3 Structural model.

The structural model presented in the figure 1, was assessed after running the bootstrapping procedure (see table 3). Our model has a good SRMR index of 0.086, below the maximum thresholds of 0.10 proposed by Henseler et al. (2016).

Table 3. Test of Hypotheses

Variables	Coef. B	p values	f ²
H1. ACQ -> ASS	0.378	0.000	0.269
H2. ACQ -> TRF	0.222	0.002	0.062
H3. ASS -> EXP	0.255	0.035	0.040
H4. TRF -> EXP	0.160	0.158	0.020
SIM -> ACQ	0.416	0.000	0.209
SIM -> ASS	0.445	0.000	0.348
SIM -> TRF	0.405	0.000	0.192
SIM -> EXP	0.259	0.008	0.057
SIMXAQU -> ASS	-0.136	0.046	0.037
SIMXAQU -> TRF	-0.123	0.053	0.020
SIMXASS -> EXP	0.102	0.491	0.004
SIMXTRF -> EXP	-0.104	0.472	0.004
Firm Size -> EXP	-0.028	0.710	0.001
Firm Age -> EXP	-0.106	0.212	0.014
			Adjusted R²
ACQ			0.166
ASS			0.557
TRF			0.336
EXP			0.340
SRMR			0.086

By analysing the adjusted-R² values, that indicate the percentage of variability accounted by predictive constructs in the model (Henseler et al., 2016), we identified that constructs in our model explain 16.6% of Acquisition, 55.7% of Assimilation, 33.6% of Transformation and 34% of Exploitation processes of ACAP in firms in the sample.

In one hand, the results provided evidence that supports the hypotheses based on Todorova and Durisin (2007) about the simultaneous nature of assimilation and transformation dimensions of ACAP. Acquisition seems to be an antecedent of Assimilation (H1) and Transformation (H2), while the dimensions of Assimilation (H3) seems to predict Exploitation dimension. The effect of Transformation on Exploitation is not significant, so H4 is not supported. Assimilation and Transformation have the lower means in the model (see table 2), and it may suggest that they are alternative dimensions, in line with Todorova and Durisin (2007).

On the other hand, the results evidenced that in firms in our sample, the use of social mechanisms have a positive effect on acquisition, assimilation, transformation and exploitation dimensions of ACAP, with effect sizes considered strong in the first three ones. As shown in table 1, the use of cross-functional teams (Dávila, North, & Varvakis, 2016) and teams composed by people with different backgrounds (Manhães & Dávila, 2016) seems to be the most important social integration mechanisms, due their correlation with this construct that influences positively the dimensions of ACAP.

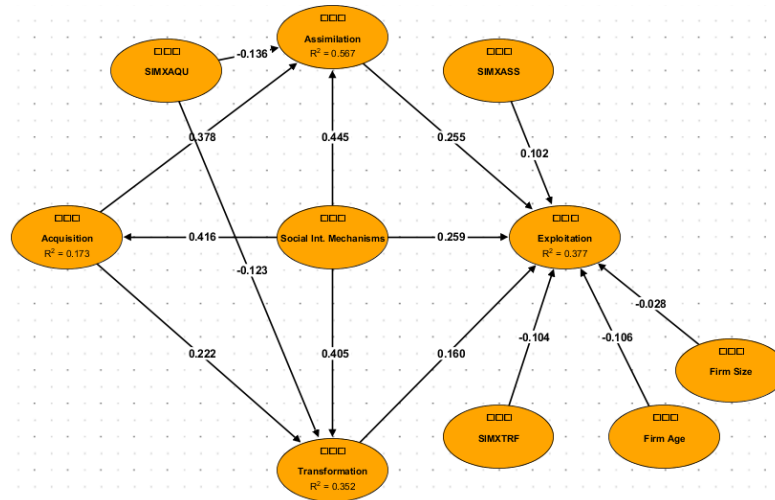


Figure 1. Path model.

Regarding moderation effects, the joint effect of social integration mechanisms and Acquisition, on Assimilation and Transformation are significant and negative, with very weak effect sizes. As Todorova and Durisin (2007) did, this can be explained by using the ‘weak-tie theory’ (Granovetter, 1977) and further developments published in studies of Hansen (2002). When the new knowledge is simple, the strong ties and use of social integration mechanisms may have a negative moderating effect on ACAP’ dimensions, by handicapping search processes. Following Hansen (2002), we may suggest that the new knowledge that Brazilian firms use to acquire is simple and not complex.

Finally, the moderating effects of firm size and firm age are not significant in our model.

6 Conclusions

This study contributed to the systematic understanding about the role of social integration mechanisms, by exploring ‘how’ these mechanisms may affect the dimensions of ACAP. In line with recent calls for deeper contextualization of the theories developed in the West (Michailova, 2011), our findings contribute to the knowledge management literature in the particular context of an emerging economy, Brazil.

By identifying the ACAP dimensions affected by social integration mechanisms, and the significance of these relationships, this study brought valuable information to managers of both Brazilian firms and foreign organisations willing to establish their operations in Brazil, for the efficient allocation of firm resources for managing knowledge and ultimately, innovation.

The moderating effects of social integration mechanisms on ACAP’ dimensions may be better explored in further studies, by including the complexity of the new knowledge that is being acquired. Other elements in the model Todorova and Durisin (2007) such as power relationships and activation triggers can be included in further research.

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References

- Armstrong, C. E., & Lengnick-Hall, C. A. (2013). The Pandora’s box of social integration mechanisms: Can they make it more difficult to realize absorptive capacity? *Journal of Strategy and Management*, 6(1), 4–26. <https://doi.org/doi:10.1108/17554251311296530>
- Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, 14(3), 396–402.
- Baregheh, A., Rowley, J., & Sambrook, S. (2009). Towards a multidisciplinary definition of innovation. *Management Decision*, 47(8), 1323–1339. <https://doi.org/10.1108/00251740910984578>
- Björkman, I., Stahl, G. K., & Vaara, E. (2007). Cultural differences and capability transfer in cross-border acquisitions: The mediating roles of capability complementarity, absorptive capacity, and social integration. *Journal of International Business Studies*, 38(4), 658–672. <https://doi.org/10.1057/palgrave.jibs.8400287>
- Cefis, E., & Marsili, O. (2006). Survivor: The role of innovation in firms’ survival. *Research Policy*, 35(5), 626–641. <https://doi.org/10.1016/j.respol.2006.02.006>
- Chimhanzi, J. (2004). The impact of integration mechanisms on marketing/HR dynamics. *Journal of Marketing Management*, 20(7–8), 713–740.
- Cohen, W. M., & Levinthal, D. A. (1990). ABSORPTIVE-CAPACITY - A NEW PERSPECTIVE ON LEARNING AND INNOVATION. *Administrative Science Quarterly*, 35(1), 128–152. <https://doi.org/10.2307/2393553>
- Cohen, W. M., & Levinthal, D. A. (1994). Fortune favors the prepared firm. *Management Science*, 40(2), 227–251.
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed*

methods approaches. Sage publications.

- Crossan, M. M., & Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: A systematic review of the literature. *Journal of Management Studies*, 47(6), 1154–1191. <https://doi.org/10.1111/j.1467-6486.2009.00880.x>
- Cuervo-Cazurra, A., & Rui, H. (2017). Barriers to absorptive capacity in emerging market firms. *Journal of World Business*, 52(6), 727–742. <https://doi.org/10.1016/j.jwb.2017.06.004>
- Davenport, T. H., David, W., & Beers, M. C. (1998). Successful knowledge management projects. *Sloan Management Review*, 39(2), 43–58.
- Davila, G. A., Durst, S., & Varvakis, G. (2018). KNOWLEDGE ABSORPTIVE CAPACITY, INNOVATION, AND FIRM'S PERFORMANCE: INSIGHTS FROM THE SOUTH OF BRAZIL. *International Journal of Innovation Management*, 22(2), 34. <https://doi.org/10.1142/s1363919618500135>
- Dávila, G. A., North, K., & Varvakis, G. (2016). How Brazilian textile enterprises learn to grow. In *Competitive Strategies for Small and Medium Enterprises* (pp. 241–254). Springer.
- Enkel, E., Groemminger, A., & Heil, S. (2018). Managing technological distance in internal and external collaborations: absorptive capacity routines and social integration for innovation. *Journal of Technology Transfer*, 43(5), 1257–1290. <https://doi.org/10.1007/s10961-017-9557-0>
- Filenga, D., Cernas Ortiz, D. A., & Machado-da-Silva, F. N. (2016). The moderating role of social integration mechanisms in two models of absorptive capacity: Evidence from Brazil. *Knowledge Management*, 16(1), 1–12. <https://doi.org/10.18848/2327-7998/CGP/v16i01/1-12>
- Flatten, T. C., Engelen, A., Zahra, S. A., & Brettel, M. (2011). A measure of absorptive capacity: Scale development and validation. *European Management Journal*, 29(2), 98–116. <https://doi.org/10.1016/j.emj.2010.11.002>
- Flatten, T. C., Greve, G. I., & Brettel, M. (2011). Absorptive Capacity and Firm Performance in SMEs: The Mediating Influence of Strategic Alliances. *European Management Review*, 8(3), 137–152. <https://doi.org/10.1111/j.1740-4762.2011.01015.x>
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50.
- Fosfuri, A., & Tribó, J. A. (2008). Exploring the antecedents of potential absorptive capacity and its impact on innovation performance. *Omega*, 36(2), 173–187. <https://doi.org/10.1016/j.omega.2006.06.012>
- Granovetter, M. S. (1977). The strength of weak ties. In *Social networks* (pp. 347–367). Elsevier.
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm, 17, 109–122.
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). Multivariate data analysis . Uppersaddle River, NJ: Pearson Prentice Hall.
- Hansen, M. T. (2002). Knowledge networks: Explaining effective knowledge sharing in multiunit companies. *Organization Science*, 13(3), 232–248.
- Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial Management & Data Systems*, 116(1), 2–20.
- Kallio, A., & Bergenholtz, C. (2012). Enhancing organisational absorptive capacity by reframing an outdated suggestion box: An action research study. *International Journal of Innovation and Learning*, 12(4), 414–429. <https://doi.org/10.1504/IJIL.2012.049353>
- Kianto, A., & Andreeva, T. (2014). Knowledge Management Practices and Results in Service-Oriented versus Product-Oriented Companies. *Knowledge and Process Management*, 21(4), 221–230. <https://doi.org/10.1002/kpm.1443>
- Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of E-Collaboration (IJeC)*, 11(4), 1–10.
- Lane, P. J., Koka, B. R., & Pathak, S. (2006). The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review*, 31(4), 833–863.

<https://doi.org/10.5465/AMR.2006.22527456>

- Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2007). Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management. *MIS Quarterly*, 59–87.
- Manhães, M., & Dávila, G. A. (2016). The Innovation Triple Challenge: A Creativity Check for SMES. In *Competitive Strategies for Small and Medium Enterprises* (pp. 77–92). Springer.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychological theory*. New York, NY: MacGraw-Hill, 131–147.
- O'Reilly III, C. A., & Tushman, M. L. (2016). *Lead and disrupt: How to solve the innovator's dilemma*. Stanford University Press.
- Peltokorpi, V. (2017). Absorptive capacity in foreign subsidiaries: The effects of language-sensitive recruitment, language training, and interunit knowledge transfer. *International Business Review*, 26(1), 119–129. <https://doi.org/10.1016/j.ibusrev.2016.05.010>
- Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, 63, 539–569.
- Schumpeter, J. (1942). Creative destruction. *Capitalism, Socialism and Democracy*, 825, 82–85.
- Todorova, G., & Durisin, B. (2007). Absorptive capacity: Valuing a reconceptualization. *Academy of Management Review*, 32(3), 774–786.
- Todorova, G., & Durisin, B. (2007). Absorptive capacity: Valuing a reconceptualization. *Academy of Management Review*, 32(3), 774–786.
- Vega-Jurado, J., Gutiérrez-Gracia, A., & Fernández-De-Lucio, I. (2008). Analyzing the determinants of firm's absorptive capacity: Beyond R&D. *R and D Management*, 38(4), 392–405. <https://doi.org/10.1111/j.1467-9310.2008.00525.x>
- Yao, F. K., & Chang, S. (2017). Do Individual Employees' Learning Goal Orientation and Civic Virtue Matter? A Micro-Foundations Perspective on Firm Absorptive Capacity. *Strategic Management Journal*, 38(10), 2041–2060. <https://doi.org/10.1002/smj.2636>
- Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27(2), 185–203. <https://doi.org/10.5465/amr.2002.6587995>
- Zahra, S. A., & George, G. (2002). ABSORPTIVE CAPACITY: A REVIEW, RECONCEPTUALIZATION, AND EXTENSION. *Academy of Management Review*, 27(2), 185–203. <https://doi.org/10.2514/1.J054260>

Smart Waste Management and Smart Parking Management as a Significant Part of the Smart City

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Abstract

Smart waste management and smart parking management are necessary improvements for civil society and significant effort how to achieve vision of smart city. Proposed innovative solutions create important knowledge to further understanding of the knowledge ecosystem in accordance to create the sustainable future. Smart trends are necessary for sustainable development and call for local and global challenges. The digital revolution and technological approaches represent unlimited source for growth. Using technological improvements and digital knowledge for innovative social solutions could significantly improve quality of life and support ecosystem. Smart devices are a key factor and ecosystem should benefit from them. Along with smart traffic, smart lighting, smart energy and smart waste management is an integral part of any smart city. There are two innovative functions of smart waste management. One is operational efficiency and second is waste reduction. Although public services and waste management companies have been around for a long time, they have implemented only limited innovations with operational efficiency, until the last few years. The other side of smart waste management deals with managing the quantity of waste created on a daily basis. Consumers and businesses create millions of tonnes of garbage every year. User friendly waste management and analytics platform could make more effective waste management. Smart waste management could simply save the costs and improve ecosystem. Another innovative approach, which is smart parking management mainly optimise parking space usage, improve the efficiency of parking operations and help traffic in city flow more freely. Smart parking designs, develops and produces outstanding leading-edge technology that enables people to manage on-street and off-street parking efficiently and cost-effectively. The first goal of the submitted article is to identify and define the key features and tools for smart waste management and smart parking management. The second goal is to examine usage of technological approaches in this area. The last aim is to draft theoretical solutions, which could be easily practically implemented into the praxis. Innovative solutions in this area will be just small step in vision of the smart city, but big improvement in quality of life. The most important contribution of the article is to highlight the necessity of smart waste management and smart parking management in contemporary world.

Keywords – Smart, City, Waste, Parking, Management

Paper type – Academic Research Paper

1 Introduction

Nowadays social processes impose requirements on innovative approaches and solutions for resolving social problems that exceed the established ways of thinking and acting. The paper contains theoretical description of smart city and innovative solutions in waste management and parking management. Smart city is a community that is sustainable, liveable and efficient. The sustainable community is one which reduces the environmental consequences of urban life and is often an output of efforts to make the city more efficient and liveable (Jurenka et al, 2019).

Smart city is created by basic infrastructure that offers a high quality of living, clean environment, renewable source of energy, and application of specific smart solutions in every day.

Smart city is a place where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business (European Commission, 2019).

The most effective definition of a smart city is a community that is efficient, liveable, and sustainable—and these three elements go hand in hand. A sustainable community is one which reduces the environmental consequences of urban life and is often an output of efforts to make the city more efficient and liveable (Charbel Aoun, 2013, Elets, 2016).

The British Standards Institution (2014) defines the term smart city as “the effective integration of human, physical and digital systems with the aim to build environment which can deliver sustainable and prosperous future for its citizens.”

Citizen-focused definitions consider smart city as friendly, clean, and with well-developed transport infrastructure. Citizen-focused definitions are also familiar words like “technology,” “connected,” “internet,” and “modern” which extend the right meaning of smart city (Centre for cities, 2014).

Basic infrastructure of smart city mainly contains well-organized and ecological urban mobility and public ways of transportation, smart waste solutions and smart waste management, citizen participation, strong information architecture with cloud solutions, safety and security systems in order to detect, analyse a prevent harmful behaviour.

Reaching of smart infrastructure is possible only in the way of applying information and communications technology (ICT) infrastructure and architecture. The availability and quality of the ICT infrastructure are important for smart cities. Indeed, smart object networks play a crucial role in building smart cities into a reality. ICT infrastructure includes wireless infrastructure (fiber-optic channels, Wi-Fi networks, wireless hotspots, kiosks) and service-oriented information systems (Jurenka et al, 2017).

The implementation of an ICT infrastructure is fundamental to a smart city’s development and depends on factors related to its availability and performance. (Hawaii International Conference on System Sciences, 2012).

2 Smart solutions

By 2050 the global population is forecast to grow to over 9 billion, 80% of which will inhabit cities. The increase in demand for all resources is unsustainable, as are traditional delivery mechanisms, which are unresponsive and too costly. To maintain quality of life expectations in the developed world, we urgently need to identify and implement innovative solutions in order to effectively manage and control human environmental interaction – particularly in cities (British Standards Institution, 2014).

Smart solutions are nowadays necessary more than ever. Smart solutions, which must be implemented in cities should focus on the following features: effective waste management, waste transformation to energy, fuel and compost, relevant public information, application of renewable source of energy, construction of green buildings, smart and safe pedestrian crossings, citizen's engagement, monitoring water quality, 100% treatment of wastewater, smart parking systems, autonomous traffic management systems, and other smart solutions.

Now more than ever, cities need to provide public services more efficiently along with supporting sustainable and long-term economic growth. The latest researches suggest that the best way to do this is becoming “smart.” This generally means to use new technologies (mainly information and communication technologies) and data to improve service delivery and address various economic, social, and environmental challenges (Jurenka et al, 2019).

As example we could point on smart transport and smart mobility initiatives, like traffic control centre, which can help the city manage traffic flows and reduce traffic jams. Real-time managing free parking spaces system, recalculating smart routes for drivers, making available bus arrival data publicly, development of new smartphones applications, special radio information systems could make commuting in the city easier.

The key components, especially of medium-sized smart cities comprises of six fundamental elements: smart people, smart mobility, smart living, smart waste management, smart economy and smart government. The aforementioned six elements are crucial for achieving the smart city goals in real meaning (Racounter, 2018).

3 Smart waste management

Based on estimates, the world cities generated 1.3 billion tonnes of waste annually. With current urbanisation and population growth rate, the global waste generation is estimated to rise to 2.2 billion tonnes by 2025. A World Bank study showed that urban areas in Asia spent USD 25 million per year on solid-waste management, and this figure will increase to USD 47 million per year (Global waste management conference, 2017).

Another prediction (Fig 1.) shows that in 2025 will be produced more than 6 million tonnes per day and in 2100 due to population growth production of the waste will rise to 11 million tonnes per day. Abovementioned predictions call for smart solutions in sector of waste management (The World Bank, European Commissions, 2018).



Fig. 1 Global predictions in waste management (NEC, 2018)

Managing waste properly is essential for building sustainable and liveable cities, but it remains a challenge for many developing countries and cities. Effective waste management is expensive, often comprising 20%–50% of municipal budgets. Operating this essential municipal service requires integrated systems that are efficient, sustainable, and socially supported (The World Bank, 2019).

Smart technologies in waste management can help optimise the budgets, municipal resources, the use of garbage trucks and improve provided services through better management. Transformation (Fig. 2) of the traditional waste management system into a smart solution could bring:

- Route optimization;
- Improvement of staff productivity;
- Measurable benefits.



Fig. 2 Transformation of waste management into a smart solution (NEC, 2018)

Benefits (Fig. 3) consist of: smart routes without traffic jams, fleet management, reducing minimum 15% operational costs, increasing of quality service, fuel savings, reducing CO2 emissions and collecting of containers only when necessary.

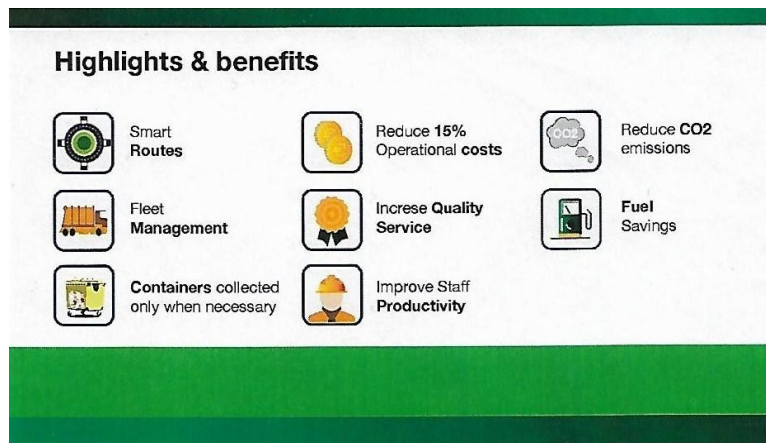


Fig. 3 Benefits from smart waste management (NEC, 2018)

Another solution for our future in waste management is to create complex strategy and effort in educating all people, how to reduce waste and how to correctly separated waste for effective repeatedly utilization. This important knowledge, we should transfer on children. Teach them these knowledge and habits especially in school and home. This is particularly important for municipalities, who must pay for the landfills and waste removal services. Creating strategy and our effort is fundamental to further understanding of the knowledge ecosystem, only in this way is possible to create the sustainable future.

4 Smart parking management

Nowadays almost in every medium size city arises parking problems that people must face each day. Traffic level rapidly increases with the level of population growth. The utilization of personal vehicles is increasing every year. Lots of people chooses personal vehicles than public ways of transportation. Very often is difficult and time consuming to find free parking lot in most of urban and commercial areas, particularly during the rush hours. (Rahman, S., Bhounik, P. 2019). Contemporary parking problems consist of:

- Insufficient parking lots in highly populated areas;
- Inefficient use of existing possible parking capacity;
- Struggle to find a free parking space;
- Traffic problems created due to poorly designed parking spaces;
- Problem to find your vehicle in very large parking areas;
- Some Parking spaces are inconvenient (too small) to use;
- Waste of fuel and other resources in searching for a free parking lot;
- Environmental problems due to excessive fuel exhaustion;
- Caused damages on vehicles during parking;
- Inadequate or very expensive parking price models;
- Confusing parking policies.

Smart parking is important part of smart mobility, which belongs into six key elements of each smart city. Smart parking management offers the optimization of traffic flow in the city and especially in busy neighbourhoods. Smart parking enables easier finding of free parking lot, reservation of parking space from home or car, digital payments, extension of parking time and detection of unauthorized parking.

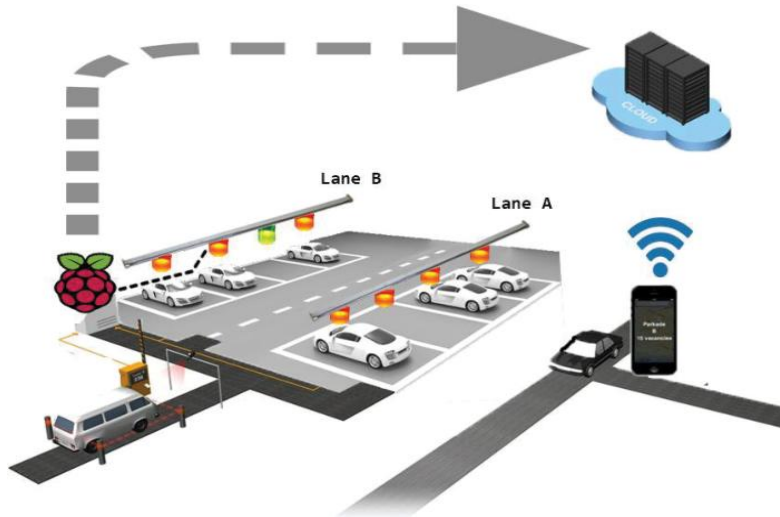


Fig. 4 Smart parking system (Khanna, A., Anand, R., 2016)

Main purpose of smart parking (Fig. 4) solution is to reduce time to locate the available parking areas. IoT-based sensors deployed in the parking area (fixed on each parking slot) easily collect the data and simply gives a signal about which parking lot is vacant and which is occupied. Information from the sensor are analysed and send to a nearby receiver which gives a continuous live update about the availability of all the available parking slots. The collected data are broadcasted to parking information system and smartphone app for drivers. Parking spaces could be reserved through the mobile app or driver can use guidance system. (Cynthia, J. et al, 2018).

Besides the location of the parking space, the drivers will get information like the size of the parking space and even nearby public transportation information, if are needed. (Jasani, M. 2019). Smart parking solution in addition also offer reservation of parking lot, reduce the man power cost, increase the efficiency and safe environment.

Another solution for smart parking management is creating big parking places in the suburbs. This type of the parking strategy has many possibilities, how to attract people. The biggest advantage of this model would be low price, assurance of free parking space and safety location. Abovementioned solutions could by divided into mores strategies, which could reflect individual possibilities and preferences of each city. First strategy could focus on providing complimentary shuttle buses from suburb parking area to main location in the city. Second strategy could focus on providing complimentary tickets on local transport system. Third strategy could provide combination of complimentary shuttle buses and local transport system. Fourth strategy could focus on providing system

of shared bikes, which could be lend in parking areas. The fifth strategy could combine complimentary shuttle buses, complimentary local transport system and system of shared bikes together in one complex system. This suburb parking areas could offer favourable daily price and also weekly, monthly, quarterly, half yearly and yearly discounted subscription. Pricing policy will contain better price and conditions, if there will be signed longer subscription. This strategy should have own marketing campaign, web address with all information like general conditions, reservation system, time tables, price list and other important information. Own mobile app is necessary requirement and referrals bonus system is highly recommended. Mobil app could provide in easy way for their users the transportation information, time tables and best connections possibilities from parking area to their final destination and vice versa. This concept could easily solve parking problems a certain group of people, reduce traffic jams in the city, save money in long term subscription, save environment and for particular people also save time.

5 Conclusion

The future of all technologies is in personalization and in cloud organisation. Smart waste management and smart parking management could be organised from cloud operations centre, which could monitor key performance indicators in order to automatically provide services. Monitoring of public indicators could focus on taking decisions for public welfare. Cloud operations centre could offer truly integrated solution, automated regulation, and designated to meet smart city requirements in a flexible, economical and efficient way.

Smart waste management solutions could simply save the costs a improve ecosystem by using the new technological systems, which comprises of volumetric sensors inside the containers, telemetry units installed in garbage trucks and by the automatic system calculating optimized routes. Optimized routes in addition save fuel, reduce CO2 emissions and reduce operational costs.

Volumetric sensor is small sensor, which can be easily installed inside all the waste bins. Sensor measures the distance from top of the bin to the inserted amount of the waste. This technology enables to monitor real amount of the waste in containers. Smart sensors allow optimize the efficiency of waste collection. All these sensors enable to collect only full containers and exclude to pick-up empty containers.

Innovative waste solutions are fundamental for sustainable future of our world. Smart solutions are also necessary in order to build an effective circular economy, which could solve potential problems resulting from growth of population. Circular economy counts with products, that are optimized and designed for recycling and repeatedly reusing. In contemporary world national and local governments embrace the circular economy. Smart solution in waste management will help promote efficient economic growth and subsequently will minimize environmental effects.

Many cities have begun to discover how to tailor their parking solutions according to specific requirements to the actual individual needs of people. For example, Dubai has

integrated portable multi-level parking structures, in order to increase the number of cars parked in a small space.

The fundamental element of perfect parking solution is in using technological development of IoT, Big Data and Cloud Technology. The smart parking systems are still evolving. In the future could be smart parking management eco-friendly and sustainable. Smart parking solutions generally bring less maintenance cost, provide security to the parking grounds, reduce the hassle, reduce traffic jams and additional parking time fee could be remotely paid through the parking app.

The vision of smart city is not just the distant future. Important technological development has been made in the past couple of years. Innovative technologies and approaches change smart city into reality. The recent growth of Internet of Things and Cloud technologies offers great potential. Smart waste management and smart parking systems have always been the core of the smart city vision. Smart waste management and smart parking systems could easily provide real time information, make abovementioned processes effective and sustainable.

References

- British Standards Institution, (2014) Smart cities – Vocabulary, [online], accessible at: <http://shop.bsigroup.com/upload/PASs/Free-Download/PAS180.pdf>, published by BSI Standards Limited 2014. ISBN 978 0 580 81874 5.
- Centre for cities, (2014) Smart Cities, [online], accessible at: <http://www.centreforcities.org/wp-content/uploads/2014/08/14-05-29-Smart-Cities-briefing.pdf>
- Cynthia, J. et al, (2018) IOT based Smart Parking Management System, International Journal of Recent Technology and Engineering, Volume-7, Issue-4S, ISSN: 2277-3878.
- Elets, (2016) Centre to guide cities for improving smart city plans, [online], accessible at: <http://smartcity.eletsonline.com/centre-to-guide-cities-for-improving-smart-city-plans/>
- European Commission, (2019) What are smart cities?, [online], accessible at: https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en
- Hawaii International Conference on System Sciences, (2012) Understanding Smart Cities: An Integrative framework, [online], accessible at: https://www.ctg.albany.edu/publications/journals/hicss_2012_smartcities/hicss_2012.pdf
- Global waste management conference, (2017) Building Sustainability in an Urbanised World through Strategic Waste Management, Pullman Bangkok Grande Sukhumvit, Bangkok, Thailand, [online], accessible at: <http://www.globalwastemanagementconference.com/>
- Charbel Aoun, (2013) The Smart City Cornerstone: Urban Efficiency, [online], accessible at: <http://www.digital21.gov.hk/relatedDoc/download/2013/079%Electric%20%28Annex%29.pdf>
- NEC, (2018) Smart Waste Solution, 5th EAI International Conference on Smart Cities within SmartCity 360 Summit, Guimaraes, Portugal.
- Jasani, M. (2019) How much Will Smart Parking Solutions Improve in 2019?, [online], accessible at: <https://hackernoon.com/how-much-will-smart-parking-solutions-improve-in-2019-fa1bac32cb77>
- Jurenka, R. et al, (2019) Social innovations in context of smart city, In Smart technology trends in industrial and business management, 1. edition, Cham, Switzerland : Springer International Publishing AG, p. 383-399, ISSN 2522-8609, ISBN 978-3-319-76998-1.

- Jurenka, R. et al, (2017) Smart City in terms of social innovations and human capital, In Smart City 360°, [online], 2nd EIA International Summit, 22-24 November 2016, Bratislava, 1. Edition, Bratislava: EAI, [8] p., ISBN 978-1-63190-149-2.
- Khanna, A., Anand, R., (2016) IoT based Smart Parking System, International Conference on Internet of Things and Applications, Maharashtra Institute of Technology, Pune, India, Publisher: IEEE, ISBN 978-1-5090-0044-9.
- The World Bank, (2019) Solid Waste Management., [online], accessible at: <http://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management>
- Rahman, S., Bhounik, P. (2019) IoT Based Smart Parking System, International Journal of Advances in Computer and Electronic Engineering, Volume 4, Issue 1, pp. 11-16, ISSN: 2456 – 3935.
- Racounter, (2018) Connectivity in smart cities, [online], accessible at: <http://raconteur.net/infographics/connectivity-in-smart-cities>

Overcoming Knowledge Workers Tunnel Vision through Intentional Unlearning

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Abstract

Purpose – In the context of business, the concept of ‘peripheral vision’ is usually used to refer to instances involving detecting information that may be important for the “safe and an effective navigation of the world”. In contrast, the concept of ‘tunnel vision’ is used to refer to the situation where peripheral vision is lost and only central vision is retained with potential deleterious effects on business performance and decision-making. This study investigates how unlearning activities can counteract the presence of tunnel vision, along with how these activities can, in turn, result in the improvement of peripheral vision.

Design/methodology/approach – In this study the influence of what has been termed ‘Intentional Unlearning’ on peripheral vision as a mediating variable between focal vision and peripheral vision is investigated through an empirical study. This study used ADANCO 2.0.1 and it involved the collection and analysis of data provided by 203 bank managers.

Findings – The findings complement organizational theories of management by providing a clearer definition of tunnel-vision and provide guidance for managers as to how they may improve peripheral vision.

Originality – This study shows the need for knowledge workers to adopt procedures that will have the effect of causing them to question the familiar frameworks they use to interpret their perceptions of the external environment.

Keywords: tunnel-vision, focal vision, peripheral vision, intentional unlearning.

Paper type – Academic Research Paper

1 Introduction

Many managers believe that the key to creating sustainable competitive advantage is through the articulation of a long-term vision, translating this vision into relevant policies and making sure that these policies are implemented efficiently (Posavac, Kardes, & Joško Brakus, 2010). It can be argued that long term vision is based, in part, on two distinct sources of information: information related to core or focal perception of the organization's environment and information related to peripheral perceptions of the organization's environment. When referring to the individual, peripheral vision is more related to what is visible to the eye outside the central area of focus whereas focal vision involves what is visible in the central focal area. Focal vision typically provides information relevant to the completion of short term tasks in appropriate detail whereas peripheral vision provides information about potential changes to the environment, such as external threats, that are critical in developing long term plans and strategies (Day & Schoemaker, 2004).

The following research develops the concepts of focal and peripheral vision in the context of knowledge workers and explores both the importance of peripheral vision and the manner in which it may be augmented. Knowledge workers may be considered to be those individuals who contribute to the transformation and exchange of information. Knowledge workers make active use of the knowledge derived from information (Reinhardt, Schmidt, Sloep, & Drachsler, 2011). Thus, knowledge workers potentially rely on both focal and peripheral vision when they obtain information from which knowledge is derived to underpin their actions.

Tunnel vision represents a situation where peripheral vision is lost but focal vision is retained resulting in a constricted circular tunnel-like field of vision (Cheveleraud, 1986). It is possible to get some idea of the nature of tunnel vision by holding a card board tube (about 125 mm long) to one eye and closing the other eye. Tunnel vision makes walking and moving about difficult for the people affected it also markedly influences the individual's ability to anticipate changes in the external environment. Thus, in the context of business, as in life, peripheral vision is usually used to detect information that may be important for the "safe and an effective navigation of the world" (Day & Schoemaker, 2004). Such information may be combined with information derived from focal vision to develop appropriate organizational responses to both current and future environmental conditions. Peripheral vision may help managers focused on existing valuable customers to recognize and predict the future needs of potential customers whilst being able to use their focal vision to gather appropriate information to satisfy the needs of their current customers (Cegarra-Navarro *et al.*, 2016).

In the same way that optometrists are able to assist patients in counteracting the loss of peripheral vision in cases of tunnel vision with special exercises (Wiegand, 1999), knowledge workers can counteract tunnel vision, potentially leading to flawed decision-making and planning, through developing and enhancing peripheral vision through the updating of procedures, standards, and knowledge (Posavac *et al.*, 2010). In prior research it has been argued that such updating of procedures, standards and knowledge (generally

referred to as knowledge and knowledge structures) involves intentional unlearning. Intentional unlearning is the act of putting aside knowledge and knowledge structures that are not appropriate for use in a given context (Fernandez & Sune, 2009). By putting aside outdated knowledge and knowledge structures and updating their knowledge and knowledge structures, both individuals and organisations may be empowered in their efforts to expand the field of vision beyond what occurs in their focal vision (Day & Schoemaker, 2004; McWilliam, 2005). In addition to implementing specific procedures supporting the removal of knowledge, unlearning may also be facilitated through the creation of an 'unlearning context'.

This study investigates how unlearning activities can counteract the presence of tunnel vision, along with investigating how these activities can, in turn, result in the improvement of peripheral vision. The research approach adopted involves carrying out an empirical investigation involving data provided by 203 bank managers. The paper is structured as follows. First, the conceptual framework and hypotheses are presented. Then, the methodology used and the results obtained are explained. Finally, a discussion of the implications and limitations of the research is presented.

2 Theoretical background and research model

From the point of view of a company, focal vision may be considered to relate to the ability of managers to focus on identifying the needs and wants of existing valuable customers (Sard, 2000). Thus, well-developed focal vision provides managers with focus and direction for setting relatively short-term operational goals relating to serving these existing customers. In addition, knowing specifically what valuable customers want enables managers to build and deliver precise solutions to meet these valuable customers' needs (Sherden, 1994). Good focal vision also guides managers in making decisions and establishing what the organisation does best (Sard, 2000).

Despite the above benefits, it should be noted, however, that focal vision has inevitable drawbacks. As it is shown in Figure 1, in the case of the human eye, focal vision addresses perceptions in the central two degrees of vision. This means that although focal vision offers the sharpest view, it also represents a very narrow view of the external visual environment (Luo & Peli, 2006). In a business context this could lead to the company ignoring external factors when making decisions that are significant for potential customers (Day & Schoemaker, 2006). Essentially there is a trade-off between the fine details and accuracy of focal vision and the much less detailed by far more extensive peripheral vision. As pointed out by Miller (1982), current models of professionalism perpetuate a very narrow perspective, with a lack of openness to other specializations or bases of expertise that promotes a form of blindness which is typically unsustainable given the complexity of organizational problems and the scope needed for their solution. It may also be noted that the development of expertise typically leads to the development of focused attention to a relatively small number of perceptual cues in problem solving. Although extremely valuable in addressing complexity it has been observed that this may lead to what has been termed the 'garden path' phenomenon

(Johnson & Thompson, 1981) where an expert is misled as a result of focusing on a small number of cues rather than perceiving the richness of the problem.

As it is shown in Figure 1, peripheral vision encompasses what is potentially visible outside the central area of focus (Chevaleraud, 1986). As noted above, in the context of ‘company vision’, focal vision is also potentially very narrow and it usually focuses on a small subset of valuable customers, while a company’s peripheral vision potentially involves a much larger visual field (Cegarra-Navarro *et al.*, 2016). It has been noted that companies utilising peripheral vision are often very successful (Day & Schoemaker, 2006). Furthermore, being unaware of peripheral signals can result in the erosion of the firm’s competitive position as new competitors enter the fray and new products invade the marketplace but are not perceived or their importance un-assessed or under-assessed (Day & Schoemaker, 2006; Mathur, Gehrmann, & Atchison, 2013).

Fairclough (2005) further asserts that when organisations ignore the events unfolding on the periphery of their business, they usually experience significant costs and risks. In contrast to peripheral vision, tunnel vision is a condition in which you can see things that are straight ahead of you but not to the side (Wiegand, 1999). As Cegarra-Navarro *et al.* (2017) have pointed out, tunnel vision is the loss of peripheral vision, which means that knowledge workers who lose their peripheral vision may have difficulty recognizing and understanding potential customers needs leading to failure to develop products and services targeted to potential customers (Day & Schoemaker, 2006; Haeckel, 2004). It may be further observed that Christensen’s work on disruptive innovation (Christensen, 2016) identifies examples of major organizations that have failed as a result of their concentrating on existing customers and failing to interpret correctly information concerning emerging technologies that although not directly related to their core technologies and competencies are more effective in addressing the needs to existing and potential customers.

What the above considerations potentially mean for knowledge workers is that the overuse of focal vision may lead to “tunnel vision effects” which may limit the scope for detecting, in particular, investment and marketing opportunities (Posavac *et al.*, 2010). In this study the overuse of focal vision within the context of organisations is defined as “tunnel vision”. As suggested by some researchers, managers are able to develop what may be considered to be limited background visual perceptions in their visual field (but maintain sharp focus on a narrow visual field). Thus, they can maintain both focal vision and peripheral vision simultaneously. This strategy avoids the pitfalls of tunnel vision (Posavac *et al.*, 2010). Thus the development of such background perceptions, blurred and limited though they are, is likely to have a positive effect on employees and, in particular, knowledge workers’ ability to detect market trends and weak signals beyond the strong signals relating to current necessities of valuable customers (Cegarra-Navarro *et al.*, 2016; Day & Schoemaker, 2006).

Fairclough (2005) further asserts that when organizations ignore the events unfolding on the periphery of their business, they usually experience significant costs and risks. For example, when Blackberry (formerly RIM) ignored the “touchscreen interface” in the belief that its valuable customers would always prefer their “tactile keyboard”, it was

misaligned its organisation around a strategic dead-end. The result was that Blackberry experienced a significant decline in business and became, essentially, a minor competitor in the smart phone business. Furthermore, both focal and peripheral visions are necessary to update the strategic thinking over the course of the company lifetime (Haeckel, 2004; Cegarra-Navarro *et al.*, 2017).

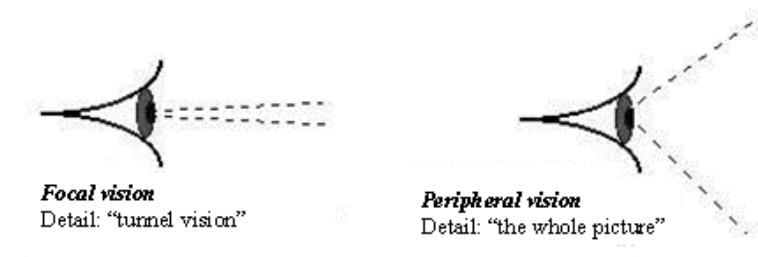


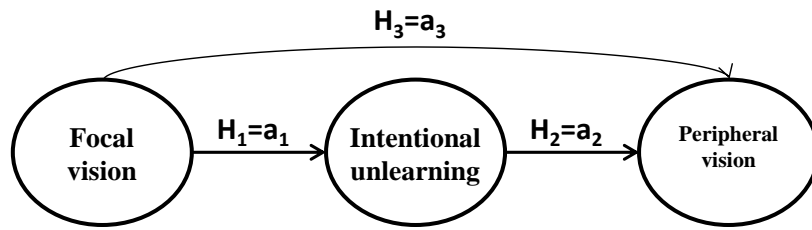
Figure 1: Focal vs Peripheral Visions

This paper focuses on the role of intentional unlearning in counteracting tunnel vision and supporting peripheral vision in an organizational context. If we extrapolate the above practices to the context of business, then it could be considered that intentional unlearning offers an excellent opportunity to overcome some of the above problems and thus to ‘see beyond’ the central two degrees of vision. Since intentional unlearning is a process that explicitly addresses the need to adapt to discrepancies between currently validated knowledge and the existing body of organizational knowledge (Wensley & Navarro, 2015) this process can be used to broaden our vision (Coombs, Hislop, Holland, Bosley, & Manful, 2013). Intentional unlearning is comprised of a set of action rules that prepare the ground for the creation and application of new knowledge and new knowledge structures (Cegarra-Navarro, Wensley, & Polo, 2014). As suggested by Aledo Ruíz *et al.* (2017), “intentional unlearning” is thus a set of actions that take place when people need to update knowledge and knowledge structures (e.g. routines, processes or protocols) that over time have become obsolete.

Based on the work of Cegarra-Navarro *et al.* (2014), awareness, relinquishing and relearning contribute to create ‘room’ for new knowledge, which in turn enables individuals to identify mistakes (Srithika & Bhattacharyya, 2009), errors or inappropriate or incorrect assumptions which may require the recognition of the restrictive nature of tunnel vision and the realisation of the power of peripheral vision (Cegarra-Navarro *et al.*, 2017; Zhao, Lu, & Wang, 2013).

Figure 2 provides a description of the hypotheses examined in this study. The first two hypotheses assume that the positive influence of tunnel vision on peripheral vision is indirect and is mediated by the presence of intentional unlearning. Therefore, the first hypothesis considers that intentional unlearning has a positive impact by removing the constraints of tunnel vision, the ‘blinkers/blinders’ that restrict and attenuate peripheral perception, and the second hypothesis considers that “intentional unlearning” is a necessary prior task in the acquisition of new knowledge that is not compatible with

current vision in different contexts and situations, thus realising the power of peripheral vision. The third hypothesis of the model relates to the direct effect of tunnel vision on peripheral vision, which is expected to enhance efficiency through the reduction of the cost of search and acquisition of weak signals. In other words, knowledge workers who have developed effective tunnel vision and are able to understand valuable customers are more likely to understand and adopt new ideas if these can improve their relationship with new and potential customers.



.Figure 2: The Proposed Theoretical Model

3 Methodology

3.1 Data Collection

This research contributes to better understand the peripheral vision of knowledge workers. To achieve this, it was seen necessary to collect data from bank managers. As previously stated by authors such as Cegarra-Navarro *et al.* (2017), bank managers have a relevant and important role to play and must have expert knowledge of every aspect of the business in order to give their customers greater service. Before conducting the surveys, managers from 690 bank branches of a major Spanish bank were informed of the objectives of the research and were also invited to participate in the study. A total of 203 managers out of the 690 initially contacted agreed to participate in the study, on the assumption that they had at least six or more employees under their own direct responsibility. The survey was administered over a period of two months, from early January to early March 2016, with a factor of error of 5.77% for $p=q=50\%$ and a reliability level of 95.5%. The response rate of 29.42% is greater than the average response rate of 15 to 25 percent suggested by Menon, Bharadwaj and Howell (1996) for surveys involving senior management.

3.2. Measures

Focal vision (FV) was measured by using four indicators initially proposed by Cegarra-Navarro *et al.* (2017). The authors adopted questions focusing on the way management faced up to change, actively introduced it into the company through projects, and fostered collaboration with profitable customers of the organisation.

Intentional unlearning is assessed through items relating to awareness, relinquishing and relearning as three reflective dimensions (Aledo Ruíz *et al.*, 2017). Awareness items recognize the support of policies and rules that encourage problems identification and the identification and investigation of mistakes. The relinquishing scale focuses on employees' ways of thinking and behaviours that guide new ways of performing tasks. Finally, relearning items describe how management faces up change, collaborates with other organization members, and introduces changes into the company through projects.

Previous studies by Day and Schoemaker (2006) provide guidance in developing items to measure peripheral vision (PV). Four items assessed the importance of 'peripheral vision' for cognitively-aware managers in relation to the enhancement of technical, administrative and social strategies due to a better understanding of the information available to potential customers.

All the selected items are shown in the Appendix.

3.3. Data Analysis

The data collected was analysed using ADANCO 2.0.1 Professional for Windows (<http://www.composite-modeling.com/>) (Dijkstra & Henseler, 2015). Intentional unlearning (IU) was operationalised as a second-order construct with three dimensions. It should be noted here that "awareness, relinquishing and relearning" capture different theme with respect to type of activity and values. Therefore, the relationships between the unlearning process and its three steps represent a second-order refractive-formative type. Following the Becker *et al.* (2012) guideline, the analysis was conducted on two levels of the first-order constructs and second-order constructs level.

An examination of the results in Table 1 shows that all first-order factor loadings and second-order factor weights were significant. In addition, all Dijkstra and Henseler's ρ are greater than 0.8, the scores for the average variance extracted (AVE) surpass the threshold of 0.5 for composites' unidimensionality, and all HTMT are below the value of 0.90, thereby providing evidence that IU is a multifaceted construct construed from awareness, relinquishing and relearning.

Table 1 Second-order confirmatory factor analysis of Intentional Unlearning

First-order construct				Second-order construct			
	Indicator	Loading	t-value	Reliability (ρ_A^a , AVE ^b)	Weight	t-value	Maximum HTMT
Awa	Awa1	0.800	18.141	$\rho_A = 0.869$ AVE=0.683	0.466	18.552	0.746
	Awa2	0.887	33.098				
	Awa3	0.788	17.474				
Relinq	Relinq1	0.707	12.116	$\rho_A = 0.824$ AVE=0.598	0.448	15.539	0.746
	Relinq2	0.858	26.715				
	Relinq3	0.748	15.371				
Rel	Rel1	0.726	12.524	$\rho_A = 0.802$ AVE=0.568	0.425	16.625	0.679
	Rel2	0.821	16.872				
	Rel3	0.710	11.981				

Discriminant validity was determined by comparing the square root of the AVE (i.e. the diagonals in Table 3) with the correlations among constructs (i.e. the lower triangle of

the matrix in Table 3). On average, each construct related more strongly to its own measures than to others' (Fornell & Larcker, 1981). The constructs correlation matrix, shared variances, means and standard deviations are shown in Table 2. As a result of this analysis, evidence of content validity, reliability and convergent validity, and discriminant validity for the constructs of the example was found.

Table 2 Construct correlation matrix

	Mean	S.D	CA	Correlation matrix		
				1	2	3
1. Focal Vision	4.420	1.200	0.900	0.833		
3. Peripheral Vision	4.315	1.248	0.889	0.728	0.818	
2. Intentional Unlearning	0.000	0.808	0.861	0.358	0.518	n.a

Notes:

S.D. = Standard Deviation; CA = Cronbach's Alpha; Intercorrelations are presented in the lower and shady triangle of the matrix. The bold numbers on the diagonal are the square root of the Average Variance Extracted. n.a→ not applicable.

4 Results

The results of the *structural model* after the PLS analysis are collected in Table 3. According to Streukens & Leroi-Werelds (2016), The results demonstrate that the inner model has satisfactory predictive relevance for Peripheral Vision ($Q^2 = 0.46$) because that value is higher than 0. As Table 5 shows, the proposed model also explains the 72 percent of the variance in Peripheral Vision (R^2). Based on Preacher and Hayes (2008), a post-hoc indirect effect analysis was carried out to test the indirect effect of independent variables on the dependent variable by way of the mediator. As Table 3 shows, as the interval determined through bootstrapping does not contain the zero value, the indirect effect of Focal Vision on Peripheral Vision via the Intentional Unlearning is statistically insignificant. Consequently, the results provided full support for both hypotheses H1, H2 and H3.

Table 3 Structural Model statistics

<i>Direct relationship</i>	Path coefficients	T value	Lower 5%	Upper 95%	Adjusted R^2	Supported
<i>H1: FV → IU (a_1)</i>	0.378 ^{***}	3.143	0.234	0.553	0.139	Yes
<i>H2: IU → PV (a_2)</i>	0.280 ^{**}	2.282	0.039	0.472	0.720	Yes
<i>H3: FV → PV (a_3)</i>	0.810 ^{***}	9.116	0.471	0.945	0.720	Yes
<i>Indirect relationship</i>						
<i>FV → IU → PV ($a_1 * a_2$)</i>	0.106 ^{**}	2.797	0.02	0.178	0.720	Yes

Notes:

*** <0.01; ** <0.05;

FV= Focal Vision. IU= Intentional Unlearning. PV= Peripheral Vision.

5 Conclusions

This research has addressed an issue of significant importance for business and raised awareness of the importance of carrying out further research to understand the many ramifications of the interaction between focal and peripheral vision and organizational

learning. There are extensive opportunities for research and practice addressing the concepts of peripheral vision, focal vision and intentional unlearning in domains currently driving socio-economic development. The findings of this research complement organizational theories of management with a conceptual framework that more clearly articulates the concepts of peripheral and focal vision and indicates how they may be used as a basis for improving peripheral vision in organizations resulting, it may be argued, in improved organizational agility.

The results of this study indicate that peripheral vision relies on both the direct and indirect effects of focal vision. Therefore, this research highlights the importance of encouraging knowledge workers to question and assess the validity of the knowledge derived from their focal vision (e.g. routines and procedures that they regularly follow). However, the ability of an organisation to unlearn and revised its knowledge and knowledge structures as result of its relationships with valuable customers and the external environment is a subject which has generally been overlooked in the extant literature. In terms of managerial implications, this work points to intentional unlearning as a mechanism for updating the knowledge and knowledge structures derived from their focal vision by identifying and putting in place new rules which can lead to new learning processes.

Despite its valuable insights, the research has limitations mainly derived from the analysis of a financial institution which is likely to be directly affected by its interaction with the dynamic environment in which it operates. Having addressed some of the limitations associated with self-report surveys, it has been confirmed that common method biases are very difficult to quantify on any self-report study. Thus, further research could be undertaken to triangulate our findings through interviews and observational case studies. It should also be acknowledged that the authors have assumed that peripheral vision focuses mainly on the understanding of needs and preferences of certain potential customers. In other words, we have not considered the possibility offered by peripheral vision that would enhance the understanding of other stakeholders of the financial institution. This assumption is currently being explored. Future research will therefore focus on carrying out more extensive empirical testing of the model proposed in this study with an aim to establish its validity and impact on organisational management and organisational performance. In addition, future research will focus on carrying out more extensive empirical testing of this model in other sectors, as well as the analysis of the “social performance” of organisations.

References

- Aledo Ruíz, M. ., Gutiérrez Ortega, J., Martínez-Caro, E., & Cegarra-Navarro, J. . (2017). Linking an unlearning context with firm performance through human capital. *European Research on Management and Business Economics*, 23(1), 16–22. <https://doi.org/10.1016/j.iemeen.2016.07.001>
- Becker, J. M., Klein, K., & Wetzels, M. (2012). Hierarchical Latent Variable Models in PLS-SEM: Guidelines for Using Reflective-Formative Type Models. *Long Range Planning*, 45(5–6), 359–394. <https://doi.org/10.1016/j.lrp.2012.10.001>

- Cegarra-Navarro, J.G., Wensley, A., Garcia-Perez, A. & Sotos-Villarejo, A. (2016). Linking peripheral vision with relational capital through knowledge structures. *Journal of Intellectual Capital*, 17(4), 714–733. <https://doi.org/10.1108/JIC-04-2016-0041>
- Cegarra-Navarro, J.-G., Wensley, A., Jimenez-Jimenez, D., & Sotos-Villarejo, A. (2017). Linking procedural memory with organizational learning through knowledge corridors. *Journal of Knowledge Management*, 00–00. <https://doi.org/10.1108/JKM-01-2017-0018>
- Cegarra-Navarro, J. G., Wensley, A. K. P., & Polo, M. T. S. (2014). A conceptual framework for unlearning in a homecare setting. *Knowledge Management Research & Practice*, 12(4), 375–386. <https://doi.org/10.1057/kmrp.2013.6>
- Chevaleraud, J. F. (1986). *Ojo y deporte*. Barcelona: Masson.
- Chevaleraud, J. F. (1986). *Ojo y deporte*. Barcelona: Masson.
- Coombs, C. R., Hislop, D., Holland, J., Bosley, S. L. C., & Manful, E. (2013). Exploring types of individual unlearning by local health-care managers: an original empirical approach. *Health Services and Delivery Research*, 1(2). <https://doi.org/10.3310/hsdrXXXX>
- Day, G. S., & Schoemaker, P. (2004). Peripheral vision: Sensing and acting on weak signals. *Long Range Planning*, 37(2), 117–121.
- Day, G. S., & Schoemaker, P. (2004). Peripheral Vision: Sensing and Acting on Weak Signals. *Long Range Planning*, 37(2), 117–121. <https://doi.org/10.1016/j.lrp.2004.01.003>
- Day, G. S., & Schoemaker, P. (2006). *Peripheral Vision: Detecting the Weak Signals That Will Make or Break Your Company*. Boston: Harvard Business School.
- Day, G. S., & Schoemaker, P. J. H. (2006). Peripheral Vision: Detecting the Weak Signals That Will Make or Break Your Company. *Panminerva Medica*, 23, 256. <https://doi.org/10.1225/R0511H>
- Dijkstra, T. K., & Henseler, J. (2015). Consistent and asymptotically normal PLS estimators for linear structural equations. *Computational Statistics and Data Analysis*, 81, 10–23. <https://doi.org/10.1016/j.csda.2014.07.008>
- Fairclough, N. (2005). Peripheral Vision: Discourse Analysis in Organization Studies: The Case for Critical Realism. *Organization Studies*, 26(6), 915–939. <https://doi.org/10.1177/0170840605054610>
- Fernandez, V., & Sune, A. (2009). Organizational forgetting and its causes: an empirical research. *Journal of Organizational Change Management*, 22(6), 620–634. <https://doi.org/10.1108/09534810910997032>
- Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39–50.
- Haeckel, S. H. (2004). Peripheral vision: Sensing and acting on weak signals making meaning out of apparent noise: The need for a new managerial framework. *Long Range Planning*, 37(2), 181–189. <https://doi.org/10.1016/j.lrp.2004.01.006>
- Luo, G., & Peli, E. (2006). Use of an augmented-vision device for visual search by patients with tunnel vision. *Investigative Ophthalmology and Visual Science*, 47(9), 4152–4159. <https://doi.org/10.1167/iovs.05-1672>
- Mathur, a, Gehrman, J., & Atchison, D. (2013). Pupil shape as viewed along the horizontal visual field. *Journal of Vision*, 13(2013), 1–8. <https://doi.org/10.1167/13.6.3.doi>
- McWilliam, E. (2005). Unlearning Pedagogy. *Journal of Learning Design*, 1(1), 1–11. <https://doi.org/10.5204/jld.v1i1.2>
- Menon, A., Bharadwaj, S. G., & Howell, R. (1996). The Quality and Effectiveness of Marketing Strategy: Effects of Functional and Dysfunctional Conflict in Intraorganizational Relationships. *Journal of the Academy of Marketing Science*, 24(4), 299–313. <https://doi.org/10.1177/0092070396244002>
- Miller, A. (1982). Tunnel vision in environmental management. *Environmentalist*, 2(3), 223–231. <https://doi.org/10.1007/BF02603102>

- Posavac, S. S., Kardes, F. R., & Joško Brakus, J. (2010). Focus induced tunnel vision in managerial judgment and decision making: The peril and the antidote. *Organizational Behavior and Human Decision Processes*, 113(2), 102–111. <https://doi.org/10.1016/j.obhdp.2010.07.002>
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and Resampling Strategies for Assessing and Comparing Indirect Effects in Multiple Mediator Models, 40(3), 879–891. <https://doi.org/10.3758/BRM.40.3.879>
- Reinhardt, J. C., Schmidt, B., Sloep, P., & Drachsler, H. (2011). Knowledge worker roles and actions results of two empirical studies. *Knowledge and Process Management*, 18(3), 150–174. <https://doi.org/10.1002/kpm>
- Sard, M. (2000). Cómo fidelizar y retener a los mejores. *Banca y Finanzas*, (51), 32–33.
- Sherden, W. . (1994). *Market ownership: The art & science of becoming n° 1*. New York: American Management Association.
- Srithika, T. M., & Bhattacharyya, S. (2009). Facilitating Organizational Unlearning using Appreciative Inquiry as an Intervention. *Vikalpa*, 34(4), 67–77.
- Streukens, S., & Leroi-Werelds, S. (2016). Bootstrapping and PLS-SEM: A step-by-step guide to get more out of your bootstrap results. *European Management Journal*, 34(6), 618–632. <https://doi.org/10.1016/j.emj.2016.06.003>
- Wensley, A. K. P., & Navarro, J. G. C. (2015). Overcoming knowledge loss through the utilization of an unlearning context. *Journal of Business Research*, 68(7), 1563–1569. <https://doi.org/10.1016/j.jbusres.2015.01.052>
- Wiegand, W. A. (1999). Tunnel Vision and Blind Spots. *The Library Quarterly*, 69(1), 1–32.
- Zhao, Y., Lu, Y., & Wang, X. (2013). Organizational unlearning and organizational relearning: a dynamic process of knowledge management. *Journal of Knowledge Management*, 17(6), 902–912. <https://doi.org/10.1108/JKM-06-2013-0242>

Appendix: Questionnaire items

Peripheral Vision: with respect to your organisation, indicate the extent to which you agree or disagree (1= strongly disagree and 7= strongly agree):
PV1: Managers seem to be open to new ideas of potential customers. PV2: Management has tried to initiate innovations focused on potential customers. PV3: Managers adopt the suggestions of peripheral customers in the form of new routines and processes. PV4: Managers are prone to collaborate with other companies and to solve potential customers' problems together. (Source: Day and Schoemaker 2006)
Awareness: with respect to your current position indicate the degree of agreement or disagreement (1= strongly disagree and 7= strongly agree):
Awa1: Employees try to reflect and learn from their own mistakes. Awa2: Employees are able to see mistakes from my colleagues. Awa3: Employees are able to listen to my customers (e.g. complaints, suggestions). (Source: Aledo <i>et al.</i> , 2017)
Relinquishing: with respect to your current position indicate the degree of agreement or disagreement (1= strongly disagree and 7= strongly agree):
Relinq1: Individuals recognise forms of reasoning or arriving to solutions as inadequate. Relinq2: New situations have helped individuals change their behaviours Relinq3: New situations have helped individuals change their thoughts and attitudes. (Source: Aledo <i>et al.</i> , 2017)
Relearning: with respect to your organization indicate the degree of agreement or disagreement (1= strongly disagree and 7= strongly agree):
Rel1: Managers adopt the suggestions of personnel in the form of new routines and processes Rel2: Managers are prone to collaborate with members of the organization and to solve problems together Rel3: Managers are concerned with the fact that the manner of answering before unforeseen circumstances will be known by all. (Source: Aledo <i>et al.</i> , 2017)

Focal Vision: with respect to your organisation, indicate the extent to which you agree or disagree (1= strongly disagree and 7= strongly agree):
<p>FV1: Managers seem to be open to new ideas of valuable customers.</p> <p>FV2: Management has tried to initiate innovations focused on valuable customers.</p> <p>FV3: Managers adopt the suggestions of valuable customers in the form of new routines and processes.</p> <p>FV4: Managers are prone to collaborate with other companies and to solve valuable customers' problems together.</p> <p>(Source: Day and Schoemaker 2006)</p>

Requirements of Implementing Knowledge Management System in Crisis Management (Case Study: Crisis Management in Chabahar Municipality)

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Abstract

While numerous management theories and technologies have been established to help managers address the challenges they routinely encounter, there are always sudden problems for which organizations are often unprepared. These low frequency and high consequence challenges are commonly defined as crises. The main characteristics of crises are uncertainty and ambiguity which threaten the productivity of an organization. For organizations to prosper and survive, they must act strategically in allocating their key resources and perform effectively and efficiently. This is especially true when dealing with crises. Unfortunately, one of the most valuable resources that organizations possess, knowledge, has been largely ignored in the CM literature. To address this deficiency, this study discusses about a knowledge management system (KMS) which helps organizations better managing of a crisis. This KMS possesses several requirements which aim to develop a strategic alignment framework that seeks to align CMS with knowledge strategy.

The use of collaborative networks regarding to the process of acquiring, sharing, and storing their knowledge is necessarily complex and also complicated for the managers. In regard to published related research works, despite the contributions of these CM studies, very limited research has been explicitly investigated the requirements of implementing KM strategies and system in a CM perspective. In order to fill this gap, our model of identifying KMS requirements will be designed and presented.

Therefore, this study aims to present the requirements of implementing knowledge management system in crisis management; a new trend which is not widely studied in research works. Knowledge management system will be helpful for managers to confront with internal and external crises effectively while it will support organizations not only to manage their knowledge but also in applying knowledge strategies properly.

This study has conceptualized the required process and elements of knowledge management system implementation through semi-structured in-depth interviews with a focus expert group selected from Chabahar municipality. Semi-structured, in-depth

interviews are utilized extensively as interviewing format possibly with a group in designing new models or processes. Recognizing focus group respondents was done through snowball sampling method. Snowball sampling is where research participants recruit other participants for a test or study. Content analysis method is used to analyze the interviews as a research technique used to make replicable and valid inferences by interpreting and coding textual material.

Chabahar municipality (at the south of Balouchestan, Iran) has been selected as a case study. Chabahar is a strategic port not only for Iran but also for India and China. Because hug amount of foreign investment in Chabahar, it is now the only sanction-except city of Iran. The strategic nature of this port confronts this port with several crises which should be managed and solved by its municipality. This organization, the same as other municipalities, is encountered with various crises during the year including natural crises like flood and human crises like social protest and even shooting in urban area. In order to achieve practical solution to implement knowledge management system, this organization is selected as a case study. The result is a seven-dimension-model that presents the requirements of implementing a KM system in organizations, extracted by using a case study. These dimensions are as following:

- 1. determine a crisis phase*
- 2. determine sensitive factors*
- 3. identify stakeholders*
- 4. data gathering*
- 5. data verification*
- 6. data analysis*
- 7. Knowledge management*

Keywords – crisis management, knowledge management, knowledge management system, Chabahar city of Iran, flood

Paper type – Practical Paper

1 Introduction

While numerous management theories and technologies have been established to help managers address the challenges they routinely encounter, there are always sudden problems for which organizations are often unprepared. These low frequency and high consequence challenges are commonly defined as crises. The main characteristics of crises are uncertainty and ambiguity which threaten the productivity of an organization.

crisis management (CM) can be described as a set of ongoing, systematic, and interrelated processes for identifying, analysing, treating and learning about various crises which an organization have been encountered or will be encountered with, in the future (Wang & Belardo, 2009). Crisis management applies management strategies and practices not only to prevent the crisis and decrease the negative effects of that but also to manage recovery and learning processes from crisis. In the other word, CM strategies

(CMS) emphasis on addressing the question of what organizations should consider in order to make appropriate decisions for managing crises (Wang & Belardo, 2009).

In other hand, for organizations to prosper and survive, they must act strategically in allocating their key resources and perform effectively and efficiently. This is especially true when dealing with crises. Unfortunately, one of the most valuable resources that organizations possess, knowledge, has been largely ignored in the CM literature (Haghani and Gharibpour, 2018). To address this deficiency, this study discusses about a knowledge management system (KMS) which helps organizations better managing of a crisis.

This KMS possesses several requirements which aim to develop a strategic alignment framework that seeks to align CMS with knowledge strategy.

The main aim of this study is to extract the requirements of knowledge management system in a municipality, as a center of commands, at the time of crisis. The crises which a municipality is faced with, will not only be limited to organizational and financial crises but it also covers all urban and natural ones. The specific nature of municipality and its responsibility to overcome all internal and external crises encouraged us to consider this kind special of organization as a case study as it mostly required a knowledge management system. To determine and conceptualize the requirements of implementing KMS in the municipality, Chabahar municipality in Iran is selected as it confronts with annual destructive Floods.

2 Knowledge management and its use in crisis management

Using Knowledge Management (KM) concepts to perform Crisis Management (CM) in the existing CM literature has been studied, in a very implicit way, and it has been categorized by Wang and Belardo (2009) into three main groups: “The first category addresses the importance of KM in terms of helping organizations acquire critical knowledge for managing crises through effective learning processes. The second category concerns the issue of recognizing the strengths and weaknesses of an organization’s KM capabilities. Studies in this category address the importance of the application of various technologies and methods to facilitate knowledge acquisition, sharing, distribution and storage. The third category concerns the sources of critical knowledge which can enhance the effectiveness of CM efforts. Studies in this category emphasize the need to develop efficient and effective means of locating and acquiring knowledge critical for managing crises”.

They believe while CM various frameworks provide valuable guidelines for organizing the crises within the organizations, they typically not include knowledge-based resources, such as the crisis management knowledge and experience of employees.

If we consider crisis as an “unusual event of overwhelmingly negative significance that carries a high level of risk, harm and opportunity for further loss (Fink, 1986)”, then we need an “IT (Information Technology)-based systems developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application (Alavi & Leidner, 2001)” which is described as a knowledge management

system (KMS). It is a main requirement of effective managing crisis while having two aspects: soft and hard.

In the other word, managing KM processes and implementing KM system can help managers to proactively respond to a highly turbulent environment and will benefit an organization (Burnell et al., 2004) while this is more significant for organizations that plan and prepare for emergencies and crisis response situations (Kostman, 2004), such as municipalities.

Moreover, a crucial element in managing crises over time by an organization concerns the constantly increasing volume of available data and knowledge. In CM, stakeholders are facing an increasing number of data sources, including non-dedicated ones. Practices, tools and usages regarding knowledge management in crisis contexts are not appropriate to this situation anymore and must be adapted (Benaben et al., 2016). Initiating suitable knowledge strategies and implementing a knowledge management system is the best way of overcoming this challenge. It seems more important when we find that CM is always performed by various types of stakeholders (to support all the involved multi-dimensional treatment actions), engaged in collaborative networks, inside or outside of an organization (Benaben et al., 2016). The use of collaborative networks regarding to the process of acquiring, sharing, and storing their knowledge is necessarily complex and also complicated for the managers.

Jennex and Raman (2009) investigate the role and relevance of knowledge management (and knowledge management systems therein) in support of crisis response. They present why crisis response efforts within an organizational context, might benefit from knowledge management initiatives and provide specific examples of how knowledge management efforts have supported crisis response in the past.

Shaw et al. (2007) found that the response to the crisis was to recognise the importance of the people and their knowledge to the organisation, and to build a strategy which employs all knowledge workers in the process of managing crises.

Their paper determines the importance of building a knowledge management strategy during times of crisis and draws out important lessons for organisations facing crisis.

In their book, Shankar and her colleagues (2008) criticized the traditional knowledge management process and tools, and suggested technology-based knowledge management. They believe that while traditional knowledge management techniques are being employed in government agencies responsible for disaster management, but many new technologies and practices, particularly the Internet and Web 2.0, are providing opportunities for individuals, responders, and trainers to share what they know and to acquire needed information, and prepare for the next crisis. They discuss that “although the Internet is already in extensive use in disaster management, knowledge management will only be effected if top-down and bottoms-up approaches to information gathering, organization, and dissemination are implemented”.

In regard to published related research works, despite the contributions of these CM studies, very limited research has been explicitly investigated the requirements of implementing KM strategies and system in CM perspective. In order to fill this gap, the following model of identifying KMS requirements will be designed and presented.

3 Identifying the requirements of implementing KM system in CM

In order to identify the requirements of KMS for supporting managers in CM, the following preconditions are assumed and obtained:

1. We reviewed all published related research works which can be helpful in recognizing different elements and process of CM or KM. The results show that Benaben et al. (2016) metamodel can be used in this study because of its comprehensiveness however, it is not empirically tested.
2. We reviewed all accessible reports published by organizations during or after crisis. Some of them were helpful as they implied the process of KM in the crisis time.
3. We further looked forward an empirical way to extract the KMS requirements, in a way that ensures managers to implement these requirements as well as the KMS. We finally concluded that interviews with the group of experts, in both KM and CM can be the best way.
4. For interviews with a group of experts (focus group), we consider municipality as an organization which confronts with various external and internal crises. To better understanding the elements and requirements of KMS, the natural crises such as earthquakes, floods, wildfires or typhons which involve different stakeholders such as government, NGOs, Red Crescent and citizens seem more useful.
5. Therefore, we recognized a group of experts (focus group) in a municipality of Chabahar (at the south of Iran), who had been faced with the latest annually floods in Balouchestan, Iran.

Chabahar is a free-port and free-trade-zone which recognized as the Iran's southernmost city. Due to its free trade zone status, the city has increased in significance in international trade. In the past years, this city has known as a strategic zone as it is Iran's closest and best access point to the Indian Ocean. Because of Chinese and Indians investment in this city's urban and marine infrastructure, this is the only city of Iran which is except from US sanctions (Haghani and Gharibpour, 2018).

While this city is developing in various aspects (financial, economic, marine, trade, industrial) its wild and unique nature causes natural disaster in each year which require a knowledge-based crises management to decrease financial and human losses. Floods and drought are at the top of them. Floods and drought are often two sides of the same coin. In certain places, they damage soil, watersystems and ecosystems in repeating cycles that exacerbate each other's impact. In Chabahar, during the dry season, any rain passes straight through what are often degraded soils, leaving crops to wither in the sun. Instead, farmers, firms and factories rely on wells that tap underground reservoirs (Haghani and Gharibpour, 2018). But this resource is quickly depleted because most monsoon rainfall runs uncontrollably off the land, without replenishing the underlying water. When flooding occurs, it is traditional to divert water away from inundated floodplains to protect people and reduce damage to homes, farms, businesses and infrastructure. But by

then, it is often already too late — and the following year the story will repeat itself (<http://SCIDEV.NET>).

Devastating floods in 2018, 2017, 2016 and 2015 affected more than 3.5 million people in Chabahar zone; leaving a lot of them in need of humanitarian assistance, more than 100 dead, and around 1500 injured. Across all affected areas, 5000 houses are destroyed, another 30,000 damaged.

The most disappointing point is repeating this deadly story without basic steps in managing these disasters over years. A knowledge management system provides a basis to manage them (Haghani and Gharibpour, 2018).

Regarding to new climate of Iran, these scientific works are more essential than any other times: during the past month (in March and April, 2019), Iran has been continuously hit by heavy rain that have led to flooding of almost all its 31 provinces, affecting more than 2,000 cities and villages.

Therefore, we selected this qualitative research methodology as it is suitable when the researcher investigates new field of study or intends to ascertain and theorize prominent issues.

Applying semi-structured, in-depth interviews assisted us to extract information through pre-set open-ended questions. Semi-structured, in-depth interviews are utilized extensively as interviewing format possibly with a group in designing new models or processes.

Recognizing focus group respondents was done through snowball sampling method. Snowball sampling is where research participants recruit other participants for a test or study.

Content analysis method is used to analyze the interviews. Content analysis is a research technique used to make replicable and valid inferences by interpreting and coding textual material.

4 Results

The following steps are presented as the results of content analysis of all interviews with 15-member- focus group. These steps are the main requirements of implementing KMS in a public organization like municipality to manage crisis with the support of KMS.

In these steps we assumed that an organization doesn't have a KMS as well as KM strategies.

First step: determine a crisis phase

- Each crisis has 5 phases which are: prevention, preparation, response, recovery, and learning).
- The feature of KMS is different regarding to each phase.

Second step: determine sensitive factors

- For each crisis phases, we have to identify some sensitive factors.
- Data and information will be extracted based on these sensitive factors in each phase.

- A group of experts are the best references of determining these factors.
- Third step: identify stakeholders
- In each phase of crisis, different stakeholders are playing roles. It is important to recognize all these stakeholders and their roles.
 - These stakeholders should be ranked regarding to their power and effect on crisis as well as their closeness and relation to the crisis.
- Forth step: data gathering
- Data should be gathered through all stakeholders regarding to their ranks.
 - Data should be categorized through its types and levels.
 - Data should be screened regarding to the sensitive factors.
- Fifth step: data verification
- All extracted selected data should be verified in this step.
 - The group of experts are the best source of verifying data.
 - Then data should be ranked to ensure better uses.
- Sixth step: data analysis
- Prepared data should be analysed in this step by KM expert.
 - The users of each data category should be determined.
 - All data and analysis process are done and stored in KM system.
- Seventh step: Knowledge management
- Knowledge should be acquired from prepared and stored data.
 - Knowledge should be stored in KM system.
 - Knowledge should be shared with all stakeholders by KM system.
 - Knowledge should be applied by all stakeholders.

This framework presents the requirements of implementing a KM system in organizations which are extracted from deep interviews. The results also indicate that all experts insisted on employing knowledge management system to better crisis management in the future years. This seven-step framework is necessary to be applied not only in Chabahar but in other city of Iran to decrease the effects of recent devastating floods which will be repeated because of climate changes.

References

- Alavi, M. and Leidner, D.E. (2001). Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly*, 25(1), 107-136.
- Bénaben, F., Lauras, M., Truptil, S., & Salatgé, N. (2016, January). A metamodel for knowledge management in crisis management. In *System Sciences (HICSS), 2016 49th Hawaii International Conference on* (pp. 126-135). IEEE
- Burnell, L., Priest, J., & Durrett, J. (2004). Developing and Maintaining Knowledge Management System for Dynamic, Complex Domains,. In J. Gupta & S. Sharma (Eds.), *Creating Knowledge Based Organizations*. London: IGP.
- Fink, S. (1986). *Crisis Management. Planning for the Inevitable*. New York: American Management Association, AMACOM.

- Haghani, M. & Gharibpour, M. (2018) investigating the implementing of knowledge management in flood managing (case study: Chabahar's flood), *the 6th international conference of managing and engineering of floods*, https://www.civilica.com/Paper-IFMC06-IFMC06_034.html
- Jennex, M. E., & Raman, M. (2009). Knowledge management in support of crisis response. *International Journal of Information Systems for Crisis Response and Management (IJISCRAM)*, 1(3), 69-83
- Kostman, J. T. (2004). 20 Rules for Effective Communication in a Crisis. *Disaster Recovery Journal.*, 17(2), 20.
- Shankar, K., Wild, D. J., An, J., Shoulders, S., & Narayanan, S. (2008). Information Technology in Times of Crisis: Considering Knowledge Management for Disaster Management. In *Building the Knowledge Society on the Internet: Sharing and Exchanging Knowledge in Networked Environments* (pp. 219-240). IGI Global.
- Shaw, D., Hall, M., Edwards, J. S., & Baker, B. (2007). Responding to crisis through strategic knowledge management. *Journal of Organizational Change Management*, 20(4), 559-578.
- Wang, W. T., & Belardo, S. (2009). The role of knowledge management in achieving effective crisis management: a case study. *Journal of Information Science*, 35(6), 635-659

Knowledge Discovery from Arts Data: a Case of Distant Listening

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Abstract

This paper addresses the topic of knowledge discovery from data in the context of Arts. In particular, the paper aims to examine the “distant listening” approach to uncover and interpret patterns and rules behind archaeology-inspired music. This approach employs quantitative data mining and graphical visualisation tools to identify and present discovered patterns in music data. For the purpose of the current study, a set of classical music pieces motivated by UNESCO-listed world heritage 'stecci' was collected and used as a source of arts data. The collected data were stored in a spreadsheet file and then analysed using Palladio software for network analysis and visualisation. The resulting relational graph enabled easy visual exploration of associations between stecci and musical forms and styles inspired by these archaeological artefacts. However, these findings need to be interpreted with caution due to present limitations. Further research is necessary that would replicate and extend current study to other contexts and questions.

Keywords –Knowledge Management, Knowledge Discovery from Data, Distant Listening, Arts, Classical Music

Paper type – Academic Research Paper

1 Introduction

The purpose of this paper is to address the topic of knowledge discovery from data in the context of Arts. With rapidly increasing quantities of arts data, there is a growing need for novel knowledge management (KM) methods and applications for analysing and presenting such big data. Knowledge discovery from data (KDD) is one such promising approach that involves the non-trivial process of identifying valid, novel, useful and understandable patterns in data (Fayyad et al., 1996). The uncovered patterns in the form of clusters, categories, associations or trends are usually described and presented in a visual mode understandable by humans. A plethora of data mining and visualisation tools are available to choose from for the purposes of knowledge discovery and presentation (Liu, 2018). Most recently, these have become an important part of a humanist's virtual knowledge space architecture (Handzic and Heuvel, 2018).

In the context of Arts, Moretti (2013) introduced the idea of KDD into literature under the term 'distant reading'. In this study, a similar 'distant listening' approach is suggested in the attempt to uncover the patterns and rules behind music. Essentially, the term 'distant listening' denotes the process of knowledge discovery from musical data using quantitative data mining and graphical visualisation tools.

The focus of the current study is on distant listening of classical music inspired by archaeology. The study was carried out in a specific context of Bosnia and Herzegovina. Arts data selected for the examination included classical music pieces motivated by UNESCO-listed world heritage 'stecci' (Nomination 1504, 2016).

The paper is structured as follows: after this brief introduction, section 2 reviews selected literature on relevant concepts (e.g. knowledge discovery, visualisation, archaeology in arts, stecci) and develops related objectives and research questions for the current study. Next, section 3 describes a case study methodology used for empirical examination. Then, section 4 presents a summary of the main findings, their implications for research and practice, current limitations and future research directions. The paper concludes with a brief summary and research contributions to the body of knowledge given in section 5.

2 Literature review

2.1 Knowledge discovery and visualisation

The growing number of digitised, as well as digitally born data is becoming an increasingly important source of new knowledge. Hence, one of the main KM issues is concerned with the discovery of knowledge that is 'hidden' in these data (Fayyad et al. 1996), and the utilisation of the extracted knowledge to support work-related activities. Two main goals of knowledge discovery include description and prediction. Whereas description is concerned with identifying patterns for the purpose of presenting them to users in an easy-to-understand form, prediction focuses on the patterns being 'mined' for the purpose of predicting future values for the variables in question.

Various data mining and knowledge discovery technologies can look for hidden patterns in groups of data to discover previously unknown trends or relationships. These applications often use complex and sophisticated algorithms to discover knowledge. In addition to trend and association analysis, clustering and classification, the current research efforts in these areas also include the use of intelligent agents (Blanning, 2000).

Making knowledge visible so that it can be better accessed, discussed, valued or generally managed is another long-standing objective in knowledge management (Eppler and Burkhard, 2007). Visualisation formats range from structured text and tables, through heuristic sketches, conceptual diagrams, visual metaphors, knowledge maps, to interactive visualisations and animations. Numerous digital tools have been developed applying different graphic means and advanced digital technologies. A list of some of the most popular general-purpose, as well as some special-purpose visualisation tools is maintained online by Liu (2018).

Eppler and Burkhard, (2007) suggest that for the effective creation and transfer of knowledge through visualisation, at least five questions should be considered with regard to knowledge visualisation: what (content), why (purpose), who (target group), where (context) and how (format). Findings from a summary of various application examples indicate the way different visualisation formats can be used to facilitate different KM tasks. Overall, these preliminary findings reveal that knowledge visualisations are particularly suited for knowledge creation and transfer.

2.2 Archaeology in Arts

Artists often find stimulation and subject matter in archaeological procedures, sites and artefacts. It is widely recognised that they can create new and enriched ways of perceiving material remains and provide new interpretive models for archaeologists to explain the past. In general, artists are considered as makers of new worlds and archaeologists as makers of past worlds. Russell and Cochrane (2014) argue that conversations and collaborations between these two groups (artists and archaeologists) are needed in order to encourage the creative interplay between different approaches and to contribute to our understanding of the world.

Lauzikas et al. (2018) note that archaeological and material cultural heritage enjoys a particular status in public as “the locus for the expression and negotiation of regional, national and intranational cultural identities, for public policy regarding the preservation and management of cultural resources, and for education, tourism, leisure and well-being”. Furthermore, Handzic and Carlucci (2019) claim that cultural knowledge rooted in heritage can be communicated through arts. While capturing artists’ imagination, heritage can become an instrument for conveying knowledge of the most important aspects of a specific culture.

2.3 Study objectives

In view of the above, of special interest to this study is KDD goal of description including identification and presentation of existing associations between archaeology and arts in a specific context of steci-inspired music.

Stecci ('standing stones') are monumental tombstones found in necropolises spread across the territory of the medieval Bosnian Kingdom. Today, there are over 3000 known necropolises with over 70 thousand tombstones. Out of these, 28 are listed on the UNESCO world heritage list (Nomination 1504, 2016). Contemporary Bosnian artists often engage with stecci (archaeological artefacts) in order to express their national cultural identity.

Therefore, the main objective of this exploratory study is to examine the potential of network analysis and graphical visualisation as KM tools to support discovery and interpretation of important and interesting relationships between stecci and music pieces inspired by these archaeological artefacts.

3 Research method

An exploratory case study (Yin, 2003) was selected as the most appropriate method for the current investigation due to the general lack of prior research on the issue of interest. In principle, a case study is recommended for answering "how" types of questions such as: how can knowledge discovery tools for network analysis and visualisation facilitate understanding of the musical knowledge domain under investigation.

For the purpose of the current study, a set of musical pieces motivated by UNESCO-listed world heritage 'stecci' (Nomination 1504, 2016) was collected and used as a source of arts data. Firstly, each piece, listed by its title, composer, genre and significant features was stored in a spreadsheet file for further quantitative analysis and visualisation. Then, network analysis with graphical presentation was applied, using a Palladio software tool developed by Stanford Humanities Center (2017), to enable visual exploration of existing associations between stecci monuments and musical forms and styles inspired by these archaeological artefacts.

4 Main findings

4.1 Summary of main findings

The analysis performed on collected data revealed an unexpected result that all music pieces under study were inspired by stecci only indirectly through the poetry of a famous Bosnian literary artist Mak Dizdar. Accordingly, related vocal compositions (with or without instruments) dominate the music space presented in Figure 1. These are followed by some instrumental and dramatic works. The figure also indicates Vojin Komadina as the most prolific and diverse composer.

Overall, these results recognise the crucial role of Dizdar's poetry in giving stecci 'stone sleepers' a voice and turning them into 'stone speakers' of national cultural identity. Their musical awakening is manifested in a variety of vocal, instrumental and dramatic works of Bosnian composers.

Generally, these composers communicate with Dizdar's poetry in two ways. In the first way, the composer creates music in order to enhance the particularly important poetic moments and layers in a poem. Such an approach is evident in vocal compositions by Vlado Milosevic, Vojin Komadina, Rada Nuic, Ramiz Tahiri, Teodor Romanic, Asim Horozic, and Ivan Cavlovic.

In the second way, a poem serves as an inspiration for the composition. Here, communication with poetic text goes beyond the basic to the imaginary layer of associative schemes (i.e. all that the work activates in the listener). Instrumental works by Vlado Milosevic and Vojin Komadina are good representatives of this approach. Both of them offer musical answers to Dizdar's poetry that recover lost memory and restore the sense of spatial and temporal belonging.

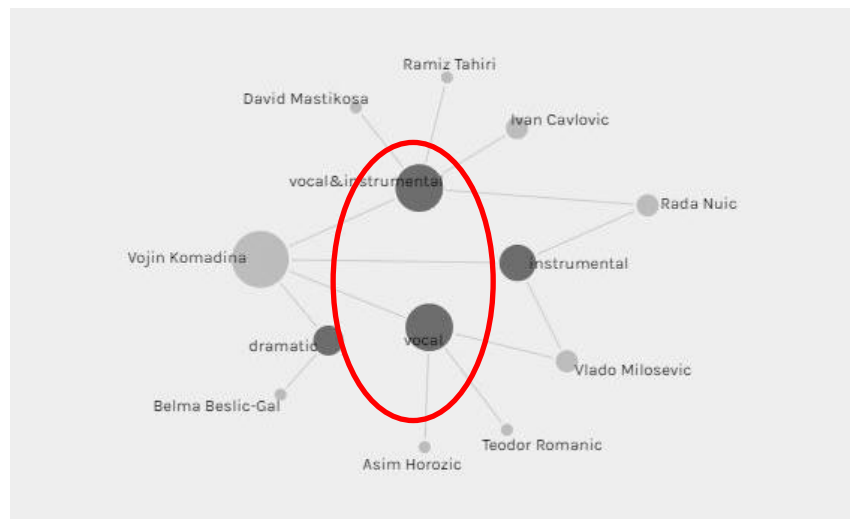


Figure 1: Results of network analysis and visualisation of music inspired by stecci

With respect to dramatic forms, 'kolo' (circle dance) serves as an inspiration for two choreographic works. In the case of musical theatre by Belma Beslic-Gal, Dizdar's poem is a starting conceptual moment for deconstruction. Her kolo is not a standard dance, but rather a magic circle in which she sees people living and which they cannot leave, except perhaps when they die. Furthermore, Dizdar's kolo is a textual foundation for a choreographic suite by Vojin Komadina. that represents an apotheosis of dance. In national mythology, the circle dance is believed to guide souls to another, everlasting world.

In summary, the applied KM initiatives (network analysis and graphical visualisation) enabled quick and easy creation of the wholistic picture of the music space under study and achievement of the learning outcomes described above.

4.2 Implications for research and practice

This study makes two important contributions to research: (i) it opens up a new line of interdisciplinary research that should benefit both KM and the Arts; and (ii) it provides preliminary empirical evidence of the value of such collaboration in a specific musical context.

With respect to the first point Handzic (2017) of argument for the field of KM to survive and grow, it needs to expand its realm. Humanities offer an interesting new context for such expansion. This has been recognised by some scholars and a number of so-called “digital” humanities projects have been initiated worldwide (Handzic and Heuvel, 2018).

With respect to point 2, in the specific case of archaeology-inspired music, the study showed how KM initiatives, such as network analysis and graphical visualisation could help to create a 'big picture' of the examined knowledge domain, provide insight and improve its understanding. In addition to such generic value, the identified specific relationships between stecci and classical music could serve as an indicator of the enduring Bosnian cultural identity.

For practice, the study implies that the increased scale of big arts data may offer new and exciting possibilities and challenges for KM practice in the Arts. Thus, KM may change the way musicologists and other arts scholars interact with their data and share their insights. Essentially, the study suggests that the network analysis and graphical visuals work well together to reveal important relationships.

4.3 Limitations and future directions

However, these implications should be considered in light of the current methodological and contextual limitations. Thus, the applied network analysis and visualisation tool was subjectively selected by the researcher. Other tools of varying levels of functionality and usability could provide different levels of support. Furthermore, a sample of classical music pieces for the study was small. A larger sample size and other music genres could have provided a wider variety of findings. Finally, the study was conducted in the context of Bosnia and Herzegovina, so the question arises if current results would hold in other communities.

These limitations of the current research can be addressed by further study replications and methodological triangulation of research with different tools in order to verify and generalise current findings. In addition, future research may extend current study to other contexts and research questions of common interest to the field of knowledge management and different arts disciplines.

5 Conclusions

This paper pushes KM research beyond the traditional organisational settings into the realm of Arts. Following the suggested need for KM expansion (Handzic 2017), the current study showed that Arts could offer an interesting new context for such development.

In summary, the preliminary study findings provided empirical evidence of the value of collaboration between KM and Arts in a specific musical context. Specifically, they showed how network analysis and graphical visualisation could facilitate user exploration of the relationships between stecci and music pieces inspired by these monuments.

Overall, these findings imply that KM technology has the potential to change the way Arts scholars interact with their data and share their insights. On the other hand, the increasing availability of digital arts data may offer KM professionals an opportunity to develop new methods and applications in order to deal effectively with the challenges of analysing and presenting such data.

However, these conclusions need to be interpreted with caution due to a number of limiting contextual and methodological factors. Future research is recommended to address these limitations and extend current research to other KM initiatives and their applications in other Arts disciplines.

References

- Blanning, R. W. (2000, July). *Knowledge Management and Electronic Commerce*. Paper presented at the Position Papers on Future Directions in Decision Support Research, IFIP, WK8.3, Working Conference on DSS, Stockholm. pp. 5-7.
- Eppler, M. J. (2003). Making Knowledge Visible Through Knowledge Maps: Concepts, elements, cases. In C. W. Holsapple (Ed.), *Handbook on Knowledge Management* (pp. 187-205). New York: Springer.
- Fayyad, U., Piatetsky-Shapiro, G., Smyth, P., and Uthurusamy, R., (1996), Eds. *Advances in Knowledge Discovery and Data Mining*, AAAI/MIT Press, Cambridge, Mass.,
- Handzic M. (2017), The KM Times They Are A'Changin, *Journal of Entrepreneurship, Management and Innovation (JEMI), Special Issue: Knowledge Management -Current Trends and Challenges*, Vol 13, Issue 3, pp. 7-27, doi: 10.7341/20171331
- Handzic M. and Heuvel C. van den (2018), Digital Humanists' Knowledge Space: A Conceptual Design, in *Proceedings of the 13th Forum on Knowledge Asset Dynamics – Societal Impact of Knowledge and Design (IFKAD 2018)*, 4-6 July, Delft, Netherlands, pp.1815-1823.
- Handzic M. and Carlucci D. eds (2019), *Knowledge Management, Arts and Humanities: Interdisciplinary Approaches and the Benefits of Collaboration*, Knowledge Management and Organisational Learning Series (Vol.7), Springer Nature Switzerland AG, Cham, Switzerland.
- Lauzikas, R., Dallas, C., Thomas, S., Kelpslene I., Huvila, I., Luengo, P., Nobre, H., Toumpouri, M. & Vaitkevicius, V. (2018). Archaeological Knowledge Production and Global Communities: Boundaries and Structure of the Field. *Open Archaeology*, 4, pp. 350–364.
- Liu A. (2018) *DH Toychest: Digital Humanities Tools*, available at URL: <http://dhresourcesforprojectbuilding.pbworks.com/> (accessed 25 January 2018).
- Moretti F. (2013), *Distant Reading*, Verso, London & New York.

- Nomination 1504 (2016) *Stecci Medieval Tombstones Graveyards*, available at URL: <http://whc.unesco.org/en/list/1504/>
- Russell, I. A. & Cochrane, A. (eds) (2014). *Art and Archaeology: Collaborations, Conversations, Criticisms*. Springer, Germany.
- Stanford Humanities Center (2017), *Digital Humanities*, available at URL: <http://shc.stanford.edu/digital-humanities>, (accessed 14 December 2017)
- Yin R.K. (2003), *Case Study Research: Design and Methods*, Sage, Thousand Oaks, CA.

Leveraging Analytics for Improving Knowledge Sharing: a Case in the Healthcare Sector

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Abstract

This manuscript investigates how Business Analytics (BA) may be practically exploited within the Knowledge Management process or activities to improve decision making. In particular, we developed a case study within a European private hospital in which we applied Process Mining – an emerging type of BA – to a six-month event dataset of the emergency department hip fracture diagnosis process for identifying delays linked to knowledge sharing issues. The evidences showed that, in over one case out of three, knowledge-sharing-related issues hindered the hospital in complying with the emergency department time targets and led to inefficient decision making. Hence, we proposed two preliminary solutions that may cope with such issues and that might decrease the patient's Length of Stay and reduce the corresponding costs.

Keywords – Knowledge sharing; healthcare; process mining; business analytics.

Paper type – Academic Research Paper

1 Introduction

Process Mining (PM) is a kind of business analytics for business process diagnosis and enhancement (van der Aalst, 2016) that can be exploited within the Big Data (BD) environment too (Maldonado-Mahauad *et al.*, 2018). With this aim, PM encompasses a set of techniques for the semi-automatic analysis of event data extracted the event logs

largely available in today's Information Systems (ISs). Probing event data through PM allows to model the actual behaviour of an IS-supported business process, to check its conformance against a reference model, or to analyse its performances from different perspectives.

PM has been framed within the process-oriented Knowledge Management (KM) scope to evaluate the knowledge-based business processes and to probe their evolution (Jung, Choi and Song, 2007). Nonetheless, the scientific literature has not deepened how analytics, such as PM, may be practically applied within KM process or activities. More in particular, Pauleen and Wang (2017) have called for more research investigating how KM may operationally use analytics to improve decision making.

Accordingly, this paper aims at answering this call. In so doing, we developed a case study in which we exploited PM to enable a more efficient (*i.e.* faster) Knowledge Sharing (KS) in a European private hospital. We chose the healthcare environment because it is knowledge-intensive (Di Ciccio, Marrella and Russo, 2015) and complex, *i.e.* it is characterized by: (I) autonomous and opinionated people that modify their behaviour to improve outcomes related to their own perspective and objective; (II) interconnected practices, processes, and behaviours; and (III) behaviours and activities that continually change and evolve over time (Antonacci *et al.*, 2018; Glouberman and Mintzberg, 2001; Reed *et al.*, 2018). In such an environment, a more punctual sharing of the medical knowledge (*e.g.* the content of the Electronic Medical Records – EMRs) is of utmost importance because it can affect the overall management efficiency in making decisions (*cf.* O'Malley, Grossman, Cohen, Kemper, & Pham, 2010).

In detail, we applied PM to one year of event data, extracted from the Emergency Department (ED) Information System, concerning the diagnosis and treatment process of patients affected by hip fracture – a very challenging clinical process involving different medical specialties. These analyses were conducted through Disco[®], a commercial PM tool. In a first phase, we discovered the control flow in the ED Information System, *i.e.* the actual sequence of activities belonging to the executed process. In a second phase, we enriched the control flow with time and frequency performances extracted from the event log. In the third phase, we analysed these results with the support from the Emergency Department (ED) staff to identify those process weaknesses related to a low-efficient KS.

The results highlighted some process issues (*e.g.* excessive waiting time before receiving the outcome about the diagnosis) due to inefficiencies in the EMRs sharing. Hence, we proposed a set of solutions to tackle the KS inefficiencies, for instance the automatic submission of the X-ray diagnosis from the Rx unit to the orthopaedist once the medical examination has finished. These knowledge-sharing-related solutions may enable a better decision-making on two different levels. First, they may permit faster diagnosis & treatment cycles, which may positively impact on patient care and satisfaction. Second, they may lead to the reengineering of the information flow within the process according to more objective, data-driven evidences.

The remainder of this manuscript is structured as follows: Section 2 details the research design; Section 3 outlines the results, which are discussed in Section 4; finally, Section 5 presents the conclusions.

2 Research Design

The research design relied on a case study developed in a mid-sized European private hospital. According to the roadmap by Yin (2013), we designed and developed a descriptive case study for (I) gathering the data needed to investigate the KS dynamics, (II) collecting the event data for the PM application, and (III) involving the hospital staff in interpreting the findings. This methodology fits our research purposes because they did not require any control over the behavioral events while focusing on contemporary events (Yin, 2013). Furthermore, it is consistent with the need to collect domain knowledge when harnessing business analytics (Waller and Fawcett, 2013). The case design was *single-case* because its descriptive nature did not require any replication or analytic generalization. The rationale of the single case was the *common case* for capturing "*the circumstances and conditions of an everyday situation*" (Yin, 2013, p. 52).

Among the business processes managed within the hospital, we focused on the hip fracture diagnosis & treatment because it is a process for which time-related KS activities may strongly affect the overall time performance. Indeed, it is not by chance that national and international clinical guidelines suggesting target thresholds for time performance process indicators have been developed (Mainz, 2003; Donabedian 1966, 1988), and PM may enable improvements in such time performances. We focused on the ED diagnosis aspect of the process because, in the ED, KS efficiency is felt as an urgent issue since it is often required for rapid decision making.

Within the ED hip fracture diagnosis activities, we applied PM as it allows to define the process flows executed by the ED Information System and to quantify the time performances of the related information exchange (Mans, van der Aalst, and Vanwersch 2015). Based on the PM evidences, which steered the identification of the KS inefficiencies, we proposed two solutions for fixing the detected issues.

In the following sections, we detail the case study (2.1) and the PM application (2.2).

2.1 The case study

The European private hospital which the case study was developed in can host up to 1000 patients across 28 departments and it provides over 4000 different diagnostic and therapeutic services. In the last years, on average, it has registered almost 60,000 hospitalizations and 1.5 million outpatient treatments. Since the first half of nineties, the hospital has established research relationships with different universities and it has been officially recognized as a research institute by the National Health Authority. Encouraged by the remarkable performance, in 2012 the top management approved a long-term development plan that is still on-going. Currently, this plan is focusing on the further digitalization of care processes, particularly those concerning the Emergency, Cardiology, and Orthopaedics departments, and on innovative treatments for genetic diseases.

The hospital IS architecture includes several Health Information Systems (HISs) that support the main health care processes. The most specialized departments are backed up by ad hoc information systems that manage the corresponding EMR flows. In particular, the ED Information System interacts with several other HISs because its health care services are heterogeneous. Yet, currently, the ED Information System lacks complete integration with the other ISs and this hampers the inter-departmental data and knowledge sharing activities.

According to the international guidelines previously cited, the hospital defined specific time thresholds for completing the diagnosis activities concerning the hip fracture cases. In detail, the related Lab Tests should not overrun 60 mins, while the X-ray activities should not require more than 90 mins. These thresholds were considered as a reference for the interpretation of the findings from the PM application, which is detailed in the following section.

2.2 The Process Mining application

The PM application was structured into three sequential phases:

- **Data collection and preparation.** The event data concerning the hip fracture diagnosis process, collected from the ED IS, were extracted and pre-processed. The collected data regarded the registration of six months of activities performed by the ED staff. Incomplete data were removed, leading to an 82-patient dataset.
- **Process discovery.** By leveraging the event dataset, we applied PM to discover the process flow (*i.e.*, the actual business blueprint) of the process under investigation. The discovery activity was performed through Disco[®], a widespread PM tool (van der Aalst 2016). Since the dataset included the timestamp of all the events, we were able to evaluate the time performance of each activity and of each information exchange involved into the process.
- **Process analysis.** Among the 82 cases, we identified the most relevant delays in the information exchange involved in the process. The relevance of the delays was evaluated against the targets, set by the hospital, for such exchanges. The detected delays were discussed together with the ED staff and the top management of the hospital to further probe their nature and the events that likely caused such deviations. Two main causes were identified, and a solution for both of them was suggested. The feasibility of the proposed solutions was evaluated along with the case respondents and a possible intervention was then formulated.

3 Results

Figure 1 depicts the discovered ED flow of the hip fracture patients. The boxes specify the activities, which are linked to each other by arrows representing the transition from an activity to the following one. The numbers detail the case frequency, *i.e.* the number of occurrences out of the 82 cases. The more an arrow is thick and the more a box is dark, the more their case frequency is high. The overall mean and median Length of

Stay (LoS) are 2.7 h and 1.78 h, respectively. Table 1 describes the activities of the analysed process.

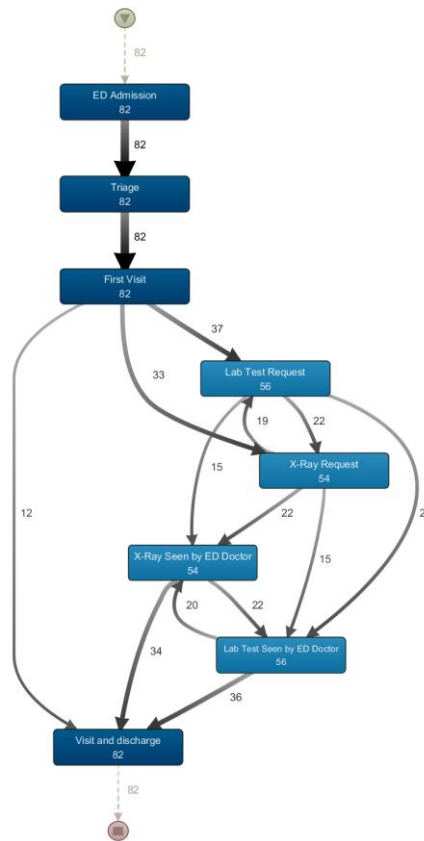


Figure 1. The discovered process blueprint of the hip fracture diagnosis process

Table 1. The activities of the analysed process

Activity	Description
ED Admission	Admission of a patient to the ED;
Triage	First evaluation of the patient severity by the nurse staff for determining the priority of the treatments;
First Visit	First medical visit of the ED patient by the ED staff;
Lab Test Request	Request of blood test(s) by the ED physician to the laboratory to deepen the patient's health condition;
X-Ray Request	Request of X-ray exam(s) by the ED physician to the radiology department to investigate the potential hip fracture;
Lab Test Seen by ED Doctor	Reading of the lab test results by the ED physician;
X-Ray Seen by ED Doctor	Reading of the X-ray results by the ED physician;
Visit and Discharge	Discharge of the ED patient after an additional visit, if needed; the patient can be discharged at home or admitted to the hospital.

Twelve cases skipped both X-ray and lab tests, as the corresponding patients were discharged from the ED after the first visit.

The arrows that link *Lab Test Request*, *X-Ray Request*, *Lab Test Seen by ED doctor*, and *X-Ray Seen by ED Doctor* highlight specific process flows that may appear to be misleading, *e.g.* from *Lab Test Request* to *X-Ray Seen by the ED Doctor*. The reason is that both x-ray and lab test activities are usually requested and executed in parallel. Hence, every sequence among the four above-mentioned activities is legit, as long as the requests precede the reading of the results.

Figure 2 outlines the process flow enriched with the time performances and is divided into two parts. The left side focuses on the lab test activities, while the right one concerns the x-ray activities. These activities were analysed separately for singling out the time impact they may exert on the overall time performance. Near each arch, we indicated both the mean and the median time. Such a time is an idle time between two consecutive activities.

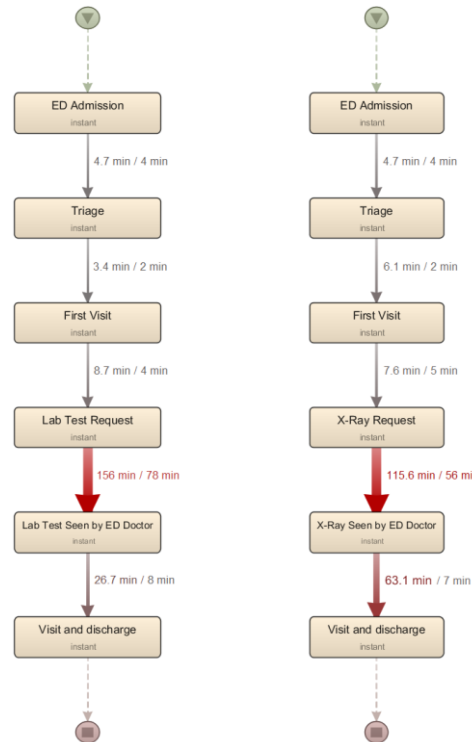


Figure 2. The Lab Test and X-Ray process blueprints enriched with the time performances

According to the evidences, a lab test was needed in 56 cases, while an X-ray analysis was requested in 51 cases. Figures 3 and 4 show the case distribution for the groups of activities: 35 lab test activities overrun the 60 mins threshold, while 31 X-ray activities exceeded the 90 mins threshold. The next section focuses on these cases and on figuring out the causes related to these delays.

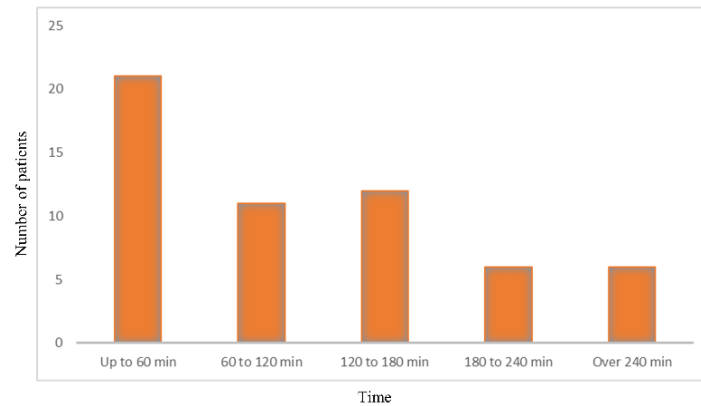


Figure 3. Time distribution of the Lab Test activities

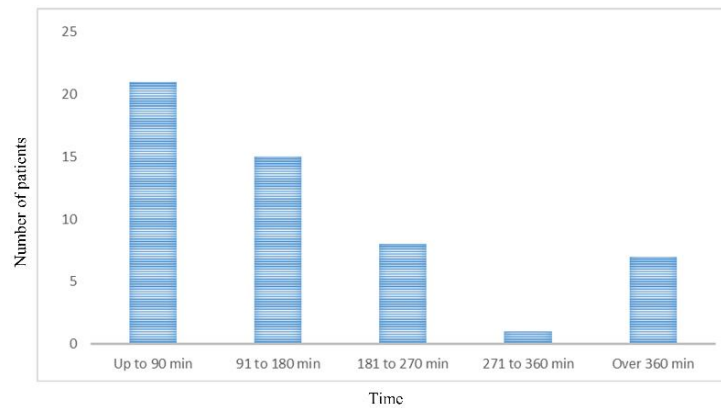


Figure 4. Time distribution of the X-Ray activities

4 Discussion

According to the hospital policies, 43% of the 82 cases showed a delay in the lab test activities, while 38% in the x-ray activities. Moreover, over 50% of the cases including lab test or X-ray overrun the time threshold. The discussion with the ED staff allowed to identify two causes for such delays, besides the physiological queue that may occur in the ED:

1. *Lack of integration.* The ED Information System (IS) exchanges information with the Radiology IS (RIS) and with the Laboratory IS (LIS), but this sharing requires a direct human intervention and, thus, it may be characterized by latency. In particular, the ED IS is not able to fetch the medical reports from the RIS and the LIS until their submission by the corresponding staff. Hence, although the medical reports are available, they may not be accessible by the ED physicians. This lack of integration may be due to two reasons: (I) the three ISs were designed and developed separately and in different points in time; and (II) no interventions for coping with this issue were performed because the top

management has privileged other strategic directions, *e.g.* pursuing healthcare-research-related objectives.

2. *Delayed reading of the medical reports.* Even when the RIS and the LIS submit the reports to the ED IS, delays in consulting the attained information may occur because of two reasons: (I) the ED physician may be busy in more urgent tasks, *e.g.* arrival of a critical patient, or (II) s/he may be unaware of the availability of the reports within the ED IS. While the occurrence of the first case may be unavoidable within an ED, the second one relates to inefficient KS.

These two causes for delay may increase the LoS and may be strongly detrimental to the ED decision making. In the following, we report three real-life examples, suggested by the ED staff involved in the case, about how the inefficient KS led to poor decisions.

- The ED physician requested a lab test, which was executed in time (45 min). The lab staff delayed the submission of the medical report to the ED IS because it was busy with concurrent analyses requested from other departments. The ED physician waited almost 260 min, forcing the patient to remain in the ED and constraining another older patient into the waiting room due to lack of gurneys.
- The ED was overcrowded, in particular due to a multiple car accident that involved four people. All of them accessed the ED and two of them had an alleged hip fracture. The ED physician requested two X-ray exams, whose medical report was available to the ED IS after 75 min. Yet, the physician intervened multiple times to calm down the relatives of the patients. These repeated interruptions led him to forget to check for the availability of the medical reports. Involved by the management of the emergency, he checked for them after additional 40 min, deferring the admission to the hospital of the two patients.
- A patient accessed the ED because of an alleged fracture to both left arm and left-side of the hip. The ED physician requests two X-ray exams – one for each limb. The report about the arm fracture was submitted to the ED IS after 50 min, while the one regarding the leg was not available yet. The physician understood that the arm was actually fractured but waited for the second report before intervening. The second report was available in the RIS 60 min after the request, but it was not submitted to the ED IS. The ED physician called the radiology department multiple times for soliciting the procedure, but she received the report only after 50 additional minutes. In the meanwhile, it was needed to hand out painkillers to the patient.

According to the evidences and to the provided examples, we suggest two feasible, potential solutions that may cope with the two above-mentioned criticalities. First, it is necessary to grant integration among the three involved ISs to reduce the information latency. With this aim, two interventions may be planned. On one side, the Information Technology infrastructure of the hospital may be provided with a specific middleware solution (Hsieh et al. 2007; Almadani, Saeed, and Alroubaïy 2016) that may achieve integration via software. On the other side, the IS architecture may be reengineered to develop a single platform with a unified database that may ensure both uniqueness of the

information and the absence of latency in its sharing. Sounder IS integration may foster the data gathering and collection for systematic, analytics-based process analyses, since health event data are typically scattered across different databases.

Second, the ED IS should offer a functionality that alerts the ED staff about the reception of a new medical report. In this way, the ED physician may immediately realise that the outcome from a lab test or an X-ray activity is ready to be evaluated within the diagnosis and treatment processes.

The two proposed preliminary solutions may help in handling the KS latency issue. Also, based on the three real-life examples we reported, they may affect the ED decision making efficiency and, thus, the LoS and the ED resource management.

5 Conclusions

Today, *Business analytics* is a recurring label for defining a wide variety of data-intensive tools which a company can benefit from in terms of advanced decision making. Nonetheless, their practical exploitation within a structured, knowledge-based process has rarely been object of investigation. Through a case study developed in a European private hospital, we applied a PM-based approach to figure out how the business analytics may be leveraged to detect KS issues in the hip fracture diagnosis process and to propose a draft of pertinent solutions. This quali-quantitative approach highlighted the following findings:

- Time and frequency performances of the ED activities regarding the hip fracture diagnosis;
- The main time bottlenecks of the process;
- The cases in which the time thresholds set by the hospital were violated.

By consulting the staff involved in the case study, we found that the evidences are strongly related to inefficient KS between the ED and both the radiology and the analysis laboratory. This inefficiency led to poor decision making, resulting in additional delays (longer LoS), worsening the ED performance and making the hospital missing its ED time targets. In line with the findings, we proposed two preliminary solutions for coping with the detected KS issues.

Thus, this paper answers the call by Pauleen and Wang (2017) about deepening how business analytics, *e.g.* PM, may be exploited for supporting the KM process and for improving knowledge-based decision making. In addition, it enriches the PM literature with evidences from a process enhancement perspective that, in healthcare, is rather low explored when compared to other PM approaches (Rojas *et al.*, 2016).

In so doing, from a health managerial perspective, it proposes a draft of solutions that potentially link a more efficient KS to a more punctual decision making on both a business process and patient care standpoint. Thus, leveraging the analytics-driven improvements in the business processes, it may cope with the current increasing costs affecting healthcare sector (Mans, van der Aalst and Vanwersch, 2015). The latter aspect is quite topical as, in the today's competitive health-care market, hospitals have to focus on ways to streamline their processes to deliver high quality health-care while, at the

same time, reducing costs (Anyanwu et al, 2003). Therefore, the sharing of knowledge among interfaces across different highly specialized organizational units and the implementation of process-oriented management practices becomes a great challenge which can give a valuable contribution to the improvement of the process of care (Lenz and Reichert, 2007).

Yet, this work is not free from limitations. First, our investigation is limited to the ED diagnosis of hip fractures, without involving the main treatment activities. Hence, we were not able to identify and to assess the impact of the KS issues on the whole hip fracture management process. Second, we focused on KS, which is only a portion of the entire KM process (*cf.* Zerbino et al., 2018). Consequently, we did not investigate how the business analytics may be practically used to support all the KM development.

Further developments of this work are strongly rooted into these limitations. In particular, we aim at extending our inquiry to the complete hip fracture diagnosis & treatment process, based on a richer event dataset. Furthermore, we intend to probe the feasibility of the proposed solutions and to practically evaluate their impact on the compliance with the ED time targets.

References

- Antonacci, G., Reed, J.E., Lennox, L. and Barlow, J., (2018) "The use of process mapping in healthcare quality improvement projects", *Health Services Management Research*, Vol. 31, No. 2, pp. 74-84.
- Anyanwu, K., Sheth, A., Cardoso, J., Miller, J. and Kochut, K., (2003) "Healthcare enterprise process development and integration", *Journal of Research and Practice in Information Technology*, Vol. 35, No. 2, pp. 83-98.
- Di Ciccio, C., Marrella, A. and Russo, A., (2015) "Knowledge-Intensive Processes: Characteristics, Requirements and Analysis of Contemporary Approaches", *Journal on Data Semantics*, Vol. 4, No. 1, pp. 29-57.
- Donabedian, A., (1966) "Evaluating the quality of medical care", *The Milbank Memorial Fund quarterly*, Vol. 44, No. 3, pp. 166-206.
- Donabedian, A., (1988) "The Quality of Care: How Can It Be Assessed?", *JAMA: The Journal of the American Medical Association*, Vol. 260, No. 12, pp. 1743-1748.
- Glouberman, S. and Mintzberg, H., (2001) "Managing the care of health and the cure of disease – Part II: Integration", *Health Care Management Review*, Vol. 26, No. 1, pp. 70-84.
- Jung, J., Choi, I. and Song, M., (2007) "An integration architecture for knowledge management systems and business process management systems", *Computers in Industry*, Vol. 58, No. 1, pp. 21-34.
- Lenz, R. and Reichert, M., (2007) "IT support for healthcare processes – premises, challenges, perspectives", *Data & Knowledge Engineering*, Vol. 61, No. 1, pp. 39-58.
- Mainz, J. (2003) "Defining and classifying clinical indicators for quality improvement", *International Journal for Quality in Health Care*, Vol. 61, No. 1, pp. 523-530.
- Maldonado-Mahauad, J., Pérez-Sanagustín, M., Kizilcec, R.F., Morales, N. and Munoz-Gama, J., (2018) "Mining theory-based patterns from Big data: Identifying self-regulated learning strategies in Massive Open Online Courses", *Computers in Human Behavior*, Vol. 80, pp. 179-196.
- Mans, R.S., van der Aalst, W.M.P. and Vanwersch, R.J.B., (2015) *Process Mining in Healthcare: Evaluating and Exploiting Operational Healthcare Processes*, Springer, Berlin.

- O'Malley, A.S., Grossman, J.M., Cohen, G.R., Kemper, N.M. and Pham, H.H., (2010) "Are electronic medical records helpful for care coordination? Experiences of physician practices", *Journal of General Internal Medicine*, Vol. 25, No. 3, pp. 177–185.
- Pauleen, D. J. and Wang, W. Y. C., (2017) "Does big data mean big knowledge? KM perspectives on big data and analytics", *Journal of Knowledge Management*, Vol. 21, No. 1, pp. 1–6.
- Reed, J.E., Howe, C., Doyle, C. and Bell, D., (2018) "Simple rules for evidence translation in complex systems: a qualitative study", *BMC Medicine*, Vol. 16, No. 1.
- Rojas, E., Munoz-Gama, J., Sepúlveda, M. and Capurro, D., (2016) "Process mining in healthcare: A literature review", *Journal of Biomedical Informatics*, Vol. 61, pp. 224–236.
- van der Aalst, W. M. P., (2016) *Process mining: Data science in action.*, 2nd ed., Springer, Berlin.
- Waller, M.A. and Fawcett, S.E. (2013) "Data Science , Predictive Analytics , and Big Data: A Revolution That Will Transform Supply Chain Design and Management", *Journal of Business Logistics*, Vol. 34, No. 2, pp. 77–84.
- Yin, R.K. (2013), *Case Study Research: Design and Methods*, 5th ed., SAGE Publications, Inc, Thousand Oaks, California.
- Zerbino, P., Aloini, D., Dulmin, R. and Mininno, V. (2018) "Knowledge Management in PCS-related ports: an assessment of the barriers", *Knowledge Management Research & Practice*, Vol. 16, No. 4, pp. 435–450.

Using Analytics to Predict Patient's Length of Stay in Emergency Department

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Abstract

In recent years, the widespread adoption of Hospital Information Systems is enabling hospitals to measure and record an ever-growing volume and variety of patient and process-related data. In such context, analytics are emerging as suitable tools and methods for extracting and analyzing such data and for providing useful insights to assist decision-making. The Emergency Department (ED) is one of the functional areas that could profit from the implementation of such tools and methods. However, the complex and dynamic nature of EDs makes the application of analytics a very challenging task which is attracting increasing attention from both academic researchers and practitioners. This work represents a first attempt to demonstrate the suitability of predictive analytics in ED environment. Specifically, we aim at developing a multi-level classification model to predict patients' length of stay (LOS), by exploiting historical information about ED patients and the advanced machine learning techniques. Given the

high variability affecting patient LOS, we determined a set of candidate predictors from the data, including patients' characteristics, temporal factors and, system-based factors (e.g., the system workload, the abandon rate and the probability of treatments' execution like radiology, laboratory and consultancy). Preliminary results show that the multi-level model achieves promising values of accuracy, outperforming the single-level classification model. It allows the early identification of patients likely to experience a long LOS in ED. Such patients may require a dedicated monitoring by ED service providers who should take appropriate actions to shorten their stays. Accordingly, predicting LOS can help ED management to dynamically monitor the crowding level of the system and make informed decisions about resource allocation.

Keywords – Data Mining, Predictive Analytics, LOS, Emergency Department, Healthcare Management

Paper type – Academic Research Paper

1 Introduction

In the last decades, while EDs were declining in number due to restrictive cost-containment policies, the demand for emergency services increased, because of the ageing of the population (Hoot and Aronsky, 2008; Arkun et al., 2010). The combined effects of these trends have dramatically increased the number of patients inside EDs at any hour of the day, leading to overcrowding situations (ACEP, 2016). Therefore, the ability of EDs to deliver a timely and efficient care is far too often hampered by lack of capacity due to overcrowding and boarding (ACEP, 2016). Consequences of ED overcrowding include increased waiting time, delayed treatment before admission to hospital or discharge, ambulance diversion, etc. (Khalifa and Zabani, 2016). In addition, overcrowding and delays in services may have unpleasant consequences for the ED staff, increasing the risk of human errors and the burnout level.

Thanks to the pervasive adoption of information systems (e.g., Electronic Medical Records (EMR)) within healthcare organizations, it is possible to access to an unprecedented amount of patient and process-related data (Fu et al., 2016). In such context, analytics are emerging as suitable tools and techniques for extracting and analyzing such data and for providing useful insights to assist decision-making (Islam et al., 2018). Accordingly, decision tools based on analytics can provide actionable information without excessive resource expenditure, helping to limit otherwise wasteful spending that may stem from diagnostic and prognostic uncertainty (Janke et al., 2016).

Nevertheless, healthcare sector is lagging other industries in the application of analytics (Bates et al., 2014). This is probably due to the privacy regulations which add a layer of complexity and, the lack of tools and training for healthcare providers to effectively and responsibly use big data for analytics. Furthermore, the quality of the collected data may be the most important rate-limiting factor in big data applications because even the most sophisticated statistical techniques cannot overcome the consequences of error-filled data (Janke et al., 2016).

The ‘always open’ and ‘ready for any eventuality’ nature of EDs makes the application of analytics a very challenging task which is attracting increasing attention from both academic researchers and practitioners. Predictive analytics are very promising tools to improve ED operations even if their potential is not yet completely exploited (Islam et al., 2018). Indeed, literature lacks studies that try to exploit analytics in the ED context. This is mainly due to the inherent complex nature of the ED.

This work represents a first attempt to demonstrate the suitability of predictive analytics in ED environment. Specifically, in this work, we aim at developing a multi-level classification model to predict patients’ length of stay (LOS), by exploiting historical information about ED patients and the advanced machine learning techniques. In so doing, the model allows the early identification of patients likely to experience a long LOS in ED. Such patients may require a dedicated monitoring by ED service providers who should take appropriate actions to shorten their stays. Accordingly, predicting LOS can help ED management to dynamically monitor the crowding level of the system and make informed decisions about resource allocation.

2 Background

Analytics include the use of mathematical and algorithmic methods for data processing, as well as the use of techniques, such as text mining, natural language processing, and visual analytics to analyze and derive insight from data (Simpao et al., 2014). Three main types of analytics exist: descriptive (i.e., exploration and discovery of information in the dataset), predictive (i.e., prediction of upcoming events based on historical data) and prescriptive (i.e., utilization of scenarios to provide decision support). Descriptive analytics are the most widely used in healthcare (48%), but predictive and prescriptive analytics have a great unexploited potential (Islam et al., 2018).

In healthcare literature, there are several analytics applications, whose can be grouped in two main categories: clinical and operational, as shown in Figure 1 (Fu et al., 2016; Islam et al., 2018). The former refers to the exploitation of medical dataset to derive prognostic and diagnostic decision support tools. These tools help physicians and nurses to make more effective decisions about disease’ treatment, improve patients monitoring and prevent medication errors (Wang et al., 2017). The latter relates to the use of analytics to support healthcare service providers’ daily operations, improve the operational flexibility and throughput quality of hospital services, reduce costs and readmission rate (Janke et al., 2016). Specifically, most of applications in the operational category involve the prediction of time - e.g., waiting time (Ang et al., 2015) and length of stay (LOS) (Hachesu et al., 2013) - and of future adverse events – e.g., hospital admissions (Billings et al., 2013), hospital readmissions (Kartoun et al., 2015), ED visits (Zhou et al., 2015), critical events in intensive care unit (Bhattacharya et al., 2014), mortality (Kortoun et al., 2016), etc.-.

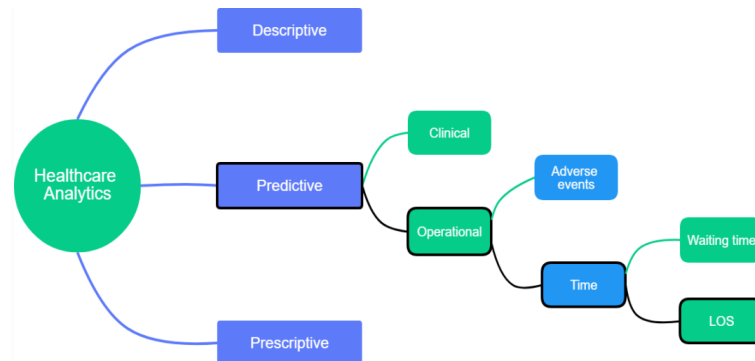


Figure 1: Healthcare Analytics Applications

Given the aim of our work, here following we reviewed the literature related to the prediction of patient LOS. The majority of works exploit predictive analytics techniques to provide an accurate forecast of hospital LOS, by using patient characteristics as main predictors. For example, Hachesu et al. (2013) applied classification algorithms (i.e., neural network, decision tree and support vector machine) to extract useful knowledge and draw an accurate model to predict the LOS of heart disease patients. Li et al. (2013) used a back-propagation neural network to predict hospital LOS. Panchami and Radhika (2014) proposed a novel approach for predicting whether the LOS of hospitalized patients is greater than one week. Their approach identified groups of similar hospital claims from the dataset utilizing a density-based clustering approach called DBSCAN. Livieris et al. (2018) proposed semi-supervised methods to predict the LOS of hospitalized patients, using demographic, clinical, and geographical factors which can be assessed at the time of admission of patients.

Currently, only few papers exist focusing on predicting patient LOS in ED. For example, Wrenn et al. (2005) developed and validated an artificial neural network using clinical and operational parameters that are commonly available during an encounter. Gul and Guneri (2015) presented an ED LOS forecasting model using artificial neural networks. They collected data of 1500 ED patients and identified several predictive variables such as gender, mode of arrival, on-call physician, treatment area and number of tests. The use of predictive analytics in the ED environment seems to be an unexplored field, valuable to investigate.

3 Research Methodology

The research methodology is organized into four main phases: data collection and preparation, data exploration and process discovery, features engineering, model implementation and evaluation.

3.1 Data collection and preparation

We collected data of all patients who presented to the ED of an Italian hospital from February to August 2017. Data was mostly gathered from the ED Information Systems. The initial event log consisted of 36'504 patient cases and more than 453'000 events. Data cleaning and pre-processing involved the removal of repeated records, irregularities, and irrelevancies, and the manipulation of records with missing value and outlier data. The refined dataset included 34'862 patient cases.

3.2 Data exploration and Process Discovery

We analyzed the correlation between the target variable *LOS*, i.e., the time between the arrival of the patient and his discharge, and the patients' characteristics extracted from the dataset (e.g., age, triage code, main complaint), in order to gain useful insights for features extraction. In addition, the dataset was analyzed from a process perspective using the Process Mining approach. Process Mining is able to discover, monitor and analyze real processes by extracting knowledge from event logs (Van der Aalst, 2016). By undertaking Process Mining, we discovered the entire patient-flow and derived information about the current state of the ED (e.g., system workload per hour, number of events occurred from triage to discharge etc.).

3.3 Features Engineering

Starting from the outcome of the previous step, a set of 17 features was developed (see Table 1). The first three features are related to patient's information, including age, arrival mode and main complaint. The temporal features, i.e., *day of the week* and *hour of the day*, consider the moment when the patient arrives to ED. The remaining variables were retrieved from the process discovery. For each triage code, the *Workload per triage code* counts the number of patients between triage and discharge, while the *NYT with priority* the number of patients with higher priority who are waiting for the first treatment. *LWBS* and *Abandon* take into account the number of patients who leave the ED before and after the first visit. *Radiology*, *Laboratory* and *Consultancy* measure the probability of the corresponding exam to be executed by a patient based on his main complaint. Finally, the *Number of events* per patient considers the average number of events from triage to discharge according to the historical data about patients with the same pathology.

Table 1: Features

Category	Attribute	Values
Patient	Age	Min = 0 years, Max = 103 years
	Arrival mode	Autonomous, By ambulance
	Main complaint	25 different pathologies
Time	Day of the week	Mon, Tue, Wed, Thu, Fri, Sat, Sun
	Hour of the day	1-23
ED system	Workload per triage code	5 variables counting the number of patients between triage and exit
	NYT with priority	Count of patients waiting for the first treatment according to priority rules
	LWBS	Count of patients who left without being seen by a physician

Abandon	Count of patients who left after the first visit
Radiology	0-1
Laboratory	0-1
Consultancy	0-1
Number of events	Min = 6, Max = 19

3.4 Model Implementation and Evaluation

In this step, we followed the multi-level classification approach (Tampakas et al., 2014). It consists of a series of hierarchical binary classifications which enable to discriminate at each step the patients with potentially long LOS in ED. This approach allows to obtain a better performance than the single-classifier approach and to solve imbalanced data problems (Srinivas et al., 2015; Tampakas et al., 2014). Specifically, we built two multi-level classification models:

- **M1**, for green codes i.e., urgent patients with serious problems, but apparently stable condition;
- **M2**, for azure codes i.e., standard patients without danger or distress, and white codes i.e., non-urgent patients, whose conditions are not true accidents or emergencies. Azure and white codes were grouped into the same model due to the low number of examples in the dataset.

Yellow codes and red codes were not considered in the analysis because they correspond to very-urgent and life-threatening patients respectively, and thus their stay in ED may mainly depend on their critical health conditions.

The model classes were defined by the quartiles of LOS distribution (see table 2).

Table 2: Triage codes' quartiles

Triage Code	1 st quartile	2 nd quartile	3 rd quartile	Number of cases
Green	75'	130'	210'	19008
Azure+White	45'	90'	160'	5399

The multi-level classification approach is summarized here following (see Fig 2).

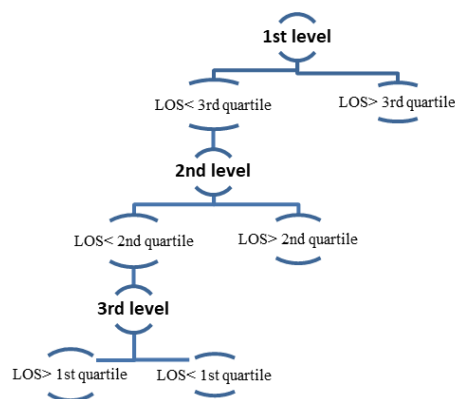


Figure 2: Multi-level classification

At first level, we classified patient LOS into two classes c1 and c2, according to the 3rd quartile. Then, at second level, the examples from class c1 were reclassified into two other classes c3 and c4, according to the 2nd quartile. Finally, at third level, we assigned the examples from class c3 to classes c5 or c6 in case of patient LOS above or below the 1st quartile respectively.

An ad-hoc program in Matlab environment was developed to run the two models M1 and M2. We used the k-nearest neighbors (k-NN) classification algorithm (Tan et al., 2006). We performed a stratified 5-fold cross validation to obtain more robust results. For each iteration of the validation process, we optimized the parameters of the k-NN algorithm. Specifically, we found the best value of k (i.e. the number of neighbors to consider) and the best choice of the distance measure (e.g. Euclidean, Jaccard, CityBlock).

To evaluate the performance of the proposed classification model, we considered four performance metrics. The first three are computed at each level of classification, while the last one is the overall accuracy of the model.

$$Accuracy = \frac{\text{number of examples correctly predicted in a single level}}{\text{total number of examples in that level}}$$

$$Precision = \frac{\text{number of examples correctly predicted in a class}}{\text{number of examples predicted in that class}}$$

$$Recall = \frac{\text{number of examples correctly predicted in a class}}{\text{number of examples of that class}}$$

$$Overall Accuracy = \frac{\text{number of examples correctly predicted}}{\text{total number of examples}}$$

4 Experimental Results

In this section we present the results of the proposed multi-level classification approach on the dataset of an Italian ED.

As shown in tables 3 and 4, the accuracy achieves the highest value in the first and third level of classification (77% and 74%). This means that the models seem to discriminate patients with the longest and the shortest LOS with higher accuracy than in the others. Moreover, precision and recall values increase from the first to the third level of the classification (tables 3 and 4). However, at first level, the recall value is quite low (13%). This means that the models may have strong issues capturing examples from the most critical class, i.e., patients with longest LOS. Nevertheless, the multilevel structure reassess these instances – incorrectly classified – in the next level where the recall index significantly increases for both models (up to 64%). In so doing the impact of the bias on the final classification is mitigated. Likewise, precision metric increases from level to level in both models, achieving a value of 75% at the 3rd level in both models.

Table 3: Green Code' Model performances

M1: Green Code Model				
	1st level (LOS>210')	2nd level (LOS >130')	3rd level (LOS>75')	Overall Accuracy
Accuracy	77%	65%	74%	68%
Precision	62.6%	64%	75%	
Recall	22%	68%	97%	

Table 4: Azure and White Codes' Model performances

M2: Azure+White Code Model				
	1st level (LOS>160')	2nd level (LOS >90')	3rd level (LOS>45')	Overall Accuracy
Accuracy	77%	62%	74%	67%
Precision	59%	61%	75%	
Recall	13%	64%	97%	

Finally, table 5 shows the results of the comparison between the performance of the proposed multi-level models and a single-level classification model with four classes. As shown in table 5, the accuracy of the multi-level classification model is almost double compared to the accuracy of the single-level model, in both cases.

Table 5: Performances Comparison between single-level and multi-level classification

	Single-level classification Accuracy	Multi-level classification Accuracy
Green Code	41%	68%
Azure +White Code	39%	67%

5 Discussion and Conclusions

In this work, we present a multi-level classification model for the prediction of patients' LOS in a real ED. The proposed model attempts to identify patients likely to experience a long LOS in ED. Such patients may require a dedicated monitoring by ED service providers who should take appropriate actions to shorten their stays. Thanks to the multi-level approach, at each step examples not correctly classified are reassessed in the next steps. Preliminary results show that the overall accuracy of the models is quite good with a value of 68% and 67% for green code and azure+white code respectively, compared to the case of a single-level classification model. Thus, it can be considered a first promising result given the high degree of variability that affects the ED. Further studies will be necessary to improve the models in order to capture such variability.

From a managerial point of view, an accurate prediction of patient LOS can support healthcare providers' in the monitoring and the early identification of patients likely to experience a long LOS in ED. Through an alert system, ED service providers could be warned of prolonged LOS for certain patients in ED and, thereby, they may take

appropriate actions to reduce their stay in ED. Furthermore, the proposed predictive model could be used as a reference model for offering customized assistance to patients according to the predicted LOS and for decision making in the resource allocation process.

Nevertheless, findings of this research have to be treated as preliminary and further test on different DBs and techniques are desirables.

As future work we aim at applying the proposed method on data from several EDs in order to extract useful information about key factors affecting patients' LOS. Another direction concerns the implementation of different learning algorithms for each level of the classification, such as decision trees and neural network to improve the overall accuracy of the model.

References

- ACEP, American College of Emergency Physicians (2016), "Emergency Department Crowding: High Impact Solutions", available at: <https://www.acep.org/globalassets/sites/acep/media/crowding> (accessed 7 April 2019).
- Ang, E., Kwasnick, S., Bayati, M., Plambeck, E.L. and Aratow, M. (2015), "Accurate emergency department wait time prediction", *Manufacturing & Service Operations Management*, Vol. 18, No. 1, pp. 141-156.
- Arkun, A., Briggs, W.M., Patel, S., Datillo, P.A., Bove, J. and Birkhahn, R.H., (2010), "Emergency Department Crowding: Factors Influencing Flow", *Western Journal of Emergency Medicine*, Vol. 11, No. 1, p. 10.
- Bhattacharya, S., Rajan, V., Huddar, V., (2014), "A novel classification method for predicting acute hypotensive episodes in critical care", 5th ACM Conference on Bioinformatics, Computational Biology and Health Informatics (ACM BCB 2014), Newport Beach, USA.
- Bates, D., W., Saria, S., Ohno-Machado, L., Shah, A., and Escobar, G., (2014), "Big Data In Health Care: Using Analytics To Identify And Manage High-Risk And High-Cost Patients", *Health Affairs*, Vol. 33, No. 7, pp. 1123-1131.
- Billings, J., Georghiou, T., Blunt, I., et al., (2013), "Choosing a model to predict hospital admission: an observational study of new variants of predictive models for case finding", *BMJ Open* **3**.
- Fu L., Li F., Zhou J., Wen X., Yao J., Shepherd M., (2016), "Event Prediction in Healthcare Analytics: Beyond Prediction Accuracy", *Trends and Applications in Knowledge Discovery and Data Mining, PAKDD 2016, Lecture Notes in Computer Science*, vol 9794, Springer, Cham.
- Gul, M., & Guneri, A.F., (2015), "Forecasting Patient Length of Stay in an Emergency Department by Artificial Neural Networks", *Journal Of Aeronautics And Space Technologies*, Vol. 8, No. 2, pp. 43-48.
- Hachesu, P.R., Ahmadi, M., Alizadeh, S., & Sadoughi, F., (2013), "Use of data mining techniques to determine and predict length of stay of cardiac patients", *Healthcare informatics research*, Vol.19, No. 2, pp. 121-9.
- Hoot, N.R. and Aronsky, D., (2008), "Systematic Review of Emergency Department Crowding: Causes, Effects, and Solutions", *Annals of emergency medicine*, Vol. 52, No. 2, pp.126-136
- Islam, M.S.; Hasan, M.M.; Wang, X.; Germack, H.D.; Noor-E-Alam, M., (2018), "A Systematic Review on Healthcare Analytics: Application and Theoretical Perspective of Data Mining", *Healthcare +*, Vol. 6, No. 54.

- Janke, A., T., Overbeek, D., L., Kocher, K., E., Levy, P., D., (2016), "Exploring the Potential of Predictive Analytics and Big Data in Emergency Care", *Annals of Emergency Medicine* Vol. 67, No. 2, pp. 227-236.
- Kartoun, U., Kumar, V., Brettman, A., Yu, S., Liao, K., et al., (2015), "A risk model for 30-day heart failure readmission using electronic medical records", *Joint Summits on Translational Science*, San Francisco, CA.
- Kartoun, U., Corey, K., Zheng, H., Shaw, S., (2016), "A prediction model to assess mortality risk in cirrhosis", *Joint Summits on Translational Science*, San Francisco, CA.
- Khalifa, M., Zabani, I., (2016), "Utilizing health analytics in improving the performance of healthcare services: A case study on a tertiary care hospital", *Journal of Infection and Public Health*, Vol. 9, No. 6, pp. 757-765.
- Li, J.S., Tian, Y., Liu, Y.F., Shu, T., Liang, M.H., (2013), "Applying a BP Neural Network Model to Predict the Length of Hospital Stay", in *Health Information Science, HIS 2013, Lecture Notes in Computer Science*, Vol. 798, Springer, Berlin, Heidelberg.
- Liu, P., Lei, L., Yin, J., Zhang, W., Naijun, W., & El-Darzi, E. (2006), "Healthcare Data Mining: Prediction Inpatient Length of Stay", *3rd International IEEE Conference Intelligent Systems*, pp. 832-837.
- Livieris, I., U., Dimopoulos, I., F., Kotsilieris, T., Pintelas, P., (2018), "Predicting length of stay in hospitalized patients using SSL algorithms", *8th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion (DSAI 2018)*, ACM, New York, NY, USA, 16-22.
- Panchami, V., U., and Radhika, N., (2014), "A novel approach for predicting the length of hospital stay with DBSCAN and supervised classification algorithms", *5th International Conference in Applications of Digital Information and Web Technologies*. 207–212.
- Simpao, A., F., Ahumada, L., M., Gálvez, J., A. et al., (2014), "A Review of Analytics and Clinical Informatics in Health Care", *J Med Syst*, Vol. 38, No. 45.
- Srinivas, M., Bharath, R., Rajalakshmi, P., and Mohan, C., K., (2015), "Multi-level classification: A generic classification method for medical datasets", *17th International Conference on E-health Networking, Application & Services (HealthCom)*, Boston, MA, 2015, pp. 262-267.
- Van der Aalst, W.M., (2016), *Process Mining: Data Science in Action*, Springer, 2.
- Wang, Yichuan & Hajli, Nick, (2017), "Exploring the path to big data analytics success in healthcare," *Journal of Business Research*, Elsevier, Vol. 70(C), pages 287-299.
- Wrenn, J., Jones, I., Lanaghan, K., Congdon, C. B., & Aronsky, D., (2005), "Estimating patient's length of stay in the Emergency Department with an artificial neural network", *AMIA Annual Symposium proceedings. AMIA Symposium*, 2005, pp.1155.
- Zhou, J., Shepherd, M., Li, F., Fu, L., et al., (2015), "Delivering actionable insights on population risk to improve health outcomes and reduce healthcare costs", *International Conference on Health Informatics and Medical Systems*.

Business Analytics Enabling Future Insights in the Private Healthcare

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Abstract

Purpose – The tendency of supporting organizational decision-making has moved from traditional industries also to the private healthcare sector, becoming more and more essential, as requirements towards up-to-date and reliable information have increased. Business analytics tools can be considered as one of the solutions to satisfy the growing needs of supporting organizational data-driven decision-making. Also, one of the goals of business analytics is to understand and improve business processes, leading to enhanced performance of the organization. The aim of this paper is to study, how business analytics (BA) can support the future requirements of enhanced decision-making in the private healthcare in Finland. In addition, this paper provides valuable insight into the future of business analytics tools utilization in the private healthcare sector, furthermore discovering the potential for new business practices.

Design/methodology/approach – The research includes private healthcare organizations, BI-vendors and management consultants in Finland. In addition, one of leading Business Analytics tools vendors in Finland and in the world was chosen for the study. The empirical data was collected during 2017-2019. In total thirty nine thematic interviews of key-personnel responsible for BA were conducted, to gain understanding on the future potential of BA in the Finnish private healthcare industry.

Originality/value – Data-driven decision-making, operational excellence and seeking for new business opportunities are currently one of the most discussed topics when considering benefits of business analytics. This study is putting together the future potential of BA utilization in the private healthcare sector, both in decision-making and discovering new business opportunities. The suggested approach has significant novelty value in the context of a Finnish private healthcare. However, it is focusing primarily on the organizational aspect of BA utilization in the private healthcare in Finland, not including clinical data aspects.

Practical implications – There are two practical outcomes of this study. The first outcome will provide understanding on the role of the future BA utilization in the private healthcare sector in Finland. The second outcome of this research provides valuable insight into the data-driven decision-making and potential of new business practices, enabled by utilizing new analytics capabilities.

Keywords – Private healthcare, business analytics tools, decision-making, new business potential

Paper type – Academic Research Paper

1 Introduction

The nature of business has changed during the past years, as globalized business environment together with disruptions in the field of technology have enforced organizations to become more agile and innovative in the ways they respond to their customers demand (Aydiner et al. 2019). During the last decade amounts of data have expanded significantly, and therefore business intelligence (BI) and business analytics (BA) have become increasingly more important in organizations (Vidgren et al. 2017). Likewise the healthcare sector has been moving towards data-driven decision-making, because of growing amounts of operative business data, that is being generated and used to support the organisational or managerial decision-making process (Ratia and Myllärniemi 2017; Stewart et al. 2016; Raghupathi and Raghupathi 2014; Raghupathi 2010; Spruit et al. 2014; Grierson et al. 2015). However, the key challenge for organizations in BI and BA utilization is, how to leverage those capabilities to create business value (Vidgren et al. 2017).

However, private healthcare is not an exception, and the same needs of enhancing the understanding of business practices and related organizational data to enable better decisions and performance are being the same. (Ratia and Myllärniemi 2017; Ratia et al. 2017; Demirkan 2013). Even though, the interest of managers and executives towards BI and BA has grown, in order to be able to explore and utilize organizational data that is traditionally been siloed in various different operational systems, there is still a long way to business analytics ecosystem with a clear data and analytics strategy (Vidgren et al. 2017; Elbashir et al. 2013). Yet, is not completely and unequivocally clear for organizations, how BA improves decision-making process in practice (Cao et al. 2015). However, in addition to enhanced decision-making process, successful utilization of BA capabilities can create potential also for other kind of business value, such as new products and services (Ratia and Myllärniemi 2018).

This paper focuses on the BA and BA utilization in the private healthcare sector in Finland. The purpose of this study is to increase understanding role of BA in decision-making, also providing valuable insight into the potential of BA utilization in creating new products and services in the private healthcare sector. This study is putting together the requirements of enhanced decision-making in the private healthcare organizations. Although it is obvious, that BA benefits organizational decision-making process, it is still unclear what are the mechanisms behind (Seddon et al. 2017). Even though the role of BA in business is becoming more and more significant, the understanding of the business value created by BA is still quite limited (Krishnamoorthi and Mathew 2018). By analysing the future potential of the BA in the private healthcare industry sector decision-making process, the research brings a significant novel value for the private healthcare

sector companies, showing also the future potential of BA utilization. The practical outcome of this research will provide valuable information as well as deep understanding on the future potential enabled by BA and BA tools in the Finnish private healthcare sector companies.

In the second chapter the aim is to show a conceptual basis for BA and business analytics success model framework (Seddon et al. 2017). Chapter 3 presents empirical setting, introducing the methodology and empirical material. Chapter 4 is of showing the results of we present our results by answering to the interview themes, based on the BASM framework, that can also be applied to evaluate competitive advantage brought by BA process. Finally, in chapter 5, the conclusions and discussion conclude the paper.

2 The potential of business analytics in enhancing decision-making

2.1. The concept of business analytics

The concept of business analytics can be seen as a complex combination of several and various definitions and also being interchangeable or alternative also to business intelligence (BI) and as a part of information processing capabilities (e.g. Sun et al. 2016; Cao et al. 2015). The literature is identifying several approaches to BI or BA. It can be described as a unifying phrase or term, combining different tools, applications and methods or as a combination of a technological and process approach (Turban et al. 2008; Nykänen et al. 2016). Another definition of concept of BA is that it enables “the extensive use of data, statistical, and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions” (e.g. Cao et al. 2015; Davenport and Harris 2007). It can be also noted, that BA and BA tools can be beneficial to organization by enhancing and improving business processes and performance as well as enabling creation of competitive advantages (e.g. Cosic et al. 2015; Davenport and Harris 2007; Kakhki and Palvia 2016). However, it is clear that BA is an emerging and fast-growing field, that can be considered to be disruptive technology and enabler of innovation, that can bring organizational decision-making to the next level (Sun et al. 2016; Cao et al. 2015).

In addition to interchangeable or alternative concepts of BA and BI, there are also several alike concepts, such as competitive intelligence, market intelligence, customer intelligence, competitor intelligence, strategic intelligence and data analytics, and it can be debatable, whether are being similar concepts or under the same umbrella concepts of BA and BI (e.g. Ratia and Myllärniemi 2018; Lönnqvist and Pirttimäki 2006). Furthermore, business analytics can also be identified as a process that is producing information and knowledge for the managers and executives as well as other decision-makers in the organization (e.g. Nykänen et al. 2016). However, BA and BI, being a selection of techniques, technologies, tools, practices and methods, can create deep understanding of business and market for organizations and support appropriate business decisions (e.g. Ratia and Myllärniemi 2018; Côte-Real et al. 2014; Nykänen et al. 2016). An extended concept of BA and BI can also include new methods and technologies, as

well as other related concepts, such as Big Data, machine learning (ML) and artificial intelligence (AI) (Ratia and Myllärniemi 2018; Trieu 2017). However, BA can also be seen as being an art of examining, accumulating and deduce conclusions out of available data (Sun et al. 2016).

Even though the concepts of BA and BI as well as the capabilities have been studied previously, it is still relatively unclear, what are the concrete elements of these concepts, that contribute to business value. However, recent researches show, that there is a connection between business intelligence or business analytics and organizational value creation process (e.g. Krishnamoorthi and Mathew 2018; Fink et al. 2017; Ratia et al. 2018; Ratia 2018). Business value can be generated by timely access to relevant information for decision-making support (Jinpon et al. 2011). Or by connecting different data types from different internal and external sources to be used efficiently in decision making (e.g. Ratia 2018; Wang et al. 2016; Wang et al. 2015).

2.2. Business analytics capabilities creating business value

To be able to follow the benefits of business analytics, executives and management has to have clear understanding of organizational BA capabilities that have influence on performance (Seddon et al. 2017). However, even though research considering BA capabilities is still scarce, it can still be said, that especially advanced analytics can be valuable in creating business value (Krishnamoorthi and Mathew 2018). More precisely, data science, predictive analytics and big data are seen to be increasingly important in business value creation (Vidgren et al. 2017; Waller and Fawcett 2013). However, operationally effective BA design and implementation of solution into practice can be very difficult and thus, true business value is also hard to generate (Nalchigar and Yu 2018). Even though practitioners identify BA and BI practices bringing competitive advantage, the literature does not identify common theoretical explanation or link (Torres et al. 2018).

One of the frameworks is BASM or business analytics success model, that can also be applied to evaluate competitive advantage brought by BA process (Seddon et al. 2017). The model consists of twenty different concepts presented in the below table 2.

Table 2. Concepts of the BASM process model (modified Seddon et al. 2017)

Concept	Explanation
Use analytic capabilities	Utilization of BA capabilities to analyze internal and/or external data to support more evidence-based decision making.
Insights	Gaining of a deeper understanding enabled by use of business BA capabilities.
Decisions	Decision-making followed by insights from BA capabilities utilization.
Purposeful actions that create value that use the organization's existing capabilities	Organizational actions with a goal to create value utilizing existing organizational capabilities or operational use of BA

	capabilities.
Intendedly value-creating actions to change the existing organization's capabilities	Actions taken by the organization with a goal to create business value that leads to changes in its current organizational capabilities.
Organizational benefits from analytics use	An overall measure of perception of the benefits from analytics use.
Enabling technology	BA related hardware, software, data, processing and governance capabilities.
Analytical people	The people within the organizational unit with an analytic mindset who help drive business value from BA.
Analytical resources	The combination of people, technology and data-analysis processes that enable it to make more evidence-based decisions.
Organizational resources	The full set of resource in the organization that enable it to provide goods and services (i.e. value) to its customers and other stakeholders.
Analytic leadership	The level of leadership of initiatives or projects to increase use of BA.
Enterprise-wide analytics orientation	The level of adoption of an enterprise-wide orientation to BA utilization.
Clear targets	The selection of targets for new analytics initiatives are selected carefully based on the combination of their business potential and whether the necessary resources, including data, are available.
Extent to which evidence-based decision making is embedded in the organizational culture	The extent to which a culture of evidence-based decision making is embedded in the core values and processes of the organization.
Current BA improvement projects	Ongoing projects can include both the implementation of new software and initiatives that apply existing functionality to new areas of decision making.
Functional fit of BA tools	Matching of BI tools to the functionalities that the organization needs to access and analyze data effectively and efficiently.
Availability and quality of data	Relevance and accuracy of data that is available for analytics use, from sources both within and external to the organization.
Analytical people	Analytical mindset within people in the organization.
Overcoming organizational inertia	Motivation to learn, use and accept the new system. During initial implementation and subsequent projects, considerable change management effort, training and support are needed to overcome organizational inertia.
Organizational benefits from BA utilization, from the perspective of senior management	An overall measure of senior management's perception of the benefits from BA utilization. For e.g. enabling visibility into organizational data, enhancing evidence-based decision making.

Even though BASM is a result of summarizing insights from numerous researches, it is still strongly a practical framework, that despite of analysis of 100 success-stories, still needs further work (Seddon et al. 2017).

There are also other perspectives to examine business value, for e.g. VRIO framework, that evaluates how valuable, rare, costly to imitate, organizationally embedded organizational BA is (Grover et al. 2018). This framework with its directional questions, enable organization to evaluate business value and potential competitive advantage of BA. However, in this research we use Seddon et al's (2017) BASM framework to show the concepts of BA utilized in the private healthcare sector in Finland.

3 Methods

The aim of this study is to increase understanding role of the future of BA, also providing valuable insight into the potential of BA tool utilization in creating new products and services in the private healthcare sector. This study has been conducted by focusing on the interest group, the private healthcare organizations, consulting companies, to be more specific of both, technology and management consultants as well as international technology vendor organizations' representatives. When examining the potential of BA from several perspectives, we get a wider picture of potential of BA in the Finnish private healthcare organizations.

The research was conducted as a qualitative study. The multiple case research strategy we used, carried out with qualitative methods was suitable for studying this kind of complex and context-dependent research topic (Yin 2003). For the purposes of this research ten different private healthcare companies were chosen. The examined companies were representing multiple different sizes of private healthcare organizations operating in Finland. Also, twenty consultants were interviewed for the study. The interviewees were representing technology and management consulting organizations having operations in Finland. The inductive approach in this research, together with semi-structured, thematic interviews, allowed us to investigate the decision-making and other BA enabled potential. This research method was selected upon others, as it is providing better explanations and deeper understanding on the research questions, also enabling the adjusted questions and gather more information flexibly, than if used quantitative study et al. 2010; Nykänen et al. 2016; Qu and Dumay 2011). The semi-structured thematic interviews were conducted face-to face interviews, skype-interviews and phone interviews. The interview discussions were recorded and transcribed to be able to systematically organize and analyse gathered data (McLellan et al. 2003).

The case organizations from the private healthcare sector, located all over Finland, were having business operations in the dentalcare, social care and healthcare businesses of the healthcare industry. The organizations involved in the research were Finnish and international companies having office representing the foreign corporation in Finland. The interviewees were top managers and executives, mostly representing ICT or financial functions, and they were chosen as of their area of responsibility for BA and BI in their organizations. The list of interviewees as well as their role is described in Table 3.

Table 3. The list of interviewees, their role and responsibility in the company

Interviewee	Position	Responsibility
1	Director, ICT	ICT functions
2	Director, Digital Services	of Digitalization
3	Head of IT	of ICT functions
4	Development Manager	Responsible for BI and development
5		of ICT functions
6	Head of Accounting and Reporting	of Controlling and BI
7	Director, Digitalization	of ICT and Digitalization
8	Manager	of ICT
9	Head of Controlling	of Controlling and BI
10	Head of Controlling	of Controlling and BI

The interviews of private healthcare organizations were conducted during the period between January and May 2017. They were carried out in discursive atmosphere, including discussion on issues e.g. what is business analytics and what is the value potential of BA.

In addition, also twenty technology and management consultants were interviewed for the study. The interviewees were focusing on BA and BI related consulting activities in their organization. In the below table 4 we present a list of interviewees, their position in the organization as well as area of responsibility.

Table 4. The list of interviewees, their position and type of the consulting company

Interviewee	Position	Type of consulting
11	Director	Technology
12	Consultant	Technology
13	Director	Technology
14	Consultant	Technology
15	Director	Technology
16	Consultant	Technology
17	Director	Management consulting
18	Consultant	Technology
19	Manager	Management consulting
20	Manager	Management consulting
21	Manager	Management consulting

22	Manager	Technology
23	Director	Technology
24	Director	Technology
25	Director	Technology
26	Director	Management consulting
27	Consultant	Technology
28	Director	Management consulting
29	Director	Management consulting
30	Director	Technology

The interviews were carried out between April and October 2017. In total twenty thematic semi-structured interviews were conducted. These discursive interviews included discussions on issues e.g. what is business analytics and what is the value potential of BA.

Moreover, one private healthcare company was chosen for deeper case study. The interviewees were business and finance directors as well as representative of controlling function. The list of interviewees among with their position in the organization and main responsibilities is presented in table 5.

Table 5. The list of interviewees of the healthcare case company.

Interviewee		work activities
31	Director	Business
32	Director	Business
33	Director	Finance
34	Controller	Business Control

Finally, one major international BA technology vendor, an international technology company, was also chosen for deeper case study. The list of interviewees among with their position in the organization and main responsibilities is presented in table 6.

Table 6. The list of interviewees of the technology case company.

Interviewee		work activities
35	Consultant	AI, ML and Advanced Analytics

36	Architect	Analytics
37	Consultant	Analytics
38	Architect	Analytics
39	Architect	AI, ML and Advanced Analytics

In the next chapter we present our results by answering to the interview themes, based on the first round of analysis. We also analyse the result with BASM or business analytics success model framework, that can also be applied to evaluate competitive advantage brought by BA process (Seddon et al. 2017).

4 The value creating business analytics capabilities in the private healthcare sector

However, we need more knowledge on about the role of BA in decision-making and other potential in order to point out the business value enabled by BA for organizations. In this chapter we summarize the identified concepts from the empirical study towards the BASM framework. The modifications to Seddon et al.'s (2017) framework have been done based on our earlier research of the private healthcare sector (Ratia and Myllärniemi 2018; Ratia 2018) as well as the recent research, to reflect the current situation in the private healthcare sector in Finland.

The business analytics success model exposes the concepts related, their explanations as well as their presence in the examined organizations. The model has been modified based on our earlier research of the private healthcare sector (Ratia and Myllärniemi 2018; Ratia 2018) as well as the recent research, to reflect the current situation in the private healthcare sector in Finland. The utilization of BA capabilities for analyzing internal and external data to support more evidence-based decision making was clearly present in the research, as many of the organizations were utilizing both internal and external data to enhance organizational decision-making. Also, gaining of a deeper understanding enabled by use of business BA capabilities can be considered to appear in the results. Data driven decision-making followed by insights from BA capabilities utilization was considered to be one of the most important aspects in organizational BA utilization, as organizations found effective and efficient decision-making process as one of the goals of BA and BI. However, organizational actions with a goal to create value utilizing existing organizational capabilities or operational use of BA capabilities was only present partly, as some of the organizations. Actions taken by the organization with a goal to create business value that leads to changes in its current organizational capabilities, such as new innovations and searching for new business opportunities. A very few organizations measure the benefits from analytics utilization, as it is yet unclear how the value can actually be measured.

Whereas in terms of technology, BA related hardware, software, data, processing and governance capabilities were very clearly scheduled for implementation or utilization. It seems, that the technology part is the most under control of the BA concepts. The human resources availability within BA activities were seen to be not so complete, as there overall perception was, that there are not enough capabilities for BA utilization. Overall, the required resources are available only partly. The analytics leadership was neither mentioned to be strongly present. Often targets are not very clear and BA is being practiced even though the goals and targets are not so clear. Organizational culture, or more specifically organizational data-culture is also a difficult issue to implement for many of the organizations. The most of organizations had active BA project activities, just had ones or were planning to implement, as BA was considered to be important in terms of data-driven decision-making. Functionality of BA tools was considered to be important, as BA was seen to be demand-based. Most of the organizations were mentioning data quality to be important, but the quality of external data sources were not mentioned. Overcoming organizational inertia was not mentioned in terms of BA and BA tool implementation. However, it can be also considered to be as part of the organizational culture and its change and development. The perspective of senior management was rather receptive than rejecting. There was a clear interest in enhancing decision-making process, and in some cases also to identify the new business concepts and business possibilities.

So, if summarized, in the conducted research, over half of the presented concepts of business analytics success model framework were present or partly present in organizational processes. Another half of the concepts was not present in the researched organizations. Clearly decision-making and enhancing the process of decision-making were strongly present. But in addition, BA was also seen as an enabler of new business concepts and business opportunities.

5 Conclusions

This paper is introducing a fairly novel approach to discussion of the impact of BA and BA tools to data-driven decision-making and its future potential in other business value deliverables, such as new business concepts, in the private healthcare sector in Finland. The amounts of data have expanded significantly during the last years, and therefore business intelligence (BI) and business analytics (BA) have become increasingly more important in organizations (Vidgren et al. 2017). Also the healthcare sector has been moving their activities towards data-driven decision-making, as of growing amounts of operative business data, that is being generated and used to support the organisational or managerial decision-making process (e.g. Ratia and Myllärniemi 2017; Stewart et al. 2016; Raghupathi and Raghupathi 2014; Raghupathi 2010; Spruit et al. 2014; Grierson et al. 2015). Here, the key challenge is, how to leverage those capabilities to create business value (Vidgren et al. 2017).

The research showed, that there were several concepts of BA utilization that were already in use, such as decision-making and seeking for new data-driven business

concepts, and also several important aspects, that had not yet been considered, such as analytics leadership. However, also the technological part was very strongly managed. Organizational culture and related concepts were though not yet playing a significant role. Also management was interested in BA activities and results. However, the exact goals and targets were not so clear yet. Also measuring BA activities and their success was not very common, and the metrics still remain unclear. As a summary we could say, that over half of the presented concepts of business analytics success model framework were present or partly present in organizational processes. Another half of the concepts was not present in the researched organizations. As a highlight, decision-making and enhancing the process of decision-making were strongly mentioned. Also BA was also seen as an enabler of new business concepts and business opportunities.

The practical outcome of this research will provide valuable information as well as understanding on the BA utilization in decision-making in Finnish private healthcare sector companies. In addition, showing the potential of future business value creation in the private healthcare. Furthermore, advanced BA practices can also open new opportunities for new business concepts. Thus utilizing of BA and BA tools, not only in enhancing decision-making, but also in creating the potential for new business opportunities. However, in order to get more specific view on this issue, we need to gather more empirical data from the private healthcare organizations, from different organizational levels. In addition, we need to study more of capabilities of business analytics, to be able to point out specific requirements and features that are essential for the private healthcare sector to gain deeper understanding of factors having impact on value creation (Ratia et al. 2017; Brandão et al. 2016; Gartner 2017).

References

- Aydiner, A. S., Tatoglu, E., Bayraktar, E., Zaim, S. and Delen, D. (2019). Business analytics and firm performance: The mediating role of business process performance. *Journal of Business Research* vol. 96 (2019). Pp. 228–237
- Brandão, A., Pereira, E., Esteves, M., Portela, F., Santos, M. F., Abelha, A. and Machado, J. (2016). A Benchmarking Analysis of Open-Source Business Intelligence Tools in Healthcare Environments. *Information*, 7(4), pp.57
- Cao, G., Duan, Y. and Li, G. (2015). Linking Business Analytics to Decision Making Effectiveness: A Path Model Analysis. *Transactions on Engineering*. Volume 62, Issue 3. Pp. 1-36.
- Côrte-Real, N., Ruivo, P. and Oliveira, T. (2014). The diffusion stages of business intelligence & analytics (BI&A): A systematic mapping study. *Procedia Technology*. Vol.16, pp.172–179
- Cosic, R., Shanks, G. and Maynard, S. (2015). A business analytics capability framework. *Australasian Journal of Information Systems*. 2015, vol. 19, pp. 5-19
- Davenport, T. H. and Harris, J. G. (2007). *Competing on Analytics: The New Science of Winning*. Boston, MA, USA: Harvard Business School Review Press, 2007.
- Demirkan H. 2013. A Smart Healthcare Systems Framework. *IT Professional*. Sept/Oct 2013. Vol.15, Issue 5, pp.38-45
- Elbashir M., Collier P., Sutton S., Davern M. and Leech S. (2013). Enhancing the Business Value of Business Intelligence: The Role of Shared Knowledge and Assimilation. *Journal of Information Systems*. Vol.27, No. 2. Fall 2013, pp.87–105

- Fink, L., Yogeve, N., and Even, A. (2017). Business intelligence and organizational learning: an empirical investigation of value creation processes, *Information Management*. Vol. 54. 2017. Pp. 38-56
- Grierson, H.J., Corney, J.R. and Hathcher, G.D. (2015). Using visual representations for the searching and browsing of large, complex, multimedia data sets. *International Journal of Information Management* 35 (2015) pp. 244–252
- Grover, V., Chiang, R. H. L., Liang, T-P. and Zhang, D. (2018). Creating Strategic Business Value from Big Data Analytics: A Research Framework. *Journal of Management Information Systems*. Vol. 35, issue 2. Pp. 388-423 .
- Jinpon P., Jaroensutasinee M. and Jaroensutasinee K. (2011). Business Intelligence and its Applications in the Public Healthcare System. *Walailak Journal of Science and Technology (WJST)*. 2011. Vol8, Issue 2, pp.97-110
- Kakhki, M. D. and Palvia, P. (2016). Effect of Business Intelligence and Analytics on Business Performance. *Business Intelligence and Analytics and Performance*. Twenty-second Americas Conference on Information Systems, San Diego, 2016.
- Krishnamoorthi, S. and Mathew, S. K. (2018). Business analytics and business value: A comparative case study. *Information & Management*. Vol. 55 (2018). Pp. 643–666
- Lönnqvist A. and Pirttimäki V. (2006). The measurement of business intelligence. *Information Systems Management* , Vol.23, 2006. Issue 1, pp.32-40
- Malmi, T. (1999). Activity-based costing diffusion across organizations: an exploratory empirical analysis of Finnish firms. *Accounting, Organizations and Society*. Vol.24, pp.649–672
- McLellan, E., MacQueen, K. M. and Neidig, J L. (2003). *Beyond the Qualitative Interview: Data Preparation and Transcription*. Sage Journals, Feb2003, pp.63-84
- Myllärniemi, J. (2013). Knowledge processes in healthcare network - a case study. 8th International Forum on Knowledge Asset Dynamics, IFKAD 2013, 12.-14.6.2013, Zagreb, Croatia. Zagreb, Croatia: Institute of Knowledge Asset Management, pp.1223-1236
- Nalchigar, S. and Yu, E. (2018). Business-driven data analytics: A conceptual modeling framework. *Data & Knowledge Engineering*. Vol. 117 (2018). Pp. 359–372
- Nykänen, E., Järvenpää, M., and Teittinen, H. (2016). Business intelligence in decision making in Finnish enterprises. *Nordic Journal of Business*, 65 (2), pp.24-44.
- Ojala, A. and Helander, N. (2014). Value Creation and Evolution of a Value Network: A Longitudinal Case Study on a Platform-as-a-Service Provider. *System Sciences (HICSS)*, 2014 47th Hawaii International Conference on, Issue Date: 6-9 Jan. 2014.
- Qu, S.Q. and Dumay, J., (2011). The qualitative research interview. *Qualitative Research in Accounting & Management*, 8(3), pp. 238-264.
- Raghupathi W: Data Mining in Health Care. In *Healthcare Informatics: Improving Efficiency and Productivity*. Edited by Kudyba S. Taylor & Francis; 2010: pp. 211–223.
- Raghupathi, W. and Raghupathi, V. 2014. Big data analytics in healthcare: promise and potential. *Health Information Science and Systems*. 2014 2:3.
- Seddon, P. B., Constantinidis, D., Tamm, T. and Dod, H. (2017). How does business analytics contribute to business value? *Information Systems Journal*. May 2017, Vol. 27 Issue 3, p237-269
- Spruit, M., Vroon, R. and Batenburg, R. (2014). Towards healthcare business intelligence in long-term care. An explorative case study in the Netherlands. *Computers in Human Behavior*, 2014. Vol.30 pp.698–707.
- Sun, Z., Strang, K. and Firmin, S. (2017). Business Analytics-Based Enterprise Information Systems. *Journal of Computer Information Systems*. Volume 57, 2017 - Issue 2. Pp. 169-178

- Stewart, R. and Davis K. (2016). 'Big data' in mental health research: current status and emerging possibilities. *Social Psychiatry and Psychiatric Epidemiology*. Aug2016, Vol.51, Issue 8, pp.1055–1072
- Torres, R., Sidorova, A. and Jones, M.C. (2018). Enabling firm performance through business intelligence and analytics: A dynamic capabilities perspective. *Information & Management*. Vol. 55 (2018). Pp. 822–839
- Trieu, V. (2017). Getting value from Business Intelligence systems: A review and research agenda. *Decision Support Systems*. Vol. 93, January 2017, pp. 111-124
- Turban, E., Aronson, J. E., Liang, T-P. and Sharda, R. (2008): *Business intelligence: a managerial approach*. Pearson Prentice Hall, New Jersey.
- Vidgren, R., Shaw, S. and Grant, D. (2017). Management challenges in creating value from business analytics. *European Journal of Operational Research*. Volume 261, Issue 2, 1 September 2017, Pp. 626-639
- Waller, M. A., and Fawcett, S. F. (2013). Click here for a data scientist: Big data, predictive analytics, and theory development in the era of a maker movement supply chain. *Journal of Business Logistics*, Vol. 34(4). Pp. 249–252
- Wang, Y., Kung, L.A., Ting, C. and Byrd, T.A. (2015). Beyond a technical perspective: understanding big data capabilities in health care. *System Sciences (HICSS)*, 2015 48th Hawaii International Conference, pp. 3044–3053
- Wang, Y., Kung, L.A., Byrd, T. A. (2016). Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations. *Technological Forecasting and Social Change* Vol. 126, January 2018, pp. 3-13
- Yeoh W. and Koronios A. (2010). Critical success factors for business intelligence systems. *Journal of computer information systems*, Spring 2010, pp.23-32
- Yin, R.K. (2003). *Case Study Research: Design and Methods*. 3rd ed., Sage, Thousand Oaks.

Creating of Entrepreneurial Ecosystem for Further Economical Growth

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Abstract

Purpose – To find tools and methods to research how we can create an entrepreneurial ecosystem in our turbulent and digital time which can be used for further economical growth of the regions and countries.

Design/methodology/approach – We propose an approach to analyse the current situation with creation of entrepreneurial ecosystem.

Originality/value – This methodology puts in evidence several examples of successful profiting from using of entrepreneurship ecosystem in the frame of current digital economics.

The entrepreneurship ecosystem approach has emerged as a response. It recognises that HGFs flourish in distinctive types of supportive environment. Distinguishing features of entrepreneurial ecosystems include the following: a core of large established businesses, including some that have been entrepreneur-led (entrepreneurial blockbusters); entrepreneurial recycling – whereby successful cashed out entrepreneurs reinvest their time, money and expertise in supporting new entrepreneurial activity; and an information-rich environment in which this information is both accessible and shared. A key player in this context is the deal-maker who is involved in a fiduciary capacity in several entrepreneurial ventures. Entrepreneurial ecosystems emerge and evolve in response to specific circumstances, usually operating in combination. In some cases it is triggered by the contraction or closure of an established company

Practical implications – The outcomes of the application can be used in business environment for the new innovative companies working in digital business (IT-technologies, Big Data applications etc)

Keywords – entrepreneurship ecosystem, economical growth, business model design, value creation, intellectual capital

1 Introduction

Over the last sixty years there has been an evolution in the manner in which governments in advanced countries have undertaken industrial and enterprise policies (Warwick, 2013). Over the past twenty years there has been an escalation in both the quantity of policy initiatives and the level of funding committed to these activities in a process termed the ‘developmental’ state (Rodrik, 2004; Block, 2008). These changes can be summarized as a shift from traditional enterprise policies to growth-oriented enterprise policies and has involved significant changes in the unit of focus, how it operates and how it interconnects with other policies.

This has resulted in a gradual change, varying across different countries, towards a much greater focus on support for growth-oriented entrepreneurship. The consequence is that policy makers across the OECD are now strongly focused on promoting high growth firms (HGFs). The rationale for this focus is that HGFs are thought to drive productivity growth, create new employment, increase innovation and promote business internationalization (Brown et al, 2014). The policy interest in HGFs can therefore be explained largely in one word: ‘jobs’ (Coad *et al*, 2014). Moreover, these firms are distributed across all industry sectors, with no bias towards technology-based firms. HGFs do not only create jobs directly; they also have important spill-over effects that are beneficial to the growth of other firms in the same locality (Mason *et al*, 2009) and industrial cluster (Feldman *et al*, 2005; Brown, 2011). There is evidence that HGFs also provide an important Schumpeterian stimulus within economies by increasing competition, promoting innovation and increasing the efficient allocation of resources within economies. Certainly, there is evidence that HGFs have above average levels of productivity growth (Mason *et al*, 2009), high levels of innovation (Coad, 2009; Mason *et al*, 2009), strong levels of export-orientation (Parsley and Halabisky, 2008) and a high level of internationalization (BIS, 2010; Mason and Brown, 2010). Recent research also shows that these firms invest heavily in human capital (Mason et al, 2012) and are more likely than non-HGFs to employ disadvantaged people in the labour market, such as the long-term unemployed and economic migrants (Coad et al, 2014).

Accordingly, policy makers are now beginning to recognize the merit of a more systems-based form of support for high growth entrepreneurship. This represents a shift away from company specific interventions towards more holistic activities which focus on developing networks, aligning priorities, building new institutional capabilities and fostering synergies between different stakeholders (Rodriguez-Pose, 2013; Warwick, 2013). One emerging approach is the focus on ‘*entrepreneurial ecosystems*’ (Zacharakis et al, 2003; Napier and Hansen, 2011; Malecki, 2011; Kantis and Federico, 2012; Feld, 2012; Isenberg, 2010). The term ecosystem was originally coined by James Moore in an influential article in Harvard Business Review published during the 1990s. He claimed

that businesses don't evolve in a 'vacuum' and noted the relationally embedded nature of how firms interact with suppliers, customers and financiers (Moore, 1993).

2 Distinguishing Features of Entrepreneurial Ecosystem

Entrepreneurial ecosystems generally emerge in locations that have place-specific assets.

At the heart of an entrepreneurial ecosystem typically there is at least one, and usually several, 'large established businesses', with significant management functions (e.g. head office or divisional/ subsidiary office) as well as undertaking R&D and production activities. These businesses will also be rich in technology. They play significant roles in developing the ecosystem. First, they are 'talent magnets', recruiting large numbers of skilled workers, many of them recent graduates, from outside the area (Feldman et al, 2005). Second, they provide business training for their employees and enable them to progress up the corporate hierarchy. It is through this process that staff who were initially recruited for their technological know-how acquire management skills to become technology managers. This represents a valuable resource for small firms. Third, they are a source of new businesses as some staff will leave to start their own companies. 'Cluster maps' showing where the founders of businesses were initially employed highlight the key role of certain companies as sources of large numbers of spin-offs. Fourth, large exogenous firms play a major role in developing regional ecosystems, especially in peripheral regions, developing the ecosystem's managerial talent pool (Adams, 2011) and providing commercial opportunities for local businesses.

A second characteristic of entrepreneur ecosystems is that their growth is driven by a process of 'entrepreneurial recycling' (Mason and Harrison, 2006). Entrepreneurs who have built successful (but not necessarily large) companies which they have gone on to sell typically leave the company soon after it is sold (although some remain as employees for a short time to take the opportunity to gain managerial expertise in a global company). But critically, they remain involved in the cluster, reinvesting their wealth and experience to create more entrepreneurial activity. Some will become serial entrepreneurs, starting new businesses. Others will become business angels, providing start-up funding for new businesses and contributing their experience through a position on the board of directors. Some may even set up a venture capital fund.

Entrepreneurial ecosystems are also characterised as being 'information rich'. In such an environment individuals can access information and knowledge on new buyer needs, new and evolving technologies, operating or delivery possibilities, component and machine availability, and service and marketing concepts, and thereby can more easily perceive gaps in products, services or suppliers to fill. Geographic proximity and tacit knowledge sharing often go hand-in-hand (Gertler, 2003). Hence, entrepreneurial ecosystems will also have "bridging assets" that serve to connect people, ideas and resources. The availability of finance is a further critical feature of entrepreneurial ecosystems. Universities also play an important role in entrepreneurial ecosystems, but

not the re-eminent role that is often attributed to them. First, leading research-based universities are not found in every ecosystems.

Finally, it is important not to overlook the presence of service providers – lawyers, accountants, recruitment agencies and business consultants – who understand the needs of entrepreneurial businesses and can assist young firms in avoiding stumbling blocks and perform non-core activities that are outsourced. Such firms are often willing to offer their support to start ups at no charge with the expectation that long term business relationships will emerge in due course.

3 The Dynamic Nature Model of Entrepreneurial Ecosystems

There are limits to the value of identifying generic features of entrepreneurial ecosystems. First, each ecosystem has emerged under a unique set of conditions and circumstances. Second, the time dimension is ignored. However, they are discussed as if they emerged fully formed and do not change. There is little understanding of how successful entrepreneurial ecosystems come into being and evolve (Feldman and Braunerhjelm, 2004).

The first point is that entrepreneurial ecosystems do not emerge just anywhere. As noted in the previous section, entrepreneurial ecosystems have typically emerged in places that already have an established and highly regarded knowledge base which employs significant numbers of scientists and engineers. These knowledge institutions – research universities, public research laboratories and corporate R&D labs – perform several roles in seeding the cluster. First their research generates the scientific discoveries, technological advances, and advancement of knowledge that form the basis for the creation of new businesses. Second they are ‘talent magnets’, attracting talented individuals in the form of eminent scholars, gifted students and ambitious scientists and engineers, further boosting the technological capacity of the region and increasing the pool of individuals who might become future entrepreneurs and employees.

There also needs to be incubator organisations which foster future entrepreneurs. This is where the entrepreneur acquires technical skills and product and market knowledge and develops understanding about appropriate organisational structures, strategies and systems. It is also where, in the course of their work experience they notice market opportunities and identify ways of exploiting them.. Indeed, it is often through this process of job mobility that scientists and engineers derive their management experience. This study also noted that although the last organisation that the entrepreneur worked in before starting their own business was often a small firm, they did have significant prior working experience in large firms. The most effective incubator organisations are rapidly growing firms operating on the cutting edge of new technology, active in the early phases of a new industry and generating too many commercial opportunities to take advantage. Garnsey and Heffernen (2005) have identified the importance of Acorn Computers as a source of spin-offs in Cambridge. Effective incubators also need to provide their employees with exposure to best practice technology and intimate knowledge of markets and customers to uncover business opportunities. Indeed, many of the entrepreneurial

ecosystems in the emerging economies are heavily mediated by foreign direct investment (FDI) which strongly resembles this truncated model. Often in these ecosystems, government intervention undertakes much more proactive forms of intervention to compensate for a lack of local subsidiary autonomy.

Government research laboratories are also ineffective incubators. They lack exposure to markets and their research often does not have an immediate commercial application (Lawton Smith, 1998). For the same reason most universities are also poor incubators. As noted above, while there is evidence of spin-offs such firms typically achieve limited growth (Harrison and Leitch, 2010).

There is an overwhelming tendency for spin-off companies to be located in close proximity to the incubator organisation. This results in clustering. There are three reasons for this. The most important is that entrepreneurs need to utilize their social networks of business associates and former employees to access the knowledge, human capital and other resources needed to start and grow their business. These networks “bind entrepreneurs to the locations in which they reside because only there do they have the access to the resources and social support required to sustain their entrepreneurial ventures (Sorensen, 2003: 24). Second it avoids disrupting family ties, enabling the spouse to continue working and bring income into the household. Third, locational preferences may play a role. As noted earlier, many entrepreneurial ecosystems have emerged in locations of high residential amenity. Moreover, many of the entrepreneurs had moved to the area earlier in their career, in part for quality of life considerations which now operated to anchor them in the locality when they started their business.

Finally, some entrepreneurial ecosystems have emerged for exogenous or even serendipitous reasons.

Once the spin-off process gathers momentum it sets in motion a virtuous, self-reinforcing process which leads to the creation of an ecosystem that nurtures and supports further entrepreneurial activity. One of the consequences is that founding a firm at an early stage in a cluster’s development is very different to founding a firm when the cluster is established (Bresnahan et al, 2001). First, successful businesses provide role models and create legitimacy for further entrepreneurial activity. Spin-offs also have the effect of diffusing high level expertise and competencies within the region when individuals carrying technical and management know how and ‘embodied expertise’ move to new organisations as founders or key employees, taking ideas that they have acquired in other local organisations, creating a process of regional collective learning (Keeble and Wilkinson, 1999). A further effect of spin-offs is that they create the critical mass which stimulates the emergence of an entrepreneurial support network (Kenney and Patton, 2005) that sustains and nourishes the creation and growth of entrepreneurial businesses. This comprises three types of service:

- Specialist business services: notably, law firms with deep expertise in handling IP, marketing firms, executive search firms, accountancy practices that are familiar with the unique needs of technology start-ups, technology marketing and PR firms, management consultants, and technology assessment consultants

- Technical services: precision machining, prototyping, precision moulding, testing, etc.
- Finance providers: venture capital firms, investment banks specialising in IPOs

These support services facilitate the process of business start-up and growth by enabling new firms to focus on their area of expertise while buying-in specialist service and support (Saxenian, 1994).

As the spin-off process gathers momentum so institutions emerge – often through the collective action of the entrepreneurial community - to nurture and encourage the formation of new firms and to solve problems which individual firms cannot solve individually, skilled labour is attracted to the region, and local institutions to develop specialist training courses (Wolfe and Gertler, 2004). These are of two main types (Corona et al, 2006): (i) technology incubation mechanisms, such as incubators, innovation centres and science parks, to provide physical space and intangible support to new technology based firms; these can be public or private sector and often designated as not-for-profit; and (ii) partnership organisations, usually comprising government, universities and the private sector, to promote networking and collaboration between members and which can ‘champion’ the region both internally and externally.

The important point to note is that the supportive conditions for entrepreneurship spontaneously follow the process in which entrepreneurship takes hold in an ecosystem. This is particularly the case with the availability venture capital – which is widely seen as a necessary attribute for technology clusters (Malecki, 1997; Norton, 2001), being required for the sustained growth and development of a cluster (Llobrera et al, 2000). Without venture capital the cluster is likely to stagnate or decline (Feldman et al, 2005). But as several authors have noted, venture capital lags rather than leads the emergence of entrepreneurial activity: it is not part of the initial environmental conditions (Saxenian, 1994; Feldman, 2001; Mason et al, 2002; Garnsey and Heffernan, 2005).

4 Supporting Entrepreneurial Ecosystems: the role of policy

Both framework conditions and general start-up policies have proved to have limited effectiveness in increasing the number of number of HGFs. The objective of ecosystem policy is to achieve this goal by improving the environment that surrounds such firms. But, this poses challenges for public policy since it is not obvious from this discussion how government intervention might promote the emergence of entrepreneurial ecosystems or stimulate the key processes of spin-offs and the emergence of entrepreneurial support in its various forms. Indeed, it is difficult to point to any entrepreneurial ecosystem that has arisen through direct government intervention. There are certainly no simplistic policy solutions or ‘silver bullet’ (Isenberg, 2011a).. This section is in two parts. First, it discusses a number of general principles that underlie the development of policies to promote entrepreneurial ecosystems. It then develops taxonomy of approaches to intervention at the level of the individual ecosystem.

First, policy-makers need to recognize that ‘you cannot create something from nothing’. We noted earlier that entrepreneurial ecosystems are based on pre-existing assets and not just a tool for high-tech industries. Traditional industries like food and drink, energy, logistics, water industry, manufacturing all provide the platform to create dynamic, high-value added entrepreneurial ecosystems. They were generally perceived to be nice places in which to live and already had some significant notably knowledge-based organizations.. However, it is doubtful that policy can systematically ‘create’ entrepreneurial ecosystems.

Second, policy approaches need to evolve over time. Ecosystems are dynamic, complex organisms. Appropriate forms of intervention will therefore be related to the maturity of the ecosystem. For example, at the emergence stage the emphasis may need to be on supporting the start-up processes, but as the ecosystem matures the need to help firms with organizational development, human capital development, internationalization support and access to growth capital will increase..

Third, here is no ‘one size fits all’ approach. Every ecosystem is unique. Many of the components will differ from one ecosystem to another. Local cultural attitudes, the structure of local banking systems and educational policies will all affect the nature of these local ecosystems. An approach which simply seeks to duplicate other ecosystems is therefore inappropriate and likely to fail.. Every ecosystem needs a different approach that is customized to local circumstances. This is underlined by the proliferation of ‘Silicon Somewhere’ (Hospers et al, 2008) which have largely turned out to be policy-driven promotional exercises which paid little attention to the specific nature and capabilities of the specific localities (Martin and Sunley, 2003).

Fourth, initiatives are likely to be ineffective if introduced in isolation. For example, increasing the supply of venture capital is unlikely to be effective if there is no deal flow. Encouraging more people to create start-ups is likely to have little impact if many occur in low growth areas. Introducing entrepreneurship education will be ineffective if graduates move to more conducive entrepreneurial environments. Policy implementation has to be holistic.

Fifth, developing entrepreneurial ecosystems has to be a blend of ‘top down’ and ‘bottom up’ approaches. Appropriate framework conditions are essential. For example, immigration laws should not provide a barrier to the attraction of talented individuals. Property rights need to be enshrined. Both corporate and individual taxation needs to provide appropriate incentives both to reward risk-taking and encourage reinvestment. On the other hand, grants and subsidies should be avoided as they may distort entrepreneurial behaviour. But there also a need for ‘bottom up’ initiatives to improve the environment. Moreover, these bottom up initiatives should not be seen as the exclusive responsibility of government. As noted earlier, Feld strongly argues that the development of entrepreneurial ecosystems requires active input from the entrepreneurial community. Isenberg (2012) sees the possibility of ‘tipping points’ when ecosystems become self-sustaining, thereby enabling government involvement to be significantly reduced.

Sixth, it is important to recognize the distinction between small business policies and entrepreneurship policies. Small business policy is a rather scattergun approach which

focuses on increasing the number of business start-ups. Shane (2009) has memorably described this approach as ‘bad public policy’ on account of their limited growth, short survival and high failure rates and high displacement of the vast majority of start-ups. Nevertheless, this approach is deeply embedded in public policy (Nightingale and Coad, 2014). Entrepreneurship policy, in contrast, is concerned with supporting businesses with high growth potential. Such firms are more likely to require relational rather than transactional assistance. Moreover, they are likely to benefit most from peer-based support (Fischer and Reuber, 2003; Mason and Brown, 2013) on account of the greater opportunities for experiential learning and tacit knowledge sharing. Moreover, in view of the “idiosyncratic and unstable” nature of firm growth (Vinell and Hamilton, 1999) such support needs to be time-sensitive, aimed at supporting firms that have experienced ‘growth triggers’ and therefore experiencing systemic changes to their structure and workings (Brown and Mawson, 2012).

Finally, policies to promote high growth entrepreneurship need to recognise the diverse nature of HGFs rather than basing them on stereotypes (Mason and Brown, 2013; Brown et al, 2014). At least ‘six myths’ can be identified (Brown et al, 2014): HGFs are not all new/young; they are not predominantly in high tech sectors; universities are not a major source of HGFs; few HGFs are venture capital-backed; they do not exhibit linear growth – fast growth is episodic; and they do not only grow organically – acquisition is also significant.

5 Conclusions

The concept of entrepreneurial ecosystems draws upon a long and rich lineage of intellectual inquiry by scholars from economic geography, economics and other disciplines, all seeking to explain why firms cluster together in geographical space and benefits that arise from this clustering for individual businesses. So, what does the entrepreneurship ecosystem perspective offer that is intrinsically ‘new’ or original? First, it has merit as a metaphorical device which offers a holistic understanding how clusters of economic activity come into being and specifically to offer a new perspective on firm growth which emphasizes the firm’s external environment rather than its internal characteristics and operations. Second, it shifts the unit of analysis away from the ‘firm’ to the entirety of the ecosystem where it is situated. This is important because often these externalized and relational aspects strongly mediate firm performance. It is also important to stress the dynamic nature of ecosystems as evolutionary rather than a static phenomenon that can be captured, like a picture, by a snapshot at a given point in time.

From a policy perspective, the implication from the entrepreneurial ecosystem view is that the goal of generating more HGFs requires the cultivation of an ecosystem that is supportive of the needs of ambitious entrepreneurs. Beyond that, its value as a tool to guide policy – and HGF policy in particular – is less obvious. Indeed, it emphasizes the limits of policy. Certain basic economic and social factors need to be present for the emergence of ecosystems, but these on their own are insufficient. Entrepreneurial ecosystems emerge and evolve in response to specific circumstances, usually operating in

combination. In some cases it is triggered by the contraction or closure of an established company. Hence, policy is unable to influence when an entrepreneurial ecosystem develops momentum. On the other hand, the spin-off process, which drives the growth of the ecosystem, is facilitated by particular environmental attributes, notably the presence of talented people, knowledge, networks, the presence of role models and the availability of advice, mentoring and resources to support entrepreneurial activity. Indeed, the more entrepreneurial activity there is, the more that further entrepreneurial activity is stimulated. This provides greater opportunities for policy intervention. However, some of the leading proponents of the entrepreneurial ecosystem approach question whether government has the competence to intervene directly and so urge caution, recommending instead that it should encourage, facilitate and enable both the entrepreneurial community themselves and the large established businesses that anchor the ecosystem to drive it forward.

References

- Adams, S (2011). Growing where you are planted: exogenous firms and the seeding of Silicon Valley, *Research Policy*, 40 (3), 368-37
- Amini, S., Keasey, K. and Hudson, R. (2012) The equity funding of smaller growing companies and regional stock exchanges, *International Small Business Journal*, 30, 832-849.
- Bleda, M., Morrison, K. and Rigby, J. (2013) The Role and Importance of Gazelles and Other Growth Firms for Innovation and Competitiveness, in Cox, D. and Rigby, J. (Eds) *Innovation Policy Challenges for the 21st Century*, pp. 36-63, Routledge, London.
- Borras S. and Edquist, C. (2013) The choice of innovation policy instruments, *Technological Forecasting and Social Change*, 80, 1513-1522.
- Block, F. (2008) Swimming against the current: the rise of a hidden developmental state in the United States, *Politics and Society*, 36, 169-206.
- Brown, R. (2011). The determinants of high growth entrepreneurship in the Scottish food and drink cluster. In G. Alsos, S. Carter, E. Ljunggren, & F. Welter (Eds.), *The handbook of research on entrepreneurship in agriculture and rural development*. Edward Elgar: Cheltenham.
- Brown, R. and Mason, C. (2012) Raising the Batting Average: Re-Orientating Regional Industrial Policy to Generate More High Growth Firms, *Local Economy*, 27, 33-49.
- Brown, R. and Mawson, S. (2013) Trigger points and high-growth firms: A conceptualisation and review of public policy implications, *Journal of Small Business and Enterprise Development*, 20, pp. 279-295.
- Brown, R. and Mawson, S. (2014) The Geography of Growth in High Growth Firms: The Implications of 'Growing Abroad', School of Management Working Paper, University of St Andrews.
- Coad, A. (2009) *The Growth of Firms: A Survey of Theories and Empirical Evidence*, Edward Elgar, Cheltenham.
- Coad, A. Daunfeldt, S-O. Hozl, W. Johansson, D and Nightingale, P. (2014) High-growth firms: introduction to the special issue, *Industrial and Corporate Change*, 23, 91-112.
- Cooke, P (2001) Regional Innovation Systems, Clusters, and the Knowledge Economy, *Industry and Corporate Change*, 10, 945-974
- Corona, L, Doutriaux, J and Mian, S A (2006) *Building Knowledge Regions in North America*. Edward Elgar: Cheltenham, Glos.

- Feld, B (2012) *Startup Communities: building an entrepreneurial ecosystem in your city*, Hoboken: NJ, Wiley.
- Feldman, M P (2001) The entrepreneurial event revisited: firm formation in a regional context, *Industrial and Corporate Change*, 10: 861-891.
- Feldman, M and Braunerhjelm, P (2004) The genesis of industrial clusters. In P. Braunerhjelm and M Feldman (eds) *Cluster Genesis: technology-based industrial development*, Oxford: OUP, pp 1-15.
- Feldman, M. A. Francis, J. and Bercovitz, J. (2005) Creating a Cluster While Building a Firm: Entrepreneurs and the Formation of Industrial Clusters, *Regional Studies*, 39, 129-141.
- Fischer E. and Reuber A. (2003) Support for Rapid-Growth Firms: A Comparison of the Views of Founders, Government Policymakers, and Private Sector Resource Providers, *Journal of Small Business Management*, 41, 346-365.
- Florida, R. (2002). *The Rise of the Creative Class: And How it's transforming work, leisure, community and everyday life*. New York: Perseus Book Group
- Garnsey, E and Heffernan, P (2005) Growth setbacks in new firms, *Futures*, 37, 675-697.
- Gertler, M. (2003) Tacit Knowledge and the economic geography of context, or The indefinable tacitness of being (there), *Journal of Economic Geography*, 3, 75-99.
- Garnsey, E., Stam, E. and Heffernan, P. (2006) New firm growth: Exploring processes and paths, *Industry and Innovation*, 13, 1-20.
- Gilbert, B A, McDougall, P P and Audretsch, D B (2008) Clusters, knowledge spillovers and new venture performance: an empirical examination, *Journal of Business Venturing*, 23, 405-438.
- Harrison, R. and Leitch, C. (2010) Voodoo Institution or Entrepreneurial University? Spin-Off Companies, the Entrepreneurial System and Regional Development in the UK, *Regional Studies*, 44, 1241-1262.
- Isenberg, D (2011a) The entrepreneurship ecosystem strategy as a new paradigm for economy policy: principles for cultivating entrepreneurship, Babson Entrepreneurship Ecosystem Project, Babson College, Babson Park: MA
- Isenberg, D (2011b) When big companies fall, entrepreneurship rises, *Harvard Business Review*, <http://blogs.hbr.org/2013/03/when-big-companies-fall-entrep/>
- Kantis, H. and Frederico, J. (2011) Entrepreneurial Ecosystems in Latin America: the role of policies, Download from: http://www.innovacion.gob.cl/wp-content/uploads/2012/06/Entrepreneurial-Ecosystems-in-Latin-America_the-role-of-policies.pdf
- Keeble, D and Wilkinson, F (1999) Collective Learning and Knowledge Development in the Evolution of Regional Clusters of High Technology SMEs in Europe, *Regional Studies*, 33 (4): 295-303.
- Kenney, M and Patton, D (2005) Entrepreneurial geographies: support networks in three high-technology industries, *Economic Geography*, 81: 201-228.
- Lawton Smith, H. (1998) National laboratories and regional development: case studies from the UK, France and Belgium, *Entrepreneurship and Regional Development*, 8: 1-17.
- Llobrera, J.T., D.R. Meyer and G. Nammacher (2000) 'Trajectories of industrial districts: impact of strategic intervention in medical districts', *Economic Geography*, 76, 68-98.
- Malecki E J. (2011) Connecting local entrepreneurial ecosystems to global innovation networks: open innovation, double networks and knowledge integration, *International Journal of Entrepreneurship and Innovation Management*, 14, 36-59.
- Malecki, E J and Nijkamp, P (1988) Technology and regional development: some thoughts on policy, *Environment and Planning C*, 6 (4), 383-399

- Martin, R. and Sunley, P. (2003) Deconstructing clusters: chaotic concept or policy panacea? *Journal of Economic Geography*, 3, 5-35.
- Mason C. and Brown R. (2013) Creating good public policy to support high growth firms, *Small Business Economics*, 40, 211-225.
- Mason, C M and Harrison, RT (2006) After the exit: Acquisitions, entrepreneurial recycling, *Regional Studies*, 40, 55 – 73
- Neck, H M, Meyer, G D, Cohen, B and Corbett, A C (2004) An entrepreneurial system view of new venture creation, *Journal of Small Business Management*, 42,:190-208.
- Napier, G and Hansen, C (2011) Ecosystems for Young Scaleable Firms, FORA Group.
- Nightingale, P. and Coad, A. (2014) Muppets and gazelles: political and methodological biases in entrepreneurship research, *Industrial and Corporate Change*, 23, 113-143.
- Norton, R D (2001) *Creating the New Economy : The Entrepreneur and the U. S. Resurgence*, Edward Elgar: Cheltenham.
- Parsley, C. and Halabisky, D. (2008). Profile of growth firms: A summary of industry Canada research. Industry Canada, Ottawa.
- Rodriguez-Pose, A. (2013) Do Institutions Matter for Regional Development? *Regional Studies*, 47, 1034-1047.
- Rodrik, D (2008) *Industry Policy for the Twenty First Century*, Harvard University, Harvard
- Saxenian, A (1994) *Regional Competitive Advantage: culture and competition in Silicon Valley and Route 128*. Harvard University Press: Cambridge, MA.
- Sorsenson, O (2003) Social networks and industrial geography, *Journal of Evolutionary Economics*, 13, 513-527.
- Tanichev, A. (2009) “Using Long Cycles Theory for Mastering Growth Strategy”, Proceedings International Scientific Conference “Insights into the Sustainable Growth of Business”, 19-21 November, Vilnius, Lithuania
- Tanichev A. (2010) Networking as a key factor for successful implementation of innovations (comprehensive analysis of Russian and European experience). ACTA Technica Corviniensis: 4, 71-76
- Vinnell, R and Hamilton, R T (1999) A historical perspective on small firm development, *Entrepreneurship Theory and Practice*, 23 (4) 5-18.
- Warwick, K (2013) Beyond Industrial Policy: emerging issues and new trends, OECD Science, Technology and Industry Policy Papers, No 2. OECD Publishing (<http://dx.doi.org/10.1787/5k4869clw0xp-en>)
- Wolfe, D A, Gertler, M S (2004) Clusters from the Inside and Out: Local Dynamics and Global Linkages, *Urban Studies*, 41,(5/6), 1071–1093
- Zacharakis, A. Shepard, D. and Coombs, J. (2003) The development of venture-capita-backed internet companies: An ecosystem perspective, *Journal of Business Venturing*, 18, 217-231.

Exploring the Relationship between Human Resource Management, Entrepreneurial Orientation, and Firm Performance: a Systematic Literature Review

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Abstract

As a growing field of analysis in management studies, several scholars have been looking at the role of human resource management (HRM) practices in boosting a firm's entrepreneurial orientation (Tansky et al., 2009). On the other hand, entrepreneurial orientation has been repeatedly proven to positively impact firm performance both at the organizational level, but also at the level of enterprise clusters. This means that within high-entrepreneurial orientation firm clusters, both the overall cluster and the firms' individual performances are positively affected (Yao et al., 2009). However, existing literature provides little guidance on how HRM practices could help firms improve their performance through fostering entrepreneurial orientation. This paper aims to shed more light on how human resource management could become a major driver of firm performance while leveraging on learning to translate individual and collective abilities into value adding entrepreneurial actions. For this purpose, this paper follows a systematic literature review as a recognized evidence-based tool for theory building (Tranfield et al., 2003). The objective is to develop an integrative theoretical framework that explains how HRM practices provide firms with superior performance, using entrepreneurial orientation as an intermediate construct. A 'grounded theory' approach was used to build higher-order theoretical constructs and the assumptions underpinning their relationships (Glaser and Strauss, 1967). We therefore followed an inductive process based on a comparative analysis to synthesize the gathered information from the

systematic literature review, build on to emphasize the meaning of each concept, and then develop the propositions underpinning the relationships between the studied constructs, which in turn form the foundations of the integrative theoretical framework.

Keywords – Human Resource Management, HRM Practices, Entrepreneurial Orientation, Corporate Entrepreneurship, Firm Performance

Paper type – Academic Research Paper

1 HRM practices

To study the effect of HRM practices on employees' entrepreneurial learning, let us first determine a base definition of HRM practices within a company. There seems to be a general agreement within the field regarding the conceptual scope of HRM practices. An HRM system includes a number of functions, activities, and processes that, put together, are organizing the firms' human capital (Kaya, 2006). The main categories of HRM activities are related to (1) identifying, attracting, and hiring potential talents that can contribute to firm performance, (2) facilitating the development of knowledge, skills, and attitudes that contribute to the company's achievements, (3) compensating employees for their contribution to the firm's success through financial and non-financial rewards, (4) monitoring the performance of the employees to ensure their contribution to the company's achievement of goals, and (5) coordinating the relations and communications between employees and departments to accommodate their needs (Edralin, 2010).

The definitions of HRM practices put employees as the main subject matter that HRM is dealing with. From a different perspective, HRM is viewed as managing the sets of knowledge, skills, and abilities considered relevant to the firm; thus, putting KSAs as the main focus of HRM (Schmelter et al., 2010). In this framework, HR functions, activities, and processes are established by firms to ensure that the employees' abilities and attitudes are continuously developed to allow the firm to attain its goals and objectives (Tang et al., 2015). This is generally based on the widely embraced theory of human capital which argues that under the management of HR practices, the knowledge, skills, and abilities of employees provide a true economic value to the firm (Teo, 2008). Regarding all these practices, Tang et al. (2008) refer to strategic HRM, and how the different functions, activities, and processes are to be viewed as a set that needs to align among its components and to be aligned with the overall strategy of the firm. Firm's HRM practices are indeed seen to be critical to ensure the cohesion between its different organizational departments through maintaining communication channels within the company (Kaya, 2006). By being aligned with the overall company performance goals, installing the appropriate HR practices can provide a strong support system and an organizational framework which ensures that all departments and employees are contributing to the achievement of the short-term but also the strategic performance objectives of the firm.

Different HRM practices have been studied in details to prove their contribution to an organization's performance. Notably, research has proven the role of training and

development. In the rapidly changing business landscape, the ability of adaptation and change is indeed critical to the survival of small and also large firms (Cucculelli and Bettinelli, 2015). Change within an organization requires a change in the behavior of employees, which in turn requires a cognitive change. Through training, the HR department works on assessing the competency gap and developing the skills required to prepare the firm for change (Murray & Donegan, 2003). It is also concluded that an effective HRM system needs to be directed towards the firm's strategic plans to be able to properly evaluate and develop the competencies needed to support its overall strategies (Tang et al., 2015). For learning to be beneficial to the firm, research has proven the necessity for firms to establish a structured process for organizational human resource development (Vasconcelos et al., 2016). First, the organizational learning process starts with information acquisition. Acquiring information can be through the intentional effort of the firm to collect relevant data by conducting customer feedback surveys for example. On the other hand, the company can have existing information about a certain aspect of its business. The second step is to analyze and interpret the information on hand. Analysis and interpretation can be done by different departments, each having a different perspective on the subject matter. When analyzing the firm's performance, for example, the finance department will give a quantitative interpretation of the financial performance, while the marketing department might have a qualitative interpretation of the intangible performance of the firm. The next step is conducting focused experimentation. This step aims at testing the outcomes of the interpretation process of information and to test its conclusions in a more controlled environment. Then, the outcomes of the focused experimentations are disseminated within the firm and communicated within the firm. The last structured step of the process is knowledge restructuring, where the firm as a whole incorporates the new findings, conclusions, and lessons to update its knowledge (Vasconcelos et al., 2016).

Research has also looked at the role of HRM in establishing an organizational structure within the firm. By organizing the hierarchical relationships between departments and employees, the HR department is directly responsible for organizing the workflow and ensuring its effectiveness and efficiency (Theodorakopoulos and Figueira, 2012). Through HR practices such as observing the employee's daily tasks, conducting interviews, analyzing job descriptions, and appraising performance, the HR department can work on analyzing productivity and restructuring the organization's processes (Murray and Donegan, 2003). Practices of company restructuring can be required for instance during times of change implementation, or simply when the company decides to optimize its resources, improve its productivity, or take advantage of a new opportunity (Kuratko et al., 2001). Evidence showed that for service firms to be competitive it is important to restructure their HR to establish an organizational structure that allows for participative decision-making and an inclusive organizational culture (Teo et al., 2008). At a larger scale, company restructuring can be legislated by governments as part of strengthening an industry to overcome an economic crisis. For instance, in 2009 the banking sector in Nigeria had to introduce a series of restructuring practices including HRM interventions to overcome the crisis (Abosed et al., 2018). The mediating role of

HR practices are also playing a critical role in establishing and maintaining the organizational culture. By organizing the relationships within departments and between management and subordinates, HRM policies are on one hand reflecting the management's philosophy and culture, and on the other hand, they are also contributing to the creation and continuous development of the firm's organizational culture (Tang, 2015).

This brings us to develop the following proposition:

Proposition 1: HRM is a set of practices and processes aiming to leverage on employees' knowledge, skills, and abilities to strengthen and further develop organizational capabilities and turn them into performance outcomes. The strategic objective of HRM is to attract, develop, and retain talented employees and to create the necessary conditions for them to use their competences to help the company achieve its strategic goals.

2 Entrepreneurial orientation

Entrepreneurial orientation was defined as the firm's tendency and ability to identify new opportunities (Park et al., 2017). Entrepreneurial orientation is not only about the identification of opportunities, but also the firm's capability to take advantage of these value-generating opportunities (Vasconcelos, 2016). This identification process is facilitated by individual employees, also called intrapreneurs, whose motivations are intrinsic, but who are also expecting the firm to reward their entrepreneurial endeavors (Kaya, 2006). Entrepreneurial orientation is believed to be the driving force behind the adoption of innovative behaviors and is leading firms to be more dynamic and flexible with regards to environmental changes (Kearney, 2013). The entrepreneurial spirit within the firm is the proactive drive to achieve novel capabilities and to update the firm's knowledge to exploit new opportunities (Real, 2014). Entrepreneurial orientation within a firm has been functionally defined as the set of practices, methods, and decision-making strategies that are used by the management to engage in entrepreneurial activities (Real, 2014). Miller's three dimensions have been identified and repeatedly used in existing literature to understand entrepreneurial orientation:

The first dimension is innovativeness, and it refers to searching for novel, original, and creative solutions and challenges (Dess and Lumpkin, 2005). Firms can generally come up with radical and incremental innovative changes, as well as technological and non-technological innovations (Omar et al., 2016). Innovation can be categorized into product, process, and market innovations. Product innovation consists of improvement in the products and services of a firm, for example, by introducing new materials or new designs. Product innovation is believed to increase the variety, value, rarity, inimitability, and differentiation of the firm's offerings, and thus, contributing to its competitiveness in the market and financial performance (Sher and Yang, 2005). Product innovation is generally capital intensive, especially as technology-based innovations and products are becoming obsolete faster (Sher and Yang, 2005). Process innovations are bringing novel ways for the company to conduct some of its operations such as the digitalization of some

administrative tasks. Process innovations aim at improving the efficiency and effectiveness of the company's operations and have been proven to increase productivity and to reduce the overall fixed costs (Kuratko et al., 2001). Finally, market innovation refers to finding new target segments, foreign markets, or niche for a firm's products and services (Gupta et al., 2014). It also includes finding new ways to serve clients in these markets through new distribution processes for instance (Cucculelli & Bettinelli, 2015).

The second aspect of entrepreneurial orientation is proactiveness, and it refers to a firm's aggressiveness in taking action. This factor determines how a firm reacts to current and anticipated market trends (Mohamad et al., 2011). A proactive firm works on predicting changes, opportunities, and threats and strategically acts on them (Serai et al., 2017). It is constantly in search of new solutions and opportunities; and mostly does not engage activities just as a reaction to outside changes (Dyduch, 2008). Urban and Sefalafala (2015) have studied how proactive activities, such as attending foreign trade fairs, particularly help firms in their internationalization strategy. Proactive firms that successfully enter a new market, adopt a new administrative process, or implement a new technology to get the first mover advantage and are likely to benefit from this pioneering position (Dess and Lumpkin, 2005). Proactivity not only allows firms to be industry leaders, but many even seek to change the whole industry and competitive landscape they operate in. Dell is a good example of how a single company's proactive action of selling computers directly to consumers, has changed the way computers are sold in the entire industry (Dess and Lumpkin, 2005).

Finally, entrepreneurial orientation is also related to a firm's tendency and readiness to take risks in investing in new business opportunities whose outcomes are uncertain (Real et al., 2014). Different firms and managers have different aversion levels towards risk. Risks are taken with the assumption that they have a considerable chance of generating high financial returns. This assumption should be backed up by intensive research and risk assessment to minimize the uncertainty and determine the acceptable balance of manageable risk and expected returns (Dess and Lumpkin, 2005). As entrepreneurial endeavors are novel by definition, they do have an inherently high risk. Haar et al. (2009) looked at the owner's passion as a driver of entrepreneurial orientation, finding that passionate owners and managers are more likely to take risks and successfully generate returns from them. However, being too passionate can negatively affect their evaluation of risk and can lead them to keep on pursuing failing business opportunities.

Entrepreneurial orientation has also been linked to organizational learning which represents the firm's attitude towards learning. In practice it is the managerial process that facilitates learning and knowledge seeking within the firm (Real et al., 2014). The nature of entrepreneurial activity involves the continuous update of knowledge, skills, and abilities to be able to identify and take advantage of novel opportunities. Two aspects of learning within an organization can be identified. First, the process of exploration enabling the firm to acquire new information and work on assimilating this new knowledge. The second aspect refers to the exploitation of what has been learned using logical tools and with the aim of applying the new acquired knowledge (Real et al., 2014). Organizational learning can also be viewed from the perspective of information sharing

channels. Feedforward learning refers to the passing of knowledge from individual employees to the group and then the organization; while feedback learning refers to organizations transferring knowledge to groups and individuals (Real et al., 2014). Integrating these channels has proven to boost firms' entrepreneurial ability since establishing a structured process of learning is leading firms to generate a new understanding of market opportunities. New knowledge, paired with the firm's existing resources and capabilities are helping firms to continuously update the knowledge, skills, and abilities necessary to engage in entrepreneurial activities (Real et al., 2014).

From this discussion the following proposition is formulated:

Proposition 2: Entrepreneurial orientation is an organizational capability that translates the firm's ability to generate new product, process, and market innovations. Entrepreneurial orientation encompasses innovativeness, proactiveness, and risk taking attitudes. Individual and organizational learning supports the firm's intrapreneurship capability through generating new knowledge resources and turning such idiosyncratic assets into innovations.

3 HRM practices and entrepreneurial orientation

HRM practices play a fundamental role in boosting a firm's entrepreneurial orientation as illustrated in various studies (Tansky et al., 2009). Kaya (2006) in his study of Turkish firms demonstrated that through activities such as structuring and assisting participative leadership, risk taking, and development of innovative strategies, HRM practices can maximize the effect of value-creating entrepreneurial activities within firms. Notably, practices of training and hiring were mentioned to be particularly important in selecting candidates that exhibit attitudes and behaviors that align with the firm's strategic goals and entrepreneurial orientation, and that continuously engage in developing their skill set. The model proposed used the following HRM practice measures: (1) training on job skills, (2) extensive training, (3) training in multiple functions, (4) written policy, (5) team activities, (6) communication of strategy, (7) interaction facilities, (8) incentives to meet objectives, (9) behavior and attitude, and (10) feedback on performance. It is concluded that firms seeking to enhance corporate entrepreneurship should invest in the development and implementation of the appropriate HRM practices.

Tang et al. (2015) investigated the effectiveness of HRM in promoting corporate entrepreneurship in the Chinese context, while considering the mediation role of devolved management practices between strategic HRM and corporate entrepreneurship. They proved that these two concepts are strongly related. To enhance entrepreneurial orientation, firms need to plan and adjust their HRM practices. The HR practices studied under devolved management include: opening communication channels, decentralizing authority, confiding in employees, delegating tasks, and inspiring subordinates. All of these practices were found to have a positive impact on employee's entrepreneurial orientation. Tang et al. (2015) also highlighted the importance of management style, as a highly contextual factor that considerably differs across cultures, in encouraging entrepreneurial practices. In the same perspective, Zhang and Jia (2010) emphasized the

particularity of the Chinese environments and the social dynamics in the workplace. Their findings suggest that management style and organizational culture play a pivotal role between HR practices and corporate entrepreneurship. Their study also considers the importance of establishing managerial and communication openness as well as a team-oriented environment to encourage employee's entrepreneurial behavior.

Babak (2016) conducted a research in Iran and looked into the hypothesis that HRM practices play a structuring role for entrepreneurial activity through three main aspects in human resource management: (1) empowering employees through improved personal evidences, organizational evidences, professional skills, and management skills; (2) administrative factors in relation to the established organizational structure, control and supervision, performance management, and human resources; (3) motivational factors that include the reward system, management support, personality factors, and job promotions. His research proved that the strongest impact comes from the establishment of empowering and training systems.

To identify the actual HRM strategies that are significant to corporate entrepreneurship, Schmelter (2010) conducted an online survey sampling 214 German companies that operate in a knowledge intensive industry. The team has studied four HRM strategies as independent variables: (1) staff selection, (2) staff development and training (3) staff rewards, and (4) specialist assignment. Also, corporate entrepreneurship was accounted for as a construct of four elements: (1) innovativeness, (2) risk propensity, (3) pro-activeness, (4) new business venturing, and (5) self-renewal. The study proved the positive influence of all the four HRM strategies on corporate entrepreneurship; notably, staff development and training followed by staff rewards had the strongest impacts. Investing in training and development is thus necessary for firms that seek to encourage corporate entrepreneurial engagement. Their study also emphasized the importance of providing insight about the measurements used to evaluate their employees' entrepreneurial engagement, as well as the knowledge, skills, and ability that are aligned with the firm's entrepreneurial orientation.

Another investigation aimed at finding the HRM practices that are the most influencing drivers of corporate entrepreneurship was conducted by Edralin (2010) within large firms in the Philippines. In his hypothesis, he considered innovation as the measure for entrepreneurship and evaluated the effect of the following HRM practices : (1) recruitment and selection, (2) training and development, (3) compensation, (4) performance management, and (5) employee relations. The qualitative analysis showed that recruitment and selection, training and development, and employee relations have a significant positive relationship with entrepreneurship, with the last variable as being the most significant factor. This study concludes with the importance of engaging in employee relations enhancement through for instance group-based introductions, open correspondence and communication channels, fair treatment of all employees, and creating an energetic and constructive atmosphere in the workplace.

Mustafa et al. (2013) studied a framework in which HRM influences corporate entrepreneurship through a specific measurement which is knowledge sharing. The study looked at how some high-performance HRM practices affect manager's behavior in

collecting and donating knowledge within the firm. It investigated the mediating role of managers' knowledge sharing behavior between HRM practices and corporate entrepreneurship. The analysis was based on 292 surveys collected from middle managers working in both private and public firms in Malaysia. The study proved the positive correlation between high performance HR practices, middle managers' knowledge sharing behavior, and corporate entrepreneurship. This research also emphasized the role of middle managers in being the hubs of knowledge, and in being a central drive for learning within the firm.

As a recurrent factor that has been emphasized in numerous studies, HR-enhanced learning plays a fundamental role in boosting corporate entrepreneurship. Learning has been repeatedly considered as a dimension of innovativeness, and thus a considerable aspect of corporate entrepreneurship (Nasution et al., 2011). Employees' knowledge, skills, attitudes, and entrepreneurial competences remain the main trigger of any entrepreneurial activity within the firm (Bin Hashim et al., 2018). In a dynamic environment, such competences require dynamic, consistent, and continuous upgrading and adaptation. Considering the role of HR practices in the assessment of competence gaps and ensuring learning, human resource development becomes a catalyst for entrepreneurial activities within the firm. In addition to considering knowledge and learning as a required input of entrepreneurial activities. Learning also occurs as an outcome of entrepreneurial activities as the identification and implementation of any innovative ideas in the workplace results in experiences that employees and firms can learn from (MacPherson, 2009). Past entrepreneurial experiences can be used as tools to evaluate the effects of such innovations, and to learn from their successes and failures (Park et al., 2017). A firm that enables learning puts in place established processes to evaluate the learning needs of its employees, and provides the strategic training to develop their knowledge, skills, abilities, and creative capabilities (Bratnicka, 2013). Pioneering firms change systematically their HR practices to give more power and autonomy to their employees over their own learning and personal advancement (Vasconcelos et al., 2016). Considering the new knowledge that entrepreneurial endeavors generate, the HR department can also contribute to the promotion of entrepreneurial activity through the establishment of structured learning processes in which new knowledge is both an input and an output of entrepreneurial activities.

This leads us to develop the following proposition:

Proposition 3: HRM practices contribute to enhancing individual entrepreneurial competences and developing organizational entrepreneurship capabilities. The most significant HRM practices include strategic training and development, performance management, and employee relations. Through such activities, HRM promotes both individual and organizational learning that represent the main triggers of any entrepreneurial activity. HRM endeavors also contribute to developing a managerial culture conducive to learning and innovation.

4 Firm performance

Identifying the right measures of business performance is still a concern for both managers and scholars (Marr and Schiuma, 2003). As there are new areas of research and development in the business field, new emerging approaches to evaluating firm performance have been developed. Many frameworks are being currently used for different purposes. However, an integrated framework that has a general approbation in the field is still missing. From the literature, many ways to account for firm performance are identified while emphasizing different indicators.

Performance can be categorized into objective and subjective. Objective performance gives a measurable evaluation of the performance of the company based on tangible figures. Objective performance mostly includes quantitative financial indicators and ratios and can also be distinguished into two types: indicators of profitability and indicators of growth. These indicators aim at projecting in numbers the firm's ability to yield gains, and how these gains improve over time (Bierwerth et al., 2015). Examples of objective performance indicators that researchers have measured include: return on assets (ROA), return on sales (ROS), sales growth (Gupta et al., 2014), IPO and market capitalization (Pastor et al., 2009), total factor profitability (TFP) (Cucculelli and Bettinelli, 2015), among other financial indicators.

On the other hand, subjective performance relies on stakeholder's perception of performance (Bierwerth et al., 2015). Although these indicators are based on intangible and subjective measures, they play an important role in accounting for the complexity of both internal and external forces influencing a company's performance. Taking into consideration that objective indicators fail to account for long-term outcomes and predict future performance, subjective performance is crucial to have a more global evaluation of the firm's real performance (Ali et al., 2016). Data regarding firm's subjective performance is usually collected through surveys and judgmental questions while involving different stakeholders, and generally goes through both quantitative and qualitative analysis. Examples of subjective performance indicators include customer satisfaction, employee satisfaction, perceived profitability, and manager's opinion. These aspects of a company's performance are considered to be strategic assets that although do not necessarily materialize into direct financial gains, they do have a considerable effect on the overall firm's performance.

Non-financial performance directly relates to intangible assets. Such idiosyncratic resources, such as R&D capabilities and licenses, represent a considerable performance driver. They are specifically identified as key resources in gaining competitive advantage in innovation-driven industries as well as for companies operating in international markets (Hsu et al., 2011). The relevance of intangible assets has been repeatedly proven in existing literature. However, an established framework to account for it is still missing. Literature recognizes the importance of performance frameworks taking intangible performance proxy indicators into account while evaluating a firm's performance. For instance, Cucculelli and Bettinelli (2015) used in their study the financial value of R&D and advertising expenses as a performance measure.

Based on the above discussion we suggest the following proposition:

Proposition 4: Firm performance encompasses both objective and subjective measures and indicators. Non-financial measures account for the intangible performance of a company. Such performance relates to the use of idiosyncratic resources that reflect the company's potential to grow and generate value for its stakeholders.

5 Entrepreneurial orientation and firm performance

Entrepreneurial orientation has been repeatedly proven to positively impact firm performance both at the organizational level, but also at the level of enterprise clusters. This means that within high-entrepreneurial orientation firm clusters, both the overall cluster and the firms' individual performances are positively affected (Yao et al., 2009). The existing literature considers different indicators to measure such an impact. Most researchers used different financial (Goosen et al., 2002), and non-financial (Mohammed et al., 2017) indicators to account for firm performance as a consequence to entrepreneurial orientation. Abosed et al. (2018) for instance took manager's perceived international business performance as an indicator. They proved the significant effect of five items of corporate entrepreneurship on international performance. They concluded that Nigerian banks that are expanding internationally are affected by their engagement in corporate entrepreneurship, and thus should adopt innovative, venturing, and proactive strategies. Ambad and Abdul Wahab (2016) also investigated the effect of corporate entrepreneurship on the performance of Malaysian large companies. This research used profitability and growth as dependent variables, while considering the moderating effect of environmental dynamism. Their study confirmed the positive impact of entrepreneurial orientation and precisely the willingness to innovate, risk-taking, and reactivity on both the profitability of the firm and its growth. In uncertain environments, entrepreneurial activity proved to have a stronger impact on the overall performance and consequently on the firm's survival chances. From another perspective, the relationship between corporate entrepreneurship and firm performance was explored through the IQP model (Innovation – Quality – Performance). This model suggests that innovation has a positive effect on product and service quality, which in turn positively affects the firm performance (Cho and Pucik, 2005). The model was proven empirically in earlier studies in the 90s, but a more recent study by Cho and Pucik (2005) also examined this model demonstrating that innovativeness was mediating the positive impact of quality on growth, and that quality mediated the impact of innovativeness on profitability. Results also showed that innovativeness has a direct impact on quality, and also an indirect impact on market value. Technology has also played an important role in improving firm's products and processes. The role of technology and technological updates have been emphasized in both Tech and non-Tech industries. As technology is becoming a central tool in business operations, it was also considered as an inhibitor of entrepreneurial activities. A study conducted in the Netherlands concluded that technological infrastructure is necessary to boost firms' entrepreneurial orientation

through facilitating knowledge acquisition and sharing, as well as integrating different business processes (Rojas, 2014).

A meta-analysis conducted Bierwerth et al. (2015) identified 42 studies whose samples include 13,237 firms. Common indicators across these studies were considered. The indicators of corporate entrepreneurship included: strategic renewal, innovation, and corporate venturing, while the three indicators for firm performance were: subjective performance, objective performance, and overall performance. The analysis tested the suggested hypotheses separately with the moderating effect of firm size, low-tech and high-tech industries, and also across the continents of America, Asia, and Europe. Results show that generally corporate entrepreneurship has a positive relationship with the overall performance, and more precisely a stronger relationship with subjective performance. The effect of strategic renewal and innovation were more significant on the subjective performance, while corporate venturing had a stronger effect on objective performance. Regarding firm size, the study proved its strong moderating effect between strategic renewal and firm performance, indicating that the larger the firm size, the stronger the relationship is. The analysis also found that industry is a significant moderator for the relationship between innovation and firm performance. The relationship is indeed stronger in high-tech industries. Regarding the country of origin, the results show that in Europe and Asia the relationship between corporate entrepreneurship and firm performance is stronger than in North America. This meta-analysis ended up reinforcing the conclusion that most existing literature came up with, demonstrating the positive impact of corporate entrepreneurship on firm performance. However, the analysis pointed out the differences in the magnitude of the impact across different types of entrepreneurial activities. Firms need to take into account such variations while engaging in corporate entrepreneurship practices, which also suggests that firms need to consider the different time frames necessary for these practices to yield any performance effects.

Studying the mediating factors of the relationship underpinning corporate entrepreneurship and firm performance remains crucial to explain the low performance of some firms despite having managers and employees who clearly display a strong entrepreneurial drive. For instance, in their study, Real et al. (2014) used a 140 questionnaire responses to test a model in which organizational learning and the firm's size were used as moderating factors between entrepreneurial orientation and learning orientation on one hand, and the perceived performance of a firm on the other hand. Results confirmed the importance of organizational learning in generating valuable knowledge and competences from entrepreneurial experiences. Corporate entrepreneurship contributes to the firm's performance through the process of learning and competence acquisition. Firms need to actively engage not just in the promotion of entrepreneurial activity but also in entrepreneurial learning. Another study attempted to investigate the relationship between entrepreneurial orientation, organizational learning, and firm performance, while considering a sample of 200 managers from 200 companies located in Brazil (Vasconcelos et al., 2016). The study conducted a descriptive quantitative survey and confirmed the strong positive relationship between entrepreneurial orientation and organizational performance across young, under

development, and mature businesses. Entrepreneurial orientation becomes a critical factor to the survival of small businesses in uncertain environments. The results also proved the considerable effect of organizational learning and suggested that businesses should establish structured learning processes to direct entrepreneurial orientation towards higher performance. Companies should engage in entrepreneurial guidance in order to improve firm's performance, and also for young companies to be competitive and have higher survival chances.

Research about start-up success and failure chances also proven that entrepreneurs who have been involved in prior entrepreneurial ventures have considerably more chances in succeeding in their second and third endeavors (Politis, 2005). This suggests that through the internalization of entrepreneurial experiences, the entrepreneur gains knowledge, skills, and attitudes that are valuable to his/her next endeavour (Minniti and Bygrave, 2001). Entrepreneurial learning is experiential in nature and differs from the conventional organizational learning since it is not transmitted through structured training but through real experiences (Richard & Leitch, 2005). It is critical to gain more insight about the type of entrepreneurial experiences and the learning processes that generate these valuable capabilities (Politis, 2005). It is also important to investigate how entrepreneurs process this newly gained information to update their decisional algorithms (Minniti and Bygrave, 2001). While making daily decisions and judgement, it is argued that entrepreneurs do not rely on exhaustive data collection and analysis but rely instead on heuristics to simplify the complexity of such situations. Although heuristics sometimes lead to errors and inaccuracies, they proved to be an effective cognitive process that generally results in reasonable judgements (Holcomb et al. 2009). Such heuristics not only influence the decision making of entrepreneurs, but also help them give meaning and extract learning outcomes from their entrepreneurial experiences. In rapidly changing industries such as technology, the importance of entrepreneurial learning is paramount to performance and success (Rae, 2006). The need for systematic knowledge updates seems more obvious in the tech field as there are considerable advances occurring at such a fast pace which requires non-structured, continuous, experiential, introspective, and social learning channels (Kelly, 2016).

Park et al. (2017) investigated the effect of entrepreneurial failure experiences on firm performance. The study was based on the human capital and entrepreneurial learning theories implying that entrepreneurs learn from their previous entrepreneurial experiences and contribute to firm's human capital (Harrison and Leitch, 2005). Considering financial and non-financial performance as dependent variables, the study demonstrated a reverse U-shaped relationship between failure in entrepreneurial activity and performance. A certain level of failure in entrepreneurial endeavors adds to the human capital's learning and positively contributes to the firm's financial performance. However, if failure exceeds a certain level, the relationship starts to negatively impact the financial and non-financial performance. This significant correlation was tested for firms that experience failure, but no significant relationship could be proven in the case of companies that had both success and failure experiences.

This leads us to the following proposition:

Proposition 5: Entrepreneurial orientation positively affects both objective and subjective performance. Endogenous factors mediate such an impact, including firm size, innovation, quality, and managerial structure. Experiential learning reinforces the organization's entrepreneurial capabilities but also contributes to nurturing, enriching, and directing the entrepreneurial orientation, at the individual and organizational levels, to attain better performance.

6 Research implications and future research agenda

We believe that by introducing a framework that demonstrates the link between HRM practices, entrepreneurial orientation, and firm performance the paper provides a significant clarification of how human resource development drive value-generation dynamics. This research also provides a step further towards understanding the concept of entrepreneurial orientation as a performance driver.

This paper is also consistent with the knowledge-based view of the firm by emphasizing the dynamic nature of entrepreneurial learning inside the firm, and suggests a conceptualization of some ideas which have recently emerged in HRM and entrepreneurship literatures, offering convergence of ideas and improved definitions of the discussed concepts as well as their relationships. It therefore provides another step towards a 'common language and understanding'.

We believe that the research presented in this paper lays a foundation for further theoretical and empirical inquiry into the nature of HRM processes, entrepreneurial capabilities, and the sources of sustainable competitive advantage. Beyond the fact that this research furthers our theoretical understanding, we hope it provides useful avenues for further empirical inquiry as well as in-depth case studies to find practical evidence of the propositions underpinning the theoretical framework as outlined in this paper. Even with an initial theoretical framework, we still know little about the specifics of how HRM, learning, and intrapreneurship drive sustainable competitive advantage and firm performance.

References

- Abosed, J.A., Fayose, J., and Eze, B.U., (2018) "Corporate Entrepreneurship and International Performance of Nigerian Banks", *Journal of Economics and Management*, Vol. 32, No. 2.
- Ali, U.W., Rosli, M., and Umair, A., (2016) "Unveiling the Direct Effect of Corporate Entrepreneurship's Dimensions on the Business Performance. A Case of Big Five Banks in Pakistan", *Studies in Business and Economics*, Vol. 11, No. 1.
- Ambad, S.N., and Abdul Wahab, K., (2016) "The Relationship between Corporate Entrepreneurship and Firm Performance: Evidence from Malaysian Large Companies", *International Journal of Business and Society*, Vol. 17, No. 2.
- Babak, Z., (2016) "Presenting an Evaluation Model of Human Resource Management's Effect on Corporate Entrepreneurship", *Journal of Organizational Studies and Innovation*, Vol. 3, No. 2.
- Bierwerth, M., Schwens, C., Isidor, R., and Kabst, R., (2015), "Corporate Entrepreneurship and Performance: A Meta-analysis", *Small Business Economics*, Vol. 45.

- Bin Hashim, N.A., Raza, S., and Minai, M.S., (2018) "Relationship Between Entrepreneurial Competencies and Small Firm Performance: Are Dynamic Capabilities the Missing Link? Academy of Strategic Management Journal, Vol. 17, No. 2.
- Bratnicka, K., (2013) "Linking two Dimensions of Organizational Creativity to Firm Performance: The Mediating Role of Corporate Entrepreneurship and the Modetating Role of Environment", Advances in Business-Related Scientific Research Journal, Vol. 4, No. 2.
- Cho, H.J., and Pucik, V., (2005) "Relationship Between Innovativeness, Quality, Growth, Profitability, and Marker Value", Strategic Management Journal, Vol. 26.
- Cucculelli, M., and Bettinelli, C., (2015) "Business Models, Intangibles and Firm Performance: Evidence on Corporate Entrepreneurship from Italian manufacturing SMEs", Small Business Economics, Vol. 45.
- Dess, G.G., and Lumpkin, G.T. (2005) "The Role of Entrepreneurial Orientation in Stimulating Effective Corporate Entrepreneurship", Academy of Management Executive, Vol. 19, No. 1.
- Dyduch, W., (2008) "Corporate Entrepreneurship Measurement For Improving Organizational Performance", Journal of Economics and Manasement, Vol. 4.
- Edralin, M., (2010) "Human Resource Management Practices: Drivers for Stimulating Corporate Entrepreneurship in Large Companies in the Philippines", DLSU Business and Economics Review, Vol. 19, No. 2.
- Goosen, C., De Coning, T., and Smit, E., (2002) "Corporate Entrepreneurship and Financial Performance: The role of Management", South African Journal of Business Management, Vol. 33, No. 4.
- Gupta, K.V., Dutta, K.D., and Chen, X., (2014) "Entrepreneurial Orientation Capability and Firm Performance under Conditions of Organizational Learning", Journal of Managerial Issues, Vol. 27, No. 2.
- Haar, J., Taylor, A., and Wilson, K., (2009) "Owner Passion, Entrepreneurial Culture, and Financial Performance: A Study of New Zealand Entrepreneurs", New Zealand Journal of Applied Business Research, Vol. 7, No. 2.
- Harrison, T.R., and Leitch, M.C., (2005) "Entrepreneurial Learning: Researching the Interface Between Learning and the Entrepreneurial Context", Entrepreneurship: Practice and Theory.
- Holcomb, R.T., Ireland, R.D., Holmes, R.M., and Hitt, A.M., (2009) "Architecture of Entrepreneurial Learning: Exploring the Link Among Heuristics, Knowledge, and Action", Entrepreneurship: Theory and Practice .
- Hsu, C.C., Tan, K.C., Laosirihongthong, T., and Leong, G.K., (2011) "Entrepreneurial SCM Competence and Performance of Manufacturing SMEs", International Journal of Production Research, Vol. 49, No. 22.
- Kaya, N., (2006) "The Impact of Human Resource Management Practices and Corporate Entrepreneurship on Firm Performance: Evidence from Turkish Firms", International Journal of Human Resource Management, Vol. 17, No. 12.
- Kearney, C., Hisrich, D.R., and Antoncic, B., (2013) "The Mediating Role of Corporate Entrepreneurship For External Environment Effects on Performance", Journal of Business Economics and Management, Vol. 14, No. 1.
- Kelly, G.T., (2016) "Entrepreneurial Orientation: What Is It and Why Might It Be a Hidden Strategy for Building Long-Term Enterprise Value?", Journal of Private Equity.
- Kuratko, F.D., Ireland, R.D., and Hornsby, S.J., (2001) "Improving Firm Performance Through Entrepreneurial Actions: Acordia's Corporate Entrepreneurship Strategy", Academy of Management Executive, Vol. 15, No. 4.
- MacPherson, M., (2009) "Entrepreneurial Learning: Secret Ingredient's for Business Success", T+D.
- Marr, B., and Schiuma, G., (2003) "Business Performance Measurement - Past, Present and Future. Management Decision, Vol. 41, No. 8.

- Minniti, M., and Bygrave, W., (2001) "A Dynamic Model of Entrepreneurial Learning" *Entrepreneurship: Theory & Practice*.
- Mohamad, O., Ramayah, T., Puspowarsito, H., Natalisa, D., and Saerang, P.E., (2011) "Corporate Entrepreneurship and Firm Performance: The Role of Business Environment as a Moderator", *IUP Journal of Management Research*, Vol. X, No. 3.
- Mohammed, K., Ibrahim, H.I., and Mohammed Shah, K.A., (2017) "Empirical Evidence of Entrepreneurial Competencies and Firm Performance: A Study of Women Entrepreneurs of Nigeria", *International Journal of Entrepreneurial Knowledge*, Vol. 5, No. 1.
- Murray, P., and Donegan, K., (2003) "Empirical Linkages between Firm Competencies and Organisational Learning", *The Learning Organization*, Vol. 10, No. 1.
- Murray, P., and Donegan, K., (2003), "Organisational Learning, Competencies, and Firm Performance: Empirical Observations", *The Learning Organization*, Vol. 10, No. 5.
- Mustafa, M., Richards, J.J., and Ramos, H.M., (2013) "High Performance Human Resource Practices and Corporate Entrepreneurship: The Mediating Effect of Middle Managers Knowledge Collecting and Donating Behavior", *Asian Academy of Management Journal*, Vol. 18, No. 2.
- Nasution, N.H., Mavondo, T.F., Matanda, M.J., and Ndubisi, N.O., (2011) "Entrepreneurship: Its Relationship with Market Orientation and Learning Orientation and as Antecedents to Innovation and Customer Value", *Industrial Marketing Management*, Vol. 40.
- Omar, N.A., Aris, M.H., and Nazri, M.A., (2016) "The Effect of Entrepreneurial Orientation, Innovation Capability and Knowledge Creation on Firm Performance: A Perspective on Small Scale Entrepreneurs", *Journal Pengurusan*, Vol. 48.
- Park, M.S., Park, J.W., and Kim, J.H., (2017) "The Effect of SME CEOs' Entrepreneurial Experience on Corporate Performance", *Academy of Entrepreneurship Journal*, Vol. 27, No. 2.
- Pastor, L., Taylor, A.L., and Veronesi, P., (2009) "Entrepreneurial Learning, the IPO Decision, and the Post-IPO Drop in Firm Profitability", *The Review of Financial Studies*, Vol. 22, No. 8.
- Politis, D., (2005) "The Process of Entrepreneurial Learning: A Conceptual Framework", *Entrepreneurship Theory and Practice*.
- Rae, D., (2006) "Entrepreneurial Learning: A Conceptual Framework for Technology-based Enterprise", *Technology Analysis & Strategic Management*, Vol. 18, No. 1.
- Real, C.J., Roldán, L.J., and Leal, A., (2014) "From Entrepreneurial Orientation and Learning Orientation to Business Performance: Analyzing the Mediating Role of Organizational Learning and the Moderating Effects of Organizational Size", *British Journal of Management*, Vol. 25.
- Richard, H.T., and Leitch, M.C., (2005) "Entrepreneurial Learning: Researching the Interface Between Learning and the Entrepreneurial Context", *Entrepreneurship: Theory and Practice*.
- Rojas, R.M., (2014) "The Use of Technology to Improve Organizational Performance Through Corporate Entrepreneurship", *The International Journal of Management Science and Information Technology*, Vol. 14.
- Schmelter, R., Mauer, R., Borsch, C., and Brettel, M., (2010) "Boosting Corporate Entrepreneurship Through HRM Practices: Evidence from German SMEs", *Human Resource Management*, Vol. 49, No. 4.
- Serai, M.H., Johl, S.K., and Marimuthu, M., (2017) "An Overview on Relationship between Corporate Entrepreneurship and Firm Performance", *Global Business and Management Research: An International Journal*, Vol. 9, No. 1.
- Sher, J.P., and Yang, Y.P., (2005) "The Effects of Innovative Capabilities and R&D Clustering on Firm Performance: The Evidence of Taiwan's Semiconductor Industry", *Technovation*, Vol. 25.

- Tang, G., Wei, L.Q., Snape, E., and Chu, N.Y., (2015) "How Effective Human Resource Management Promotes Corporate Entrepreneurship: Evidence from China", *The International Journal of Human Resource Management*, Vol. 26, No. 12.
- Tansky, W.J., Soriano, D.R., and Dobon, A.R., (2009) "Guest Editor's Note: What's Next? Linking Entrepreneurship and Human Resource Management in Globalization", *Human Resource Management*, Vol. 49, No. 4.
- Teo, T.S., Lakhani, B., Brown, D., and Malmi, T., (2008) "Strategic Human Resource Management and Knowledge Workers: A Case Study of Professional Service Firms", *Management Research News*, Vol. 31, No. 9.
- Theodorakopoulos, N., and Figueira, C., (2012) "What Can Situated Learning Theory Tell Us About Leading to Develop Organizational Learning Capabilities for Entrepreneurial Performance? Lessons from a Knowledge- Intensive Small Firm", *Thunderbird International Business Review*, Vol. 54, No. 6.
- Urban, B., and Sefalafala, R.M., (2015) "The Influence of Entrepreneurial Intensity and Capabilities on Internationalisation and Firm Performance", *South African Journal of Economic & Management Sciences*, Vol. 18.
- Vasconcelos, V.N., Silveira, A., and Bizarria, F.S., (2016) "The Relations Between Entrepreneurial Orientation, Organizational Learning and Organizational Performance of Small Enterprises", *International Journal of Professional Business Review*, Vol. 1, No. 2.
- Yao, X., Wen, W., and Ren, Z., (2009) "Corporate Entrepreneurship in the Enterprise Clusters Environment - Influence of Network Resources and Entrepreneurial Orientation on Firm Performance", *Frontiers of Business Research in China*, Vol. 3, No. 4.
- Zhang, Z., and Jia, M., (2010) "Using Social Exchange Theory To Predict The Effect Of High-Performance Human Resource Practices On Corporate Entrepreneurship: Evidence From China", *Human Resource Management*, Vol. 49, No. 4.

Genius loci and Social Capital as the Glue for the Success of Entrepreneurial Ecosystems

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Abstract

The role of social capital in entrepreneurship has become an increasingly prominent topic in business literature, and the debate about pros and cons has become increasingly complex. This study aims to shed light on the pre-conditions (the so called 'genius loci') that, by leveraging social capital, favour forms of participatory territorial governance aimed at enhancing regional development and wellbeing, also through the spur of high-tech startups.

We focused on a paradigmatic case study: the Marche Region, (Italy). Indeed, in the age of the so-called "Italian economy miracle", the Marche region was an example of flexible specialisation and the development of industrial clusters and districts, investigated by renowned researchers.

The case we have explored focuses on innovative Marche startups and aims to understand if and how the sharing of shared values linked to the history of the territory can still be the source of social capital that allows new businesses to benefit from positive externalities.

From our analysis, focused on the behaviour of three key players of the entrepreneurial ecosystem of the Marche region (the PA, the new crowdfunding platforms and universities), evidence would appear to confirm what has already emerged from other research..

Indeed, social capital is the glue that decrees, at a meso-level, the success of local development thanks to the form of governance and territorial social responsibility promoted by networks of local actors, public and private, who are oriented to sustainable development.

Keywords – entrepreneurial ecosystems, sustainable local development, social capital, Italian Regions

Paper type – Academic Research Paper

1 Introduction

"Entrepreneurial ecosystem" has recently emerged as a popular concept to explain the birth of high-growth entrepreneurship within regions (Stoker 1988 and 2006; Spigel, 2017). In this regard, one aspect that requires particular attention is the link between ecosystems and the endowments distinguishing a territory.

When talking about endowments distinguishing a territory, we are not only referring to the resources made available to entrepreneurs in terms of accessibility and facilities concerning financial capital, skilled human resources (human capital) and new technologies in infrastructure. We are also referring to social capital, which is *the set of personal relationships, trust and cultural, social, institutional and economic bonds that allow entrepreneurs to benefit from positive externalities* (Putnam et al., 1994; Helliwell & Putnam, 1995; Sobel, 2002; Bourdieu, 2011).

Drawing from these perspectives our study aims to shed light on the pre-conditions that, by leveraging social capital, favour forms of participatory territorial governance (Del Baldo & Demartini, 2012, 2014 and 2016) aimed at enhancing regional development and wellbeing, also through the spur of high-tech startups.

We call these preconditions the *genius loci*. In Greek and Roman mythology each location was linked to a particular tutelary deity or *genius loci*. The *genius loci* had a particular relationship with the harmony of the location and presided over the good relationship between the different elements present in the surrounding environment.

The formation of a place's soul was intended as the result of a long process, the accumulation of values, feelings and experiences handed down by generations of the people who had previously lived there. Therefore, the *genius Loci* is the sediment of memories and collective stories that characterise a specific territory that feeds the sense of belonging and commonality of the people who live there.

Social capital, which economists have described as a fundamental factor for the birth and development of industrial districts and the territory, depends, in turn, on what we have mentioned above and labelled *genius loci*.

Thus our paper's two related research questions are as follows:

- a) how does the *genius loci* influence social capital?
- b) how does social capital influence the spur of entrepreneurship?

The paper is structured as follows. In Section 2, a brief review of the relevant literature is presented. Section 3 details the methodology, and Sections 4 summarises the findings of our analysis. Finally, Section 5 provides a research agenda for a more in-depth investigation in the future.

2 Literature Review: Social Capital, Entrepreneurship and Entrepreneurial ecosystems

The role of social capital in entrepreneurship has become an increasingly prominent topic in business literature, and the debate about pros and cons has become increasingly

complex (Casson and Della Giusta, 2007; Light and Dana, 2013; Ramadani and Dana, 2013).

As per the definition of Bourdieu (1986), social capital describes circumstances in which entrepreneurs can use membership in a community and networks to secure economic benefits. This formulation treats social capital as an attribute of an individual that cannot be evaluated without knowledge of the society in which the individual operates (Putnam et al., 1994; Sobel, 2002).

Firms' relationships within regions have been explained through concepts such as industrial districts (Becattini, 1990) and clusters (Porter, 2003). Both streams consider social relations with a community and the actors of the territory, as a fundamental element of the birth and success of enterprises (Minguzzi and Passaro, 2000). In the recent past, the economic geography of clusters has been changing, with new clusters developing in some locations (Bresnahan et al. 2001) and some old clusters, facing intense pressure because of globalisation, which loosens ties with territorial roots.

Recently, the entrepreneurial ecosystem has emerged as a popular concept to explain the birth of high-growth entrepreneurship within regions. Entrepreneurial ecosystems can be defined as “the union of localised cultural outlooks, social networks, investment capital, universities, and active economic policies that create environments supportive of innovation-based ventures” (Spigel, 2017). However, ecosystem literature is still underdeveloped.

One aspect that requires particular attention is the link between ecosystems and the talents and endowments distinguishing a territory, the so-called *genius loci* (Pellegrini et al., 2015). Social capital includes personal relationships, trust and bonds of various kinds (emotional, cultural, social, institutional and economic) that allow entrepreneurs to benefit from positive externalities. Personal relationships can take the form of informal relationships with family and friends. This networking, specifically in the initial phase, is particularly important to bring out intangible resources and competencies of various kinds, such as technological, commercial, administrative and organisational capabilities, that a single entrepreneur hardly possesses (EIU, 2016; Romano et al., 2017). Also, relationships with the community and the territory are equally important because they can facilitate the procurement of financial resources, through mechanisms such as crowdfunding (Giudici et al., 2018).

Furthermore, strong relationships with a local community and business network are even more crucial in shaping small businesses and family firm innovation activities. Historical roots and emotional attachment might also become a source of ideas and knowledge, whose recombination with new technologies or new meanings leads to unique innovations (De Massis et al., 2016).

Finally, another aspect that should be analysed and deepened is whether social capital is the glue that decrees, at a meso-level, the success of local public-private initiatives (Lerro and Schiuma, 2008), thanks to the form of governance and territorial social responsibility promoted by networks of local actors, public and private, who are oriented to sustainable development (Demartini and Del Baldo, 2015).

3 Methodology

In order to answer our RQs:

- 1) how does the *genius loci* influence social capital?;
- 2) how does social capital influence the spur of entrepreneurship?;

a qualitative methodology was adopted: the case study (Yin, 2013; Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Flick, 2009), because it is a research strategy whose goal is to understand in practice, the dynamics characterising a specific phenomenon.

3.1. Case selection

When selecting the case to be analysed the following reasoning was investigated. First, it was necessary to identify a territory that was characterised:

- by the presence of civil society actors, institutional and economic, characterised by a high level of interaction and attention to the issues of social responsibility;
- by an entrepreneurial fabric that has historically made social capital one of its strengths and is still today characterised by a high rate of entrepreneurship and the birth of new businesses.

The presence of these two factors allows us to investigate the "roots" (or *Genius Loci*) of social cohesion among local actors and how this influences social capital at the base of the birth and development of local businesses.

That said, we focused on a paradigmatic case study. We selected the Marche Region, (Italy) as the territory for our analysis for the following reasons:

- The Marche region is an example of regional governance based on multi-actor (i.e., public, private, for-profit and non-profit organizations and civil society) engagement (Del Baldo & Demartini, 2016, 2018).
- After the Second World War, in the age of the so-called "Italian economy miracle" the Marche region was an example of flexible specialisation and the development of industrial clusters and districts, investigated by renowned researchers (Fuà & Zacchia, 1983; Fuà, 1988; Becattini, 1990; Helliwell & Putnam, 1995; Porter 2003).
- Today, after the crisis that hit the companies of traditional manufacturing sectors (Balloni & Iacobucci 2004), the Marche regions is still among the regions of Italy with the highest activation rate of innovative start-ups in proportion to the population, with Ancona and Ascoli Piceno among the top five provinces in Italy (Register of Companies—Italian Chamber of Commerce, 2018).

3.2. Data gathering and analysis

To answer the first question: how does the genius loci influence social capital? We analysed the literature of economists and historians on the economic development of the

Marche region (among other Bagnasco, 1977, 1988; Paci, 1980; Fuà & Zacchia, 1983, Sori, 1999).

To answer the second questions: how does social capital influence the spur of entrepreneurship? We analysed, gathering information from multiple sources (academic articles, websites, interviews released to newspapers), how the main actors of the Marche entrepreneurial ecosystem support the spur of innovative start-ups. Our aim is to assess whether elements such as social cohesion, trust and shared values, can still be considered critical success factors for the creation of innovative start-ups.

In particular, we will analyse the behaviour of actors such as public administration, crowdfunding platforms (as an expression of civil society) and universities, as key players in the entrepreneurial ecosystem aimed at encouraging the creation and development of innovative startups.

The data we collected, focusing our attention on the role that social capital plays today in the birth and development of new businesses, are signs of an emerging phenomenon whose features have not yet been analysed by scholars. For this reason, our research is exploratory, and we adopted the critical analysis approach. In detail, a critical analysis is subjective writing because it expresses the writer's opinion or evaluation of selected texts and data. The objective of this preliminary analysis is to develop a sense of new understanding of the links between *Genius Loci* and social capital in the light of a renewed economic and social context and to develop a research agenda for further investigations.

4 Findings

4.1. The Marche Region *genius loci*: values and roots

In recent years, the perspective with which one looks at the processes of industrialisation that took place in Italy and other advanced countries has changed. In fact, scholars of economic development have given a growing space to the territory and the social environment within which companies are born and develop.

Economic historiography, in particular, has aimed at an analysis on a regional scale with a long-term perspective. This optic has allowed us to identify the "multiple local models of development" (Pollard, 1984, pp. 188-206), offering a plurality of alternatives to the classical model for a long time considered the only possible one, namely that of the << English industrial revolution >>, characterised by a strong and sudden acceleration of the accumulation process that occurred in the eighteenth and nineteenth centuries.

It is precisely from this change of perspective that the reality of the *Terza Italia* (Bagnasco, 1977) or the North-East-Centre (Fuà and Zacchia, 1983) emerged.

Indeed, more precise analyses have shown that many of the Italian districts are rooted in a humus made fertile by previous manufacturing experiences already in the medieval age (from the 13th to the 16th century)¹.

¹ Scholars that deal with the industrialisation of the North-East-Centre cannot forget that Italy does not enter the ranks of the most advanced countries in the twentieth century, but that for several centuries, from the early

In the Marche region, these proto-industrial activities were carried out in the form of craftsmanship in the numerous inhabited centres of medium-small size scattered throughout the territory which, despite their low demographic weight, had the name of the city. Moreover, it is precisely in the Italy of the Municipalities and the "hundred cities" that economic historians have rediscovered the roots of the widespread entrepreneurship that characterised the development of the *Terza Italia* (Moroni, 2001 e 2002; Sabbatucci Severini 1996).

Among the many factors that have contributed to the genesis of entrepreneurial development in the Marche region, the particular production relationships present in the countryside deserve to be mentioned.

Economic historians (For all, see: Paci, 1980) have underlined how important the role of the peasant family, organised as an autonomous productive unit, in transmitting to future generations not only "know-how" and the organization of work but also a set of values that constituted the social amalgamation that allowed the development of local production systems after World War II.

For our purposes, it is especially important to underline the heritage of values that are particularly widespread in the peasant world of the time that constitute the genetic heritage of many entrepreneurs of the second post-war period: the aptitude for cooperation, the ethics of work and sacrifice, orientation towards savings aimed at the purchase of land, the constant desire to improve the social status of family members (Sabbatucci Severini, 1985).

The process of modernisation and the structural transformations that took place in the second post-war period in the Marche region, in fact, occurred combining modernity and tradition, social changes and cultural persistence (Fuà and Zacchia, 1983).

The birth of local production systems (or "industrial districts", Becattini, 1979), which are based on forms of collaboration and trust between companies within a division of labour often organised by a directing company, are also justified, as the work was organised and subdivided among the members of the peasant family (Paci, 1999).

The numerous cases of excellent small and medium-sized enterprises oriented to CSR are also explained, in which entrepreneurs carry out a mission for which the purpose of the company is to create wealth for all those that have decreed its success: employees, suppliers, business partners, customers, as well as in the peasant family of the past. The aim was to improve the social conditions of all members of the group to which they belong (Del Baldo, 2010,2013).

Last but not least, even in a historical key, we explain the attachment to the territory and the sense of belonging to a local community (Crevoisier, 1996; Midtun, 2005) that, even today, characterises public and private actors and, more generally, the Marche civil society.

The influence of local communities on small businesses in the Marche region is expressed, therefore, at various levels, offering the cultural, institutional, political and social milieu that allowed them to reconcile, throughout the years of economic

thirteenth to the early seventeenth century, our country was the centre of the European economy-world (Braudel, 1979).

development, new industrial activities with the identity and traditional values of the local society.

Putnam (1993) underlined the importance of a widespread associative fabric, which has contributed to creating cohesion and promoting efficiency at the political-administrative level. Triglia (1986) investigated the role played by political subcultures (Catholic and social-communist) in promoting less conflicting social relations between capital and labour. Bagnasco (1988) noted that the objective of reconciling competition and cooperation has safeguarded social cohesion and, at the same time, guaranteed the growth of the widespread economy.

It is, therefore, this set of intangible, socio-cultural factors that, in our opinion, constitute the premises that determine collective and individual attitudes favourable to the widespread social responsibility and that characterise social capital on which the Marche entrepreneurs have levered in the era of “the Italian miracle”.

What should now be explored is whether, even today, the various institutional, economic and social actors of the Marche region still have a shared vision on the subject, shifting the perspective from the second world war to the emerging phenomenon of innovative start-ups, whose birth and development cannot ignore the existence of a local entrepreneurial ecosystem.

Based on what has been analyzed, our hypothesis is that the *genius loci*, which we have discussed, is still alive in the Marche civil society, and this can be leveraged as a factor in the development of the territory even today because, as is known, the socio-cultural factors are elements that develop their training and evolution times over the long term.

4.2. Innovative startups and social capital

The economy of the new millennium is driven by new political, social, environmental and technological changes. The development of territorial economies is based on the ability to be competitive and to know how to renew itself thanks to the vitality of its businesses.

The birth of new innovative companies is considered a fundamental element of the vitality of a production system (Romano). Hence, we focused our analysis on the Italian context, where with law 221/2012, the definition of an innovative start-up, which is a new innovative enterprise of high technological value, has been introduced with the purpose to provide a favourable environment for the establishment and development of innovative companies. The legislation in question does not apply to all newly established companies but just to those that present a clear connection to technological innovation, regardless of their sector, be it software, manufacturing or agriculture.

The goals of the Italian Government seem to be multifaceted, as follows: to support innovative entrepreneurship; to contribute to greater social mobility; to strengthen the links between universities and businesses; to make people more inclined to take business risks; and to contribute to making the country more attractive for foreign capital and talents.

In this contest, we can see how fundamental an entrepreneurial ecosystem is in supporting the birth and development of innovative startups. In the literature, an

entrepreneurial ecosystem is defined as “the union of localised cultural outlooks, social networks, investment capital, universities and active economic policies that create environments supportive of innovation-based ventures”.

Based on this definition, in the following section, analyzing the role of three fundamental actors: the Public Administration, the new crowdfunding platforms and the universities, we will highlight whether and how the sharing of shared values linked to the history of the territory can still be a source of social capital that allows new companies to take advantage of positive externalities and gain benefits in terms of obtaining resources (human, capital and infrastructural).

4.2.2. The role of local PA and other institutional actors in supporting innovative startups

In recent years, the role of regions in supporting the Italian startup ecosystem has been strengthened and clearly defined at the institutional level through regional policies, funding, measures and projects in the context of the European and national policy that aims to support the development of young innovative companies with high growth potential and their partners, primarily accelerators and incubators. A clear direction of the local government emerged in support of the startups always with the view of involving the various actors and through synergistic local forms of collaboration, involving research centres (starting with universities), business associations, professional associations, companies and civil society organizations.

With specific reference to the Marche region, a clear direction of the PA emerges in support of innovative startups. “The role of the regions must increasingly be to support the development of an adequate ecosystem to promote the growth of innovative startups, through targeted policies both from the point of view of forms of financing and from the point of view of services and technological and organizational networks, avoiding the fragmentation and overlapping of roles and interventions, thanks to a strategic coordination between the various actors” (Regional Councilor for Economic Development).

This direction is also expressed through concrete, supportive actions. In fact, the Marche Region has dedicated an important part of its policies in recent years to support the start-up and consolidation of new entrepreneurial activities on the market, also through specifically dedicated tenders, issued on the resources of the ROP ERDF 2014-2020 and POR ESF 2014-2020.

The birth and affirmation of new companies in innovative sectors on the market represent a driving force for the development of the regional system, a fundamental and strategic element for renewing and dynamising the local productive fabric for the Marche Region. “An indispensable opportunity to respond to future challenges and create new business models that could serve as technology providers by offering our traditional companies high-value services and technologies to innovate and be competitive nationally and internationally”. (Regional Councilor for Economic Development).

In summary, borrowing from the words of Fuà and Zacchia (1983), the shared objective remains the development of an entrepreneurial system “without fractures”, and of “renewal in continuity”.

4.2.2 Crowdfunding and social capital

Through equity crowdfunding platforms, startups can directly collect capital from private individuals contributing to the improvement of fundraising. Evidence exists that geography matters in crowdfunding, especially if reward-based (Ordanini et al., 2011; Agrawal et al., 2011; 2015). The overarching idea of this research stream, in line with our research focus, is that geographical proximity reduces information asymmetries, which are particularly severe in crowdfunding.

What is even more relevant for our study is that Del Giudice et al. (2017) documented that the *altruism* of people residing in the area increases the likelihood of success of crowdfunding. Additionally, the authors' findings suggest that the strength of this effect depends on the level of *localised social capital* (measured following the approach of Laursen et al. 2012a)

As far as the Marche Region is concerned, we have highlighted the case of the Platform Next Equity, held by Next equity crowdfunding Marche Srl, born thanks to an agreement with the University of Camerino to promote innovative ideas, which was one of the first actors operating in the equity crowdfunding field in 2014. Now there are 32 platforms authorised by the Supervisory authority in Italy (Consob), and three of them are located in the Marche Region.

As it emerges from the last report by the Crowdfunding Observatory of the Milan Polytechnic (2016, 2017, 2018), the Marche Region is quite active, being second only to the Lombardia Region, as individuals and entity investors. In particular, this, in our opinion, seems like an important sign for the purposes of our investigation, aimed at witnessing a level of outreach and engagement expressed by civil society and economic operators in support of new local entrepreneurship.

Another aspect that can be useful to highlight is what the characteristics of the entrepreneurial ideas that have been launched and funded by crowdfunding platforms are, again to assess whether, from the nature of the projects, how the awarded projects are those that present a mission based on common values and shared by the Marche civil society emerges. So far, Next Equity has already financed 4 entrepreneurial projects with success, and 5 others are still running, and from the analysis of the entrepreneurial projects on the platform website, we can see how different businesses develop in the agriculture, bio-technologies, green economy and social field. All this testifies to a correspondence with the values of the *genius loci* of the Marche region: respect for the territory and attention to social issues.

4.2.3. The role of the Universities

In the last decade, Italian universities have developed the institutional purpose of the third mission, which has become an integral part of the policies aimed at developing the themes of social responsibility and orientation towards sustainability.

With specific reference to the Marche, the universities in this region strongly support projects of entrepreneurial contamination and the birth of new enterprises through activities of pre-incubation of ideas with entrepreneurial potential, incubation and

dissemination activities. In particular, we cite, among others:

- the CultLab project (partners: Urbino University, Macerata, Consorzio Meccano), a Creative Business Incubator united in a temporary association of purpose—"CultLab—Spin-off of cultural enterprise" of the inter-territorial cooperation project "Advanced Cultural District of the Marche—Spin-off for the selection of business ideas in the culture sector with features of product and service innovation.

- the ECAPITAL project, business plan competition (partner: Univ. Politecnica, University of Urbino and ISTAO with Adriatic Startup School) Funded by ISTAO and Fondazione Marche

- the BP Lab project (Partner: Urbino University, Marche BP Cube incubator), a competition reserved for students, graduate students and alumni of the University of Urbino in order to select, train and entrepreneurize competent teams and innovative ideas. This project is part of a preliminary phase (pre-incubation), dedicated to focusing on and validating the idea and, finally, verifying the entrepreneurial attitude of the participants.

- collaboration with the local entrepreneurial fabric carried out through research centers, such as the CRIMPI Research Center on Entrepreneurship and Small-medium firms, active at the University of Urbino. The centre aims for the development of collaborative relationships with other universities, companies, bodies and institutions (local, national and international) in the context of the processes and management dynamics of small and medium-sized enterprises and to this end intends to promote agreements and other forms of understanding.

5. Conclusions, limitation and future research

To answer our research questions, we focused the analysis on an Italian territorial case that we consider paradigmatic for our purposes: the Marche region, the territory of the "Terza Italia", which in the past has been the subject of international analysis, as an example excellent of widespread entrepreneurship.

From our analysis of the founding values of the social fabric of the Marche region (the so-called "genius loci"), we have found that social capital has been a fundamental element for the creation of new businesses and the development of the Marche economy from the second post-war period to the present.

Today it emerges how territorial entrepreneurship can no longer be separated from a systemic logic in which different actors play a fundamental role, as is evidenced by the research stream in the entrepreneurial ecosystem. The case we have explored focuses on innovative Marche startups and aims to understand if and how the sharing of shared values linked to the history of the territory can still be the source of social capital that allows new businesses to benefit from positive externalities and obtain benefits in terms of obtaining resources (human, capital and infrastructural). From our analysis, focused on the behaviour of three key players of the entrepreneurial ecosystem of the Marche region (the PA, the new crowdfunding platforms and universities), evidence would appear to confirm what has already emerged from other research on the territory's development. Indeed, social capital is the glue that decrees, at a meso-level, the success of local

development (Lerro and Schiuma, 2008), thanks to the form of governance and territorial social responsibility promoted by networks of local actors, public and private, who are oriented to sustainable development (Demartini and Del Baldo., 2015).

However, it should be emphasized that ours is an explorative analysis subject to limitations.

In our paper, we have adopted a critical analysis approach. In fact, the answer to the questions we asked ourselves is based on the critical reading of literature.

With particular reference to the phenomenon of innovative startups, whose birth and development cannot be separated from the existence of a local entrepreneurial ecosystem, we have also used some partial empirical evidence that can be defined as signalling the importance that still today plays the role of social capital. We deem that it is an emerging phenomenon that has not yet been studied extensively in the literature and that deserves further attention from researchers and policymakers.

A Research Agenda

The research agenda begins with the questions that our analysis brings out and calls for empirical and conceptual articles that could be based on diverse theoretical and methodological approaches for examining the role of social capital in the birth and the development of entrepreneurship and entrepreneurial ecosystems:

- What are the pre-conditions that favour/hinder the development of social capital in different territories?
- How has the concept of belonging to a territorial community for entrepreneurs changed today?
- What is the role that public administration can play in favouring the economic development of a territory by leveraging social capital?

References

- Ashely, P.A. (2012a). The Master Model on Multi-actor, Multilevel and Territorial Social Responsibility: A Mapping Tool for Social Responsibility, Development and Equity Policies and Studies. In P.A. Ashley, & D. Crowther, *Territories of Social Responsibility. Opening the Research and Policy Agenda* (pp. 161-174). Surrey, UK: Gower.
- Ashely, P.A. (2012b). Corporate Social Responsibility: From Business Leadership to Multi-actors' Policy Coherence. In P.A. Ashley, & D. Crowther, *Territories of Social Responsibility. Opening the Research and Policy Agenda* (pp. 29-48). Surrey, UK: Gower.
- Balloni, V., & Iacobucci, D. (2004). The role of medium-sized and large firms in the evolution of industrial districts. The case of Marche. In *The evolution of industrial districts* (pp. 175-197). Physica, Heidelberg.
- Becattini, G. (1990), "The Marshallian district as a socio-economic notion," in F. Pyke, G. Becattini, and W. Sengenberger, eds., *Industrial districts and intra-firm collaboration in Italy*, Geneva: International Institute for Labor Studies.
- Bourdieu, P., 2011. The forms of capital.(1986). *Cultural theory: An anthology*, 1, pp.81-93.
- Crevoisier O. (1996), "Proximity and Territory versus Space in Regional Science", *Environment and Planning A*, vol. 28, n. 9, pp. 1683-1697.

- Del Baldo M. (2010), "Corporate social responsibility and corporate governance in Italian SMEs: toward a 'territorial' model based on small 'champions' of CSR", *International Journal of Sustainable Society* (IJSSoc, 1756-2538 print ISSN; on line 1756-2546), Inderscience, vol. 2, n. 3, pp. 215-247. doi 10.1504/IJSSOC.2010.034762
- Del Baldo M. (2010), "Corporate Social Responsibility and Corporate Governance in Italian SMEs: the Experience of some "Spirited Business";, DOI 10.1007/s10997-009-9127-4, 12.01.2010.
- Del Baldo, M. (2012). Corporate social responsibility and corporate governance in Italian Smes: the experience of some "spirited businesses". *Journal of Management and Governance*, 16(1), 1-36. DOI 10.1007/s10997-009-9127-4.
- Del Baldo M. (2013), "Values-based enterprises: the good practices of Italian SMEs, passionately committed to people, environment and community", In Bruni Luigino & Sena Barbara (EDS.), *The Charismatic Principle in Social Life*, Routledge, Taylor & Francis Group, London and New York, p. 112-150.
- Del Baldo, M. & Demartini (2010). Values-Based public-private networks. Best Practices in Italian Local Government: the case of 'Regione Marche'. *Corporate Ownership and Control Journal*, 8(1) Fall, 2010, Continued 8, 772-784.
- Del Baldo, M. (2017). CSR, shared territorial governance and social innovation. Some exemplary Italian paths. In N. Capaldi, S.O. Idowu, & R. Schmidpeter (Eds.), *Dimensional Corporate Governance. An inclusive approach* (pp. 103-120). Cham, Switzerland: Springer International Publishing.
- Del Baldo, M. & Demartini (2010). Values-Based public-private networks. Best Practices in Italian Local Government: the case of 'Regione Marche'. *Corporate Ownership and Control Journal*, 8(1) Fall, 2010, Continued 8, 772-784.
- Del Baldo, M., & Demartini, P. (2016). Regional Social Responsibility and Knowledge Economy: The Italian In W.D. Nelson (Ed.) *Advances in Business and Management* (pp. 13-36). Volume 9, pp. 13-36. Hauppauge, New York: Nova Science Publishers.
- Demartini, P., & Del Baldo, M. (2014). An Intellectual Capital Perspective for Local Governance and Sustainable Growth. In J. & V. Murthy, V (Eds.) *Proceedings of the International Conference on Intellectual Capital Knowledge Management & Organizational Learning - ICICKM* (pp. 127-137). Reading UK: Academic Conferences and Publishing International Ltd.
- Demartini P., Del Baldo M. (2015), "Knowledge and Social Capital: Drivers for Sustainable Local Growth", *Chinese Business Review*, February 2015, Vol. 14, No. 2, 106-117 doi: 10.17265/1537-1506/2015.02.001
- Del Baldo, M., & Demartini, P. (2019, February). Participatory governance for sustainable regional development: How much does the 'genius loci' matter?. In *Corporate Governance: Search for the Advanced Practices* (pp. 31-34). Virtues Interpress.
- Eisenhardt, K.M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, 14(4), 532-550.
- Eisenhardt, K.M., & Graebner, M. E. (2007). Theory building from cases: opportunities and challenges. *Academy of Management Journal*, 50(1), 25-32.
- Flick, U. (2009). *An Introduction to Qualitative Research*, 4th ed. London: Sage Publication.
- Fuà G., Zacchia C. (a cura di) (1983), *Industrializzazione senza fratture*, Bologna: Il Mulino.
- Fuà, G. (1988). Small-scale industry in rural areas: the Italian experience. In *The balance between industry and agriculture in economic development* (pp. 259-283). Palgrave Macmillan, London.
- Helliwell, J. F. and R. D. Putnam (1995), "Economic growth and social capital in Italy," *Eastern Economic Journal* 21 (3), pp. 295-307.
- Leonardi, R. (1995). Regional development in Italy: social capital and the Mezzogiorno. *Oxford Review of Economic Policy*, 11(2), 165-179.

- Lerro, A., & Schiuma, G. (2017). Understanding and exploiting intellectual capital grounding regional development: Framework and metrics. In *The Routledge Companion to Intellectual Capital* (pp. 91-99). Routledge.
- Light, I. and L-P. Dana (2013), "Boundaries of social capital in entrepreneurship," *Entrepreneurship Theory and Practice* 37 (3), pp. 603-624.
- Midttun A.(2005), "Policy making and the role of government. Realigning business, government and civil society. Emerging embedded relational governance beyond the (neo) liberal and welfare state models", *Corporate Governance: International Journal of Business in Society*, 5(3), pp.159-174.
- Minguzzi A., Passaro R. (2000), The network of relationship between the economic environment and the entrepreneurial culture in small firms, *Journal of Business Venturing*, Vol. 16, No. 2, pp. 181-207.
- Porter, M.E. (2003). The economic performance of regions. *Regional Studies*, 37 (6-7), 549-578.
- Putnam, R. (2001). Social capital: Measurement and consequences. *Canadian journal of policy research*, 2(1), 41-51.
- Putnam, R.D., Leonardi, R., & Nanetti, R.Y. (1994). *Making democracy work: Civic traditions in modern Italy*. Princeton: Princeton University Press.
- Register of Companies—Italian Chamber of Commerce. (2018). Website: startup.registroimprese.it, downloaded on January 2019.
- Romano, M., Nicotra, M., & Schillaci, C. (2017). Nascent Entrepreneurship and Territorial Social Capital: Empirical Evidences from Italy. In *Technology-Based Nascent Entrepreneurship* (pp. 71-93). Palgrave Macmillan, New York.
- Schiuma, G., & Lerro, A. (2008). Knowledge-based capital in building regional innovation capacity. *Journal of Knowledge management*, 12(5), 121-136.
- Sobel, J. (2002). Can we trust social capital? *Journal of Economic Literature*, 40(1), 139-154.
- Spigel, B. (2017), "The relational organization of entrepreneurial ecosystems," *Entrepreneurship Theory and Practice*, 41 (1), pp.49-72.
- Stoker, G. (2006).Public value management. A new narrative for networked governance?" *The American Review of Public Administration*, 36(1), 41-57.
- UN - United Nations (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*. United Nations General Assembly New York, 25-27 September, 2015, <https://www.un.org/sustainabledevelopment/>
- UNGC - United Nation Global Compact (2007). *Joining Forces for Change: Demonstrating Innovation and Impact through Un-Business Partnership*, Geneva: UNGC.
- Wilson, L., & Boyle, B. (2004). The role of partnerships in the delivery of local government museum services: A case study from Northern Ireland. *International Journal of Public Sector Management*, 17(6), 513-533.
- Winter, G. (Ed.) (2006). *Multilevel Governance of Global Environmental Change: Perspectives form Science, Sociology and the Law*. Cambridge: Cambridge University Press.
- Yin, R.K. (2013). *Case study research: Design and methods*. Thousand Oaks, CA: Sage Publications.

Using Academic Entrepreneurship for Digital Economy Development

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Abstract

The paper is devoted to examining the possibility of developing digital technologies through academic entrepreneurship, which can in its turn boost digital economy implementation. Nowadays, universities are under the process of increasing their part in regional and national socio-economic growth. That objective can be reached with universities' technologies commercialization and Triple Helix collaboration. In Russia, this process is far from the level established by the government. At the same time, Russian authorities put forward ambitious goals for digital economy development. In the government's strategic plans, universities are considered as one of the pillars for that. Universities' administrations have to identify ways to facilitate digital technologies transfer, which forces them to intensify academic entrepreneurship as well. That will require implementing of new forms of management, new official and unofficial organizational rules, and specific support system. Nevertheless, academic entrepreneurship based on digital technologies has a number of advantages. Part of them is attributed to lower consumption of the resources needed to commercialize such technologies. Another advantage comes from young people's and commercial organizations' craving for digitalization. Three forms of academic entrepreneurship (creating spin-offs, joint research and licencing) are reviewed as methods of digital technologies commercialization.

In the last section of the paper, a few hypotheses for the future research are formulated. The goal of the research is to assess differences in perception of business creation and academic entrepreneurship among the respondents from two prominent universities: St. Petersburg State University and ITMO University.

Keywords – academic entrepreneurship, entrepreneurial university, university's innovation infrastructure

Paper type – Academic Research Paper

1 Introduction

In the last decades, the understanding of universities' part in technology transfer has dramatically changed. H. Etzkowitz calls this transformation "second academic revolution", which implies the inclusion of knowledge commercialization in university's main functions (along with traditional functions of research and education) [Etzkowitz,

2001]. This third university's function takes form of so-called academic entrepreneurship – commercial activity for the purpose of technology transfer performed by faculty members, students and graduates of the university. Through this activity, universities become a vital component of Triple Helix collaboration that is the basis for the future economic growth in regions and countries.

Simultaneously, the digital economy concept also requires modern universities to redesign their traditionally established models. Digitalization changes both business practices and education procedures. Since scientists expect digital economy to occur in the nearest future, it is necessary to start modify university practices in the present.

Therefore, the purpose of this paper is to identify advantages of academic entrepreneurship as a tool for digital economy development. In addition, the author frames the research of students' and faculty members with respect to entrepreneurship.

2 Academic entrepreneurship as a vital activity of modern universities

2.1 Forms of academic entrepreneurship

The essence of academic entrepreneurship is commercialization of a university's intellectual capital. That capital involves not only patents and other forms of IPRs, but also university's knowledge and its entrepreneurial ecosystem impact. As far as specific forms of academic entrepreneurship are concerned, they usually include 1) creating of enterprises (spin-offs or joint companies), 2) joint research with the business, 3) selling of technology licenses, 4) scientists' mobility, etc. Some scholars and universities (for example MIT) believe that creating business by alumni is also attributed to the university's impact and, therefore, that is one of the forms of academic entrepreneurship. Summing up, there is a great number of ways how a university can transfer its technologies to a practical application.

Academic entrepreneurship allows universities to receive additional financial resources in the short term, strengthen their status in the medium and long term, as well as to contribute to the socio-economic level of the region in which they are located. Recently, this activity has been also mentioned as a needed essential component for evaluating a university's rank [OECD, 2017].

For a university that actively implements academic entrepreneurship, a special term is used in literature – “entrepreneurial university” [Etzkowitz, 2013]. Among leading entrepreneurial universities in the world, experts name the following: Massachusetts Institute of Technology (USA), Stanford University (USA), Cambridge University (USA), Imperial College London (United Kingdom), Oxford University (United Kingdom), Technion (Israel Institute of Technology) [Brighton et al., 2015]. Obviously, most of leading entrepreneurial universities are located in the United States. That fact can be explained by the peculiarities of higher education system there (in particular, limited government funding of universities), and the established culture of active entrepreneurship. However, in other countries all over the world, a remarkable number of

universities has recognized the need for greater involvement in technology transfer and knowledge commercialization.

2.2 Ways of supporting academic entrepreneurship

One of the key attributes of entrepreneurial university is the specific support system that facilitates academic entrepreneurship in that university – the innovation infrastructure. The development of such infrastructure requires changes in university's structure, management policies and organizational culture. Specifically speaking, it is a set of particular departments (for example, technology transfer office, business incubator, etc.), procedures, formal and informal norms of the university. Obviously, universities vary considerably in their strategic objectives, size, status, financial capabilities, etc. A significant role is also played by the experience of academic entrepreneurship and partnerships with other universities, scientific and commercial organizations. In this regard, establishing and developing of the innovation infrastructure can take various forms.

In the author's opinion, one of the most important components of the support ecosystem is organizational culture and trust with regard to entrepreneurship in or together with a university. In Russia, most faculty members are focused on education and a little less on R&D. It was partly confirmed during the author's study of teaching and research personnel of St Petersburg State University. When conducting research and development, scientists rarely have plans concerning further implementation of its results in business practice. It is the reason why a university's management should identify and properly support "early adopters" of academic entrepreneurship. The first step could be regular surveys containing questions about business aspirations and preferred forms of university support.

A university can improve its support measures through finding and implementing best practices of the universities-leaders (benchmarking). It is especially true for Russian universities since they do not have much experience in academic entrepreneurship so far. For example, St Petersburg State University collaborates closely on this matter with Helsinki University (Finland), Technische Universität Ilmenau (Germany) and other universities.

3 Universities' role in digital economy development

3.1 Digital economy's effect on universities

In recent years, digital economy has become the prospect that cannot be disregarded. Business community pay much attention to digital technologies and the ways of how they can be implemented into business models. Yet, there is no unity in the definition what digital economy's characteristics are. Nevertheless, usually they refer to the active expansion of the ICT technologies and e-commerce [World Bank Group, 2018]. That fact means massive changes in interaction between all actors on markets. The process of

digital technologies implementing transforms processes of designing, manufacturing, delivering, maintaining and providing of services of any kind.

Obviously, universities have no other choice but to follow that trend. Most of all, it affects educational practices. Graduates must meet the requirements of the new digitalized business models. At the same time, it influences the other two main functions of universities – research and academic entrepreneurship. The leading universities all over the world take part in exploring of emerging digital technologies. For instance, The MIT Initiative on the Digital Economy (IDE) is a comprehensive research project that is focused on several areas:

- productivity, employment, and inequality;
- big data and information privacy;
- new digital business models;
- social analytics and digital experimentation [MIT Initiative on the Digital Economy, 2018].

Through this project, the MIT connect scientists and practitioners from different countries and industries in order to understand how digital technologies will change the world in the future. That helps the MIT to be fully engaged in the transition to digital economy and at the same time transform its educational and business practices.

In Russia, the State Program “Digital Economy” was approved in 2017 with allocation of the state budget financing of \$1.8 billons annually until 2025. The main goals of the Program include enhancing of the Russian economy competitiveness and the development of high-tech businesses. With respect to Russian universities, two main tasks are set: 1) proper personnel training; 2) conducting research and development in digital technologies [“Digital Economy of the Russian Federation” Program]. There is no doubt that universities should take part in the human capital development for digital economy and actively introduce innovative educational technologies for that [Richter, Pakhomova, 2018]. At the same time, the World Bank Report notes that there is still weak interaction between business, government, universities and research organizations (i.e. Triple Helix collaboration), which prevents formation of the digital ecosystem in the country [The World Bank Report].

Many Russian universities are considered as leaders in the field of digital technologies research, which can be the crucial in the development of digital economy. Academic entrepreneurship in such universities can make a significant contribution to achieving the goals set forth in “Digital Economy” Program. It also facilitates creating connections between various participants of the digital transformation.

3.2 Forms of digital academic entrepreneurship

As it was stated, universities should be engaged in digital technologies transfer, and not only because the government instructs them to. The first reason is that development of digital technologies has an advantage of relatively less needed resources than, for example, of chemical ones, also it takes less time to design and redesign digital products. The second reason is that young generation should be adequately educated in digital

technologies. Third, young people are especially interested in such technologies and eager to explore them.

Let us discuss some forms of academic entrepreneurship that can be used for digital technologies' commercialization in Russian universities.

1) *Creating spin-offs*. In Russia, the procedure for universities to establish small business enterprises was put into force only in 2009. Since then, 2013 spin-offs were registered [Accounting and monitoring...]. Universities' management rarely pays much attention to this activity, and spin-offs are created under the pressure of authorities and the government's requirements. The most threatening point in this process is uncertainty with regard to assessing spin-offs' performance. In many cases, universities set financial targets for them (such as revenue, profit, cash flow, etc.), which are almost unreachable for new technological businesses in the first years. For digital technologies, on the contrary, it is much easier to meet these requirements.

2) *Joint research with companies*. On the one hand, partnership with business contributes to the rapid transfer of digital technologies from university environment. On the other hand, it provides the reverse process – immediate feedback: information about the required improvements or product customization directions. In addition, business can form an exact request for a university to train the personnel with specific digital technologies' competences. Such cooperation can also result in creation of university spin-offs, though this form is not much widespread in Russia.

3) *Licensing*. Doubtlessly, developing of some digital technologies demands special equipment and competencies which are not available in a university. In such case, the IPRs can be offered for further commercialization in business organizations. Correspondingly, this form enables similar relationship between business and university as the previous one.

Thus, digital technologies development in the form of academic entrepreneurship can be embodied in a variety of forms. A university may choose the form based on its strategy, peculiarities and existing support system. In general, the main obstacle for academic entrepreneurship in Russia is the lack of collaboration experience both of business companies, and universities.

It is worth to emphasize that digital academic entrepreneurship also contributes to modernizing educational programs.

3.3 Proposed research on entrepreneurial component of university's organizational culture

The author has been conducting surveys of students' and faculty members' opinions and business aspirations. Based on the importance of supporting academic entrepreneurship in the sphere of digital economy, the next goal of the research has been set. It is planned to form the pull of respondents from the two major Russian universities that are situated in St Petersburg: St Petersburg State University (SPbU) and National Research University ITMO. SPbU is one of the biggest and oldest universities in Russia. It provides education and research in a wide range of fields – from physics and chemistry

to philology and psychology. Mathematics and Mechanics Faculty's alumni are among the most preferable candidates for companies of software development industry.

The ITMO was founded 100 year ago and used to be the educational institution in the field of mechanics, optics and watchmaking. Since those disciplines require profound knowledge of mathematics, it is no surprise that nowadays it is famous for its alumni's skills in programming and engineering. Additionally, one of the ITMO's goals is to support business initiatives of students and faculty members. It is intended to get answers from students of bachelor and master programs.

The survey is aimed at studying digital business aspirations and preferable ways of support of business creation in the sphere of digital technologies. The minor objectives are assessing dynamics of opinions (comparing to the previous results) and determining the share of early adopters among respondents.

Based on the results of previous research, preliminary hypotheses have been formulated as follows:

- students of major in economics tend to have lower business aspirations;
- students and faculty members are most interested in getting consultancy and entrepreneurial skills training as forms of university support;
- respondents with some business experience value different kinds of support;
- trust matters when creating of business is concerned;
- students and professors of the ITMO are more inclined to start business projects with the participation of their university;
- respondents from the ITMO are aware of entrepreneurship support in greater extent.

The answers obtained will be used to elaborate recommendations for enhancing innovation infrastructure in universities.

4 Conclusions

Universities must take an active part in digital economy development. They traditionally interact with young generation that consists of future producers and consumers of digital products. In turn, universities in Russia possess the widely recognized competence in digital technologies, which can partly provide the strong foundation for developing digital economy.

Summing up, it is necessary to highlight the promise of academic entrepreneurship as one of the tools for digital economy development. The commercialization of university technologies allows to increase the digitalization of business, to provide highly qualified and experienced personnel. However, universities' management is supposed to create the innovation infrastructure in order to support academic entrepreneurship effectively. Implementation of such support system in universities still requires close examination and taking into account opinion of students, research and educational personnel.

References

- Accounting and monitoring of small innovative enterprises of the scientific and educational sphere.
URL : <https://mip.extech.ru/index.php> (in Russian) (accessed 11.04.2019).
- Brighton, D., Zajko, M., Pezoldt, K. (2015) *Successful Innovations? Efficient Knowledge and Technology Transfer and International Collaboration*. Universitätsverlag Ilmenau. 2015.
- Etzkowitz, H. (2001) "The second academic revolution and the rise of entrepreneurial science", *Technology and Society Magazine*, Summer, pp. 18–29.
- Etzkowitz, H. (2013) "Anatomy of the entrepreneurial university", *Social Science Information*, No. 52(3), pp. 486–511.
- MIT Initiative on the Digital Economy. Annual report of 2018. URL : http://ide.mit.edu/sites/default/files/MIT2018report-final-digital_0.pdf (accessed 05.04.2019).
- OECD (2017) *Benchmarking higher education system performance: Conceptual framework and data, Enhancing Higher Education System Performance*, OECD Paris.
- Richter, K.K., Pakhomova, N.V. (2018) "Digital economics as a 21 c. innovation: challenges and chances for sustainable development", *Problems of modern economics*, No. 66(2), pp. 22–31.
- The State Program "Digital Economy of the Russian Federation" (Government Resolution N 1632-r from July 28th 2017).
- The World Bank Report "Competition in the digital age: strategic challenges for the Russian Federation" URL : <http://documents.worldbank.org/curated/en/848071539115489168/pdf/AUS0000158-RUSSIAN-WP-REVISED-P160805-PUBLIC-Disclosed-10-15-2018.pdf> (accessed 05.01.2019).
- World Bank Group. 2018. *Malaysia's Digital Economy: A New Driver of Development*. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO. URL : <https://openknowledge.worldbank.org/bitstream/handle/10986/30383/129777.pdf> (accessed 01.04.2019).

Cross-Country Analysis of Perception and Emphasis of Hotel Attributes

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Abstract

This study investigates the effect of cross-country differences on online hotel reviews. More in details, it investigates differences in the way Italians, Americans, and Chinese travelers perceive and emphasize hotel attributes. Based on a random sample of 9,000 online reviews, the study used text link analysis to extrapolate the frequencies of predefined hotel attributes on which further multivariate analyses and tests were performed. Answers are provided to two research questions: Do travelers from different countries place different emphasis on hotel attributes? Do travelers from different countries perceive hotel attributes differently? Findings suggest that the differences in perceptions and emphasis are significant. The adopted text-mining method could be useful for hotel business managers to hear the voices of consumers and include them in performance evaluation and service design processes.

Keywords – user-generated contents; cross-country; perception; emphasis; text-mining; hotel attribute.

Nature of the proposed paper: Academic Research Paper

1. Introduction

Customer satisfaction has been defined as a customer's subjective evaluation of a product/service provided on the basis of expectations and actual performance. For example, when judging hotels, customers evaluate their degree of satisfaction based on how they perceive the attributes of hotels that they consider most important. Thus, evaluations of hotels attributes are considered dimensions of satisfaction. Investigating customer satisfaction is of interest as, according to a huge number of studies (e.g., Radojevic et al., 2018; Rajaguru and Hassanli, 2018), it plays a fundamental role in encouraging customers in making a recommendation to their friends, returning, and

giving positive reviews, thus affecting customers' behavioral loyalty and marketing signals.

In the tourism management literature, one significant challenge related to the study of customers' satisfaction and its antecedents is the diversity of consumers, which should be taken into consideration using segmentation (Bodet et al., 2017). Among segmentation variables, consumer culture has received growing interest and was recognized as crucial by several scholars (e.g., Bodet et al., 2017). With the trend of globalization and the emergence of culture-related issues, national and cultural differences have revealed their significance in explaining consumers behavior (Huang and Crofts, 2019).

Despite the recognized importance played in investigating the diversity of consumers, the debate as to 'if' and 'to what degree' national cultural differences should be considered remains unresolved (e.g., Huang and Crofts, 2019). On the one hand, a 'global consumer' perspective has emerged, grounded on the idea that all consumers share a common set of values, preferences, and behaviors (e.g., Nowak and Kochkova, 2011). Scholars belonging to this perspective believe that the cultural differences are collapsing, creating a smaller more homogenous world brought about by a variety of forces including the global media, the internet, economic unifications, and migration and tourism.

On the other hand, others (e.g., de Mooij and Beniflah, 2016) stressed that travelers have different expectations and preferences that are partly rooted in their shared societal or cultural values. This alternative perspective derives from the fields of psychology and anthropological psychology and assert that humans are predisposed, consciously or unconsciously, to break society up into different groups, thus creating an 'us' versus 'them' (Huang and Crofts, 2019).

This study attempts to add to this debate by investigating the effect of cross-country differences on hotels online reviews. More specifically, it is focused on two issues: (i) cross-country differences in terms of emphasis devoted to hotel attributes and (ii) cross-country differences in terms of perception of hotel attributes. This because contrasting findings emerged in the literature with reference to these issues. Therefore, questions such as "Do travelers belonging to different countries emphasize the same hotel attributes?" and "Do travelers belonging to different countries perceive similarly hotel attributes?" remain unanswered. Based on a random sample of 9.000 online reviews, the analysis adopted Text Link Analysis to extrapolate the frequencies of predefined hotel attributes on which multivariate analyses and tests were performed. Answers to the two research questions are provided. The text-mining method adopted could help hotel business managers to hear the voices of consumers and include them in performance evaluation and service design processes.

2. Emphasis and perception of hotel attributes

Schuckert et al. (2015) provided a theoretical summary of previous studies dealing with the effect of cultural differences on customer satisfaction. They classified them into four areas: differences in perceiving hotel attributes (perception difference), different expectations about hotel and service quality (expectation difference), emphasis given to

each hotel attribute or service aspect (emphasis difference), and different behaviors in complaint activities (complaint difference).

In the present study, cross-country differences were investigated with regard to emphasis and perception. For both types of differences, contrasting thoughts were identified in the literature, which made further investigation interesting. In the following, such thoughts will be presented as well as the research questions (RQs) emerging from the debates.

2.1. Emphasis difference

With the term emphasis, Schuckert et al. (2015) referred to the importance placed by travelers on various hotel attributes. In the hospitality management literature, one research stream is focused on understanding whether different cultural backgrounds determine significant differences in the emphasis placed by consumers on various hotel attributes. The large majority of studies compared eastern and western cultures. The results obtained by scholars were often contradictory both in terms of the existence of emphasis differences between users belonging to different cultures and which hotel attributes are emphasized by each cultural group of users.

As for the former (the existence of emphasis differences between users belonging to different cultures), some scholars (e.g., McCleary et al., 1998) found little difference in the importance placed by western and eastern travelers on various hotel issues, thus arguing that no such differences in emphasis exist. Others (e.g., Poon and Low, 2005) argued the opposite, that is, that significant emphasis differences exist between users belonging to different cultures.

As for the latter (which hotel attributes are emphasized by each cultural group of users), several contrasting findings were identified. Poon and Low (2005) argued that Asian travelers place more emphasis on factors such as pricing and staff hospitality, whereas Western travelers place more emphasis on hotel appearance. Regarding staff, Tsang and Ap (2007) proposed that Asians emphasize the staff's competence while Westerners emphasize the staff's attitude. Conversely, Kuo (2007) stressed that American travelers emphasize hotel employees' problem-solving abilities while Taiwanese customers are more affected by politeness.

Based on these contrasting findings, there is a question regarding whether groups of individuals from different countries emphasize hotel attributes differently, which leads to the following:

RQ1: Do travelers from different countries place different emphasis on hotel attributes?

2.2. Perception difference

When evaluating something, people can perceive the same product or service differently. The present study conjectures that an individual's country of origin (and thus his or her culture) could play a significant role in shaping his or her perception of hotel attributes. Weiermair (2000) argued that every country has its peculiar culture and unique perception of hotel attributes, so travelers from different countries may have remarkably different perceptions of the quality of the same service received. More recently, Hsieh and

Tsai (2009) found that cultural differences could create different perceptions of service quality.

Some scholars (e.g., Kuo, 2007; Tsang and Ap, 2007) stressed that Asian tourists, in general, tend to have higher expectations and to evaluate service performance less favorably compared to Western tourists. These authors offered the following reasons for these differences: (i) Asian cultures are collectivistic, and Asian tourists are likely to expect greater courtesy and consideration compared to individuals from less people-oriented and individualistic societies, and (ii) Asian tourists are likely to view themselves as being much more powerful than their service providers due to the fact that the power distance is higher in Asian cultures compared to Western cultures.

Conversely, other scholars (e.g., Zhang et al., 2008) stressed that individuals belonging to more individualistic societies, such as Americans and Europeans, have higher expectations in terms of service quality. Therefore, they should be generally less satisfied compared to Asians and should be stricter in their service evaluation.

Again, based on these contrasting findings, there is a question regarding whether groups of individuals from different countries perceive hotel attributes differently, which leads to the following:

RQ2: Do travelers from different countries perceive hotel attributes differently?

3. Research Settings

The methodological process followed in the study is described in the following Figure 1. In brief, the idea is to analyze UGCs with Text Link Analysis (TLA), using a commercial software able to identify specific parts of speech in the hotel reviews context, classify them according to a predefined number of categories and count the number of comments (frequency) for each category. Based on such extracted frequencies, a series of multivariate analysis and statistical tests were implemented to provide answers to the RQs.

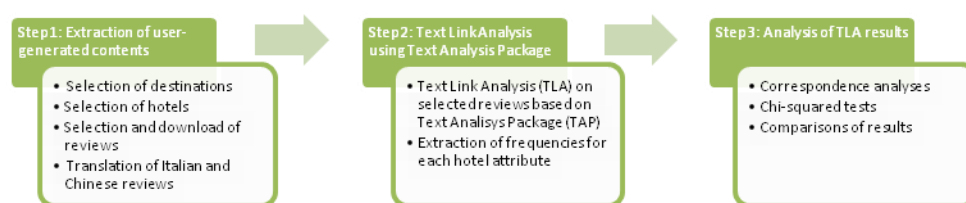


Fig. 1. The methodological process.

Hotels and reviews were randomly collected from one of the leading online booking services Booking.com™. Specifically, 9000 reviews were randomly selected and downloaded.

Table 1 provides additional descriptive statistics:

Table 1. Descriptive statistics

Regions	4
Destinations	4
Hotels (total)	123
1-star	38
2-star	24
3-star	18
4-star	17
5-star	26
Average number of reviews per hotel (approximated)	73
Average length of reviews (words-approximated)	13

Reviews extracted in Italian and Chinese languages were translated in English by two professors, one for each language.

The resulting xls file included, for each review, the user's country (US, China, or Italy), and positive and negative textual comments in English (as Booking.com provides a distinction for positive and negative comments).

Then, hotels' reviews were analyzed through Text Link Analysis. Text link analysis is a pattern-matching technology that enables the definition of pattern rules and compares these to actual extracted concepts and relationships found in a given text. For the purpose of the present research, IBM SPSS Modeler Text Analytics was used. It relies on linguistics-based text analysis, which is based on the field of study known as natural language processing.

The extraction process was based on fine-tuned linguistic resources (libraries, types, synonyms, and more), labeled as Text Analysis Package (TAP). The TAP used is specifically devoted to the analysis of user-generated contents in the hotel reviews environment. This implies that the extraction process was designed to search for hotel-specific part of speech and to classify hotel attributes according to a predefined classification (included in TAP), which includes the following categories:

- Hotel amenities (Booking, Car parking, Check-in and Check-out, Cleanliness, Comfort, Elevator, Internet, Quietness, Restaurant, Sport facilities, Television and newspaper, Transportation, Upgrade);
- Budget - considerations related to the cost of the room and of the other services offered;
- Service (Attitude, Competence, Promptness);
- Location;
- General satisfaction.

The total number of extracted documents is larger than the number of inputs/UGCs, as each online review can include more than one category (for example, a review can express dissatisfaction about cleanliness and large room). At the same time, the extraction was not able to extract information from all reviews (thus a limited number of reviews was not classified).

The last step of the methodology was aimed at answering the RQs through the implementation of multivariate analysis and statistical tests on extracted frequencies. Cross-country differences in terms of emphasis and perception of hotel attributes were

investigated. To detect emphasis differences, correspondence analysis was implemented, while to identify perception differences, several chi-squared tests were conducted.

4. Results

4.1. Cross-country analyses of emphasis and perception of hotel attributes

The first results obtained through TLA consist of frequencies extracted from online reviews (Table 2). Positive (pos) and negative (neg) frequencies for each hotel attributes were extracted for each country, which were then summed to obtain the column total (tot). For example, with reference to the hotel attribute “Check-in and Check-out” (labeled as *h_check_in_out*) the text link analysis for US individuals identified: 21 positive reviews and 40 negative reviews. The sum of these two values results in a total of 61 online reviews discussing this issue. The hotel attributes for which the frequency value was lower than 5 were not reported, as they could not be used for subsequent multivariate analyses.

Table 2. Extracted frequencies

Hotel attribute	US			China			Italy		
	tot	pos	neg	tot	pos	neg	tot	pos	neg
<i>h_check_in_out</i>	61	21	40	102	45	57	98	30	68
<i>h_cleanliness</i>	649	371	278	856	407	449	821	399	422
<i>h_comfort</i>	1912	850	1062	2334	863	1471	1917	447	1470
<i>h_internet</i>	148	25	123	149	37	112	159	61	98
<i>h_quietness</i>	191	89	102	133	31	102	185	66	119
<i>h_restaurant</i>	931	477	454	613	357	256	1499	575	924
<i>h_sport_facilities</i>	261	134	127	141	76	65	95	36	59
<i>h_upgrade</i>	66	28	38	57	26	31	128	81	47
<i>budget</i>	678	220	458	647	287	360	704	57	647
<i>service_attitude</i>	593	409	184	589	318	271	575	401	174
<i>service_competence</i>	829	555	273	725	404	321	186	129	57
<i>location</i>	979	914	66	968	913	55	880	850	30
<i>general_satisf</i>	742	422	320	597	365	232	778	360	418

4.1.1. Cross-country emphasis differences

To investigate cross-country emphasis differences, the columns labeled as “tot” in Table 2 were considered. They indicate how many positive and negative reviews highlight a given hotel attribute for each sample of individuals (Americans, Chinese, and Italians). Discussing a given attribute in an online review is an unconscious revelation of what is important for the user, thus the measure is consistent with the emphasis concept. To test cross-country emphasis differences, correspondence analysis based on chi-squared tests and adopting symmetric normalization (Fig. 2) was implemented. It utilizes the coordinates on the bi-plot, which is the basic outcome of this analysis, showing the correspondence between the items of the two basic categories, countries and hotel attributes, according to their distance to each other. The results of correspondence

analysis are shown in Table 3 and include the number of dimensions, the eigenvalues, and proportions of explained variance from calculated dimensions. To present these results, the same approach adopted by Toral *et al.* (2018) was followed.

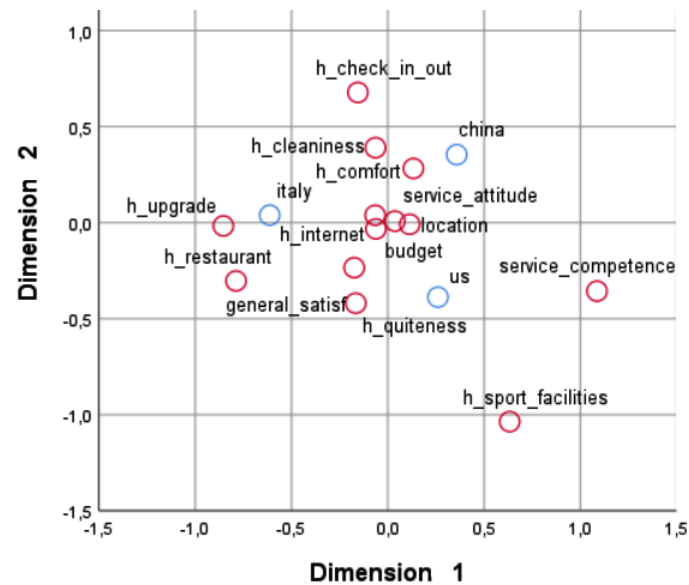


Fig. 2. Correspondence analysis - cross-country differences in terms of emphasis placed on hotel attributes

Table 3. Statistical summary of correspondence analysis between countries and hotel attributes

Dimension	Eigenvalue	Variance %	Cumulative variance %
1	0,19	81,1	81,1
2	0,09	18,9	100

Dimensions are formed by identifying those axes for which the distance between the profiles and axes is minimized while simultaneously maximizing the amount of explained inertia¹. Each dimension has an eigenvalue which represents its relative importance and how much of the inertia it explains (Clausen, 1998). Dimension 1 represents the largest deviation from independence; dimension 2, the second largest. The axes of Figure 4 detail the percentage of variance explained by the first two dimensions, which accounted for 81,1% for the horizontal axis and 18,9% for the vertical axis. Dimensions can be only interpreted based on how the variables' response categories separate on either side of the dimensions. Moreover, the further away from the origin a response category is along a particular dimension, the greater its importance on that dimension (Sourial *et al.*, 2010). Consequently, Dimension 1 can be characterized by the attributes "upgrade",

¹ Inertia is defined as the total Pearson Chi-square for a frequency table divided by the total sum of all observations in the table.

“restaurant”, “general satisfaction”, “sport facilities”, and “service competence”, while Dimension 2 by the attributes “check-in and check-out”, “cleanliness”, “comfort”, “quietness”, and “sport facilities”. The significance of the differences observed between countries in terms of hotel attributes is given by the chi-squared test ($F = 1078,37$, $p\text{-value} = 0.000$), which means a highly significant association.

The results displayed in Figure 4 show that there is a clear difference among individuals belonging to the three countries considered, which occupy different quadrants in the bi-plot, thus providing an answer to RQ1. Each country is depicted near the hotel attributes mostly emphasized by its citizens. More in detail, Figure 4 shows that: Chinese emphasized, more than Americans and Italians, attributes like cleanliness, comfort, and check-in/check-out issues; Italians emphasized, more than Americans and Chinese, issues related to restaurant (breakfast-lunch-dinner) and room upgrade; Americans emphasized more than Italians and Chinese sport facilities, quietness, general satisfaction and staff’s competence. Other attributes extracted are not useful in segmenting individuals, thus meaning that no significant differences were identified with reference to the emphasis paid to them by Italians, Americans, and Chinese. These attributes (namely location, service attitude, internet, and budget) are closer to zero when considering both Dimension 1 and Dimension 2, thus demonstrating a low discriminating power.

4.1.2. Perception differences

To investigate cross-country perception differences, the columns labeled as “pos” and “neg” in Table 2 were considered. To measure perception differences, a series of chi-squared tests were implemented, one for each hotel attribute, taking into account the Bonferroni correction for multiple tests. A significant value obtained in the test for a given attribute meant that individuals from different countries perceived that attribute differently. This analysis was possible only because the number of reviews extracted for each country is the same for each hotel considered. Therefore, considering a given hotel attribute and finding a significantly different number of positive vs negative reviews when compared cross-country differences implies a different perception of the same hotel attribute.

For example, as for the first hotel attribute (h_check_in_out), the test was performed on the following Table 4 of extracted frequencies:

Table 4. Contingency table for the Check-in and Check-out attribute.

	pos	neg
US	21	40
CHINA	45	57
ITALY	30	68

in which the result of the Pearson Chi-Square test was 4,110, the degrees of freedom were 2 and the Asymptotic Significance (2-sided) was 0,128, thus indicating non-significant cross-country differences for the perception of the check-in and check-out attribute.

In the following (Table 5), results deriving from chi-squared tests for each hotel attribute are presented.

Table 5. Chi-squared tests –cross-country differences in terms of perception of hotel attributes

Hotel attribute		Value	df	Asymptotic Significance (2-sided)
h_check_in_out	Pearson Chi-Square	4,110	2	,128
	Likelihood Ratio	4,101	2	,129
	N of Valid Cases	261		
h_cleanliness	Pearson Chi-Square	15,697	2	,000
	Likelihood Ratio	15,742	2	,000
	N of Valid Cases	2326		
h_comfort	Pearson Chi-Square	194,024	2	,000
	Likelihood Ratio	199,452	2	,000
	N of Valid Cases	6163		
h_internet	Pearson Chi-Square	18,458	2	,000
	Likelihood Ratio	18,504	2	,000
	N of Valid Cases	456		
h_quietness	Pearson Chi-Square	18,432	2	,000
	Likelihood Ratio	18,897	2	,000
	N of Valid Cases	509		
h_restaurant	Pearson Chi-Square	82,277	2	,000
	Likelihood Ratio	82,639	2	,000
	N of Valid Cases	3043		
h_sport_facilities	Pearson Chi-Square	6,565	2	,038
	Likelihood Ratio	6,621	2	,037
	N of Valid Cases	497		
h_upgrade	Pearson Chi-Square	7,794	2	,020
	Likelihood Ratio	7,806	2	,020
	N of Valid Cases	261		
budget	Pearson Chi-Square	231,865	2	,000
	Likelihood Ratio	259,327	2	,000
	N of Valid Cases	2029		
service_attitude	Pearson Chi-Square	40,265	2	,000
	Likelihood Ratio	39,715	2	,000
	N of Valid Cases	1757		
service_competence	Pearson Chi-Square	25,192	2	,000
	Likelihood Ratio	25,126	2	,000
	N of Valid Cases	1739		
location	Pearson Chi-Square	10,487	2	,005
	Likelihood Ratio	11,117	2	,004
	N of Valid Cases	2828		
general_satisf	Pearson Chi-Square	33,410	2	,000
	Likelihood Ratio	33,458	2	,000
	N of Valid Cases	2117		

From these tests, it emerged that check-in and check-out, sport facilities and upgrade attributes were perceived similarly by individuals belonging to the three different countries, as their relative tests resulted to be not significant. Conversely, Americans, Chinese, and Italians perceived the other hotel attributes differently, thus providing an answer to RQ2. To understand more in-depth which group of individuals perceived more

positively/negatively each hotel attribute, the ‘partitioning chi-squared’ procedure (Agresti, 2007) was implemented. Agresti (2007) stressed that chi-squared statistics having degrees of freedom > 1 can be broken into components with fewer degrees of freedom. The procedure was implemented on each contingency table to understand which group of individuals contributes the most to the significance of the test. This implied the repeated removal of a group of individuals and the recalculation of the chi-squared test for each hotel attribute. As a result, we identified for each attribute which group of individuals perceives it more positively/negatively compared to the others (see Table 6). restaurant, quietness and budget attributes are included in different rows, as the partitioning chi-squared resulted to be significant more than one time.

Table 6. Summary of results for tests on cross-country differences of hotel attributes

	Attributes perceived more positively (compared to individuals belonging to other countries)	Attributes perceived more negatively (compared to individuals belonging to other countries)
US	Cleanliness, Quietness	
CHINA	Restaurant, Budget	Quietness, Service Attitude, Service Competence
ITALY	Internet, Location	Comfort, Restaurant, Budget, General Satisfaction

5. Conclusions

5.1. Discussion

This study investigated cross-country differences in terms of emphasis and perception of hotel attributes, providing answers to the two RQs proposed—*Do travelers from different countries place different emphasis on hotel attributes? Do travelers from different countries perceive hotel attributes differently?*

Results suggest that cross-country emphasis and perception differences are noticeable and could be extrapolated from online reviews. In the following, results obtained for each RQ are discussed in detail.

5.1.1. Travelers belonging to different countries place different emphasis on hotel attributes

The emphasis paid to hotel attributes and the relative countries’ position was graphically displayed in a bi-plot representation (correspondence analysis) where distances are proportional to the dissimilarity of countries and emphasis paid to hotel attributes. Results obtained clearly highlight that each group of travelers (Americans, Chinese, and Italians) emphasized hotel attributes differently. Cleanliness, comfort, and check-in/check-out were considered more important by Chinese, sport facilities, quietness, general satisfaction and staff’s competence were considered more important by Americans, and restaurant and room upgrade were considered more important by Italians. Conversely, for other hotel attributes (i.e., location, service attitude, internet, and budget) no significant cross-country differences were observed. This means that the emphasis devoted to each of

these hotel attributes by Italians, Americans, and Chinese was the same. However, the three groups of individuals were clearly differentiated, as demonstrated by the significance of the correspondence analysis. Therefore, this study suggests that travelers belonging to different countries place different emphasis on hotel attributes.

5.1.2. Travelers belonging to different countries perceive hotel attributes differently

Regarding the second RQ, first strong support for cross-country perception differences was provided, highlighting which hotel attributes were perceived more positively/negatively by each group of individuals. It emerged that, compared to the others: Americans perceived more positively cleanliness and quietness; Chinese perceived more positively restaurant and budget but more negatively quietness, service attitude and service competence; Italians perceived more positively internet and location but more negatively comfort, restaurant, budget, and general satisfaction. The findings also highlighted the presence of three attributes, namely check-in and check-out, sport facilities, and upgrade that were perceived similarly by the three groups of travelers. Despite the presence of these non-differentiating attributes, the large majority of them were perceived differently by Italians, Chinese, and Americans. This suggests that travelers belonging to different countries perceive hotel attributes differently.

5.2. Implications for managers

By identifying the factors of importance for segmented customers and how they are perceived, the findings of this study may also help hotel managers in determining the optimal allocation of scarce financial resources with respect to customer satisfaction criteria.

The effective segmentation of the hotel's customer base and the analysis of emphasis and perception of hotel attributes may reveal subtle performance issues that could be easily remedied but that can hamper the reputation of hotels if left unaddressed. For example, it could be of importance to understand whether guests belonging to specific countries (Americans in our sample) pay specific attention to sports facilities and quietness as managers could establish specific agreements with external structures and reserving silent rooms to them (where possible), thus increasing guests' satisfaction at no cost. Understanding that Italians pay attention to room upgrade could lead to propose such improvement to them, where possible, at no cost. The use of software devoted to analyzing large-volume of text, like online reviews, allows the identification of such issues.

Finally, the identification of detailed cross-country differences in terms of emphasis and perception of hotel attributes may be crucial for hotel managers in designing persuasive marketing campaigns, promotions, and communications based on specific hotel attributes or that emphasize such attributes instead of others.

5.3. Limitations and future research

Two main limitations of the study are recognized. The first refers to the tool used to perform the text link analysis and the categorization of concepts through predefined hotel attributes. The present study represents the first attempt to implement this methodological approach to extract frequencies of hotel attributes from UGCs through a text mining software. Although the tool allows the extraction of concepts from a large set of UGCs, it cannot identify some specific issues deriving from human language, therefore ignoring some potentially useful part-of-speech. This could result in lower frequency values for some specific or for all hotel attributes, thus somehow affecting the analysis. In addition, although categorization based on predetermined hotel attributes has the advantage of extracting issues or topics effectively based on keywords, there are disadvantages. The main refers to the fact that it is not possible to score the degree of positive/negative intensity due to the nature of the algorithm. This degree of intensity, which could be useful in understanding more in-depth cross-country differences in terms of perception and emphasis, cannot be determined through our approach (which is based on frequencies).

The second limitation refers to the number of UGCs considered in the analysis and the generalizability of results. Despite adopting a random sampling method, the number of observations included in the study was limited if compared with the huge number of hotel online reviews. The decision to limit the analysis to 9000 reviews derived from the need to be accurate in manually translating UGCs from Chinese and Italian to English, which was a very time-consuming process. Such limited number led to extract a small number of frequencies for some of the hotel attributes considered, which could not be included in the multivariate analyses. In addition, it prevented the possibility to analyze the effect of geographical location of the hotels on the emphasis and perception constructs, as this would have led to excessive fragmentation of extracted frequencies. Therefore, although the findings suggest that cross-country emphasis and perception differences of hotel attributes are noticeable and could be extrapolated from online reviews, it cannot be claimed that the observed cross-country differences in terms of emphasis and perceptions will be valid when considering UGCs deriving from different settings. Additional analyses considering a larger number of UGCs should be performed to confirm the validity of our findings.

References

- Agresti, A., (2007), *An introduction to categorical data analysis*. John Wiley Hoboken, NJ, USA.
- Bodet, G., Anaba, V. and Bouchet, P., (2017) "Hotel attributes and consumer satisfaction: A cross-country and cross-hotel study", *Journal of Travel & Tourism Marketing*, Vol. 34, No. 1, pp. 52-69.
- Clausen, S.E., (1998), *Applied Correspondence Analysis*. Thousand Oaks, CA: Sage.
- Hsieh, A.T., and Tsai, C.W., (2009), "Does national culture really matter? Hotel service perceptions by Taiwan and American tourists", *International Journal of Culture, Tourism and Hospitality Research*, Vol.3 No.1, pp.54-69.

- Huang, S.S. and Crotts, J., (2019) "Relationships between Hofstede's cultural dimensions and tourist satisfaction: A cross-country cross-sample examination", *Tourism Management*, Vol. 72, pp. 232-241.
- Kuo, C.M., (2007), "The importance of hotel employee service attitude and the satisfaction of international tourists", *The Service Industries Journal*, Vol.27 No.8, pp.1073-1085.
- Mccleary, K.W., Choi, B.M. and Weaver, P.A., (1998) "A comparison of hotel selection criteria between US and Korean business travelers", *Journal of Hospitality & Tourism Research*, Vol.22 No.1, pp.25-38.
- de Mooij, M. and Beniflah, J., (2016) "Measuring cross-cultural differences of ethnic groups within nations: Convergence or divergence of cultural values? The case of the United States", *Journal of International Consumer Marketing*, Vol. 29, No. 1, pp. 2-10.
- Nowak, J. and Kochkova, O., (2011) "Income, culture, and household consumption expenditure patterns in the European Union: Convergence or divergence?", *Journal of International Consumer Marketing*, Vol. 23, No. 3/4, pp. 260-275.
- Poon, W.C. and Low, K., (2005) "Are travellers satisfied with Malaysian hotels?", *International Journal of Contemporary Hospitality Management*, Vol.17 No.3, pp.217-227.
- Radojevic, T., Stanic, N., Stanic, N. and Davidson, R., (2018) "The effects of traveling for business on customer satisfaction with hotel services", *Tourism Management*, Vol. 67, pp. 326-341.
- Rajaguru, R. and Hassanli, N., (2018) "The role of trip purpose and hotel star rating on guests' satisfaction and WOM", *International Journal of Contemporary Hospitality Management*, Vol. 30, No. 5, pp. 2268-2286.
- Schuckert, M., Liu, X. and Law, R., (2015) "A segmentation of online reviews by language groups: How English and non-English speakers rate hotels differently", *International Journal of Hospitality Management*, Vol.48, pp.143-149.
- Sourial, N., Wolfson, C., Zhu, B., Quail, J., Fletcher, J., Karunanathan, S., ... and Bergman, H., (2010), "Correspondence analysis is a useful tool to uncover the relationships among categorical variables", *Journal of Clinical Epidemiology*, Vol.63 No.6, pp.638-646.
- Toral, S.L., Martínez-Torres, M.R., and Gonzalez-Rodriguez, M.R., (2018), "Identification of the Unique Attributes of Tourist Destinations from Online Reviews", *Journal of Travel Research*, Vol.57 No.7, pp.908-919.
- Tsang, N.K., and Ap, J., (2007), "Tourists' Perceptions of Relational Quality Service Attributes: A Cross-cultural Study", *Journal of Travel Research*, Vol.45, pp.355-363.
- Weiermair, K., (2000), "Tourists' perceptions towards and satisfaction with service quality in the cross-cultural service encounter: implications for hospitality and tourism management", *Managing Service Quality: An International Journal*, Vol.10 No.6, pp.397-409.
- Zhang, J., Beatty, S. E., and Walsh, G., (2008), "Review and future directions of cross-cultural consumer services research", *Journal of Business Research*, Vol.61 No.3, pp.211-224.

On the Value of Food Information Services under a Consumer Perspective

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Abstract

Food consumer behavior has changed substantially over the past decades. The contemporary food consumer has become more critical and outspoken, demanding more relevant, accurate and reliable information necessary for his/her food decision making or learning. This new context makes research studies on the relationship between the behaviours of food consumer and food information user quite important. Several studies addressed the role of food information in food consumption activities. However, literature lacks of a holistic overview of the dimensions impacting on consumer's perception of the value of food information when he/she is involved in food a food consumption process. The recent wave of the so-called "Internet-of-Food" (IoF) provide consumer with countless mobile apps and food-related objects and devices which are augmented with sensing, computing and communication capabilities in order to provide advanced information services. Nevertheless, the available research lacks in defining an approach capable to analyze the value of information provided to targeted audiences by Food Information Services (FISs). This paper intends to fill these gaps through a literature review of scientific research that combines knowledge on food consumer's and food information user's behaviours to identify main value dimensions in food information services that constitute a base for a multidimensional framework to identify the value proposition of a FIS.

Keywords – Food Information Services, Information Value, Value Proposition, Internet-of-food

Paper type – Academic Research Paper

1 Introduction

Due to the significant changes in life-styles and values taken place in the last decades, consumer's behaviour in food-related choices has been transformed. Smaller, higher-educated families, single-person have triggered a quiet revolution that is gradually doing away with conventional eating patterns (Costa and Jongen, 2006). The growing importance of values such as quality of life, well-being, as well the renewed interest towards local food-culture and heritage, exerts a high degree of influence on the way consumers perceive and evaluate food. In facts, contemporary food consumer has become more critical and outspoken, demanding and expecting to get more relevant, accurate and reliable information necessary for his/her food decision making.

In this frame, the challenge of food information management is to deliver the information that enables consumers to make appropriate choices according to their own individual objectives as they are involved in food consumption activities. An effective and efficient Food Information Service (FIS) should deliver the right information to the right people, at the right time, and at the right place.

FISs that deliver massive and generic food information have a limited chance of success since they carry high search costs for the consumer and can hamper the ability to detect and correctly identify information that is needed in his/her decision or learning process (Verbeke, 2008; Bialkova, et al., 2013). Employment of conventional channels (e.g., store shelf and package labels) allows neither to retrieve actionable information from sources that are appropriate for the current consumer's situation, nor, more in general, to provide personalized food information.

Recent advances in the convergence of information and communication technologies (e.g. "internet of food") have led to the development of new FISs that let consumers get more relevant food information than they usually obtain through on-product labelling, mass media or other traditional channels. By leveraging on context-awareness, ubiquity, pervasiveness, and mobility features, mobile based FISs are suitable for an effective and efficient food information provision, providing value to the food consumer.

The added value of food information results from the utility that a recipient obtains by appropriating the new data, interpreting them and placing them in context by combining them with existing personal information, while he/she is involved in a food related activity.

Although several studies addressed the role of food information in food consumption activities, literature lacks of a holistic overview of the dimensions impacting on consumer's perception of the value of food information. This paper intends to fill these gaps through a literature review of scientific research that combines knowledge on food consumer's and food information user's behaviour (Browne et al., 2017) to identify main value dimensions in food information services that constitute a base for a multidimensional framework to identify the value proposition of a FIS. This conceptual tool can be used both to map current offerings of these services and to identify added value of mobile and app-based FISs with respect to conventional or traditional information services.

2 Background and motivations

Consumers are daily involved in food-related activities: planning what to eat, purchase, store and cook food, eating, and disposing remnants. The sequence of consumer's food-related activities, triggered by a food related need, is known as food provisioning or food consumption process (Marshall, 1995). Consumers need to get information on food attributes in order to make appropriate choices when they are involved in food consumption activities. Need for information emerges from the recognition of a gap between a person's knowledge current state and his/her desirable state (Belkin et al., 1982). Due to its nature, an information need arises as an output of a more basic need. It is a part of the search for the satisfaction of a physiological, affective or cognitive need, as an individual is engaged on "information seeking towards the satisfaction of needs" (Wilson, 2006).

In that sense, a food information need usually arises from food-related primary needs associated with a consumer's activity in a stage of the food consumption process (e.g. purchasing appropriate food products, choosing where to buy food, planning meals). The identification of a food information need represents the first stage of the information usage process. It starts as soon as the consumer recognizes an aroused food-related primary need or a need to fill a knowledge gap. The food consumer becomes aware that food information should be acquired and collected in order to meet that need. He/she translates a food-related need or the awareness of a food knowledge gap into an information question relevant to a choice in a specific food consumption stage (Lioutas, 2014).

Food information seeking is the second stage of the information usage process. In this stage, the food information user is actively and purposefully involved in a conscious effort to acquire information in response to a food-related need or a need to fill a food knowledge gap (Kuttscheuter et al., 2017). From a decisional point of view, food information users have to choose the appropriate information channel and the information source able to meet his/her food information need. A user may explore several information channels (e.g. labels, social media, mobile apps) and information source (e.g. food producers, distributors or other food supply chain stakeholders) and ends his/her research when he/she evaluates the retrieved information as sufficiently relevant and reliable. The output of food information seeking is an information cue that a consumer could use to support his/her food decision-making or learning process.

Once food information is selected, consumers can use it for some food choices in a food-related activity, i.e. an activity of the food consumption process or an activity of a food learning process. How consumers interpret, give meaning to, evaluate, and use food information depends on their previous experience, expertise, and needs, as well as their current consumption context, i.e. situational and temporal conditions in which the consumer's food choice occurs (Volpentesta et al., 2017). Context awareness has a significant influence on the food information user, as context cues can support user to better interpret food-related information. In fact, context awareness provides the user with sensory and cognitive cues that allow him/her to refer delivered data and information to

food items (Machin, 2014) (Volpentesta et al., 2018). An information content can be properly interpreted by taking into account other elements within the environment surrounding food products the information content is referring to, e.g. other food products, specific physical conditions (e.g. light, humidity, temperature, localization, spatial layout, package integrity) or organizational features (e.g. operation rules, shop opening).

The above food information usage process and its interrelation with the food consumption process is presented in Figure 1.

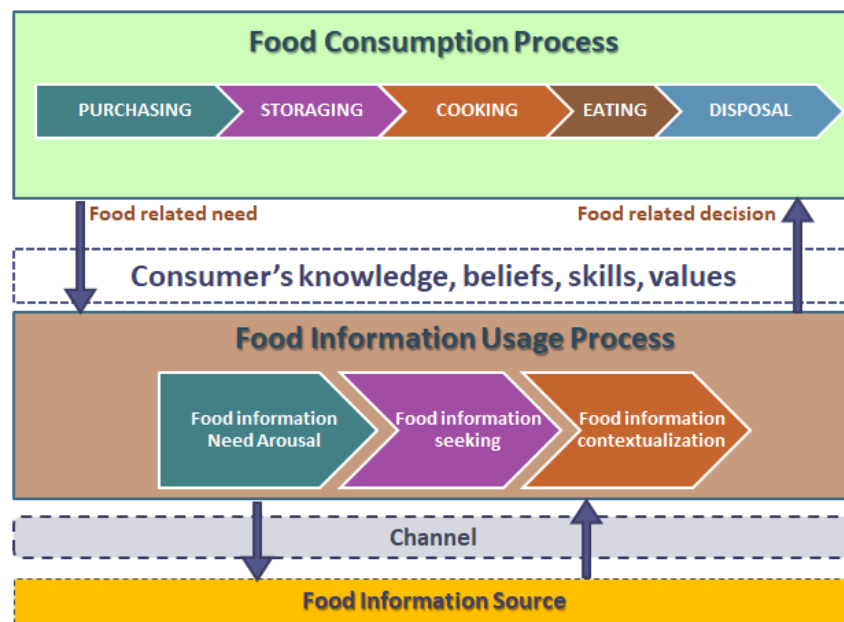


Fig. 8. The food information usage process and the interrelation between the food consumer's behavior and the food information user's behavior.

3 Literature Review

3.1 Methodology

In this paper we carried out a systematic literature review (Kitchenham, 2004), in order to provide a complete, exhaustive summary of relevant literature addressing the consumer's perceived value of food information services when involved in a food information usage process. We selected Scopus as scientific database where to perform our search. We initialized a list L of search keywords with English terms related to the above mentioned scientific domain (e.g. "information seeking", "need for information", "information need arousal", "consumer behaviour", "information behaviour", as well as synonymous, and other broader/wider terms). We performed a search on Scopus database by using keywords in the list L. At the end of this cycle, we obtained the final set P,

consisting of 64 papers to be analysed. For each paper $p \in P$ we identified the components impacting on consumers perceived value of food information services.

3.2 Results and discussion

For sake of clarity, we present our results in three subsections each of which corresponds to one of the main activities of food information usage process. The complete list of papers P we reviewed is available at:

https://drive.google.com/open?id=1NGNDkVRtusIcm_C6w6cBga2DAJQlHT8X

3.2.1 Food information needs identification

Extant literature attempts to explain the link between the rational consumer and necessary inputs, capabilities and willingness to engage in a food decision making process. A food information need arouses as a consequence of consumer's involvement in a food consumption activity, and it is affected by some consumer's attributes (interests, attitudes, experiences, and knowledge) (Nocella et al., 2014). We may summarize the general research questions in literature about the identification of food information needs as follows: "Why do consumers need food information and what information do they need?". These questions have been tackled under either a specific perspective reflecting a psychological perspective related to the antecedents of a consumer's interest. We grouped such perspectives in 6 broad classes, namely healthiness, safety, convenience, hedonism, culture and ethics/sustainability, as reported in table 1:

Table 2. Research directions on food information needs identification.

<i>Perspective</i>	<i>Description</i>	<i>References</i>
Healthiness	impact of health-related consumers' values on food information user's needs. Researches are centred on the identification of consumer's interest towards healthiness/wellness related properties of food. Survey-based research demonstrated that consumers with health related interests, have continuous and more intense information needs about food.	P1,P2,P3,P4, P5,P6
Safety	researches are devoted to investigate the way a consumer's information need arises under a safety-related perspective, They show that this arousal is strictly entwined with the consumer's perception of risks associated to food-related hazards (chemical/microbiological contaminants, preservatives, colorants).	P7,P8,P9, P10,P11,P12, P13
Convenience	Research addressed to study food information need arousal in consumers whose main interest is towards food costs and convenience (e.g. buying food at a lower price, finding the nearest food store, and, in general, gaining benefits during food related activities).	P14
Hedonism	few research works focus explicitly on the relationship between the pleasure of food and information need arousal. Food information needs of consumers are mainly driven by concern for sensory quality of food products, helping to understand how consumers conceptualize and express food information needs into words	P15,P16
Cultural	impact of socio-cultural interests towards the arousal of food information needs. Some researchers have linked up these interests with food consumers (called foodies) who recognize their food information needs in a continuous commitment to self-education (learning about typicity, traditions and values, culinary history)	P17,P18,P19, P20

Ethical	information needs are driven by taking social and environmental concerns of food products into account (ethical consumerism). Research investigate consumer's preferences and needs of information about 'fair trade' aspects (e.g., fair prices to farmers, integration of disabled people, animal welfare) and other food-related sustainable practices (e.g. greenhouse gases reduction, protection of the tropical rainforest, prevention of child labour)	P21,P22
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3.2.2 Information seeking

When a user is consciously involved in an effort to acquire information about food, he/she has to choose the appropriate information channel and the information source able to meet his/her food information need. Information channel refers to a medium used by the consumer in finding food information (mobile-apps, blogs, newspapers, radio, tv). Information source refers to persons or organizations (public authorities, food firms, third parties' food product certifiers, educational organizations, information practitioners) from which food information comes to consumers (Muth et al., 2014).

Research on food information seeking attempted to understand how users behave when they search for food information, emphasizing factors affecting the selection and the evaluation of information sources and channels. Table 2 reports research directions on food information seeking:

Table 2. Research directions on food information seeking.

<i>Perspective</i>		<i>Description</i>	<i>References</i>
Channel related benefits	Availability	Identification of benefits linked up to information channel availability in terms of time and place. Benefits have been investigated for many internet and mobile-based channels that can overcome some limitations of traditional channels, as making information retrievable whenever and wherever the consumer needs for.	P25,P26,P27
	User's effort	Physical and cognitive efforts required by information searching on a given channel.	P28,P29,P30, P31,P32,P33
Source Credibility	Perceived expertise	the degree to which recipients perceive the information source as having the experience, skills, and capacity to provide accurate information.	P35,P36,P37,P38, P39,P40,P41,P42,
	Trustworthiness	the confidence that the source provides objective and correct information.	P8,P44,P45,P46, P47,P48,P49,P50, P51,P52,P53
	Attractiveness	the degree to which an information source is appealing to consumers by exerting verbal, physical, or technology-mediated communication.	P53

3.2.3 Information contextualization and use

Several studies have been conducted on the influence of food information on consumer choices in food consumption activities, but they rather limited their scope to some aspect of the information use process. Most of them have been focused on consumers' use of nutritional labels for purchasing decisions and dietary change.

Researches from the literature reveal that factors influencing the information use in food consumer's choices pertain to the three main entities involved in food decision-making: consumer (who takes the decision), context (situational and temporal conditions in which the decision should be taken), and information (input of the decision-making process). Table 3 summarizes factors affecting food information use.

Table 3. Research directions on food information use.

<i>Perspective</i>	<i>Description</i>	<i>References</i>
Consumer's characteristics	consumer's attributes that influence consumer's interpretation, evaluation, and use of a food information cue. They may be grouped in demographic characteristics (e.g. age, gender, education), interests (e.g. food involvement), and food knowledge (e.g. ability to understand food information);	P1,P63,P55, P56,P60,P61, P62,P63,P64
Context	the way users give meaning and importance to information depends on temporal and location attributes of items within the context where users make decisions.	P11,P53,P58
Information	Few studies examine how much information use depends on the quality of the information a consumer receives. Aspects pertain information accuracy, currency, completeness, as well consumer preferences about information content format. Unfortunately research limited their scope to investigate nutrition label formats	P54,P59

4 A multidimensional framework for modelling a value proposition space for FIS

Information Service Offering refers to a set of activities performed by an information service to satisfy consumer information needs (Tan et al., 2011). Extending the concept of "fitness for use", related to information value and information quality (Eppler et al., 2004; Borek et al., 2014), the value of an information service offering is usually understood as the overall utility that the user receives when using the information service. In the case of FIS, the user is a food consumer who requires the information necessary for his/her food decision-making or learning process, as he/she is involved in food consumption activities in some situations.

The value proposition is defined as an implicit promise a company makes to its customers to deliver a particular combination of values (Sweeney and Soutar, 2001). Several authors (Fojt, 1996; Walters and Lancaster, 1999) agree that business value proposition of information services leverage on three main components: content (i.e. the product or service to be purchased), context (i.e. the environment in which content is offered) and infrastructure (i.e. the way content is delivered).

A FIS must be useful and add value to the tasks of a food consumer. In other words, the value that consumers perceive as a result of a Food Information Usage Process refers to an assessment of benefits and costs deriving from the interaction between consumers and the process. From the supply side perspective, the value proposition of a FIS refers to the ability of a FIS to facilitate a better performance in accomplishing the food information usage process and it reflects service performances impacting on the consumer's judgement about the utility he/she receives when using the service in a food

consumption process. This assessment varies from a consumer to another and from situation to another as it is affected by consumer's attributes (food related values, attitudes, experiences, and knowledge) and context (food consumption place, time, activity, social relations, etc.) in which the decision should be taken (Grunert, 2002). However, utility dimensions impacting on its dimensions can be objectively identified. In the assessment of the perceived value, the consumer will determine the importance of each dimension and its component levels according to his/her own concerns/attitudes and situational context.

The FIS value is therefore characterized by a set of utility dimensions along which consumers assess the utility they receive from FIS performances during the three phases of the food information usage process. In other words, the value proposition of a FIS is a multidimensional space where consumer values can be mapped. In our view, the FIS value is characterized by a set of utility dimensions emerged from the analysis of literature review on food information consumer behaviour, as presented in section 3

In what follows, we introduce three main FIS performances, namely food information (content), information on context where the content is originated (provenance) and the set of devices where information is made available to consumers (interface). These performances affect, respectively, three basic components of the consumer's value, namely, "content relevance", "content credibility", and "content accessibility".

4.1 Content

It consists of information 'cues' that the service provides to a consumer in order to support his/her food decision-making. An information cue has a twofold nature: declarative (it describes food quality attributes) procedural (it is concerned with food consumption activities). Consequently, any performance factor of the information content has two dimensions:

- **food quality topicality.** This performance factor into account the declarative nature of the content cue that reflects some food quality attribute. From the large quantity of literature concerning food consumption choices, we link food quality attributes to the consumer's food values and interests identified in section 3.2.1, namely *convenience/cost*, *healthiness/ wellness*, *sustainability*, *social culture*, *sensory quality*, *safety*. Despite many classifications are based on when, where and how consumers can evaluate the quality aspects of food products, our categories rather take into account "why" a consumer evaluate food quality aspects, as we are interested in the utility a consumer expects from the information content.
- **consumption stage topicality.** This performance factor dimension takes into account the procedural nature of the content cue that deals with parameters, conditions and steps for food consumption activities. From the literature, we have grouped these activities according to the stages of the food consumption process, namely *purchasing*, *storing*, *cooking*, *eating*, *disposal/tidy-up*.

A consumer usually assesses the relevance of a FIS information content in accordance to his/her own food values and information needs related to a food consumption activity.

Therefore, the relevance of the information content reflects how much (topically) the content corresponds to the information demand of the consumer with a certain food value and involved in a food activity of a certain consumption stage. The higher the value is, the more the content fits specific motivations and information expectations of the consumer, as letting him/her infer, or judge, a food quality attribute, and evaluate actions for better achievement of a stage consumption objective.

4.2 Provenance

The content provenance refers to a set of external information cues on the provenance of the content, affecting the consumer value perception of a FIS, in terms of source credibility. Source credibility is widely recognized as the main determinant affecting consumer's choice of a food information source. It refers to the extent to which a recipient believes that the source has considerable knowledge, skills and experiences to provide objective information without bias. As previously evidenced, source credibility leverage on three main sub-dimensions, namely "perceived expertise", "trustworthiness" and "attractiveness". The higher the information source is credible, the more the content is considered as reliable.

Besides identity characteristics of information source, content freshness is also recognized as important factor in building information reliability. The term "content freshness" refers to the "up-to-dateness" (recency) of an information cue (Lewandowski, 2008). Recency is a structural feature that convey "situational relevance" of the content with regard to current events or new information (Saracevic, 1996). Content freshness-related cues prompt an immediate assessment of information reliability and are found to be often used by information users in determining their information behavior's paths (Sundar et al., 2007). The information freshness can be formally defined as the distance between the time the information was created and the time it reaches the user. The higher the information is "fresh", the more the content is considered as reliable.

4.3 Interface

Interface deals with the set of devices where information are made available to consumers. From an infrastructural point of view, the value proposition of information provision services has changed substantially over the past decades, mainly due to the increasing level of technology readiness in the ICT domain. The role of technologies in improving the efficiency and the effectiveness during the phases of the food information usage process is widely discussed in literature. In particular, research focuses on benefits affecting the selection of information channels.

Some research works have focused on the role of technologies in reducing physical and mental efforts that consumers have to sustain to interact with the process and to carry out food-related decisions (e.g. ability to use food information tools and ability to understand and use food information). Extant research on information systems evidences that the way users give meaning and importance to information depends on temporal and location attributes of items within the context where users make decisions. Unfortunately, contextual factors have not been prioritized in previous research related to food

information use. Few studies deal with the influence of context on food consumer decision making, focusing mainly on environmental factors.

An overview of the framework components and their relationships is given in table 4.

Table 4. Summary of the multidimensional framework for modelling the FIS value space

<i>Performance</i>	<i>Set of performance factors</i>	<i>Utility dimension</i>
Content	food quality topicality	Declarative utility
	consumption stage topicality	Procedural utility
Provenance	identity and quality of information source	Source credibility
	time of information creation	Information Freshness
Interface	spatial availability of information	accessibility in terms of proximity of output device to consumer's place
	time availability of information	accessibility in terms of timeliness with respect to consumer's information need
	Context dependency	environmental closeness: information provision depends on physical and organizational properties of the environment (food in context)

5 Conclusions

Our study examines which attributes of are prioritized in scientific literature as factors affecting the food information usage process. These attributes are used as a basis to identify value components of FIS supporting consumers in their food-related decision making.

Despite the great interest that researchers have shown in food consumer's information behaviour over past decades, the interrelation between the food consumer's behaviour and the food information user's behaviour has been investigated without taking into account current paradigms of FIS. Current context-sensitive technologies make urgent to open up research directions aimed to investigate the role of food information contextualization in the food information usage process.

In this paper, we propose a multidimensional framework for modelling a food information provision space where to position the value proposition of FISs, according their utility in meeting food consumer information expectations. Components fall into three broad classes: content (what information is provided to the consumer), provenance (who is involved in the information provision process, and interface (how/where/when the information is made available to the consumer). Our framework may represent a valuable tool to analyze the value proposition of FISs according to a consumer perspective. Moreover, it could be used to suggest some direction to obtain fruitful insights for the design of a new generation of food information services or to identify potential service delivery improvements within the IoF domain.

References

- Belkin, N. J., Oddy, R. N., Brooks, H. M. (1982) "ASK for information retrieval: Part I. Background and theory", *Journal of Documentation*, Vol. 38, No. 2, pp. 61–71.
- Bialkova, S., Grunert, K.G. Van Trijp, H. (2013) "Standing out in the crowd: The effect of information clutter on consumer attention for front-of-pack nutrition labels", *Food Policy*, Vol. 41, pp. 65–74.
- Bititci, U.S., Martinez, V., Albores, P. and Parung, J.(204) "Creating and managing value in collaborative networks", *International Journal of Physical Distribution & Logistics Management*, Vol. 34 No.3/4, pp. 251-268.
- Booth, D. A. (1985) "Food-conditioned Eating Preferences and Aversions with Interceptive Elements", *Annals of the New York Academy of Sciences*, Vol. 443, No. 1, pp. 22-41.
- Borek, A., Parlikad, A. K., Woodall, P., Tomasella, M. (2014), "A risk based model for quantifying the impact of information quality", *Computers in Industry*, Vol. 65, No. 2, pp. 354-366.
- Browne, G. J., Cheung, C. M., Heinzl, A., Riedl, R. (2017), "Human Information Behaviour", *Business & Information Systems Engineering*, Vol. 59, No. 1, pp. 1–2
- Costa, A. I., Jongen, W. M. F. (2006). "New insights into consumer-led food product development", *Trends in Food Science & Technology*, Vol. 17, No. 8, pp. 457-465.
- Eppler, M. J., Helfert, M., Gasser, U. (2004), "Information quality: Organizational, technological, and legal perspectives", *Studies in Communication Sciences*, Vol. 4, No. 2, 1-16.
- Foijt M. (1996) "Doing business on the information superhighway", *Internet Research*, Vol. 6, No. 2/3, pp. 79-81.
- Grunert, K. G. (2002) "Current issues in the understanding of consumer food choice", *Trends in Food Science & Technology*, Vol. 13, No. 8, pp. 275-285.
- Kitchenham, B. (2004). *Procedures for performing systematic reviews*. Keele, UK, Keele University,
- Lewandowski, D. (2008), "A three-year study on the freshness of web search engine database", *Journal of Information Science*, Vol. 38, No. 6, pp. 817-831.
- Kuttschreuter, M., Rutsaert, P., Hilverda, F., Regan, Á., Barnett, J., Verbeke, W. (2014), "Seeking information about food-related risks: The contribution of social media", *Food Quality and Preference*, Vol. 37, No. 10-18.
- Lioutas, E.D. (2014) "Food Consumer Information Behavior: Need Arousal, Seeking Behavior, and Information Use" *Journal of Agricultural & Food Information*, Vol. 15, No.2, pp. 81-108,
- Machín, L., Giménez, A., Vidal, L. and Ares, G. (2014) "Influence of Context on Motives Underlying Food Choice", *J Sens Stud*, Vol. 29, pp. 313–324
- Marshall, D.W. (1995) *Food choice, the consumer and food provisioning*, D.W. Marshall (Ed.), *Food choice and the consumer*, Blackie Academic & Professional, pp. 3–17.
- Muth, M. K., Karns, S. A., Zmuda, M., Coglaiti, M. C., Koyanagi, M., Duffey, K., Gregory, C. (2014). Price, nutrition, time, and other trade-offs: a Web-based food value analysis application to compare foods at different levels of preparation and processing. *Nutrition Today*, 49(4), 176-184.
- Nocella, G., Romano, D., & Stefani, G. (2014). Consumers' attitudes, trust and willingness to pay for food information. *International journal of consumer studies*, 38(2), 153-165.
- Saracevic, T. (1996). *Relevance reconsidered*. In P. Ingwersen & N.O. Pors (Eds.), *Information science: Integration in Perspective*, Copenhagen: Royal School of Library and Information Science, pp. 201–218.
- Sundar, S.S., Knobloch-Westerwick, S., Hastall, M.R. (2007), "News cues: Information scent and cognitive heuristics", *Journal of the American Society for Information Science and Technology*, Vol. 58, No. 3, 366–378.

- Sweeney, J. C., Soutar, G. N. (2001). Consumer perceived value: The development of a multiple item scale. *Journal of Retailing*, 77(2), 203–220
- Verbeke, W., (2008) “Impact of communication on consumers' food choices. Proceedings of the Nutrition Society”, Vol. 67, No. 3, 281-288.
- Volpentesta, A. P., Felicetti, A. M., Ammirato, S. (2017) Intelligent Food Information Provision to Consumers in an Internet of Food Era. In *Pro-VE 2017, 18th Working Conference on Virtual Enterprises*, Springer 725-736.
- Volpentesta, A. P., Felicetti, A. M., Frega, N. (2018). Organizational and Technological Aspects of a Platform for Collective Food Awareness. *Advances in Human-Computer Interaction*.
- Tan, X., Alter, S., Siau, K. (2011) “Using service responsibility tables to supplement UML in analyzing e-service systems”, *Decision Support Systems*, Vol. 51, No. 3, pp. 350-360.
- Walters, D., Lancaster, G. (1999) “Value-based marketing and its usefulness to customers”, *Management decision*, Vol. 37, No. 9, pp. 697-708.
- Wilson, T. D. “On user studies and information needs”, *Journal of documentation*, Vol. 62, No. 6, pp. 658-670.

Management Innovations in Cultural Organisations: the Role of the Web and Social Media

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Abstract

Recent innovation in digital technologies have triggered public sector organisation in search for improvement of their performance. Social media and participatory web are allowing public sector organisations to implement new form of civil engagements for citizens and to enhance their performance, contributing to the growth of the community.

The paper aims to investigate if and how IT tools (web and social media) affect performance management systems in public-sector cultural organisations, provoking also changes in the relationship with visitors, donors and the local community.

The paper adopts a case-study approach, investigating the Archaeological Park of Paestum (PAE), an autonomous museum of the Italian Ministry of Cultural Heritage and Tourism. Relying on interviews to top-management and consultants as well as on questionnaire to visitors, triangulated with data from official documents, we found that digital technologies have a positive impact of on the performance of PAE, in terms of revenue, donations and sponsorship received, number of visitors, and changes in internal routines.

Findings from the study provide interesting implications for policy-makers regarding the effectiveness of digital technologies, highlighting that public sector entities can improve their global performance investing in innovations and social media.

Keywords – digital technologies, cultural organisations, organisational systems

Paper type – Academic Research Paper

1. Introduction

Reforms implemented in the last decades have stimulated public sector entities to innovate their management in search for efficiency and effectiveness (Pollitt and Bouckaert 2004). Under this wave of change, digital technologies represent a great

challenge in the improvement of organisational performance. In particular, internet and social media are allowing public sector organisations to implement new forms of relationship with citizens (Dahlgren, 2009; Ducci, 2015), at the same time positively affecting their performance. Moreover, management innovations also affect administrative change, including new management systems and processes that make the organisation working more efficiently (Walkers et al., 2011).

Among public entities, cultural organisations have been challenged by a large set of reforms, in part related to the New Public Management philosophy and in part brought by the increasing competition in the world of art and tourism, coupled with the acquisition of a certain autonomy (Bakhshi and Throsby, 2009; Bonini Baraldi, 2014). Managerial innovations, introduced through the performance management system, have become a great opportunity for these organisations to improve their performance, taking advantage of IT innovation and introducing change in administrative processes and practices.

Grounding on the theoretical framework about innovation provided by Walker et al., (2011), this paper aims to investigate - through the case study of the Archaeological Park of Paestum, an heritage assets located in the South of Italy - if and how the use of innovative technologies, such as web and social media, positively affect the performance management systems (PMS) in cultural organisations and the overall performance, also provoking changes in the relationship with visitors, donors and the local community. To this end, after a brief review of the literature on innovation in cultural organisations, section three introduces the methodology adopted, while section four presents and discusses results. Section five concludes and depicts the path for further development of the research.

2. Literature review

Innovation has gained considerable attention in any organisation, not only in relation to technological and product innovation but also in terms of organisational and management style perspectives (Mol and Birkinshaw, 2009). Walker (2007, p. 592), referring to public sector entities, defines innovation as “a process through which new ideas, objects, and practices are created, developed or reinvented.” Moreover, to have innovation, implementation of a new idea has to occur.

In public-sector entities, innovation may be driven by legislation and cannot affect the everyday practices. Furthermore, innovation “is evolutionary rather than radical” (Walker, 2007, p.592), thus it results as a consequence of several incremental changes, progressively bringing modifications in everyday routines (Burns and Scapens, 2000).

Scholars have provided different classifications of innovation, like *service innovation* (Osborne, 1998), *organisational process innovation* (Edquist et al., 2001) and *ancillary innovation* (Damanpour, 1987) which, differently by the first two categories of innovation, depend on factors outside an organisation’s control.

In the context of cultural organisations, Vicente et al. (2012) state that innovations may touch upon management processes (*technological innovation in management*), products and services for visitors (*technological innovations for the audience*),

organisational structure and processes (*organisational innovations*), programming work and exhibitions (*artistic innovations*).

Despite the relevance of the theme, there is scant literature dealing with effects and consequences of innovation in PMS adopted by cultural organisations (Bakhshi and Throsby 2009; Leicester and Sharpe, 2010; Manes Rossi et al., 2015).

Scholars (Rogge et al., 2017) argue that digital technologies are playing an important role in the enhancement of public sector entities' performance, also contributing to the growth of the community. More specifically, among the IT innovation, cultural organisations have been particularly challenged by internet and social media. The former has gained a pivotal role both for communication and for building digital collections (Ke and Hwang, 2000). The need of being digital to meet visitors' expectation and the use of social media to attract visitor have become a question of survival (Bakhshi and Throsby, 2009).

At the same time, implementing IT innovations affect internal processes and involves also the management system in place.

Discussing the different type of innovations, the Walker et al. (2011) framework focuses on management innovations (MIs), interpreted as the generation or implementation of a new management practice, process, structure and technique intended at improving the multifaceted aspect of the performance and involving decisional and operational processes (Walker et al., 2011). This framework is convenient for analysing MIs in public-sector entities and examining their relation with organisational performance, as it takes into account some characteristics such as their multipurpose objective and goal ambiguity, the service production process and the bureaucratic approach, despite all New Public Management reforms promoting managerial logics (Pollitt and Bouckaert, 2004).

Walker et al. (2011) underline that MIs can play a central role in the process of changing organisations, improving the overall performance. Although the framework provided has been developed in regards to local government, the classification of IT and administrative innovations can be applied in public cultural organisations as well, assuming that the public nature of this organisations strongly affects their management.

According to Walker et al. (2011) *IT innovation dimension* includes both new information technology and new management information systems. Similarly, *administrative innovation dimension* encompasses new approaches to service planning and budgeting, new approaches to organisational improvement (e.g., reengineering, quality management) and new management processes (e.g. new job descriptions, establishing new teams of staff) (Walker et al., 2011, p.374). The authors prove that MIs affect organisational performance mainly through performance management systems, thus demonstrating the mediating role of the PMS in allowing innovation to affect the organisational performance.

Applying the framework of Walker et al. (2011) to the case of PAE makes it possible to interpret how and to what extent MIs related to IT tools and the administrative dimension have provoked changes in the PMS with specific regard to decisional and operational processes, definitely affecting the overall performance.

3. Research methodology

The paper adopts a case-study approach, investigating the Archaeological Park of Paestum (PAE), an autonomous museum of the Italian Ministry of Cultural Heritage and Tourism. Preliminary information is provided in the following subsection, to ensure a better understanding of the case under observation.

3.1. *Setting the context*

Several reforms have promoted the adoption of managerial approach to heritage assets in Italy, starting from 1992 with a specific law aimed at “economising” the management of heritage assets (Bonini Baraldi, 2014). Nonetheless, it was necessary to wait for the year 2004 for the first Cultural Heritage Code. The Code represents the first attempt to introduce a certain degree of autonomy in the management of public heritage assets in Italy. Nonetheless, the limited amount of financial resources in the governmental budget devoted to these organisations, coupled with the persisting dependency on the Ministry for human resources, have affected the ability in programming activities.

The turning point arrives in 2014 with the so-called Franceschini Reform, which has definitely determined an increased autonomy through participative management and innovation in the domain of Italian heritage assets. However, despite the claimed autonomy, it should be kept in mind that the directors cannot hire the staff members directly. Their duties include the management of the museum, the organisation of expositions and other performance, the task of conservation, protection and promotion of the heritage assets under their control. To gain a certain ability to operate both current and investment expenses beyond the budget assigned by the Ministry, directors are allowed to collect financial resources through sponsorships and donations, and define the fee for tickets. Furthermore, they can create partnerships with other public or private organisations on the territory (Marzano and Castellini, 2018).

The cultural organisation selected as case study for this research is the archaeological site of Paestum (PAE). PAE is located in Capaccio-Paestum (near Salerno, in the South of Italy) and it is part of a wider national park including a large geographical area of utmost importance from the archaeological viewpoint and the annexed museum. Since 1998, it has been recognised as part of the UNESCO World Heritage Site. As many other archaeological sites located in the same region (Manes Rossi et al., 2018), the park was not well managed neither promoted. The three Doric temples, built almost 2500 years ago, and the annexed Museum narrating the age-old history of the city, today welcome visitors with several innovations, including social media, especially Facebook, to promote events, to engage visitors as well as to attract donors, with the aim of improving both efficiency and effectiveness. These innovations have been prompted by the new Director, Gabriel Zuchtriegel, appointed in 2015. To approach new technologies, the director asks for the collaboration of a web agency, named 3d0, which currently manages both the website and the Facebook page of PAE.

3.2. Research method

The basic criteria for a theoretical sampling approach (Eisenhardt, 1989; Eisenhardt and Graebner, 2007) have been used to select the case-study of the PAE. Firstly, cultural organisations such as PAE are complex entities, having multiple objectives. Secondly, the managerial autonomy of PAE, coupled with the steering at-a-distance role of the MiBACT, has stimulated several innovations (more active use of the web and social media, a pro-active approach of employees towards visitors, and so on), determining an in-depth changing process, based on redefining PAE's strategic objectives. Although these innovations could be considered as a quasi-natural effect of the NPM paradigm, they are not so frequent in this context, characterised by a conservative management culture (Zan, 2000). Only recently, the role and the opportunities related to an active use of web and social media on museums emerge. A holistic approach is required, considering web and social media as components of a broader strategic initiative and investigating the impact on organisational routines (Burns and Scapens, 2000) and on the global performance. Therefore, the case-study selected for this research is expected to give insight on relationships and logic among constructs (Eisenhardt and Graebner, 2007, p. 27).

Following Scapens (1990), our case study can be classified as explanatory, as this research aims to understand and explain the reasons for management change, considering the use of web and social media and evaluating their impact on PAE's decision-making processes and performance.

Consistent with these research objectives, this study adopts both a questionnaire with yes-and-no questions as well as Likert-scale questions, and semi-structured interviews (Qu and Dumay 2011), with open-answer questions.

The survey by questionnaire was carried out in July 2018, involving visitors of the PAE, and it was based on both dichotomous and Likert-scale based questions. It was pilot tested on ten visitors, randomly selected at the entrance of the PAE, to spot any unclear questions or possible misunderstandings. The results of the pilot test were positive.

Semi-structured interviews, conducted between February 2018 and July 2018, involved the Director and key managers of PAE, as well as the CEO of the external web agency (3d0), which is charge of managing the web page also giving assistance to the use of social media (see Table 3).

Table 3: Role of the interviewees and duration

Role of Interviewee	Time (hours)
Director	2
Press office Manager	2
Visitors and surveillance Manager	1
Accounting office Manager	1
Front office Manager	2
Web agency CEO	2
Total	10

Transcripts of interviews were sent to the interviewees for a check, to reduce any bias due to the personal interpretations of the researchers. Moreover, other sources of data

were used, such as statistical data provided by the MiBACT (http://www.statistica.beniculturali.it/Visitatori_e_introiti_musei.htm). This guarantees the triangulation of the data, increasing the probability of credible results (Liguori and Steccolini, 2012; Badia et al., 2018). Furthermore, following Eisenhardt (1989), a multiple-investigators strategy was adopted, allowing the case to be observed from the different perspectives of the research team components; finally, two researchers coded all data independently, and no relevant differences were found.

4. Discussion of results

4.1. Analysis of the questionnaire

The survey respondents were 214. The vast majority (68%) belongs to Italy, while the 23% of them come from Europe and the remainder 9% from outside Europe.

Though respondents mainly ask for information from traditional sources (travel agencies, tourist offices and so on), about 20% of them obtains information from the website, consistently with findings of previous studies (Padilla-Meléndez and del Águila-Obra, 2013) which show the increasing relevance of the webpage of cultural organisations. In this vein, 43% of respondents have visited the PAE's webpage, collecting information regarding the temples, which mainly attract the interest of tourists. Conversely, the vast majority of visitors did not participate in events organised by the PAE. Finally, only the 20% of them knows that the PAE has a Facebook page, and a low level of interaction has emerged from the questionnaire. However, people were asked to express their point of view regarding their future behaviour and their future interaction/use of the Facebook page of the PAE. The vast majority of them is in the "agreement" area.

4.2. Analysis of the interviews

Following the Walker et al. (2011) framework, the interviews were carried out and results were interpreted to capture both the IT and the administrative dimensions of management innovations (MIs), assessing the effects on organisational routines simultaneously. Furthermore, a third line of investigation was followed, to consider the effects of MIs on the global performance, at the same time unveiling future steps to undertake, consistently with the PAE's strategic objectives.

IT dimension of MIs

The IT dimension of MIs focuses on the use of new information systems, aiming to improve the efficiency of operating systems and processes. Therefore, the interviewees were asked to clarify the reasons for implementing a new communication strategy, and several interesting aspects emerged. Firstly, the Director and his staff perceived a broad dissatisfaction among visitors concerning several issues (low quality of several collateral services, lack of clear information regarding how to reach the Park, the time of opening, the events organised, and so on). However, at that time (2015), the PAE did not have a

systematic communication channel: the website was based on a one-way approach, which did not allow establishing a bilateral (or multilateral) relationship with visitors, and it was not so friendly and easy to surfing in; social media were not used. Accordingly, the first implemented measures were improving the webpage and starting using social media (especially Facebook). Therefore, a collaboration with a web agency started.

“When I was appointed as a Director, initially I tried to improve the quality of the services provided to visitors. I perceived the dissatisfaction of many visitors, but I lacked the information in order to improve them. I felt that the Park needed to improve its relationship not only with visitors but also with the local community.” (Director of PAE).

“When the Director of the Park contacted me, I was delighted to collaborate with him and his staff: supporting the communication strategy of one of the most important cultural site of the south of Italy, made me proud. Indeed, having understood the financial difficulties of the Park, which was in its first time of autonomy, I proposed starting the collaboration without asking a fee.” (CEO of the web agency 3d0).

As a result, the website was completely redesigned, with the primary aim being making it friendlier and more responsive, in order to allow interacting with surfing people and to monitor their activities, receiving valuable feedbacks. Furthermore, it was decided to open a Facebook profile. Actually, some Facebook pages were still active, but they were not managed from the PAE itself (they were labelled as “Friends of the Park” or similar expressions), because the lack of managerial autonomy *de facto* impeded to open an institutional page (several bureaucratic authorisations were required). In this case too, it was asked the collaboration of the web agency regarding how to structure and manage the Facebook page. This implied a complete reorganisation of all the activities concerning communication and relationship with visitors and media.

“In the past, the communication office was not so effective, since the lack of autonomy impeded to have an ad-hoc budget and to implement some basic initiatives to establish a direct relationship with visitors. Therefore, we considered these little innovations (redesigning the website, opening a Facebook page, a Twitter and an Instagram profiles) as the starting point of a new era. My colleague and I were thrilled to be in charge of the new press office.” (Press Office Manager).

The collaboration with the external web agency was reinforced step by step, and many services concerning both the webpage and the Facebook page were outsourced. On a monthly basis, the Park started to promote some events and initiatives on Facebook, with the aim of capturing the attention of (prevalently) the local community. It is worth noting that this focus is coherent with the results of the questionnaire.

Administrative dimension of MIs

The second MIs’ dimension deals with the implementation of new management systems and processes to improve the effectiveness.

The autonomy of the Park changed the role of the Director’s staff and the employees. In the past, employees had a “passive” role, merely keeping under surveillance the archaeological sites to impede people could damage them. However, the Director retained employees as pivotal “assets” of the Park, therefore he contributed to the development

and valorisation of human resources, whose role changed progressively. They understood the importance of being more active and collaborative, especially with visitors. As a result, several initiatives were launched. For example, the project named “Paestum viva” (“Paestum alive”; <http://www.museopaestum.beniculturali.it/paestum-viva-tutti-i-giorni/>) dedicated to families, consists of interactive activities, laboratories, music-therapies, to explain the history of the temples and the whole Park to children in an entertaining and enjoyable way. Moreover, the initiative named “Paestum per tutti” (“Paestum for everyone”), where the collaboration of employees is essential, allows disabled people visiting the areas inside the temples in a comfortable way.

“The strategic reorientation of the Park is possible only if employees and all the staff concretely perceive how essential their role and their collaboration is. Their positive thinking helps make visitors’ experience memorable”. (Director of PAE).

“In the past, employees acted mainly as guards, and their competences were not sufficiently appreciated. The strategic reorientation of the Park has radically changed this. Now, employees play an active role, giving visitors a warm welcome, providing them with all the information they require, assisting disabled people during their visit to the temple of Hera and the temple of Athena, making the innovations possible”. (Visitors and surveillance Manager).

Indeed, when new communication strategies were adopted, and innovative initiatives were launched, a resistance to change was observed. Traditionally, the behaviour of employees was anchored to a bureaucratic set of rules, and organisational routines were based on formal procedures to comply with. Besides, employees were (and still are) paid directly by the MiBACT, which impeded the implementation of a system of punishment and rewards, directly connected with their performance. The autonomy of the PAE has progressively changed - and it is still changing - the organisational behaviour of staff members and employees. Progressively, due to the feedbacks received from the website and the Facebook page and the motivator role played by the Director, they became aware of their mediator role between visitors and the archaeological site and the museum.

“The autonomy of the Park has progressively allowed us to appreciate and develop the skills and competencies of employees, while in the past the human resource management was completely «jammed»”. (Visitors and surveillance Manager).

“Day by day, we have a look at the Facebook page, to collect feedbacks from visitors, to answer their questions and to respond quickly to criticisms. Furthermore, the web agency provides us periodically with a report of feedbacks from the website. Finally, we received 15/20 daily reviews on average on Google. This information helps us in understanding how we [Director’s staff members and employees - ed.] could support this new way of thinking”. (Press Office Manager).

Furthermore, specific fundraising strategies were implemented, to establish a “sense of belonging”, involving visitors, the local community and local firms. The most relevant ones are:

- “Adopting the wall of Paestum” (see <http://www.museopaestum.beniculturali.it/adotta-un-blocco-delle-mura/>): people

can contribute to the maintenance and restoration of the site by giving 50 €, receiving an annual membership card and a periodical newsletter;

- “Circolo di Athena” (“Circle of Athena”), a group principally composed of local firms, which is financing the restoration of the façade of the temple of Athena;
- a local industry has financed three researchers to carry out digs;
- a no-profit organisation, named “Amici del Parco” (“Friends of the Park”) is financing several restorations.

Effects on performance and future initiatives

The interviewees claimed that the managerial innovations described above are boosting internal managerial relations, having a positive effect on the PAE’s performance. To avoid the risk, common to all social research method (Liguori and Steccolini, 2012; Badia et al., 2018), that ex post rationalisations of events could influence such reconstruction of events, the research team triangulated the data, by referring to reports provided by the PAE and data from official sources.

Table 4 illustrates both the number of visitors and gross revenue during the period 2014-2017. A significant increase in both indicators can be easily observed, especially in the last two years. It is worth recalling that all the initiatives described above were implemented from 2015 onwards.

Table 4: Number of visitors and gross revenue (2014-2017)

Year	No. of visitors	Gross revenue
2014	280,503	938,897.32
2015	300,343	1,100,489.93
2016	383,172	1,621,820.59
2017	441,196	1,917,050.23

Source: http://www.statistica.beniculturali.it/Visitatori_e_introiti_musei.htm

These results could be interpreted in the wake of Walker et al. (2011), according to whom performance management systems play a mediating role, allowing innovation to affect organisational performance.

Nevertheless, according to the interviewees, these results should be retained as a starting point, and future goals to furtherly boost high quality and coherent policy are going to be introduced. The keyword of programmed future innovations is “digitalisation”. In fact, future initiatives will concern:

- Improving the webpage in two main directions: participatory web, to interact better with visitors; improving the English version as well as developing it in other European languages;
- Launching an interactive guide, to allow visitors to automatically retrieve information regarding the artefacts they are observing, by using a smartphone or a tablet;
- Publishing a digital magazine regarding the museum and the archaeological site;
- Improving the Street view service, to allow people to go into the museum and the temples;

- Making the touristic tour enjoyable and entertaining both for children, and hearing-deficient people, through ad hoc audio guides (based on cartoons and the sign language, respectively);
- Promoting an interactive and social report, to friendly illustrate both financial results and non-financial outcome.

All in all, these initiatives would consist of both IT and administrative MIs, and a further positive impact on the global performance of the PAE is expected.

5. Conclusions

Public cultural organisations have been challenged in recent years by high competition in the world of art and culture, as well as by normative and institutional changes, including increased autonomy and reduced public resources. In this context, IT tools represent a challenge for these organisation to improve their performance, contributing to the growth of the community.

Grounded on the literature on managerial innovation, the paper has investigated – through the case study of PAE - if and how IT innovations (namely web and social media) and administrative innovations can affect the performance management systems, provoking also changes in the relationship with visitors, donors and the local community.

Results emerged by the case study furtherly proves that when managerial innovations - both IT and administrative one - present a high degree of affinity with existing goals and are able to provide support to cultural organisations in meeting their objectives, they are more likely to succeed and the new practices being implemented. Furthermore, it demonstrates that IT and administrative innovations, mediated through the performance management systems, can increase the overall performance of a cultural organisation, also affecting the relationship between the entity and the main external stakeholders, namely visitors, donors and the local community.

The paper suffers from some limitations, generally related to the case study approach, as results cannot be generalised. Nonetheless, it offers a contribution to the existing knowledge of managerial innovations in cultural organisations, highlighting how these innovations – namely IT and administrative one – can contribute to the enhancement of the overall performance of the organisations. The research may provide interesting implications for policy makers in supporting the wide use of IT tools by public cultural organisations. Future development of the study may consider comparative case studies, in order to better detect the role played by Directors in promoting managerial innovations.

References

- Bakhshi, H., and Throsby, D. (2009). Innovation in arts and cultural organisations. Hamburgo: NESTA. Available at https://media.nesta.org.uk/documents/innovation_in_arts_and_cultural_organisations.pdf
- Badia, F., Dicuonzo, G., Petruzzelli, S. and Dell’Atti, V. (2018), “Integrated reporting in action: mobilizing intellectual capital to improve management and governance practices”, *Journal of Management and Governance*, <https://doi.org/10.1007/s10997-018-9420-1>

- Bonini Baraldi, S. (2014). Evaluating results of public sector reforms in Rechtsstaat countries: The role of context and processes in the reform of the Italian and French cultural heritage system. *International Public Management Journal*, Vol. 17, No. 3, pp.411-432.
- Burns, J., and Scapens, R.W. (2000) "Conceptualizing management accounting change: An institutional framework", *Management Accounting Research*, Vol. 11, pp. 3-25.
- Dahlgren, P. (2009) *Media and Political Engagement: Citizens, Communication and Democracy*. Cambridge: Cambridge University Press.
- Damanpour, F. (1987) "The adoption of technological, administrative, and ancillary innovations: Impact of organizational factors", *Journal of management*, Vol.13 No.4, pp. 675-688.
- Ducci, G. (2015) "Public Communication in the Processes of Transparency and Accountability in the Era of Open Data", *Sociology Study*, Vol. 5 No. 2, pp. 83-90
- Edquist, Charles, Leif Hommen, and Maureen D. McKelvey. 2001. *Innovation and employment. Process versus product innovation*. Edward Elgar, Cheltenham, UK.
- Eisenhardt, K. M. (1989) "Building theories from case study", *Academy of Management Review*, Vol. 14, No. 4, pp. 532-550
- Eisenhardt, K. M. and Graebner, M.E. (2007) "Theory building from cases: opportunities and challenges", *Academy of Management Journal*, Vol. 50, No. 1, pp. 25-32.
- Ke, H.R. and Hwang, M.J. (2000), "The development of digital libraries in Taiwan", *The Electronic Library*, Vol. 18 No. 5, pp.336-46.
- Leicester, G., and Sharpe, B. (2010). *Producing the Future. Understanding Watershed's Role in Ecosystems of Cultural Innovation*. International Futures Forum Bristol: Watershed.
- Liguori, M. and Steccolini, I. (2012), "Accounting change: explaining the outcomes, interpreting the process", *Accounting, Auditing and Accountability Journal*, Vol. 25 No. 1, pp. 27-70.
- Manes-Rossi, F., Allini, A. and Dainelli, F. (2015). *Innovations in the Measurement of Cultural Value: The British Museum*. In *Innovation in the Public and Nonprofit Sectors*, Eds. Julnes De Lancer P. and Gibson E., pp. 35-55. Routledge.
- Manes-Rossi, F., Allini, A., Spanò, R. and Macchioni, R. (2018) "Performance management change in archaeological sites: The case of Herculaneum Conservation Project", *Journal of Management and Governance*, Vol. 22 No. 4, pp. 947-979.
- Marzano, M., and Castellini, M. (2018), "The Reform of the Italian Ministry of Cultural Heritage: Implications for Governance of the Museum System", *The Journal of Arts Management, Law, and Society*. Vol. 48 No. 3, pp. 206-220.
- Mol, M. J., and Birkinshaw, J. (2009) "The sources of management innovation: When firms introduce new management practices", *Journal of business research*, Vol. 62 No.12, pp.1269-1280.
- Osborne, S. (1998) *Voluntary organizations and innovation in public services*. Routledge, London.
- Osborne, S.P., Radnor, Z., Vidal, I. and Kinder, T. G. (2014) "A Sustainable Business Model for Public Service Organizations?", *Public Management Review*, Vol. 16 No. 2, pp. 165-172.
- Padilla-Meléndez, A. and del Águila-Obra, A.N. (2013) "Web and social media usage by museums: Online value creation", *International Journal of Information Management*, Vol. 33, pp. 892-898.
- Pollitt, C., and Bouckaert, G. (2004). *Public management reform*. Oxford Univ. Press, Oxford.
- Qu, S. Q., and Dumay, J. (2011) "The qualitative research interview", *Qualitative Research in Accounting & Management*, Vol. 8, No. 3, pp. 238-264.
- Rogge, N., Agasisti, T. and DeWitte, K. (2017) "Big data and the measurement of public organizations' performance and efficiency: The state-of-the-art", *Public Policy and Administration*, Vol. 32 No.4, pp. 263-281
- Scapens, R.W. (1990) "Researching management accounting practice: the role of case study methods", *British Accounting Review*, Vol. 22, pp. 259-281.

- Vicente, E., Camarero C., and José Garrido, M. (2012) "Insights into innovation in European museums", *Public Management Review*, Vol. 14 No.5, pp. 649-679.
- Walker, R.M. (2007). "An empirical evaluation of innovation types and organizational and environmental characteristics: towards a configuration framework", *Journal of Public Administration Research and Theory*, Vol18, pp. 691-615.
- Walker, R.M., Damanpour, F., and Devece, C.A. (2011). Management innovation and organizational performance: the mediating effect of performance management. *Journal of Public Administration Research and Theory*, 3-28
- Zan, L. (2000) "Management and the British Museum", *Museum Management and Curatorship*, Vol. 18, No. 3, pp. 221–270.

Estimating the Impacts of Airbnb on the Hotel Industry: Direct Effects on Performance and the Moderating Role of Hotel Location

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Abstract

The rise of sharing economy, made possible by technological evolution, has changed the way people make use of underutilized goods and has also changed the competition dynamics between incumbents and new players of many sectors. One sector that has been more revolutionized by the sharing economy is the tourism industry, given the rise of many new intermediaries and new players. Among them, Airbnb, an online marketplace that enable people to list, find and book rooms around the world, has very quickly changed the rule of competition of the hospitality industry. Given the strong position in the tourism sector, Airbnb has become a new competitor of hotels, that need to understand how to react and to compete against it.

Previous research has already analysed some perspectives of AirBnB rise phenomenon, but the results vary a lot depending on the context and they are still far to be somehow conclusive regarding the systematic description of sector behaviour.

Thus, given the previous outcomes on the possible disruptive effect of Airbnb on the hotel industry have not reached a final and unique conclusion, and given the importance for hotels to constantly update their strategic choices, the present study has the aim of replying to the following two research questions: “Does Airbnb impact negatively the hotel economic performance?” and “What are the key moderators among hotel’s online and offline positioning strategies, capabilities, and characteristics of the Airbnb’s local supply?”.

Overall, the present study contributes to the emerging literature debate on the economic impacts of sharing economy on the incumbent hotel industry across an even broader variety of consumer markets. From a managerial point of view, this study informs hotels that they are no longer just competing with other hotels in their markets. They are also competing with Airbnb, and other home-sharing services, in their neighbourhood. A way to succeed, as demonstrated by this study, is to develop the appropriate capabilities to defend their economic performance and to look closely at why Airbnb is succeeding, to fight back and protect their investment.

Keywords – Airbnb, hotel industry, performance, online managerial capabilities, sharing economy.

Paper type – Academic Research Paper

1 Introduction

How home-sharing services are changing accommodation sector? That is a pretty interesting question, and given our strategic/managerial background we are going to focus on structure changes looking at performance indicators of involved players. Particularly, looking at the entrance of new players in the sector, we wonder whether they are “stealing” pieces of incumbents’ cake or maybe if the cake is getting much bigger thanks to their intervention.

In 2017 total contribution of travel and tourism industry (included accommodation, transportation, entertainment and attractions of these industries: accommodation services, food & beverage services, retail trade, transportation services and cultural, sports & recreational services) to global economy was 8.27 trillion \$, while direct contribution accounted for 2.57 trillion \$. By comparison in 2017 the whole globe produced goods for a value of 80.05 trillion \$ (IMF, 2018). It means roughly 10 % of economic value produced in the world concerns touristic goods or services, that’s impressive.

In the same year world hotel sector market size was 570 billion \$, 22% of the value of direct contribution to global production by travel and tourism industry (2019, Statista). Even if hotel market size is increasing (+ 8% from 2015 to 2017), direct and total contribution from travel and tourism industry is increasing even more (+ 15 % from 2015 to 2017 for both numbers), roughly twice the rate. It is clear that the weight of hotel in travel and tourism industry is decreasing (from 7.35 % of total contribution in 2015 to

6.89 % in 2017) and that led us to wonder more about possible causes of that phenomenon.

Previous literature explored the impact of new players against hotels value chain from a vertical perspective, where new services suppliers, so called infomediaries, have great bargaining power, (Raguseo, Neirotti, & Paolucci, 2017) while now in this paper we will examine horizontal competition coming from a possible substitute product. In fact, in the last years, we have witnessed an incredible growth of short term private owned homes/rooms rentals offered through websites like HomeAway, VRBO, VayStays and the most important one: AirBnB. Previous research has also already studied the impact of Airbnb on the hotel industry, but contradictory evidences emerged. On the one hand, Zervas et al. (2017) demonstrated that a 1% increase in Airbnb supply decreases hotel revenue by 0.04%. Dogru et al. (2017) demonstrated that an active supply of entire homes impacted hotel RevPAR (Revenue Per Available Room) by 0.02% and both ADR (Average Daily rates) and OCC (Occupancy Rates) by 0.01%. Furthermore, Neeser et al. (2015) shown a negative impact of Airbnb supply on hotel room prices. On the other hand, other empirical evidence did not confirm this negative impact. For example, Choi et al. (2015) did not found any negative impact of Airbnb supply on hotel revenues in Korea. Blal et al. (2018) found that overall hotel RevPAR is not related to total Airbnb supply.

Thus, given these mixed results on the possible disruptive effect of Airbnb on the hotel industry, and given the possible existence of different impacts that Airbnb can have on hotels according to its location in a city, the present study has the aim of replying to the following two research questions: “Does Airbnb impact the hotel economic profitability?” and “Does the hotel location in a city influence this relationship?”.

In order to reply to these research questions, we adopted the theory of disruptive innovation (Christensen, 2015) and we created a large scale database collecting a high volume of information on Airbnb and financial data about hotels in five big Italian touristic cities, that are Turin, Milan, Venice, Florence and Naples. We found that Airbnb supply impacts negatively on the hotel performance. However, our most interesting results consist in identify two different dynamics according to the hotel localization. Specifically, we found that Airbnb supply has a negative effect on hotels’ profitability in case the hotel is not located in the city centre, while it has not any significant effect in case the hotel is located in the city centre.

We chose as research setting Italy since it was in last years the 5th country in the word by international touristic flows (2018, UNWTO), and travel and tourism industry represents one of the biggest sources of value production for the nation, being the 11.5 % of GDP in year 2017, 223 billion \$ over 1935 billion \$ (2018, Statista).

It is clear that travel and tourism industry represents a peculiar and fundamental feature of Italian economic system, and there is evident need of better understanding of what is currently happening under the surface and its consequences.

2 The importance of Airbnb in the accommodation sector

Today Airbnb collects in its website more than 6 million listings from 192 countries (Airbnb, 2019); In august 2017, Airbnb had more listings than the number of rooms built by the top five hotel brands combined (Hotel News Now, 2017), 4 million compared to roughly 3.9 million.

AirBnB business model is simple, given the fact it makes possible the matching between host and guest they both have to pay (Hansen Henten & Maria Windekilde, 2016) a percentage of daily cost: 1) Guests pay a percentage between 6 % and 12 %, this number decreases when more nights are booked, making more convenient booking longer periods; 2) Hosts pay a fixed 3 % fee of the room price.

Just to make a rough estimate of Airbnb alone market size let's consider on average 12 % fee on room price (9 % fee on average from the guest and 3 % from the host), knowing 2017 revenue of 2.6 billion \$ (2018, Zaleski) we can say they come from a number somehow similar to 22 billion \$, which represents the transactions between hosts and guests made possible by the platform.

Looking at those numbers is clearly visible that Airbnb impact cannot be neglected, on the contrary it should be closely measured in order to better understand its consequences on incumbents and society.

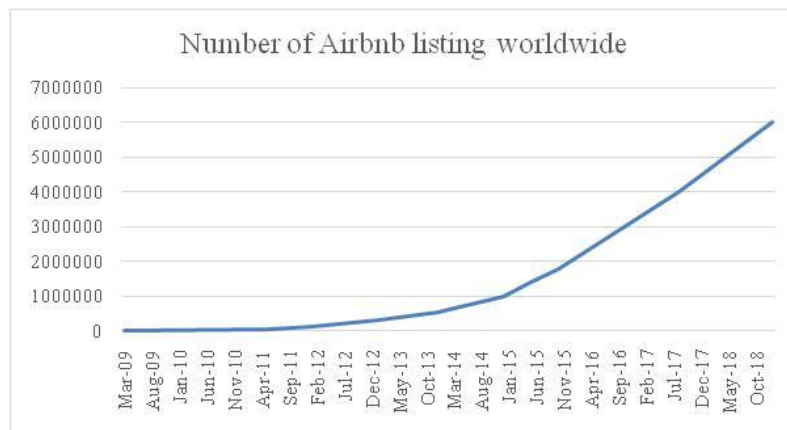


Figure 5: Number of Airbnb listing worldwide.

In Figure 5 it is possible to see the elbow of the curve at the end of 2014; at the beginning of the chapter we showed a decrease in the share of hotel market size with respect to direct and total travel and tourism industry from 2015 to 2017; could the two events be somehow related each other?

The impressive growth described by the figure can be explained taking into consideration the following factors. First, easy access to internet – this technological revolution allowed to easily collect, exchange and publish information, dramatically reducing the transaction cost related to making a choice related to travel and tourism;

before this revolution few players (mainly travel agencies) were able to efficiently collect and manage information regarding travel and tourism, while today many users could consider more efficient looking for holiday on the web with respect to going to travel agency. Indeed, the internet allowed some players (Uber, Google, etc...) to organize a lot of information in a way that it is easy to access for everyone, making easier than ever before to compare different solutions. AirBnB is one of those players and it has been able to reduce a lot the cost of comparing possible accommodation solutions for the user (Hansen Henten & Maria Windekilde, 2016).

Second, disruptive innovation effect – as described by Clayton Christensen, competition pushes incumbents to improve their products in order to survive and succeed, and in many cases they end up offering “services that are actually too sophisticated, too expensive, and too complicated for many customers in their market. [...] However, by doing so, companies unwittingly open the door to ‘disruptive innovations’ at the bottom of the market. An innovation that is disruptive allows a whole new population of consumers at the bottom of a market access to a product or service that was historically only accessible to consumers with a lot of money or a lot of skill.” These innovators initially are characterized by a simpler product, lower return and market size, and incumbents often are not interested in competing (Christensen, 2015), but then they “relentlessly move up market, eventually displacing established competitors” (Christensen, 1997). AirBnB has been able to offer a really basic product at low price, and travellers not in need of high level services sustained its growth, until it became so big to make reasonable the following question: Is AirBnB a substitute product with respect to hotels?

In fact, the result is a player able to convince investors about its value, today AirBnB is the undisputed leader of its segment (short term apartment/rooms rental platform) and has a solid position in tourism ecosystem, with an estimated valuation of 31 billion \$ in year 2016, as a comparison the most valuable hotel brand at the time was Marriot International, just 7 billion more valuable (2017, Deanna Ting).

3 Theoretical background

Previous research has already studied the impact of Airbnb on the hotel industry, but contradictory evidences emerged. On the one hand, Zervas et al. (2013) demonstrated that in Texas, a 1% increase in Airbnb supply decreases hotel revenue by 0.04% (Zervas, Proserpio, & Byers, 2013). Dogru et al. studied the phenomenon in 10 main US cities and demonstrated that an active supply of entire homes impacted hotel RevPAR (Revenue Per Available Room) and ADR (Average Daily rates) by 0.02% with significant effect on all hotel segments, while the effect on OCC (Occupancy rate) is not always significant (Dogru, Mody, & Suess, 2019). Furthermore, Neeser et al. (2015) shown a negative impact of Airbnb supply on hotel room prices.

On the other hand, other empirical evidence did not confirm this negative impact. For example, Choi et al. did not found any significant negative impact of Airbnb supply on hotel revenues in Korea (Choi, Jung, Ryu, Kim, & Yoon, 2015).

Other researchers show mixed or complex relationships: Blal et al. (2018) found that overall hotel RevPAR is not related to total Airbnb supply, but that every increase in the review score of Airbnb properties had a negative impact on hotel RevPAR, so hotel negative impact comes from the “quality” of the substitute supply instead of the “quantity” (Blal, Singal, & Templin, 2018). Koh et al. (2017) interviewed a set of hotel representatives in Singapore and the majority of them reported increased competition in the sector with impact on economic performances, but there’s lack of evidences about the source of competition increase (Koh & King, 2017). Xie et al. (2017) observed in Austin that RevPAR of hotels is negatively correlated with total Airbnb listing number, but the relationship is moderated by the pricing strategy of Airbnb listing in the same area (Xie & Kwok, 2017).

Couple of researches even found positive relationship between the AirBnB and hotel economic performance. Aznar et al. measured the number of Airbnb listings in a radius of one km from a set of hotels in Barcelona, then analysed economic results and found positive relationship with Return on Equity. They explained this outcome by linking higher number of Airbnb listing with better areas (Juan Pedro Aznar, Josep M Sayeras, Alba Rocafort, 2017). Ginindza et al. explored the case of an emerging touristic destination, the kingdom of Swaziland: in this developing country the authors noted a positive relationship between the hotel Occupancy rate and Airbnb Occupancy rate, indeed Airbnb platform was found to appeals to a different tourist market profile than does that of hotels (Ginindza & Tichaawa, 2017).

Table 1: Literature review

Research team	Title	Data/Analysis method	Dependent variable	Impact on hotels
Zervas, Proserpio, & Byers, 2013	The Rise of the Sharing Economy: Estimating the Impact of Airbnb on the Hotel Industry	Airbnb’s entry in Texas, US/10; 555 hosts and 13,935 listings from 2008 to August 2014	Room revenue	Negative
Xie & Kwok, 2017	The effects of Airbnb’s price positioning on hotel performance	Airbnb’s entry in Austin, Texas, 86 hotels quarterly financial data from Q3 2008 to Q2 2011	RevPAR	Negative
Blal, Singal, & Templin, 2018	Airbnb’s effect on hotel sales growth	Airbnb’s entry in San Francisco, 11 data points, about 101 hotels between Dec 2013 and Feb 2016	Growth of RevPAR	Negative
Dogru, Mody, & Suess, 2019	Adding evidence to the debate: Quantifying Airbnb’s disruptive impact on T ten key hotel markets	AirBnB entry in Boston, Chicago, Denver, Houston, Los Angeles, Miami, Nashville, New York, San Francisco, and Seattle, between July 2008 and June 2017.	RevPAR, ADR, Occupancy rate	Negative
Ginindza & Tichaawa, 2017	The impact of sharing accommodation on the hotel occupancy rate in the kingdom of Swaziland	46 hotels and 35 Airbnb monthly data from 2012 to 2016 in the towns of Mbabane, Ezulwini, Matsapha and Manzini	Occupancy rate	Positive

Koh & King, 2017	Accommodating the sharing revolution: a qualitative evaluation of the impact of Airbnb on Singapore's budget hotels	6000 Singapore properties average price and interviews to hotels managers	NA	Negative
Juan Pedro Aznar, Josep M Sayeras, Alba Rocafort, 2017	The irruption of Airbnb and its effects on hotel profitability: An analysis of Barcelona's hotel sector	43 hotel in Barcelona data from 2008 to 2013, Airbnb listings 1 km from those hotels	ROE, revenue	Positive
Choi, Jung, Ryu, Kim, & Yoon, 2015	The Relationship between Airbnb and the Hotel Revenue: In the Case of Korea	Hotel revenue in Seoul, Busan & Jeju, from 2010 to 2013	Revenue	No relationship

Literature review in **Error! Reference source not found.** revealed both a lack of researches in our geography (Italy) and a lack of results taking into consideration fundamental profitability ratios like Return On Asset and Return On Sale. Moreover, the outcomes analysed show a great variety of results based on context, environment and variables observed, so we strongly believe our research will add valuable content to the debate ongoing regarding new services impact on incumbents in accommodation sector.

4 Hypotheses

Thus, given these mixed results on the possible disruptive effect of Airbnb on the hotel industry, and given the importance for hotels to choose the right positioning strategies, to develop the adequate online managerial competences for defending their economic performance, and given the influence that the characteristics of the Airbnb's local supply can have in explaining the economic returns of hotels, the present study has the aim of replying to the following two research questions: "Does Airbnb impact negatively the hotel economic performance?" and "What are the key moderators among hotel's positioning strategies, capabilities, and characteristics of the Airbnb's local supply?".

To investigate these two research questions, we refer to the theory of disruptive innovation (Christensen, 1997). According to this author, the process of disruptive innovation occurs in two phases:

- 1) an initial step when the innovation is not adopted by mainstream customers, performs worse than existing products, and is used only in niche markets;
- 2) in a later stage, mainstream customers adopt the innovation rapidly, thus disrupting the leading firms in the market.

Accordingly, we apply this theory because Airbnb passed through these two phases that characterize a disruptive innovation (Blal et al., 2018) and because Airbnb occurs outside the value network of existing firms, and introduces a different package of attributes offered to and valued by travellers that eventually transforms a product or service (Guttentag and Smith, 2017).

Given the impressive growth of Airbnb rooms we are witnessing in the last years and the similarity between the basic needs (a bed in a room) hotels and Airbnb both respond it is reasonable to take into consideration the possibility of substitution effect between the two, with the result that the incumbents lose at least one between market share and profit to remain competitive. Thus, we formulate the following hypothesis:

H1. Airbnb supply in a city lead to a profitability decrease to the hotels in the same city;

The lower fixed cost Airbnb owners face allows them to set lower price with respect to hotels (Einav, Farronato, & Levin, 2015). It is reasonable to suppose that the scarcity of time and money most people have to deal with while choosing accommodation for holidays lead them to make their choice with one of the following criteria, once a general level of quality expectation has been set: 1) the accommodation respecting the budget closest to main touristic attractions; 2) the cheapest accommodation in the area of touristic attraction;

Given the fact that in the cities taken into account in our analysis the centre collects the main touristic attractions it is reasonable to conclude that before the rise of Airbnb people could choose between higher price hotels in the city centre and second choice hotels more distant from it.

Now Airbnb in city centre represents an alternative to hotels in suburbs and our hypothesis comes from the fact that people prefer to stay closer to touristic attraction when facing comparable level of price. Hotels in suburbs consequently saw a decrease in number of bookings or in price requested to customers or both, causing a decrease in profitability indicators. Thus, we formulate the following hypothesis:

H2. In the city centre hotels profitability is not suffering from Airbnb impact, while hotels in suburbs are suffering the most.

Therefore, the research framework investigated in this study is shown in Figure 6.

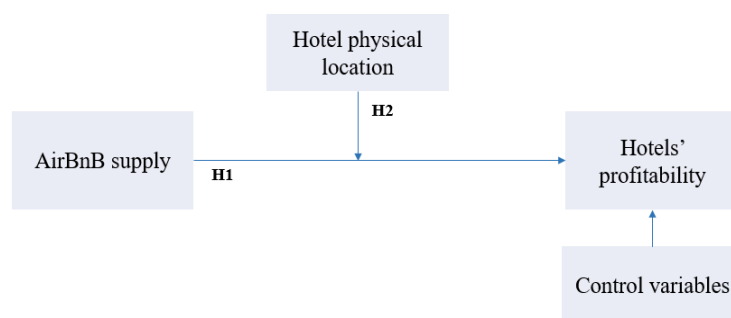


Figure 6: Research framework

5 Methodology

In order to prove our hypotheses, we created a comprehensive dataset collecting a large volume of information from many different sources about hotels in 5 big Italian touristic cities, that are Turin, Milan, Venice, Florence and Naples. We have chosen those 5 cities because they are among the most representative in Italy regarding touristic flows but we avoided Rome since it is much bigger than the others. We collected the variables from many different sources, that are:

- Tripadvisor website through a scraper;
- Istat through the website and through custom requests;
- AirDNA proprietary database;
- Agenzia delle Entrate real estate quotation database;
- Bureau Van Dijk financial database AIDA;

We merged the data in order to obtain a longitudinal database where each row represents the characteristics of a hotel in a given year.

Variables

The dependent variables of the model are the Return On Sales (*ros*) and Return On Asset (*roa*) of the hotels per each year, the first one represents the ratio between profit and total revenue of the hotel in the year, while the second is the ratio between the profit and the balance sheet value of the assets. They both come from the AIDA financial database.

The independent variable (*log_nearairbn_total*) is the logarithm of total number of active AirBnb listings in the same city of the hotel per each year. The data about monthly performance of AirBnb listings comes from AirDNA proprietary database. We considered as active all listings available for booking, even for a small period of time, during the year.

Here's the list of all control variables used to run the model:

- *count_review_hotel_cum*: it is the total number of reviews the hotels received on Tripadvisor website at the end of previous year, the variable has been collected through a scraper;
- *count_response_hotel_cum*: it is the total number of answers to reviews the hotels wrote on Tripadvisor website at the end of previous year, the variable has been collected through a scraper;
- *average_month_rent_m2*: it is the average between minimum and maximum squared meter monthly rental price for residential real estate in a city in a year, the variable has been collected from Agenzia delle Entrate real estate observatory;
- *log_revenue*: it is the logarithm of the revenue of a hotel in a year, it controls for hotel size, the variable has been acquired from Bureau Van Dijk AIDA database;

- *norm_touristic_flow_presence*: it is the normalized number of overall nights tourists spent in a city in a year, the variable has been acquired from ISTAT website;
- *2015.year, 2016.year, 2017.year*: it is the dummy variable for the year of observation, it has been generated knowing the year of the row;
- *hotel_5l_count*: it counts the number of 5 star or more hotels in a city in a year, it has been acquired from ISTAT;
- *hotel_4_count*: it counts the number of 4 star hotels in a city in a year, it has been acquired from ISTAT;
- *hotel_3_count*: it counts the number of 3 star hotels in a city in a year, it has been acquired from ISTAT;
- *hotel_2_count*: it counts the number of 2 star hotels in a city in a year, it has been acquired from ISTAT;
- *hotel_1_count*: it counts the number of 1 star hotels in a city in a year, it has been acquired from ISTAT;
- *dummy_citycentre*: this variable has been used to explore the effects of Airbnb on two different categories of hotels, the one in city center and the one in the suburbs (see model 3, 4, 5, 6). The authors have arbitrarily set the distance from city center that determines a hotel being in it or in the suburbs given their knowledge of the cities.

The descriptive statistics of the variables are shown in Table 5.

Table 5: Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
<i>Roa</i>	2794	3.7	13.019	-145.64	73.12
<i>Ros</i>	2594	4.173	11.355	-49.95	29.95
<i>log_nearairbn_total</i>	1795	9.056	.667	7.783	10.073
<i>count_review_hotel_cum</i>	1468	172.884	235.318	0	2681
<i>count_response_hotel_cum</i>	1468	57.215	145.243	0	1325
<i>average_month_rent_m2</i>	2668	10.667	2.216	5.434	13.338
<i>log_revenue</i>	2782	13.618	2.281	0	17.574
<i>norm_touristic_flow_presence</i>	2020	0	1	-2.262	0.945
<i>hotel_5l_count</i>	2525	15.819	6.191	2	23
<i>hotel_4_count</i>	2525	102.413	31.383	25	141
<i>hotel_3_count</i>	2525	136.931	35.992	63	175
<i>hotel_2_count</i>	2525	56.388	20.798	9	78
<i>hotel_1_count</i>	2525	47.177	15.877	16	70

The number of observation varies across the variables, meaning not all the cells are correctly given a value. That's because some variables cover a longer period than others, we excluded all the rows not 100% complete. Our observed variables, *ros* and *roa*, are positive on average, meaning the set of hotels have a positive return on both sales and assets. We excluded extreme values of those variables in order to have a normal shaped distribution.

Looking at Tripadvisor review count we can note our set received on average 173 reviews and answered to 57 of them. Standard deviation of number of responses is

proportionally higher than standard deviation of number of review, meaning that the value is more spread, that is what we expected, since we observed that most of hotels respond to almost all reviews or do not respond at all.

The log of the revenue of the hotel is an approximation that allows us to control for hotel size, while the average cost of renting and the touristic flows are really important control variables not directly manageable by hotels. The first one gives the model an insight about the perceived value of livable space, while the second allows us to control the effect on profitability coming from a different number of tourists.

Finally, we collected the number of hotels per year per city of any category to control the “competition” from other hotels.

Model

In order to clean the dataset from outliers we plotted leverage vs residual-squared graph to exclude high impact extreme points, then we checked collinearity with variance inflation factor.

Only complete observations have been included in the model, and the two dependent variables have been cleaned from extreme values. **Error! Reference source not found.** shows the correlation matrix of the variables included in the regression model.

Table 3: Correlation matrix

Variables	ros	roa	log_nearairbn_total	count_review_hotel_cum	count_response_hotel_cum	average_month_rent_m2	log_revenue	norm_touristic_flow_presence	hotel_5l_count	hotel_4_count	hotel_3_count	hotel_2_count	hotel_1_count
ros	1												
roa	.66	1											
log_nearairbn_total	.03	0.06	1										
count_review_hotel_cum	.07	.07	.30	1									
count_response_hotel_cum	-.01	.01	.22	.64	1								
average_month_rent_m2	.11	.10	.09	.02	.02	1							
log_revenue	.15	.19	.15	.37	.30	.09	1						
norm_touristic_flow_presence	.12	.11	.48	.13	.10	.88	.12	1					
hotel_5l_count	.12	.12	.52	.12	.10	.84	.12	.99	1				
hotel_4_count	.08	.10	.53	.09	.09	.76	.12	.95	.94	1			
hotel_3_count	.16	.12	.04	.07	.03	.83	.04	.81	.81	.64	1		
hotel_2_count	.09	.07	.53	.01	.05	.56	.05	.79	.81	.73	.71	1	
hotel_1_count	-.01	.02	.62	.01	.07	.50	.12	.74	.71	.80	.27	.68	1

The correlation matrix shows there's no particularly high relationship between dependant variables and independent variables, even if some expected high correlation values appear among control variables.

Fixed effect regression models have been run with robust standard errors in order to verify the hypotheses, controlling for fixed year effects using STATA 14.0 software. In next chapter we present the result of empirical analysis. We expect that models confirm our hypotheses.

6 Results

Overall, the present study contributes to the emerging literature debate on the economic impacts of sharing economy on the incumbent hotel industry across an even broader variety of consumer markets. From a managerial point of view, this study informs hotels that they are no longer just competing with other hotels in their markets. They are also competing with Airbnb, and other home-sharing services, in their neighbourhood. A way to succeed, as demonstrated by this study, is to develop the appropriate capabilities to defend their economic performance and to look closely at why Airbnb is succeeding, to fight back and protect their investment.

Stata outcome (reported hereunder here in **Error! Reference source not found.**) clearly shows negative and significant impact from the logarithm of Airbnb listings per city per year on both dependent variables, ROS (model 1) and ROA (model 2), when considering the whole city, confirming H1 where we stated that Airbnb supply in a city led to a profitability decrease to the hotels in the same city.

Further exploring the models, it is evident that also H2 is confirmed, in fact both ROS (model 5) and ROA (model 6) show negative and significant impacts restricting the model to the hotels in suburbs, and that impact in both cases is stronger than the case concerning the whole city. On the other hand, the impact on the hotels in city centre does not show significant coefficients, so we cannot conclude Airbnb is affecting the profitability of these hotel category and H2, in the city centre hotels profitability is not suffering from Airbnb impact, while hotels in suburbs are suffering the most, is confirmed.

Table 4: Fixed effect model outcome

	All	All	City center	City center	Suburbs	Suburbs
VARIABLES	<i>ros</i>	<i>roa</i>	<i>ros</i>	<i>roa</i>	<i>ros</i>	<i>roa</i>
Model	(1)	(2)	(3)	(4)	(5)	(6)
Hypothesis	H1	H1	H2	H2	H2	H2
<i>log_nearairbn_tot</i>	-16.270*	-17.500**	-11.810	-12.400	-28.900*	-32.320*
	(8.613)	(8.796)	(11.630)	(10.800)	(16.540)	(17.190)
<i>count_review_hotel_cum</i>	0.002	0.002	0.003	0.002	-0.001	0.001
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)

<i>count_response_</i> <i>hotel_cum</i>	-0.000	-0.001	-0.004	-0.003	0.007	0.003
	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.007)
<i>average_month_</i> <i>rent_m2</i>	28.910**	36.850***	22.580	28.790*	38.160*	47.940***
	(11.480)	(11.320)	(15.360)	(14.710)	(20.430)	(16.550)
<i>log_revenue</i>	7.980	1.061	5.940	3.700**	18.090***	0.421
	(5.273)	(0.748)	(5.334)	(1.492)	(4.637)	(0.377)
<i>norm_touristic_</i> <i>flow_presence</i>	59.030***	67.870***	45.000	41.070*	86.620**	118.000***
	(20.740)	(19.650)	(27.390)	(24.050)	(35.990)	(33.740)
<i>hotel_5l_count</i>	-0.206	0.799	-0.571	-1.343	2.154	4.138
	(2.157)	(1.881)	(2.746)	(2.215)	(3.760)	(4.991)
<i>hotel_4_count</i>	2.574**	3.246***	1.910	2.130	4.364*	5.611***
	(1.278)	(1.242)	(1.708)	(1.549)	(2.246)	(2.061)
<i>hotel_3_count</i>	-1.526**	-1.616**	-1.124	-0.674	-2.670*	-3.264**
	(0.754)	(0.716)	(0.978)	(0.835)	(1.379)	(1.571)
<i>hotel_2_count</i>	-1.409	-1.764**	-1.210	-1.703	-1.300	-1.359
	(0.940)	(0.888)	(1.262)	(1.172)	(1.622)	(1.239)
<i>hotel_1_count</i>	5.445**	5.860**	3.959	3.173	9.510**	11.530***
	(2.427)	(2.356)	(3.202)	(2.832)	(4.397)	(4.376)
Constant	-543.700***	-598.700***	-366.800	-413.000*	-1,089***	-1,135***
	(196.300)	(192.100)	(234.000)	(218.900)	(412.100)	(379.000)
Observations	1115	1162	697	725	418	437
R-squared	0.242	0.164	0.160	0.128	0.400	0.237

Note: Robust standard errors in parentheses; dummy variables that refer to the years are omitted in the table; *** p<0.01, ** p<0.05, * p<0.1

7 Conclusions

This research clearly shows that AirBnB is having a significant impact on hotels' profitability, in fact even if touristic flows are generally increasing (with some exception) hotels are not fully able to benefit from the additional profit and suffer a partial market overlapping from various substitute products, among which the biggest one is surely AirBnb. Generally speaking, the technological paradigm shift we witnessed in last 20 years gave most developed countries citizens access to an amazing quantity of well-organized information and instantaneous communication possibility, allowing the quick development of new services able to threaten incumbents in many sectors, that saw barriers to entry in their space lowered in a short period of time.

In this context some incumbents have been able to benefit from the new range of possible services and they are riding the wave of digital transformation, but in accommodation sector they are mostly large groups, while smaller incumbents struggle to

reinvent themselves. For example, Marriott's group has established a partnership with Netflix to deliver customizable entertainment services, while Hilton, Starwood and Intercontinental Hotels Group partnered with Uber to offer more comprehensive range of services (GrantThornton, 2016). It is not a coincidence two of them, Marriott's and IHG, are listed among the 50 most innovative companies in 2018 ranking by Boston Consulting Group (Boston Consulting Group, 2018).

Having observed that we would like to go more in depth both from the side of the incumbents, analysing strategic choices behind their performances and from the side of the entrants, applying case study methodology to extract new moderators to test with quantitative analysis.

We know the research has some limitation, our main target is in fact to further explore the moderating effects of managerial variables and online reputation variables. Furthermore, we aim at expanding the geographical and temporal scope of current study, including new categories of areas and older/newer data.

Last but not the least, not only hotels are impacted from sharing-economy or technology-enabled services, there are in fact many other incumbents in tourism ecosystem that are facing somehow similar challenges.

References

- Agenzia delle Entrate – Osservatorio del mercato immobiliare (Real estate market observatory)
- AIDA (n.d.) Bureau Van Dijk Italian national Financial database, a Moody's Analytics Company - <https://www.bvdinfo.com/en-gb/our-products/data/national/aida>
- AirBnB press room, (n.d.) fast facts, 2019, from <https://press.airbnb.com/en-uk/fast-facts/>
- Airdna, LLC (n.d.) AirBnb database - <https://www.airdna.co/>
- Barney, J.B., (1991) "Firm Resources and Sustained Competitive Advantage", *Journal of Management*, Vol. 17, No. 1, pp. 99-120.
- Blal, I., Singal, M., & Templin, J. (2018). Airbnb's effect on hotel sales growth. *International Journal of Hospitality Management*, 73(February), 85–92. <https://doi.org/10.1016/j.ijhm.2018.02.006>
- Bloomberg news, (Olivia Zaleski), Inside Airbnb's Battle to Stay Private, February 6, 2018, from <https://www.bloomberg.com/news/articles/2018-02-06/inside-airbnb-s-battle-to-stay-private>
- Boston Consulting Group (M. Ringel, H. Zablit, F. Grassl, J. Manly, C. Moller), *Most Innovative Companies 2018: Innovators Go All In on Digital*, January 17, 2018, from <https://on.bcg.com/2DIueRx>
- Choi, K. H., Jung, J., Ryu, S., Kim, S. Do, & Yoon, S. M. (2015). The Relationship between Airbnb and the Hotel Revenue : In the Case of Korea, 8(October).
- Christensen, C. M. (2013). *The innovator's dilemma: when new technologies cause great firms to fail*. Harvard Business Review Press.
- Christensen, C. M., Raynor, M. E., & McDonald, R. (2015). What is disruptive innovation. *Harvard Business Review*, 93(12), 44-53.
- GrantThornton (n.d.), *Business model innovation: hotels' roadmap to 2020*, April 21, 2016, from <https://www.grantthornton.global/en/insights/articles/business-model-innovation/>
- Davenport, T. H. and Prusak, L., (1998) *Working knowledge: How organizations manage what they know*, Harvard Business School Press, Boston.
- Dogru, T., Mody, M., & Suess, C. (2019). Adding evidence to the debate : Quantifying Airbnb ' s

- disruptive impact on ten key hotel markets. *Tourism Management*, 72(June 2018), 27–38. <https://doi.org/10.1016/j.tourman.2018.11.008>
- Einav, L., Farronato, C., & Levin, J. (2015). Peer-to-Peer Markets (Working Paper of the National Bureau of Economic Research), 34. Retrieved from <http://www.nber.org/papers/w21496>
- Ginindza, S., & Tichaawa, T. M. (2017). The impact of sharing accommodation on the hotel occupancy rate in the kingdom of Swaziland. *Current Issues in Tourism*, 0(0), 1–17. <https://doi.org/10.1080/13683500.2017.1408061>
- Hansen Henten, A., & Maria Windekilde, I. (2016). Transaction costs and the sharing economy. *Info*, 18(1), 1–15. <https://doi.org/10.1108/info-09-2015-0044>
- Hotel News Now (n.d.) Updated infographic: Look at hotel industry's 'largest', February 14, 2017, from <http://hotelnewsnow.com/Articles/115537/Updated-infographic-Look-at-hotel-industrys-largest>
- IMF, (n.d.), IMF DataMapper, World Economic Outlook, GDP at current prices, October 2018, from <https://www.imf.org/external/datamapper/NGDPD@WEO/OEMDC/ADVEC/WEOWORLD>
- ISTAT (n.d.) Statistiche ISTAT (ISTAT statistics) - <http://dati.istat.it/>
- Juan Pedro Aznar, Josep M Sayeras, Alba Rocafort, J. (2017). The irruption of Airbnb and its effects on hotel profitability: An analysis...: Find articles, e-books in one search, 13(1), 147–159. Retrieved from <http://eds.a.ebscohost.com/laureatech.idm.oclc.org/eds/pdfviewer/pdfviewer?vid=1&sid=dc70efda-1e60-4d94-b80c-2311a5a79e98%40sessionmgr4006&hid=4208>
- Koh, E., & King, B. (2017). Accommodating the sharing revolution: a qualitative evaluation of the impact of Airbnb on Singapore's budget hotels. *Tourism Recreation Research*, 42(4), 409–421. <https://doi.org/10.1080/02508281.2017.1314413>
- Marr, B. and Schiuma, G., (2001) Measuring and Managing Intellectual Capital and Knowledge Assets in New Economy Organisations, in *Handbook of Performance Measurement*, ed. M. Bourne, Gee, London.
- Raguseo, E., Neirotti, P., & Paolucci, E. (2017). How small hotels can drive value their way in infomediation. The case of 'Italian hotels vs. OTAs and TripAdvisor.' *Information and Management*, 54(6), 745–756. <https://doi.org/10.1016/j.im.2016.12.002>
- Skift (D. Ting), Airbnb's Road to an IPO: Everything You Could Possibly Need to Know – August 2, 2017, from <https://skift.com/2017/08/02/airbnbs-road-to-an-ipo-everything-you-could-possibly-need-to-know/>
- TUI. (n.d.). Market size of the global hotel industry from 2014 to 2017 (in billion U.S. dollars). In Statista - The Statistics Portal. Retrieved March 27, 2019, from <https://www.statista.com/statistics/247264/total-revenue-of-the-global-hotel-industry/>
- UNWTO, (n.d.) Tourism highlights: 2018 edition, 2018, from <https://www.e-unwto.org/doi/pdf/10.18111/9789284419876>
- WTTC. (n.d.). Direct and total contribution of travel and tourism to the global economy from 2006 to 2017 (in trillion U.S. dollars). In Statista - The Statistics Portal. Retrieved March 27, 2019, from <https://www.statista.com/statistics/233223/travel-and-tourism--total-economic-contribution-worldwide/>
- WTTC. (n.d.). Total contribution of travel and tourism to GDP in Italy from 2012 to 2028* (in billion euros). In Statista - The Statistics Portal. Retrieved April 4, 2019, from <https://www.statista.com/statistics/627988/tourism-total-contribution-to-gdp-italy/>
- Xie, K. L., & Kwok, L. (2017). The effects of Airbnb's price positioning on hotel performance. *International Journal of Hospitality Management*, 67(December 2016), 174–184. <https://doi.org/10.1016/j.ijhm.2017.08.011>
- Zervas, G., Proserpio, D., & Byers, J. (2013). The Rise of the Sharing Economy: Estimating the Impact of Airbnb on the Hotel Industry. *Ssrn*, 1–45. <https://doi.org/10.2139/ssrn.2366898>

Africa Seed Business Knowledge Ecosystem

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Abstract

Knowledge is the most important resources of an organization as depicted in the knowledge-based theory of the firm. Systems to gather knowledge and process it to be useful for decision making are vital. Further, knowledge is time sensitive and hence loses relevance as environment changes. Agriculture and especially seed sector in Africa is one sector which require creation of a seed business knowledge ecosystem to aid in timely exchange of knowledge across, governments, seed companies, supply chain partners and farmers. When knowledge is exchanged between the aforementioned entities, it allows humans to relay thoughts, relay perceptions of environment and adapt hence take advantage of opportunities or minimize potential threats in their operating environments, leading to production and distribution of the required amount of seeds to enhance agricultural productivity and hence reduce hunger and poverty in the African continent. The paper used cross sectional survey design of papers published in the African seed sector as at end of March 2019. The aim of the review was to establish key findings and recommendations advanced with view of providing a workbench to find out whether the recommendations and the findings have been made use of by the time of writing the paper. The authors make the conclusion that its not easy to establish the readers of each report published and value of the information derived from reading the paper and implementing the appropriate recommendations. Due to the shortcomings of housing knowledge in published reports, the authors propose an ICT based seed knowledge ecosystem which will allow aggregation and disaggregation of seed information for ease of decision making. The proposed ecosystem to be dubbed the Africa Seed Sermo will provide an interactive dynamic adaptive system which will enable conversions between actors, online surveys, opinion poling, voting issues, management of awards/pay-outs/registration fees possible. Additionally it will change the landscape of seed related literature to make data gathering, storage, processing and archiving easy creating a solid base for information generation which when integrated with the intellectual capacity of interpretation, comparison, connections and conversations build the intended knowledge for agricultural transformation.

Key words; Knowledge Ecosystem, Aggregation, disaggregation, Africa Seed Sermo, Interactive dynamic adaptive system

Type of Paper - practical paper

1. Introduction

Agriculture is the lifeline of majority of the countries in Sub-Saharan Africa creating 70% employment opportunities, contributing 33% of gross domestic product and 40% of export earnings, (World bank, 2014). Though agriculture is central to economic development in Africa and plays a major role in poverty eradication and reduction of food insecurity, agricultural productivity remains low and indeed has been falling over the years. The foundation of high agricultural productivity is a vibrant seed sector. Overall seed trade done in Africa was US\$ 800 Million being less than 2% of the global total, (AGRA, 2015). This percentage is low because majority of the farmers plant informal seeds which then in return contribute to poor yields.

The seed sector in Africa can greatly benefit through creation of a seed knowledge ecosystem and hence harness the power of knowledge to propel agricultural transformation. Knowledge ecosystem denotes the happenings that occur as collated knowledge is converted into silent knowledge as time progresses mainly through experiential and learning process. To create a knowledge ecosystem, communities of practice interact with bodies of knowledge, tools, technologies and practices which facilitate upgrading of knowledge over time. A seed knowledge business ecosystem consists of knowledge generated by breeders, seed enterprises, agro dealers, farmer organizations, farmers, government regulatory bodies and agriculture funding agencies. These bodies put together under a knowledge management system can be the answer to Africa's food crisis.

The discipline of knowledge management has witnessed three phases of evolution, Snowden, (2002). First stage focused on distributing information to decision makers so as to enable them make decisions timely. The second age replaced the information technology focus with one on tacit/explicit knowledge transformation motivated by Nonaka's SECI model. The third age is the one in which knowledge is viewed paradoxically as a thing and a flow, context, narrative and management of content generated through comparisons and conversations between knowledge generators. The final phase calls for lots of integration among various actors in the knowledge area while at the same leveraging on the power of information communication technology to generate knowledge, synthesize, adapt it and grow it as operating environments change.

2. Rationale for African Seed Knowledge Ecosystem

Countries of Africa have witnessed liberalization of the seed industry for over two decades now. This has led to departure from government monopolized seed trade to perfect competitive seed market where private sector firms play a major role. To better manage seed issues, many countries have country based seed associations and the continent has an umbrella, body dubbed Africa Seed Trade Association (AFSTA) to champion the involvement of private sector enterprises in seed production and distribution. The association (AFSTA) was formed in 2000 with the main objective of promoting the use of improved formal seed in Africa and hence improve agricultural

productivity. Since the formation, membership has grown to include seed associations in respective countries, associations/companies outside Africa, Non-governmental organizations and companies involved in seed trade.

The main mission of AFSTA has been to move farmers in Africa to routinely replace their seed varieties with improved varieties to transform agricultural productivity. Improved seeds are climate smart varieties which adapt to changing climate conditions and are hence key to embrace given the issues of global warming noted. If agricultural productivity is improved, poverty will be reduced, there will be more women engaged in agriculture and nutrition of societies will improve leading to less sick people.

Public and private sector organizations invest in improved varieties for common good. Its however worthy noting that farmers in some areas continue to use obsolete varieties. Knowledge ecosystem should be able to convey information real time to farmers preferably using mobile phone technology about new released varieties. Same channel could also be configured by seed marketing agencies and other entities to promote and distribute the improved varieties more efficiently and cost effectively. Support offered by government agencies should be inline with appropriate policy and if not, the ecosystem should trigger inconsistency to arise before release so as to enable the relevant arms of governments and regulatory agencies to develop the appropriate policy. To create demand for the improved seeds, innovative ways are required to sensitize farmers, this is possible through links with social media platforms like facebook and other highly customized mobile applications like “Viusasa” in Kenya.

3. Methodological Approach

The study utilized an online literature review of existing reports on the Africa seed sector. In total 5 reports were reviewed to uncover key findings which actors in Africa were expected to work on after the reports were presented. From Table below, its clear that even though the findings were useful, its not easy to know how many people have accessed the information and how the information has been of value in creating impact in the seed sector. Sometimes readers of reports may find contradicting information and concerns which were addressed by authors inappropriately and hence a conversion between a reader and an originator of a report would be an excellent opportunity for knowledge sharing.

Serial No.	Report Book Title	Website	Organization/Author	Form of Report	Date Published or presented	Extract of Findings / Expected Outcome	Consumers of information	Frequency of accesses	Impact of information
1.	Seed security assessment report, Northern Bahr el Ghazal state, South Sudan	http://www.fao.org	FAO, Southern Sudan	Pdf	2014	Major crops cultivated in 2013 include; sorghum by 100 percent of the households interviewed, groundnut (52%), sesame (40%), Jew mallows (42%), maize (35%) and okra (31%) These crops are typically grown under rain-fed conditions with the planting season starting around May and extending into June depending on the crop and variety	Seed companies, South Sudan Government	Can't be assessed	Can't be assessed
2.	Report of the Expert Consultation Workshop on Seed Policy Formulation, Milan, Italy	http://www.fao.org	FAO., Milan, Italy	Pdf	2011	Contribute to the development of a vibrant seed sector in developing countries that will allow farmers' to have better access to quality seed adapted to their needs.	Development partners, governments, Seed companies	Can't be assessed	Can't be assessed
	strengthening seed systems: a contribution to the preparation of the second report on the state of the world's plant genetic resources for food and agriculture		FAO, Rome, Italy	Pdf	2009	This was the twelfth session and hence other sessions have reports which were not assessed; Findings ; - Challenges from outside the seed sector itself include ecological pressures, such as the emergence of new strains of important diseases and climate change leading reorganization of ecological zones	Breeders , governments, farmers	can't be assessed	can't be assessed
3.	Performance of the formal seed sector in Africa: Findings from the African Seed Access Index	https://agecons.earth.umn.edu	Edward Mabaya, 5th International Conference of the African Association of Agricultural Economists, September 23-26, 2016, Addis Ababa, Ethiopia	pdf	2016	Kenya has a limited numbers of breeders, only about 40 public and 28 private breeding programs are active for over 6 million farming households	Universities, Government, Funding agencies, Breeders , Crop seed enterprises	Not easy to establish	Not easy to establish
4.	The expansion of the commercial seed sector	https://acbio.org.za/wp-content/uploads/2015/12/Seed-Sector-Sub-	The African Centre for Biodiversity www.acbio.org.za a PO Box	pdf	2015	Maize and horticulture are the two biggest seed markets on the continent, valued at around US\$ 500 million and US\$ 250	Seed enterprises, governments,	Can't be assessed	Can't be assessed

	in sub-Saharan Africa: Major players, key issues and trends	Sahara-report.pdf	29170, Melville 2109, Johannesburg, South Africa. Tel: +27 (0)11 486 1156			million respectively and there has been a heavy focus on these two markets by the private seed industry	funding agencies		
5.	the seed sector in developing countries: a framework for performance analysis	https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/6969.pdf	Elizabeth Cromwell, Esbern Friis-Hansen and Michael Turner “ Working Paper 65 Results of ODI research presented in preliminary form for discussion and critical comment”	pdf	1992	Research on extent to which structure and ownership are die major constraints to improved performance and therefore the extent to which privatisation or market liberalisation can bring about an improvement in the seed sector.	Government, seed enterprises	Not easy to assess	Not easy to assess

4. Proposed Africa Seed Sermo

Sermo is a latin word that means “conversation”. It will allow a team of self-described community of crop seed actors and professionals to both communicate and filter knowledge in a knowledge ecosystem. This shall be modelled through an internet-based system which would allow actors in seed business to register in the system so as to be allowed to post seed related literature or retrieve information from such a system. To make sure that information contained in the system is authentic, the system envisaged should be a closed system so as to better manage knowledge quality. A closed system as March (1991), argues can exceed the performance of democratic or open communities in detecting previously unfamiliar elucidations to relevant problems. An indispensable diversity of actors is key if a complex dynamic adaptive system like the one proposed is to respond to unanticipated emergent concerns, as observed by Anderson , (1999).

In order to use the Africa seed knowledge ecosystem, the seed actors will be allowed to voluntarily register in the system. Registration can be set at individual and corporate levels and a registration fee can be agreed on so as to raise funds for running the knowledge system. Alternatively, a registration fee can also be charged for running the system but can additionally be sponsored by philanthropists in the seed industry. It is expected that no confidential Information on seed will be posted into the system and hence interested parties will need to be allowed to register using their official identities. Its however worthy noting that if the community of actors is expected to vote for any of the players concerning an issue for some award, then use of pseudonyms is encouraged. Encouraging anonymous contribution can discourage corruptive influences, extortion and vote buying in a closed knowledge ecosystem and additionally registered participants may feel free to voice their disquiets or opinions which would not be voiced if acknowledgement was a prerequisite, (Wade-benzoni et al. 1996).

The actors in seed business knowledge ecosystem will be in two broad categories, those with expert knowledge on a topical issue of interest and those who would want know and use new and expert knowledge generated from the interaction of the experts. Experts will include breeders, regulators, general research community and marketing officers of seed companies among others. Users of knowledge generated will include farmers, agro dealers and distributors. The ecosystem will allow actors who have the capacity to belong to the two categories to do so and hence categorization will not be mutually exclusive. The knowledge ecosystem designed will be a dynamic adaptive decision support system that fosters knowledge exchange opportunities and enables knowledge generated to evolve as the operating environment changes, Bray (2007). The main challenge of non-decision support based system is that employees may not easily know the knowledge available to be known, its value and the currency of such knowledge. Further disaggregation and aggregation of such knowledge to provide leads to decision making opportunities offers a great challenge.

In many fields of study, Polanyi. (1966) argues that tacit knowledge is better than explicit knowledge which is conventionally housed in forms like published reports in websites, journals or textbooks. It's highly contextualized and experience based knowledge surpassing taught or presented verbatim. The decision support system will allow the seed community to tacitly accumulate the relevant insights in their areas of expertise gathered through regular practice, share the same with others and hence create a more productive force in agricultural productivity increase. The proposed design of the system will be such that it will make actors be able to pose questions and expect to get answers from other ecosystem members a feature which a published report or a textbook hardly provides. The questions will represent unforeseen or unknown problems of decision makers which many writers may not know at the time of writing a book or a report and hence the proposed seed knowledge ecosystem will present a probabilistic rather than a deterministic model in knowledge cultivation, Simon (1991).

Knowledge ecosystems are good frontiers for research. It's envisaged that clients in addition to paying regular subscription fee to hook on to the system will also pay additional fee to post surveys for the entire continent, ecological zones or countries. Additionally, corporations and individuals whose work will be frequently accessed will also be rewarded through pay-outs. This design feature will be a selling point to many support organizations like FAO, AGRA, CYMMYT, Bill and Melinda Gates Foundation, Rockefeller Foundation and others whom in the past have sponsored Africa seed related research.

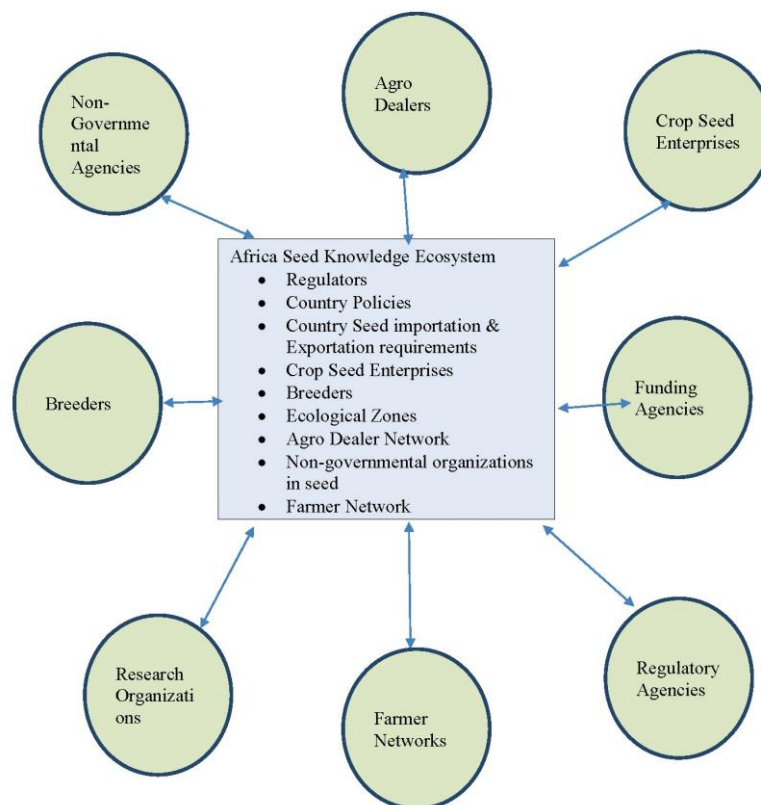


Figure 3.1 African Seed knowledge Ecosystem Components

5. Conclusions

Knowledge management in the seed sector in Africa is centred on published reports many of which are available online. Though this is a great development from the physical documentary archival of yester years, it presents a number of challenges which include;- lot of time required to search for knowledge available, lack of opportunity to converse with originators of the knowledge archived and lack of dynamism in the said knowledge. Moreover, not many farmers can download reports from websites because some don't have computers and others have limited ICT skills.

The mentioned challenges can be overcome greatly through the use of computer software to create an interactive, dynamic and adaptive knowledge management system which will provide timely seed specific knowledge interactively, more efficiently and effectively and hence make seed actors optimize on use of existing knowledge for growth in agricultural productivity. Further, the interactive nature of mobile phone applications has brought ICT power to the palms of farmers and other actors who can now interact

with systems they could not interact with there before at the comfort of their farms. Funding the development of a seed knowledge ecosystem is easy because the money expended in form agricultural aid which approximated at about USD 4 billion annually and also specific country agricultural sector support can be utilized for such endeavour. Resources utilized this way can achieve more value than continuing to fund isolated reports whose impact is difficult to measure and track. After inception, the sustainability of the ecosystem is possible thorough funds collected through registration, gaming, participation in awards, online client surveys and philanthropists who have been companioning agricultural growth.

References

- AGRA 2015. Progress report 2007 – 2014. Nairobi. Alliance for a green revolution in Africa (AGRA)
- Anderson, P. "Complexity Theory and Organization Science," *Organization Science* (10:3), 1999, pp. 216-232.
- Argote, L., and Ingram, P. "Knowledge Transfer: A Basis for Competitive Advantage in Firms," *Organizational Behavior and Human Decision Processes* (82:1), 2000, pp. 150-169
- Bray, D. "Knowledge Ecosystems: A Theoretical Lens for Organizations Confronting Hyperturbulent Environments," in *Proceedings of the International Federation for Information Processing 8.6: Organizational Dynamics of Technology-Based Innovation*, Manchester, UK, 2007.
- Cummings, J. "Work Groups, Structural Diversity, and Knowledge Sharing in a Global Organization," *Management Science* (50:3), 2004, pp. 352-364.
- March, J. "Exploration and Exploitation in Organizational Learning," *Organization Science* (2:1), 1991, pp. 71-87
- Polanyi, M. *The Tacit Dimension*, 1st Edition. Garden City, NY: Doubleday, 1966.
- Simon, H. "Bounded Rationality and Organizational Learning," *Organization Science* (2:1), 1991, pp. 125-13
- Snowden D. "Complex Acts of Knowing; Paradox and Descriptive Self-awareness", *Journal of Knowledge Management*, 6(2), pp. 1-14, May 2002.
- Wade-Benzoni, K., Tenbrunsel, A., and Mazerman, M. "Egocentric Interpretations of Fairness in Asymmetric, Environmental Social Dilemmas: Explaining Harvesting Behavior and the Role of Communication," *Organizational Behavior and Human Decision Processes* (67:2), 1996, pp. 111-126.

The Rise of a New Business Ecosystem? Insights by the Strategies of Exaptation and Brokerage

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Abstract

We are living the era of the ecosystem, a concept whose use in management studies has grown exponentially in recent years. On the other hand, the ecosystem is becoming a fuzzy concept. In particular, following Teece (2007), many scholars define the business ecosystem in a rather generic way as an environment that includes the subjects that have some impact on the firm's competitive advantage. Others scholars associate the concept of business ecosystem with the strategy that leads to the creation of a new market space through an (ecosystem) platform. In this paper, we compare this platformation strategy with two other disruptive strategies meant as strategies that create an uncontested market space: exaptation and brokerage. We conclude that the (ecological) niche construction offers a particularly appropriate metaphor (rather than ecosystem) for the three strategies discussed in the paper.

Keywords: business ecosystem, platformation, exaptation, brokerage, niche construction

Paper type – Academic Research Paper

1 Introduction: creating a new market space through an ecosystem platform

We are living the era of the ecosystem, a concept whose use in management studies has grown exponentially in recent years with reference not only to high-tech sectors but also to those more established, from services to manufacturing (Barile, 2016; Jacobides et al., 2018). The ecosystem is also becoming a fuzzy concept. As shown by the recent review by Tsujimoto et al. (2018, p. 49) "the term *ecosystem* seems to be used without clear definition or sound theoretical backing".

The analysis by Tsujimoto et al. (2018) identifies four research perspectives: industrial ecology, business ecosystem, platform management, multi-actor network. Among these, the platform management perspective is distinguished by being anchored to a clear concept (platform), from which derives a specific way of conceiving the business ecosystem, and also a specific disruptive strategy. In this work, we adopt the platform perspective and evaluate its usefulness in understanding disruptive strategies meant as strategies that create an uncontestable market space.

The concept of platform was introduced by Cusumano and Gawer in pioneering works (Cusumano and Gawer, 2002; Gawer and Cusumano, 2002), where the authors analyze cases studies such as Intel and Microsoft, to provide valuable insights for managing innovation by the platform leader. In doing so, they use the term "ecosystem" (industry or innovation ecosystem) quite clearly: "With vision that extends beyond their current business operations or the technical specifications of one product, platform leaders can create an industry ecosystem greater than the sum of its parts. [...] The ecosystem can be greater than the sum of its parts if companies follow a leader and create new futures together." (Cusumano and Gawer, 2002, pp. 51, 58). Subsequently, the same Gawer and Cusumano refined the platform approach, explicitly linking the platform to its own business ecosystem (Gawer, 2014; Gawer and Cusumano, 2014). In particular, the external (industry) platforms are distinguished from the internal (company) platforms, and defined as "products, services, or technologies that act as a foundation upon which external innovators, organized as an innovative business ecosystem, can develop their own complementary products, technologies, or services" (Gawer and Cusumano, 2014, p. 417). Due to the technological characteristics of high modularity that characterize these sectors, empirical studies on ecosystem platforms usually focus on computing, telecommunications, and other information-technology intensive industries (Gawer and Cusumano, 2014; Tsujimoto et al., 2018).

In the ecosystem literature, one of the most cited contributions – appeared when the concept was still in its infancy (Moore 1993; Cusumano and Gawer, 2002; Iansiti and Levien, 2004; Adner, 2006; Dhanaraj and Parkhe 2006) – is that of Teece (2007) where the business ecosystem is defined in a rather generic way as an environment that includes the subjects that have some impact on the competitive advantage of the company. However, recently Teece (2016) proposed a much more limited view of the business ecosystem, defining it as "a group of interdependent organizations collectively providing valuable goods and services to their customers. The collective evolution of the system is typically reliant on the technological and business leadership of one or two firms that

provide common standards and hence a platform around which other system members align their investments and strategies to provide inputs and complementary products. A 'platform' can be said to exist when some common standards and interfaces permit the elements of the ecosystem to innovate independently while advancing collectively" (p. 1). Teece also points out that platform ecosystems develop through the action of an initiator or "captain" that is "an innovator developing and/or establishing standards and choosing which elements of the value chain must be internalized, and what needs to be supported externally, in order to provide it with the best opportunity for capturing value" (p. 2) and that can then become the platform leader. This is clearly a description that perfectly represents what the review by Tsujimoto et al. (2018) defines "platform management perspective".

Moving along the Teece's furrow, Sections 2 and 3 describe two strategies linked to the rise of a new market or a new market segment – exaptation and brokerage; the final section 4 compares these two strategies with that of the creation of a new market space through an ecosystem platform. On the one hand, critical reflections emerge about the evanescent use of the business ecosystem concept prevalent in the extant literature; on the other hand, it emerges the usefulness of the concept if it is appropriately specified, as in the case of platform ecosystems.

2 Exaptation, or creating a new market by means of a functional shift of an artifact

The term "exaptation" was coined by the paleontologists Gould and Vrba (1982) to indicate a distinct evolutionary process following that of Darwinian adaptation. To be more specific, it occurs when a character previously shaped by natural selection for a given function (an adaptation) is coopted for a new use. Unlike the concept of adaptation, in its gradualist sense, the concept of exaptation honors "the unpredictable discontinuity of change in complex systems" (Gould, 1991, p. 64). On the other hand, exaptations give rise to new adaptive cycles. As Gould and Vrba (1982, p. 12) explained, "any coopted structure (an exaptation) will probably not arise perfected for its new effect. The primary exaptations and secondary adaptations can, in principle, be distinguished".

Although evolutionary biologists are still debating the meaning of exaptation, and the ways in which it occurs, what has been generally accepted is the existence of structures associated with one particular function that may later serve another (Casinos, 2017). On these grounds, it comes as no surprise to see the transition from exaptation as an evolutionary mechanism in the history of biological species to exaptation as an evolutionary mechanism in the history of artifacts and their embodied technologies. In this latter sense, exaptation means the emergence of a new function for an existing artifact, a function for which it had not originally been designed (Andriani and Cattani, 2016). Mokyr, the first author to perceive the sustainability and potential of this analogy, ventures that "in the history of technology, exaptation is probably more common than in natural history. Many of the most dramatic inventions of the modern age were originally selected for purposes that were quite different from what eventually turned out to be their

most enduring trait” (Mokyr, 2000, p. 57). Not all exapted artifacts prompt the appearance of new markets, but the cases that have most attracted the attention of scholars of technological evolution are those – such as the often-mentioned microwave oven – in which, in much the same way as a biological exaptation, technological exaptations have generated discontinuities, and been associated with the emergence of new product markets (Bonifati, 2010; Andriani and Cattani, 2016; Mastrogiorgio and Gilsing, 2016). As Bonifati put it (2010, p. 754), “new products and new markets emerge as exaptation phenomena whenever new functionalities activate new uses of a technology, giving rise to transformations in the relations between production, technology, and consumption”. The discontinuity also affects the strictly technological domain: more often, what is exapted is not a fully-developed product, but a product component or module; and its inclusion in an entirely new product involves a fairly effortful development process (Andriani and Cohen, 2013). These are the reasons why, here again like the exaptation studied by biologists, the technological exaptation we are discussing here is a process that includes a primary event (a pre-adaptation) and a number of successive adaptations (Andriani and Cattani, 2016).

Studies that have focused on specific technological exaptation processes also provide information about the agents (firms, inventors, and so on) involved in these processes. They also inform about the relationships between agents, which seem to have had an important role in every case of exaptation studied to date. The role of the agents and their networks remains in the background, however, because the unit of analysis in such studies is usually the artifact or the technology.

In the present contribution, we diverge from the above-reviewed literature on exaptation, shifting: (1) the unit of analysis from the artifact to the enterprise; and (2) the primary focus of analysis from exaptation as a process to exaptation as a strategy. To be more precise, we consider exaptation as a strategy that enables a firm to create a new market by means of a novel product that derives from changing the function of an existing product, or a product component or module. If we divide the process of exaptation into a phase of exploration (moving from the idea of a functional shift to a new artifact) and a phase of exploitation (from the new artifact to a new market), then the crucial agent for the purposes of the strategy of interest to us here is the firm involved in the latter phase. Of course, the same firm might be involved in the exploratory phase too. The firm that succeeds in creating the new market may be in operation already, albeit in another market, or it may be newly established, its birth more or less coinciding with that of its new market. It is worth noting here that studies on exaptation focused strongly on processes of exaptation that involved existing enterprises. Some also tried to pinpoint what makes a firm a likely candidate for the development of a successful exaptation (Dew et al., 2008; Felin et al., 2016; Garud et al., 2016, 2018). Garud et al. (2016, p. 162), for instance, spoke of “some ways for organizations to create *exaptive pools*, maintain them through narratives, and sensitize employees to actively pursue *exaptive events* by cultivating serendipity in forums designed for such purposes, what we have labeled as *exaptive spaces*” such as 3M case (Goldenberg and Mazursky, 2002).

3 Brokerage, or bridging different knowledge domains to create a new market segment

Unlike the concept of exaptation, brokerage stems from original research conducted by the sociologist Ronald Burt (1992, 2004) on the connection between social networks and social capital. His approach is founded on the theory of social capital developed by Coleman (1988), who saw it as a function of social structure producing advantage. Specifically, individuals who do better – i.e. who receive higher returns for their efforts – are better connected. But why are better-connected individuals at an advantage? It is in dealing with this question that Burt adds his contribution. In short, for the purposes of our analysis we can consider two (or more) different networks that are only loosely connected together, and therefore represent non-redundant sources of information and knowledge, sources that are more additive than overlapping. Burt describes such a configuration as being rich in structural holes, adding that it gives a competitive advantage to the player that bridges the holes. Individuals or organizations (through the individuals working for them) that find themselves in this advantageous position may develop innovation by combining knowledge absorbed from non-redundant networks. In Burt's words, "people who stand near the holes in a social structure are at higher risk of having good ideas" (2004, p. 349). Having identified such a perfect position for identifying business opportunities, Burt goes on to delineate the individuals or organizations that occupy it, both as knowledge brokers¹ and as entrepreneurs (entrepreneurial firms).

According to Burt's theory, brokerage is an activity that leads to combine knowledge from networks with a limited degree of overlap, and consequently representing distinct and even distant knowledge domains. As such, brokerage can nurture any innovative process (Hargadon, 2002; Burt, 2004; Fleming et al., 2007a; Tortoriello, 2015). In particular, it can have an important role in supporting the previously-analyzed exaptation strategy, given that the innovation to be developed (a new market) originates from a connection and a combination between different domains (Hargadon, 2002, p. 53). Unlike other innovations deriving from knowledge combination, in the case of exaptation there is a considerable cognitive distance – as Nooteboom would say (2000) – between the domains involved in the combination. On the one hand, we have a technology that, up until the moment of exaptation, had been channeled into certain uses (domain A). On the other, we have a completely novel usage context for this technology, and an entirely new product if the exapted artifact was a product component or module. This new system of relations between production, technology, and consumption (Bonifati, 2010) has yet to take shape when the exaptation comes to light, but there is already a broader system capable of containing it (e.g., cooking at home in the case of the domestic microwave oven), and this is the domain B with which the domain A must be combined. If we consider what Garud et al. (2016) called "planned" exaptation, then the "exaptive spaces" that a firm can create within its own organization (or attend elsewhere) could clearly also be called "brokerage spaces", where the goal of bridging between non-redundant sources

¹ The term "broker" is used very differently here from its common meaning of an agent mediating the transfer of something (e.g., knowledge) between two other parties (Grandinetti, 2018).

of knowledge is to explore potential exaptation pathways. On the other hand, we know that the passage from the exploratory phase of exaptation to the exploitation phase cannot be taken for granted. To achieve this passage, and contain the lead time of the process as a whole, the firm will benefit once again from using brokerage to deal with the numerous problems that crop up after the functional shift.

However, brokerage *à la* Burt can also be a specific innovation strategy, on a par with exaptation. An excellent example of brokerage used for this purpose comes from the Cirque du Soleil, mentioned by Kim and Mauborgne (2005) as a significant example of *Blue Ocean Strategy*. Established in 1984 and still hard to imitate, it was created by a group of street performers in Montreal – a creative city (Cohendet et al., 2010), meaning a setting in which different cognitive domains or small worlds come into contact (Fleming et al., 2007b), creating brokerage opportunities for the emergence of new ideas. For the purposes of our analysis, its most interesting feature lies in the creation of a new market space (or segment) in the vast market of entertainment, and specifically of urban live entertainment, by means of a brokerage between two domains – circus and theater.

While exaptation introduces a discontinuity that leads to the formation of a new market (rather like a new species in the biological world), the new market space opened up by a brokerage strategy is more like a segment in the context of an existing market, even when it is as highly innovative as in the case of Cirque du Soleil. Leaving aside this far from trivial difference (due once again to the different cognitive distance separating the knowledge domains being combined in the two strategies), a successful brokerage strategy also involves an exploratory phase followed by a phase of exploitation. An organization lacking in the necessary capabilities on both of March's frontiers (1991) will not succeed. The broker that develops a new market segment may be a firm already operating in the reference market or a new venture established ad hoc. In the latter case, brokers might be employees of incumbent firms who can exploit their position in their employer's organization to fine adjust the innovative idea, then leave to found a new business (Agarwal et al., 2004; Furlan and Grandinetti, 2016).

Organizations that are large – especially if they are diversified as regards the geographical areas in which they invest and/or the product market in which they engage – have more structural holes, and consequently more opportunities for brokerage (Burt, 2000; Tortoriello, 2015). This situation gives rise to internal networks, which then become connected with specific external sources of knowledge. For such a configuration to be turned to advantage for the organization as a whole, it must contain internal brokers capable of forming bridges between its various domains. A firm that meets these requirements is in a good position to identify new market spaces by acting as an "internal" broker or bricoleur.¹

¹ In a situation like the one described, the concept of brokerage and bricolage tend to overlap. In the wake of Levi-Strauss's idea of "doing things with whatever is at hand" (1966, p. 17), we can see bricolage not as a process or activity, or even as an innovation strategy in its own right, but as a variant of brokerage, with more emphasis on the sources of knowledge inside the enterprise than on those outside.

4 Strategies for creating new market spaces and business ecosystems: a reassessment

In the studies we have considered to analyze exaptation and brokerage as strategies capable of introducing disruptive changes, the concept of ecosystem has almost never been used. Yet in these works, the role played by the innovator relations (with suppliers, customers, coopetitors, institutions, private individuals) in promoting the rise of a new market (new segment) clearly emerges. Basically, it deals with the same elements that have led other scholars to speak of business ecosystem.

Let us return to the definition of business ecosystem contained in Teece (2007). The author aims to enlighten that the dynamic capabilities framework is able to explain the sources of firm-level competitive advantage over time. At this aim, he disarticulated these capabilities "into the capacity (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets" (p. 1319). Dynamic capabilities work in a business ecosystem, which Teece defines as "the community of organizations, institutions, and individuals that impact the enterprise and the enterprise's customers and supplies" (p. 1325). Then, in the concept of ecosystem, the interdependencies and the interactions among the subjects that compose it are implicit. The ecosystem affects the firm's dynamic capabilities and thus its ability to build sustainable competitive advantage, but at the same time these capabilities "embrace the enterprise's capacity to shape the ecosystem it occupies" (p. 1320). Teece aims to underline the difference between the business ecosystem and industry, and therefore the difference between its approach to competitive advantage and that of Porter (1980, 1985) based on the Five Competitive Forces. However, it should be noted that Porter was well aware of the difference between the industry (meant as a system of competitive forces) and the wider competitive environment, as well as the fact that the latter includes factors (such as the government) capable of influencing the competitive advantage not being one of the five forces.

Ultimately, in the concept of business ecosystem proposed by Teece (2007) and adopted by many followers, it is difficult to find something that is not already contained in the concept of competitive environment, applied for a long time in studies on strategy, industrial organization, management, or marketing, and also useful for framing the strategies discussed in the previous sections of the paper, such as any strategic action carried out by a company. An interesting shift is to associate the concept of business ecosystem with the strategy that leads to the creation of a new market space through an (ecosystem) platform. As mentioned in the introduction, this strategy – summarized with the term "platformation" (Parker et al., 2016) – was studied in particular by Cusumano and Gawer (Cusumano and Gawer, 2002; Gawer and Cusumano, 2002, 2014 ; Gawer, 2014), and recently attracted the attention of Teece himself (2016, 2018). What distinguishes the platformation from the strategies of exaptation and brokerage is that the platform involves the rise of a system of interdependencies among actors, which in turn is anchored to the platform. Scholars emphasize the bright side of the platform strategy and

leadership: "The industry-wide goal is to facilitate complementary innovations by third-party firms. Platform leaders must also strive to establish a set of business relationships that are mutually beneficial for ecosystem participants and be able to articulate a set of mutually enhancing business models" (Gawer and Cusumano, 2014, p. 423). However, there is also a dark side that has its potential cause in the power imbalance in favor of the platform leader, an aspect that has not yet been sufficiently investigated.¹

Going deeper into the strategy of platformation, we realize that the most appropriate biological metaphor is not the ecosystem but the ecological niche, and only secondarily the ecosystem. It is, in fact, a strategy of construction niche, a relevant concept in the managerial studies, defined by Luksha (2009, p. 273) as "sustained change to the resources and relations in the organizational environment that have long-lasting effects upon the strategy of the focal organization(s) and organizational constituents. The transformation or creation of organizational niche, therefore, results in the sustained change in patterns of strategic activities". Every strategy aiming to create a new market space seeks to foster an ecological niche. It is no coincidence that in the works focused on exaptation scholars frequently use the expression "technological" or "market niche": for example "it took nearly 20 years to elaborate the features that defined the microwave oven market niche" (Andriani and Cattani, 2016, p. 120). Rare, on the other hand, the use of the term in studies on brokerage for market segmentation: for example, Kim and Mauborgne (2005) do not speak in terms of niche in their analysis focused on the Cirque du Soleil, however, the strategy they describe is precisely that of construction of a niche in the performing arts industry, as Ghazzawi et al. (2014) underlined. Curiously, even in the business ecosystems literature the concepts of niche and niche construction are little practiced, with the laudable exception of the theoretical paper by Adamides and Mouzakitis (2009).

It is also interesting to see how niche construction is defined in biology: the capacity of organisms to modify their environments. The concept was developed in the 1980s by Lewontin (1983) and by Odling-Smee (1988). Later, it became an important research ground at the intersection of ecology and evolution studies: "Niche construction refers to the capacity of organisms to construct, modify, and select important components of their local environments, such as nests, burrows, pupal cases, chemicals, and nutrients. [...] Through niche construction organisms not only influence the nature of their world, but also in part determine the selection pressures to which they and their descendants are exposed, and they do so in a non-random manner. [...] A parallel movement has emerged in ecosystem ecology, where researchers stress the utility of regarding organisms as ecosystem engineers, who partly control energy and matter flows" (Day et al., 2003, p. 80). So, the concepts of "niche construction" and "ecosystem engineering" are synonymous. Clearly, the niche construction also involves human beings, who "can and do modify their environments mainly through cultural processes, and it is this reliance on culture that lends human niche construction a special potency" (Laland and O'Brien,

¹ While there is a certain tradition of studies on the dark side of dyadic cooperative relationships, particularly of a buyer-seller type (Grandinetti, 2017), the extension of the concept to an entire network or community is still in its infancy.

2011, p. 194). There seems to be no doubt that the niche construction offers a particularly appropriate metaphor for the strategies discussed in this paper that is exaptation, brokerage and platformation. At the same time, it suggests a more basic use of the concept of (business) ecosystem, remembering that in biology ecosystem is simply "the complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space" (*Encyclopaedia Britannica*).

References

- Adamides, E.D. and Mouzakitis, Y. (2009), "Industrial ecosystems as technological niches", *Journal of Cleaner Production*, Vol. 17 No. 2, pp. 172-180.
- Adner, R. (2006), "Match your innovation strategy to your innovation ecosystem", *Harvard Business Review*, Vol. 84 No. 4, pp. 98-107.
- Agarwal, R., Echambadi, R., Franco, A.M. and Sarkar, M. (2004), "Knowledge transfer through inheritance: spin-out generation, development, and survival", *Academy of Management Journal*, Vol. 47 No. 4, pp. 501-522.
- Andriani, P. and Cattani, G. (2016), "Exaptation as source of creativity, innovation, and diversity: introduction to the special section", *Industrial and Corporate Change*, Vol. 25 No. 1, pp. 115-131.
- Andriani, P. and Cohen, J. (2013), "From exaptation to radical niche construction in biological and technological complex systems", *Complexity*, Vol. 18 No. 5, pp. 7-14.
- Barile, S., Lusch, R., Reynoso, J., Saviano, M. and Spohrer, J. (2016), "Systems, networks, and ecosystems in service research", *Journal of Service Management*, Vol. 27 No. 4, pp. 652-674.
- Bonifati, G. (2010), "'More is different', exaptation and uncertainty: three foundational concepts for a complexity theory of innovation", *Economics of Innovation and New Technology*, Vol. 19 No. 8, pp. 743-760.
- Burt, R.S. (1992), *Structural Holes. The Social Structure of Competition*, Harvard University Press, Cambridge.
- Burt, R.S. (2000), "The network structure of social capital", in Sutton, R.I. and Staw, B.M. (Eds.), *Research in Organizational Behavior*, JAI Press, Greenwich, pp. 345-423.
- Burt, R.S. (2004), "Structural holes and good ideas", *American Journal of Sociology*, Vol. 110 No. 2, pp. 349-399.
- Casinos, A. (2017), From Cuénot's préadaptation to Gould and Vrba's exaptation: a review", *Biological Journal of the Linnean Society*, Vol. 121 No. 2, pp. 239-247.
- Cohendet, P., Grandadam, D. and Simon, L. (2010), "The anatomy of the creative city", *Industry and Innovation*, Vol. 17 No. 1, pp. 91-111.
- Coleman, J.S. (1988), "Social capital in the creation of human capital", *American Journal of Sociology*, Vol. 94, pp. S95-S120.
- Cusumano, M.A. and Gawer, A. (2002), "The elements of platform leadership", *MIT Sloan Management Review*, Vol. 43 No. 3, pp. 51-58.
- Day, R.L., Laland, K.N. and Odling-Smee, F.J. (2003), "Rethinking adaptation: the niche-construction perspective", *Perspectives in Biology and Medicine*, Vol. 46 No. 1, pp. 80-95.
- Dew, N., Read, S., Sarasvathy, S.D. and Wiltbank, R. (2008), "Outlines of a behavioral theory of the entrepreneurial firm", *Journal of Economic Behavior & Organization*, Vol. 66 No. 1, pp. 37-59.
- Dhanaraj, C. and Parkhe, A. (2006), "Orchestrating innovation networks", *Academy of Management Review*, Vol. 31 No. 3, pp. 659-669.

- Felin, T., Kauffman, S., Mastrogiorgio, A. and Mastrogiorgio, M. (2016). "Factor markets, actors, and affordances". *Industrial and Corporate Change*, Vol. 25 No. 1, pp. 133-147.
- Fleming, L., Mingo, S. and Chen, D. (2007a), "Collaborative brokerage, generative creativity, and creative success", *Administrative Science Quarterly*, Vol. 52 No. 3, pp. 443-475.
- Fleming, L., King III, C. and Juda, A.I. (2007b), "Small worlds and regional innovation", *Organization Science*, Vol. 18 No. 6, pp. 938-954.
- Furlan, A. and Grandinetti, R. (2016), "Spinoffs and their endowments: beyond knowledge inheritance theory", *Journal of Intellectual Capital*, Vol. 17 No. 3, pp. 570-589.
- Garud, R., Gehman, J. and Giuliani, A.P. (2016), "Technological exaptation: a narrative approach", *Industrial and Corporate Change*, Vol. 25 No. 1, pp. 149-166.
- Garud, R., Gehman, J. and Giuliani, A.P. (2018), "Serendipity arrangements for exapting science-based innovations", *Academy of Management Perspectives*, Vol. 32 No. 1, pp. 125-140.
- Gawer, A. (2014), "Bridging differing perspectives on technological platforms: toward an integrative framework", *Research Policy*, Vol. 43 No. 7, pp. 1239-1249.
- Gawer, A. and Cusumano, M.A. (2002), *Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation*, Harvard Business School Press, Boston.
- Gawer, A. and Cusumano, M.A. (2014), "Industry platforms and ecosystem innovation", *Journal of Product Innovation Management*, Vol. 31 No. 3, pp. 417-433.
- Ghazzawi, I.A., Martinelli-Lee, T. and Palladini, M. (2014), "Cirque du Soleil: an innovative culture of entertainment", *Journal of the International Academy for Case Studies*, Vol. 20 No. 5, pp. 23-46.
- Goldenberg, J. and Mazursky, D. (2002), *Creativity in Product Innovation*, Cambridge University Press, Cambridge.
- Gould, S.J. (1991), "Exaptation: a crucial tool for an evolutionary psychology", *Journal of Social Issues*, Vol. 47 No. 3, pp. 43-65.
- Gould, S.J. and Vrba, E.S. (1982), "Exaptation: a missing term in the science of form", *Paleobiology*, Vol. 8 No. 1, pp. 4-15.
- Grandinetti, R. (2017), "Exploring the dark side of cooperative buyer-seller relationships", *Journal of Business & Industrial Marketing*, Vol. 32 No. 2, pp. 326-336.
- Grandinetti, R. (2018), "The KIBS paradox and structural holes", *Knowledge Management Research & Practice*, Vol. 16 No. 2, pp. 161-172.
- Hargadon, A.B. (2002), "Brokering knowledge: linking learning and innovation", *Research in Organizational Behavior*, Vol. 24, pp. 41-85.
- Iansiti, M. and Levien, R. (2004), *The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability*, Harvard Business School Press, Boston.
- Jacobides, M.G., Cennamo, C. and Gawer, A. (2018), "Towards a theory of ecosystems", *Strategic Management Journal*, Vol. 39 No. 8, pp. 2255-2276.
- Kim, W.C. and Mauborgne, R. (2005), *Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant*, 1st edition, Harvard Business School Press, Boston.
- Laland, K.N. and O'Brien, M.J. (2011), "Cultural niche construction: an introduction", *Biological Theory*, Vol. 6 No. 3, pp. 191-202.
- Lévi-Strauss, C. (1966), *The Savage Mind*, University of Chicago Press, Chicago.
- Lewontin, R.C. (1983), "Gene, organism, and environment", in Bendall, D.S. (Ed.), *Evolution from Molecules to Men*, Cambridge University Press, Cambridge, pp. 273-285.
- Luksha, P. (2009), "Niche construction: the process of opportunity creation in the environment", *Strategic Entrepreneurship Journal*, Vol. 2 No. 4, pp. 269-283.

- March, J.G. (1991), "Exploration and exploitation in organizational learning", *Organization Science*, Vol. 2 No. 1, pp. 71-87.
- Mastrogiorgio, M. and Gilsing, V. (2016), "Innovation through exaptation and its determinants: the role of technological complexity, analogy making & patent scope", *Research Policy*, Vol. 45 No. 7, pp. 1419-1435.
- Mokyr, J. (2000), "Evolutionary phenomena in technological change", in Ziman, J. (Ed.), *Technological Innovation as an Evolutionary Process*, Cambridge University Press, Cambridge, pp. 52-65.
- Moore, J.F. (1993), "Predators and prey: a new ecology of competition", *Harvard Business Review*, Vol. 71 No. 3, pp. 75-86.
- Nooteboom, B. (2000), *Learning and Innovation in Organizations and Economies*, Oxford University Press, Oxford.
- Odling-Smee, F.J. (1988), "Niche constructing phenotypes", in Plotkin, H.C. (Ed.), *The Role of Behavior in Evolution*, The MIT Press, Cambridge, pp. 73-132.
- Parker, G.G., van Alstyne, M.W. and Choundary, S.P. (2016), *Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You*, W.W. Norton & Co., New York.
- Porter, M.E. (1980), *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, Free Press, New York.
- Porter, M.E. (1985), *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press, New York.
- Teece, D.J. (2007), "Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance", *Strategic Management Journal*, Vol. 28 No. 13, pp. 1319-1350.
- Teece, D.J. (2016), "Business ecosystem", in Augier, M. and Teece, D.J. (Eds.), *The Palgrave Encyclopedia of Strategic Management*, Macmillan, London, pp. 1-4. DOI: 10.1007/978-1-349-94848-2_724-1
- Teece, D.J. (2018), "Profiting from innovation in the digital economy: enabling technologies, standards, and licensing models in the wireless world", *Research Policy*, Vol. 47 No. 8, pp. 1367-1387.
- Tortoriello, M. (2015), "The social underpinnings of absorptive capacity: the moderating effects of structural holes on innovation generation based on external knowledge", *Strategic Management Journal*, Vol. 36 No. 4, pp. 586-597.
- Tsujimoto, M., Kajikawa, Y., Tomita, J. and Matsumoto, Y. (2018), "A review of the ecosystem concept: towards coherent ecosystem design", *Technological Forecasting and Social Change*, Vol. 136, pp. 49-58.

Business Model Innovation and its Antecedents. The Case of the Space Industry

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Abstract

Antecedents of Business Model Innovation (BMI) may be many, different in nature, placed at several levels, and they can be internal or external to the firm. The current debate has barely connected such antecedents to the type of innovation of the Business Model (BM), if modular or architectural. To fill this gap, our study draws on an exploratory case study of an innovative firm operating in the Space Industry that over time developed various BMs capable of creating value by exploiting Earth Observation big data. The Copernicus Programme has in fact opened a vast amount of Earth Observation daily data to the world, giving firms the opportunity to compete in new ways and allowing the development of an ever-increasing number of downstream products and services.

As a result, Big Data from Space has changed considerably the Space Industry and firms are now in need to reconsider their BMs configurations. On the premises that big data in the Space Industry joins the incomplete conversation about the antecedents of BMIs, our study builds on complexity theory and innovation theory as interpretative theoretical lenses, with the aim of developing a research agenda directed towards the development of a theoretical framework for BMI by mean of explorative multiple case study from firms mainly operating in the Space Industry.

Our findings, show the relevance of external antecedents to the BMI. These findings are then organized around a set of propositions, which enforce the up to now scant literature about antecedents and BMI.

Keywords – Architectural Innovation, Modular Innovation, European Space Agency, Copernicus Program

Paper type – Academic Research Paper

1 Introduction

In the last decade the Space Industry has seen the multiplication of initiatives offering open access to Big Data from space and hence the possibility for firms to exploit the huge quantity of data made available at an ever increasing rate. This is for instance the case of downloaded data from Earth Observation satellites that in the past were mainly sold to service providers, which on their turn made a profit by selling them to end-users such as consultant companies, cost guards, fisheries etc.. Indeed, since 2014, the Copernicus Programme, with over twelve Terabytes of Earth Observation (EO) data generated daily (the third largest data provider globally), has established a full, free and open data policy which allows anyone anywhere in the world to access and use the data and geo-spatial information.

Copernicus is coordinated and managed by the European Commission (EC) and implemented in partnership with the Member States, the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), EU Agencies and Mercator Océant.

Nowadays, a huge amount of global data from satellites and from ground-based, airborne and seaborne measurement systems are being used to provide information to help service providers, public authorities and other international organisations as well as private commercial partners, improve the quality of life for the citizens of Europe.

Thus allowing many new commercial downstream services to be developed. Hence, ESA, through the Copernicus Programme, has opened a vast amount of Earth Observation daily data to the world, giving firms the opportunity to compete in new ways and allowing the development of an ever-increasing number of downstream services.

As a result, big data from space made available through the Copernicus Programme has changed considerably the Space Industry and firms are now in need to reconsider their Business Models (BM) (Saebi and Foss, 2017). To put it in other words, big data can be interpreted as an antecedent which triggers Business Model Innovation (BMI) in the Space Industry. Building on the fact that a BM whatever is its conceptualisation in the theory (Latronico et al., 2018) - is to be interpreted as a system (Simon, 1962) made up of different components [recurring components in the main BM frameworks proposed in the scientific literature are: the value proposition, the customer segments, the infrastructure resources / activities / partners - required for realizing the value proposition and the financial structure (Chesbrough and Rosenbloom, 2002; Morris et al., 2005; Osterwalder and Pigneur, 2010)], innovation of the BM can be carried out at the architectural or at the modular level (Henderson and Clark, 1990; Demil and Lecocq, 2010; Morris et al., 2005). Innovation is modular if it mainly involves changes in one/more components, without relevant changes in the way components interact with each other. Innovation is architectural if it regards the general structure or the interactions between the above components.

According to Saebi and Foss (2017), up to now the extant scientific literature and empirical research have scarcely investigated the antecedents of BMIs (one exception is

de Reuver et al., 2009). In fact, the current debate has barely connected such antecedents to the type of innovation of the BM, if modular or architectural. To fill this gap, our study draws on an explorative case study operating in the down-stream applications and services commercial domain.

In the following section a general overview of the literature on BMs and BMIs is provided. The third section outlines the methodology. The fourth and fifth sections present the results and their discussion, respectively.

2 Literature Review

Over the last 15 years, BMI has gained an increasing amount of attention in management research and among practitioners. The emerging BMI literature addresses an important phenomenon but lacks theoretical underpinning, and empirical inquiry is not cumulative (Foss & Saebi, 2017). While BM and BMI are no doubt related, research on BMI introduces the additional dimension of innovation. Hereby a number of crucial theoretical and empirical questions are not currently being systematically posed, addressed, and answered, reflecting the emergent nature of BMI research. Notably, in comparison with the huge volume of research on BMs, the number of published papers that address BMI per se is still comparatively low at 349 (peer reviewed and otherwise, see Fig. 1).

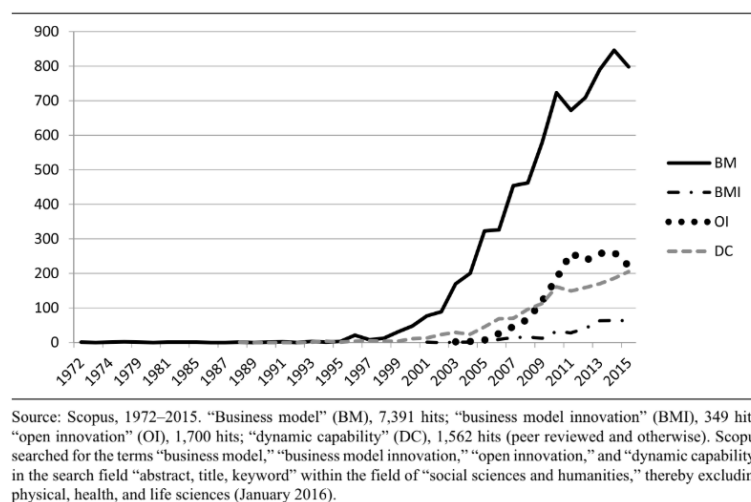


Figure 1 Use in the Scholarly Literature of Some Key, Related Macro-constructs

While on the one hand the BMI construct is to a large extent used as mainly a classificatory device, on the other hand, systematic research on the antecedents, moderators, and implications of BMI remains limited, leading to question whether a true theory of BMI exists (Foss and Saebi, 2016). BMI represents a novel and more holistic

form of organisational innovation that warrants theory building, operationalisation, and testing.

Cumulative theorizing and successful empiricism require clear identification of the causal structure in a theory—that is, how the key constructs of interests are causally linked. Postulating certain cause-effect relationships involves unpacking the causal mechanisms at work (Fry & Smith, 1987). As a minimal starting point, BMI theorizing should clearly identify the antecedents and consequences of the focal phenomenon.

As regards consequences, early CEO-level surveys indicated that BMI is a key source of sustained value creation (IBM Global Business Services, 2006), even trumping new products and services as a source of future competitive advantage (Economist Intelligence Unit, 2005). In fact, innovative BMs are found to positively influence the performance of entrepreneurial firms, “even under varying environmental regimes” (Zott & Amit, 2007). Similarly, established firms that innovate their BMs experience positive performance effects (Cucculelli & Bettinelli, 2015).

There are few studies of the drivers or antecedents of BMI. Nevertheless, antecedents of BMI may be many, different in nature, and placed at different levels, and they can be internal or external to the firm. Studies on changing BMs highlight changes in the external environment, such as changing demands of stakeholders (Ferreira, Proença, Spencer, and Cova, 2013), changes in the competitive environment (e.g., de Reuver et al., 2009), and opportunities brought about by new information and communication technologies (Pateli & Giaglis, 2005; Wirtz et al., 2010). Given that BMI differs in terms of scope and novelty, the antecedents for evolutionary or adaptive BMI might be different than for more complex forms of BMI.

2.1 Research problem and questions

On the premises that big data in the Space Industry joins the incomplete conversation about the antecedents of BM innovations, this manuscript builds on complexity theory (Simon, 1962) and innovation theory (e.g., Henderson and Clark, 1990), as interpretative theoretical lenses in order to developing further the topic. Specifically, this manuscript aims at answering the following research questions:

- RQ1 – What are the main drivers of BMI in the space industry?
- RQ2 – Can a specific driver be associated with both a modular and an architectural BMI?
- RQ3 – In the case of modular BMI, in which circumstances a specific antecedent is associated with innovation in a specific BM component (i.e. the value creation, value delivery and value capture)? In other words, while using Osterwalder and Pigneur (2010)’s words, is the same antecedent always associated with the same epicentre from which BMI departs?

3 Methodology

The research methodology adopted in this paper is case study. Two main reasons underpin our choice.

Firstly, case study are recognized as big opportunities (McClintock et al., 1979) in terms of (i) taking into account the richness of the context and hence avoiding instrumentation artefacts of standardized measurement procedures, (ii) allowing detailed examination of organizational process, (iii) and illuminating specific factors which may allow greater understanding of causality.

Secondly, case studies are reckoned to be better than quantitative studies in terms of theory building (theoretical generalisation and falsification) and theory testing. We are aware that it is not likely that a new theory can be developed from a single study, but our study can be useful for generating theoretical implications (Tsang, 2014), according to an exploratory theory building research. Given our aim of throwing light on the mechanisms that relate a specific antecedent with the type of BMI (architectural/modular), we relied on case study methodology because of the possibility it gives to analyse mechanisms and influential drivers.

Specifically we relied on a single, following several steps: definition of the research questions, case selection, identification of the unit of analysis, definition of the reference research framework, data collection, data elaboration, and data analysis (Barczak, 2015).

3.1 Definition of the research questions

As put forward above in the literature analysis, we have three main research questions.

3.2 Case selection

Our case study appeared to be very interesting in that over time it developed BMs capable of exploiting Earth Observation data provided by ESA through which it delivered an appropriate value (i.e. theoretical sampling).

3.3 Identification of the unit of analysis

We address the single firm as unit of analysis. We believe that the firm-level is the most promising unit for this article. Indeed, we are not addressing the process the firm followed to change its BM, but rather the components and/or the architecture of its BM that were object of innovation. And, although the BM could be either explicitly defined or emergent, anyhow it is at the firm-level that the components and the architecture are defined.

3.4 Definition of the reference research framework

In order to answer our research questions we used the BM framework provided by Teece, 2010, composed of value creation, delivery and capture because it is a widely accepted conceptualisation of a BM.

The above research framework served as a starting point to conduct interviews as it allowed the definition of the variables at play (Eisenhardt, 1989). Indeed respondents were asked to describe how the BM was conceived before and after it was innovated. However, according to an exploratory approach, we avoided thinking about specific relationships between the constructs, so striving to maintain a neutral position when asking firms to explain how the BMI took place.

3.5 Data collection

Data were collected in a one-month period, and included several primary and secondary sources (Table 1) according to a multiple data collection method (Eisenhardt, 1989) in order to enhance the validity and relatability of the data provided by the informants.

Table 1: Topics, information sources and supporting tools

Investigated topics	Primary sources	Supporting secondary sources	Supporting Tools
Description of firm; identification of key informants for the case study	CEO of firm A	Firms' website; slides presented at conferences	Interview guide, part I
Detailed description of the BM components and architecture for the analysed firm before the Copernicus Programme			Interview guide, part I
New BMs configuration, in terms of components and architecture, aimed at taking advantage of the drivers			Interview guide, part II
Final verification of the case study validity	CEO of firm A	—	—

As primary sources, the first contact points was the CEO, who allowed us to access two sets of information: i) the detailed description of the initial BM(s) and how it changed across the time ii) the detailed description of the new BM(s) configuration. Semi-open questions were used for direct interviews. Semi-open questions allowed gathering all the necessary data, at the same time leaving interviewed people the opportunity to enrich the context description and to enlarge the set of variables investigated. The interviews lasted one hour and a half.

As secondary internal sources, we analyzed the firms' website. Other secondary sources were provided by the interviewee and used to triangulate information gathered during the interview (slides presented at the 6th international Workshop on On-Based Payload Data Compression).

3.6 Data elaboration

The interviews were recorded and transcribed my means of a software tool (Dragon Professional v.15). All the information gathered by means of interviews and secondary sources were elaborated with data categorization, using the categories/variables suggested by the literature on BMI. For each variable, information collected by the different sources was compared.

For each variable investigated, the triangulation of data was guaranteed: data from the direct interviews were integrated with the secondary sources in order to ensure construct validity and to limit post hoc rationalization.

3.7 Data analysis

Data collected and categorized were used according to the reference models on BMI in order to answer the research questions. Specifically, we analyzed the main drivers of BMI in the space industry (RQ1), and aimed at understanding in which specific circumstances the antecedent we investigated is associated with an architectural or rather a modular innovation (RQ2). In this last case, we analyzed in which circumstances a specific antecedent is associated with innovation in a specific BM component (RQ3).

4 Results

4.1 The firm

Firm A (whose name won't be revealed for anonymity reasons) is an Italian Small and Medium Enterprise (SME), established in 1994, which currently employs 50 employees (in 1994 they were four). Firm A provides solutions to exploit the value of geospatial data through all phases of data life cycle from acquisition, storage, management up to analysis and sharing.

It operates in many application areas ranging from environmental and land monitoring to open-government and smart cities, and including defence and security, as well as scientific missions and planetary exploration. Table 2 reports main characteristics.

Table 2. Main characteristics of firm A

Firm	Founded	Country	Size	Industry	Products / Services	Funding	Type
A	1994	IT	~ 50 employees, SME	Aerospace	-Private Geographical Information Services(GIS) -Earth Observation consultancy - Information land management.	Private and Public	Privately held

4.2 Environmental background

Firm A operates in an environment in which in a few years both the market and the technology evolved, implying both difficulties and opportunities. Indeed, the technology, while evolving, has reduced the technical difficulties in getting higher and higher EO data, characterised by greater levels of quality with lower and lower investments. Many factors contributed in this direction. In a first phase, this is due to better G-resolution; in a second phase, the big data with higher levels of resolution supplied by means of the

Copernicus Programme, the lowering cost of HPC (High Performance Computing) up to the artificial intelligence have allowed the growth of on-board processing capabilities.

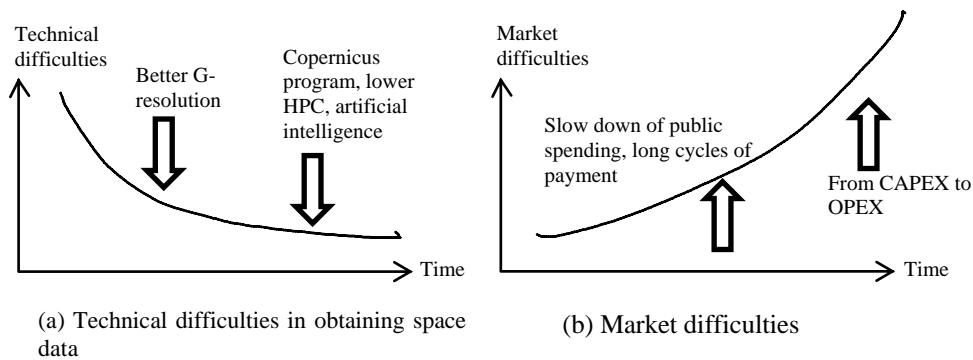


Figure 2 (a and b)

As regards the market, there has been an evolution in the type of actors interested in the value, which can be extracted from EO data, as well as in their needs (Fig. 2b). As regards the type of actors, at the beginning the customers were represented almost exclusively by the public administrations, but over time, the reduction in public spending shifted the attention towards business partners. However, over time the needs in the b2b market changed: in a first phase customers asked for tailor-made software and afterwards the request evolved from bespoke software to software as-a-service (SaaS).

Firm A innovated twice its BM in order to cope with technological and market threats but also to tap into the opportunities both the market and the technological developments entailed. Below we put forward a description of the different BMs firm A adopted and in what the BMI consisted.

4.3 BMI at firm A

Since its very beginning, firm A has been a technology-driven start-up operating in the space industry. In the first architecture of its BM (South-East in Fig. 3), the value creation consisted of offering EO data mainly delivered to the public administration; value appropriation consisted of the revenues from the public administration, accompanied by income cash flows from project funded by the European Space Agency and European Commission. The high technological difficulties – and hence the low level of competition – together with the low attention to the business market made selling EO data to the public administration a viable BM, which indeed allowed delivering value to the only customer who, while being able to find value in firm A's value proposition, was willing to pay for it.

However, soon the BM architecture tuned out to be inadequate because one of the BM component was challenged by the market. Specifically, the slowdown of the public spending, together with the excessive length of the payment cycle (that lasted 2 years), made value capture unable to sustain the whole architecture of the BM.

Therefore, a new way of capturing value was strongly deemed necessary and this, in turn, required the identification of new customers at whom the value could be delivered and who may be willing to pay for it. Private firms, and specifically firms working in the oil&gas and the transport industries, were identified as new customers. In the words of the CEO: *“the main innovations were a modification of our structure that from a more production-oriented became a more market-oriented organisation [...] a new business was created in order to take care of the growth of the interests of commercial services applications for private subjects e.g. oil & gas, transport etc.”*.

A new value proposition was offered them (in the centre of Fig. 3): not only, as before, EO data selling, but also EO data embedded in software applications and software for data elaboration. In a word: geo-information. The creation of a new value was possible because of the technological developments such as better G-resolution.

Firm A is undergoing a new BMI process which, as in the previous innovation, starts from the need of restructuring the value capture. This time, however, the change of the value capture component is not due to an internal need, but rather is a consequence of the necessity of the EO service market to move from CAPEX to OPEX, i.e. to change the nature of the cost: from an investment in a desktop software to an operating cost connected with software subscription: *“abandon selling of the desktop software and provide a software as a service scalable in space and time dimensions”*. Such shift from CAPEX to OPEX determined a new revenue stream: from sales revenues, to revenues from subscription. In addition, this change in the value capture entailed a different value creation: the shift to SaaS entailed *“transform these data in ready-to-use knowledge by user. New available satellite data reshape the design approach from geo-information to geo-analytics Info-as-a-service scalable in space and time dimensions”*. This challenge is particularly felt by firm A in that the threat from new entrants in the market is a really serious concern: *“new players are able to identify downstream services such as tailored analytics [...] and] have great chances of winning funds and advancing in development”*.

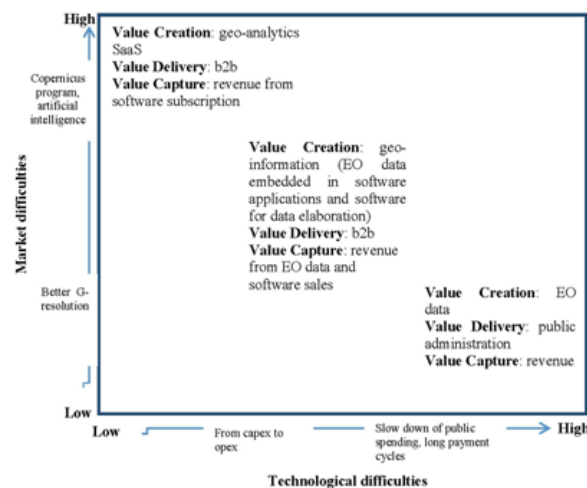


Figure 3 Business Model Innovations over time

5 Conclusions

In this paper we present the case of firm A, an Italian SME, that since its foundation in 1994 went through two BM innovations (the second is still undergoing). These two innovations were initially triggered by threats coming from the market which in both cases challenged the value capture. Also, these two BM innovations were endorsed by the technological opportunities which allowed the access to greater and greater amounts of space data characterised by higher and higher resolution levels, with lower and lower costs. In this sense, the market operated like a challenge to be coped with, while the technology provided the opportunity to improve the value offered to the market (RQ1).

Hence the following proposition can be put forward:

Proposition 1. Start-ups begin as a technology-driven idea but innovate their BM in response to market challenges.

Although both the market threats jeopardise the same BM component - i.e. the value capture - their nature is completely different. The first challenge (slowdown of public spending and length of the payment-cycle) is internal to firm A: in other words, the market does not require firm A to do something different in the way it captures (part of) the value. Rather, the problem is that, at a certain point, the way the value is captured reveals to be unsuitable for the viability of the BM, at the point that the sustainability of the firm is seriously jeopardised. The second challenge (the necessity for EO customers to move from CAPEX to OPEX) is external, in the sense that it is the EO market which requires a change in the value capture. Differently from the previous market challenge, the viability of the BM and the sustainability of the firm would have been maintained, had the market remained the same.

This different origin – internal or external - of the market threats produced different outcomes in terms of BMI. The first challenge to the value capture imposed firm A to looking for new customer segments at whom deliver a value proposition for whom they could be willing to pay. The second challenge to the value capture was required by the EO market that also asked to innovate another component of the BM, i.e. the value creation. This means that in both cases of BMI, a specific driver (in this article we analysed a challenge from the market), even though initially focused on only one component, always implies an architectural innovation (RQ2).

Hence the following propositions can be put forward:

Proposition 2. BMI involves all the value architecture elements: value creation, value delivery and value capture.

Proposition 3. Internal problems regarding value capture determine an increased attention to value delivery in order to find customer segments which can solve the problems connected with value appropriation. After the identification of the customer segments, an effort should be done in order to formulate a value proposition to be addressed to such segments and make those segments willing to pay.

Proposition 4. External problems regarding value capture require a change in the value creation and value capture. Customer segments at whom the value is delivered, do not change. What changes is the value offered to them.

The main aim of this paper is to contribute on the relevance of external antecedent to different kinds of BMI, distinguished according to their modular or architectural level. Therefore, this paper, although retrospective and inductive, is a first step, which enforces the up to now scant literature that has empirically tested the effect of different antecedents on the propensity to innovate the BM.

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References

- Barczak, G., (2015) “From the Editor. Publishing Qualitative versus Quantitative Research”, *Journal of Product Innovation Management*, Vol. 32 No. 5, pp. 658-659.
- Bohnsacka, R., Pinkseb, J. and Kolka, A., (2014) “Business Models for Sustainable Technologies: Exploring Business Model Evolution in the Case of Electric Vehicles”, *Research Policy*, Vol. 43, pp. 284-300.
- Chesbrough, H. and Rosenbloom, R.S., (2002) “The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation’s Technology Spin-Off Companies”, *Industrial and Corporate Change* Vol. 11, pp. 529–555.
- Cucculelli, M. and Bettinelli, C., (2015) “Business models, intangibles and firm performance: evidence on corporate entrepreneurship from Italian manufacturing SMEs”, *Small Business Economics* DOI 10.1007/s11187-015-9631-7.
- De Reuver, M., Bouwman, H., and MacInnes, I., (2009) “Business Models Dynamics for Start-Ups and Innovating E-Businesses”, *International Journal of Electronic Business*, Vol. 7, pp. 269-286.
- Demil, B. and Lecocq, X., (2010) “Business Model Evolution: In Search of Dynamic Consistency”, *Long Range Planning* Vol. 43, pp. 227–246.
- Ferreira, F. N. H., Proença, J. F., Spencer, R. and Cova, B., (2013) “The transition from products to solutions: External business model fit and dynamics”, *Industrial Marketing Management* Vol.7, pp.1093–1101.
- Foss N.J. and Saebi, T., (2017) “Fifteen Years of Research on Business Model Innovation: How Far Have We Come, and Where Should We Go?”, *Journal of Management*, Vol. 43 No. 1, January, pp. 200–227.
- Fry, L. W., & Smith, D. A., (1987) “Congruence, contingency, and theory building”, *Academy of Management Review*, 12(1), 117 – 132.
- Henderson R. and Clark K.B., (1990) “Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms”, *Administrative Science Quarterly*.
- Latronico, L., Aloini, D., Fanucci, L. and Pellegrini, L., (2018) “Business Models in the Space Sector: A Literature Review Paper”, *CINet Conference “Continuous Innovation: Spinning out and Spinning in”*, 9-11 September, Dublin, Ireland, pp. 239-250.

- Morris, M., Schindehutte, M. and Allen, J., (2005) "The Entrepreneur's Business Model: Toward a Unified Perspective", *Journal of Business Research*, Vol. 58, pp. 726–735.
- Osterwalder, A. and Pigneur, Y., (2010) *Business Model Generation*, John Wiley & Sons, Inc., Hoboken, New Jersey.
- Simon, H.A., (1962) "The Architecture of Complexity", *Proceedings of the American Philosophical Society*, 106, pp. 467-482.
- Eisenhardt, K.M., (1989) "Building Theories from Case Study Research", *Academy of Management Review*, Vol. 14, No. 4, pp. 532-550.
- McClintock, C.C., Brannon, D., Steven Maynard-Moody, S., (1979) "Applying the Logic of Sample Surveys to Qualitative Case Studies: The Case Cluster Method", *Administrative Science Quarterly*, Vol. 24, No. 4, pp. 612-629.
- Pateli, A. and Giaglis, G., (2005) "Technology innovation-induced business model change: A contingency approach", *Journal of Organizational Change Management*, Vol. 2, No.18, pp. 167-183.
- Teece D.J., (2010) *Business Models, Business Strategy and Innovation*, *Long Range Planning*, Vol. 43, No. 2–3, April–June, pp. 172-194.
- Tsang, E.W.K., (2014) "Generalizing from Research Findings: The Merits of Case Studies", *International Journal of Management Reviews*, Vol. 16, pp. 369–383.
- Voss, C., Tsikriktsis, N., Frohlich, M., (2002) "Case Research in Operations Management", *Journal of Operations & Production Management*, Vol. 22, No. 2, pp. 195-219.
- Wirtz, B.W., et al., (2010) "Strategic Development of Business Models: Implications of the Web 2.0 for Creating Value on the Internet", *Long Range Planning*, Vol. 2, No 43, pp.272-290.
- Zott, C. and Amit R., (2007) "Business Model Design and the Performance of Entrepreneurial Firms", *Organization Science*, 18 (2), 181-199.

What is Knowledge Governance?

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Abstract

This paper presents the results of an exploratory literature review on Knowledge governance. Looking at the literature this concept was starting be located at firm level and has evolving towards ontological multilevel integration. The challenge is to build a conceptual framework by using the lens defined by article's objectives:

- a) Identify Knowledge Governance definition(s);*
- b) Identify main concepts; and*
- c) Identify the main background theories.*

This article add theoretical contributions to value existing knowledge, as well as understanding and shaping the knowledge base of the Education, Science, Innovation, Ecosystem and Policy ecosystem, which range from different financial to non-financial types of impacts.

Keywords – Knowledge governance, Knowledge processes, Knowledge Management, knowledge dynamics, models

Paper type – Academic Research Paper

1 Introduction

All organizations have a common denominator: they are based on knowledge (Alvesson, 1993). However, some organizations have knowledge as their core output, supply knowledge to the public, or aggregate workers who are mainly experts developing and providing knowledge (Grandori, 1997).

More and more organizations acknowledge that their main activities are related to the management of knowledge, and that knowledge is a strategic resource that must be governed to achieve and sustain competitive advantage (Argote *et al.*, 2003).

To turn clear and avoid some ambiguity, we start by using some working definitions provide by Michael Gallagher (2001):

- *Governance* is the structure of relationships that bring about organisational coherence, authorise policies, plans and decisions, and account for their probity, responsiveness and cost-effectiveness;
- *Leadership* is seeing opportunities and setting strategic directions, and investing in and drawing on people's capabilities to develop organisational purposes and values;
- *Management* is achieving intended outcomes through the allocation of responsibilities and resources, and monitoring their efficiency and effectiveness;
- *Administration* is the implementation of authorised procedures and the application of systems to achieve agreed results.

Knowledge governance is closely related to knowledge management; both seek to capitalize knowledge or creating value from knowledge, but at different scopes. Knowledge management is concerned with knowledge processes at organizational level, Knowledge governance refers to choosing structures and mechanisms that can influence the processes of knowledge looking the interrelation between micro, meso and macro levels, with a strategic focus. From our exploratory review we found some seminal documents (Foss, 2007; Grandori, 1997, 2001; Nonaka, 1994) and some relevants (Antonelli *et al.*, 2014; van Kerkhoff, 2013).

The main goal of our study is the development of a conceptual model showing how knowledge governance can be used to enhance knowledge use in different ontological levels (micro, meso, macro and network). We build a framework that can be used to strategically map the possible alternatives and transversal insights.

In a time of increasing specialization and apparent knowledge silos, it becomes crucial to have a comprehensive picture where the integration of various components and their relationships is clear. In sum, a people-centric knowledge approach is our proposed way to capitalise information systems and knowledge processes.

Why perform a Literature review about Knowledge Governance? The societal and complex problems call for solutions based on knowledge cutting across diverse disciplines, experience and continuous learning which they are embedded in different sectors of human activity. Emerging technologies and new concepts and new drivers such as Big Data, Internet of things, Artificial Intelligence and Open Science create cyber-physical systems that provide new opportunities to value data and information.

Despite this wealth of resources there seems to be a gap in building and valuing existing knowledge. Our focus is on knowledge governance from the perspective of how can we facilitate the use of existing knowledge (intellectual capital) in order to valuing it, through not only by the identification of knowledge needs and its localization but also the integration of specialized and dispersed knowledge. Knowledge integration aims bringing together cognitively unrelated or distant bodies of knowledge (Rafols, 2014). Here we adopt human-centred assets of Bontis' intellectual capital, as the collective intangible assets and their stream of knowledge.(Bontis, 2001, p. 10).

2 Methodology

How the review was conducted? In general the review followed three main stages: planning the review; conducting the review and reporting the outcomes from the review (Tranfield et al., 2003). Arising from initial question (What is Knowledge Governance?) we define specific research question:

- a) What are Knowledge Governance definition(s)?
- b) What are the main concepts that constitute the blocks that structure the topic KGov?
- c) What are their main background theories?

The achievement of our research goal requires searching, filtering and analysing several publications. To deal to this complex work review, we used computer-aided text analysis (CATA) tools to organize and manage data, to code bibliographic categories and to make a content analysis of full text of seminal, relevant and core publications. We choose use *WebQDA* software because it provides an ubiquitous research workspace where researchers can work individually and collaboratively both in data processing and their analysis and validation, by an user-friendly and intuitive way (Fornari *et al.*, 2019a; Fornari *et al.*, 2019b). We choose to use Scopus database to search publications between 1980 and 2018 and next we selected 142 relevant publications.

In order to organize publications into ontological dimension level we classified in four levels (see **Error! Reference source not found.****Error! Reference source not found.**). If we stay at national level (macro), knowledge governance can be about how to facilitate use of scientific knowledge by industry to increase international competitive position. At organizational level (meso) a choice of one strategic focus on how knowledge should be managed to benefit organization, can be considered organizational knowledge governance. Similarly, for individual level (micro) maximize individual knowledge for increasing individual performance can be also part of knowledge governance. This macro-meso-micro perspective can help to separate systems elements and also integrate them when we need a dynamic outlook of the change and coordination of the system. We add another level (network) that cross all the previous levels. Studying social networks not only interest to social researchers (Cross et al., 2006; Cross et al., 2002; Inkpen & Tsang, 2005; Latour, 1996; Watts, 2004) but others ones, like physicists. As Newman (2001b) asked: “why should a physicist be interested in social networks?” He thinks that is because they can apply some familiar techniques of statistical and modelling. This author carried out a study about scientific collaboration networks.

Newman start from social network definition as “a set of people or groups (actors) each of which has connections (ties) of some kind to some or all of the others” (Newman, 2001a, p. 1), but there are a broad types of networks, such as Knowledge Networks (Phelps et al., 2012) or research collaboration networks (Leite & Pinho, 2017).

LEVELS OF ANALYSIS

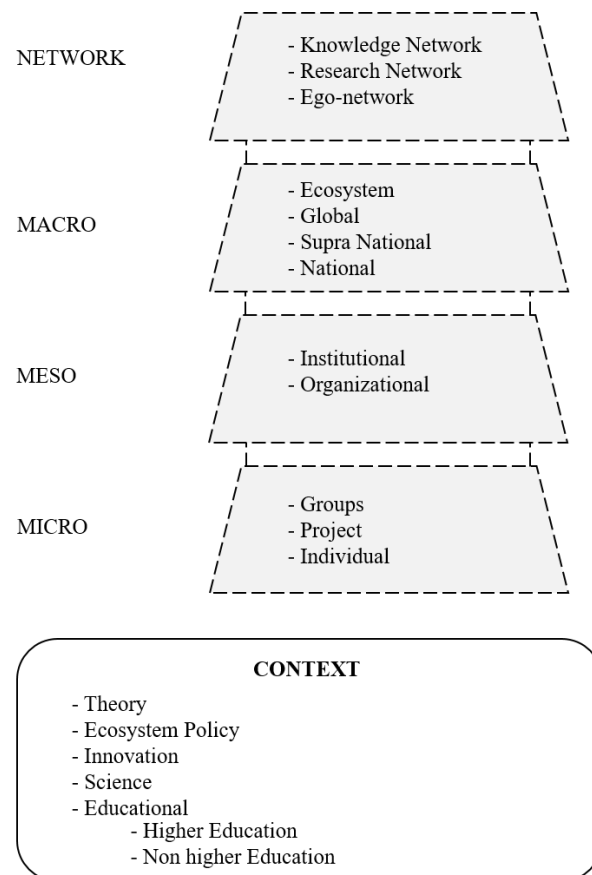


Figure 7 - Levels of analysis and contexts

3 Results

The presentation of main results follows article’s objectives: Identify Knowledge Governance definition, identify main concepts; and identify the main background theories.

From an exploratory questioning to the data some terms and words are more associated to the different ontological levels. At Micro level the most cited keywords are “Project management” (14.8%), “Knowledge governance” (11.1%), “Knowledge sharing”

(8.6%), “Organisational learning” (7.4%) and “Governance mechanisms” (6.2%) are the most cited terms (see Figure 8).

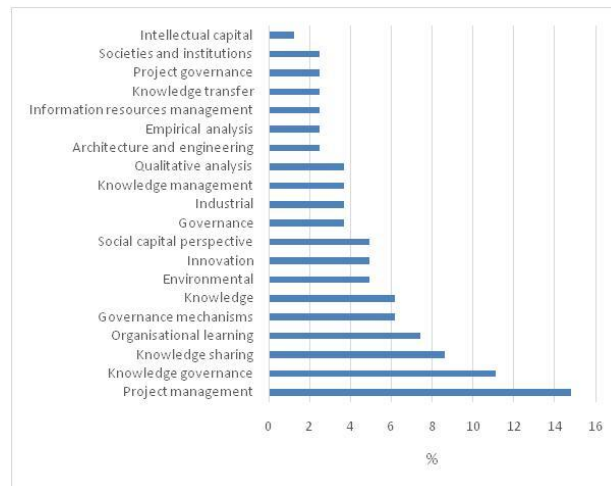


Figure 8 - The 20 most frequent words in keywords for Micro level

At Meso level the most cited keywords are “Knowledge” (12.4%), “Knowledge governance” (8.8%), “Organizational knowledge” (8.0%), “Knowledge management” (7.3%) and “Construction Management” (6.6%), as shows in Figure 9.

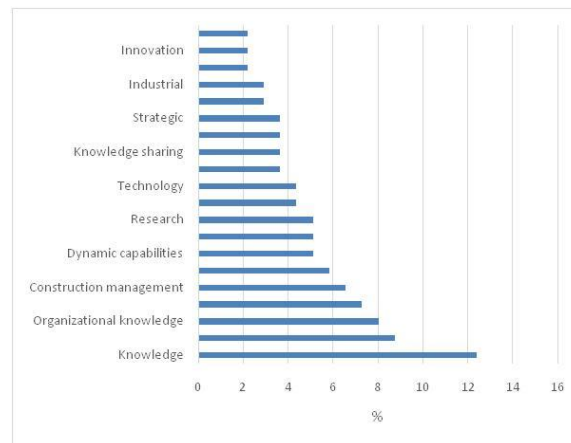


Figure 9 - The 20 most frequent words in keywords for Meso level

At Macro level the most cited keywords are “Knowledge governance” (11.3%), “Knowledge” (7.3%), “Organisational innovation (6.9%), “Informal management” (6.5%) and “Project (global)” with 6.2% (see Figure 10).

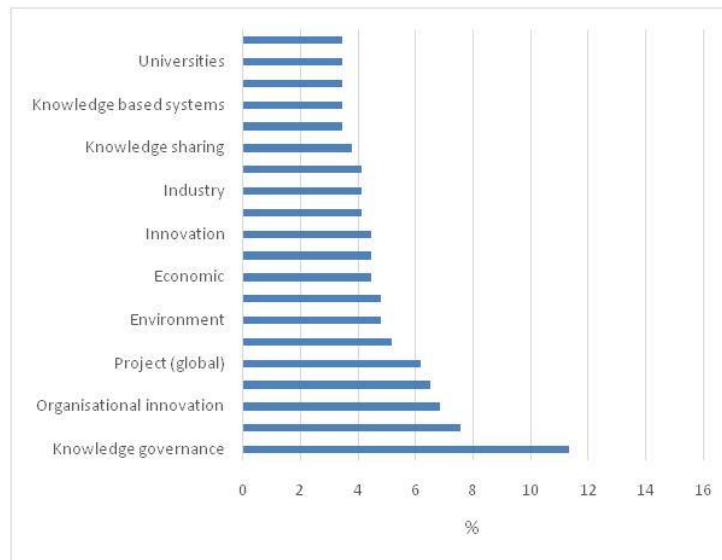


Figure 10 - The 20 most frequent words in keywords for Macro level

At Network level the most cited keywords are “Information management” (10,7%), “Knowledge network” (10.7%), “Biological” (7.1%), “Climate” (7.1%) and “Health” (7.1%), as shows Figure 11)

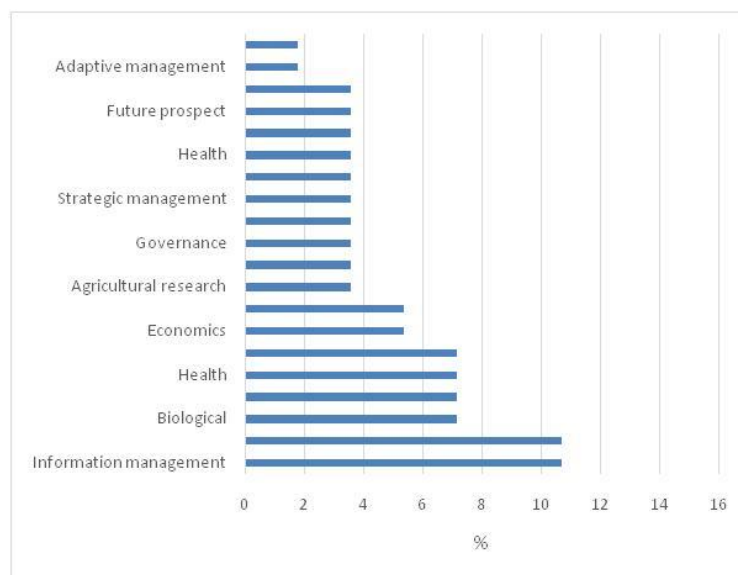


Figure 11 - The 20 most frequent words in keywords for Network level

Each ontological level has a particular words landscape that provide a first overlook. Next a ground-theory approach was used to identify key concepts (Charmaz, 2006; El Hussein *et al.*, 2017).

a) *Identify Knowledge Governance definition(s);*

When trying join “knowledge” and “governance” we can find “knowledge governance” and “governance of knowledge” with similar meaning (Pemsel & Müller, 2012; Zyngier, 2012).

Knowledge is an asset for any organization, institution system and country. However, the challenge is to capture and integration of knowledge that exist but are isolated (Davenport, 1997; Grant, 1996). Indeed, knowledge has limited value if knowledge is not shared. The ability to integrate and apply specialized knowledge is fundamental to improve efficiency, resiliency, and added value, to all resources inside and through diverse Context.

In terms of defining the research problem, this is related to the lack of wise use of global knowledge resources at organizational, local, regional and Network levels.

The term “governance” has several meanings. According to the political scientist Roderick Rhodes, the concept of governance is currently used in contemporary social sciences with at least six different uses: the minimal State, corporate governance, new public management, good governance, social-cybernetic systems and self-organised networks. This concept is related to change, or to the need of changing, in our network society. Changing the boundaries of the state meant the boundaries between public, private and voluntary sectors became shifting and opaque and the continuing interactions between network members, caused by the need to exchange resources and negotiate shared purposes leads to game-like interactions, rooted in trust and regulated by rules of the game negotiated and agreed by network participants. Some degree of autonomy from the state is one of the characteristics of networks and they seem to be self-organising (Rhodes, 1996).

From seminal article of Anna Grandori, that coined the “Knowledge Governance” term (Grandori, 1997), others authors developed related definitions in different contexts (Antonelli, 2006; Foss, 2007; Foss et al., 2010; Foss & Michailova, 2009; Gerritsen et al., 2013; Grandori, 2001; Nooteboom, 2000; Pemsel et al., 2014) (see Table 6).

Table 6 – Knowledge Governance definitions

Autor (data)	Definição	Level of Analysis
Grandori (1997, p. 96)	The notion of “knowledge governance” as convergence between organisational economics and the knowledge-based view in strategic management based on coordination mechanisms employed. – Including authority and agency relations, group decision-making, negotiation, and institutionalization of rules and norms – can be found both in inter-firm and in intra-firm governance structures.	Theory
Nooteboom (2000, p. 70)	Thus knowledge exchange is repeatedly identified as a central feature of innovation and of social capital. In that context it is connected with issues of governance: collective action, mutual dependence, relational risk. This article analyses the value of knowledge exchange, how it takes place, and instruments for its governance. For the value and processes of knowledge exchange it employs a constructivist, interactionist theory of knowledge. It attempts to develop this theory into a logic of knowledge and learning.	Organizacional
Grandori (2001, p. 396)	Continuous governance, occurring intra and inter-organization, using mechanisms combine the organization's systems: a) considering both intra-firm and inter-firm relations, and b) explicit and develop the analysis of possible conflict between objectives that were quite limited and ‘buried’ in contingency theory and explicitly ‘suspended’ in recent knowledge-based theorizing.	Meso Organizacional

Antonelli (2006, p. 229)	Business knowledge governance is the set of institutions, corporate strategies, types of transactions and forms of interactions that characterize and shape the organization of knowledge production, exchange and usage in the business sector.	Meso Organizacional
Peltokorpi, C. e Tsuyuki (2006); Peltokorpi and Tsuyuki (2006, p. 36)	Knowledge governance mechanisms – consensus-based hierarchy, shared human resource practices, and performance measures and output control – that promote knowledge processes in project-based organizations	Micro Project
Foss (2007); Foss and Michailova (2009); Foss and Mahoney (2010)	Knowledge Governance, i.e. choosing organizational structures and mechanisms that can influence the processes of using, sharing, integrating, and creating knowledge in preferred directions and towards preferred levels (Foss et al., 2010, p. 456)	Meso Organizacional
Gerritsen <i>et al.</i> (2013, p. 605)	Knowledge governance as the intentional achievement of societal and policy change through the purposeful production and dissemination of knowledge. In other words, knowledge governance aims to deliver new and innovative insights and solutions which enable actors to leave traditional insights and practices behind and move away from inert interaction patterns, stalemate negotiations and conflicts of interest. In the concept of knowledge governance the coordinative power is learning, which is made possible by knowledge production and dissemination of shared ideas in social networks (Van Buuren and Eshuis 2010). In order to achieve its challenging ambitions, knowledge governance may take advantage of knowledge management activities such as: constructing a research agenda, organizing stakeholder platforms, making sense of what is happening in society and producing definitions of problems.	
Pemsel <i>et al.</i> (2014, p. 866)	Knowledge governance practices in project-based organizations. Concern about (1) governance of knowledge creating processes; and (2) knowledge governance in intra- and inter-firm relationships. The unit of analysis is the relationship between knowledge governance practices and mechanisms behind them.	Project

4 Knowledge Governance Conceptual Model

In this section we pretend going from Framework analysis to build the Knowledge Governance Conceptual Model. Here we identify the main building blocks and

4.1 The building blocks

In order to explore how knowledge governance topic is structured we decided organize publications into four levels of analysis: Network, Macro, Meso and Micro (see Figure). Additionally we also classify them into diverse context (Education, Science, Innovation, Ecosystem Policy and Theory).

Educational Context

The new 2030 Agenda for Sustainable Development explicit point Quality Education as a goal (Goal 4-Ensure inclusive and quality education for all and promote lifelong learning). For attainment of inclusive and sustainable growth we must focus on education of all kinds—higher education, postgraduate studies, basic education, technical-vocational education, and life-long and continuing education (Morta et al., 2016). Here we divide Educational Context in two subcategories: Higher Education and Non Higher Education.

Quality Education is also a key enabler for attaining all other goals. This justify our Governance approach by using evaluation tools to implement a monitoring system based on assessment for learning (Wiliam, 2011). The debates about the role of evaluation and the classification evaluation types, between formative and summative evaluation, define a

field of study with a strong link between theory and practice (Leite *et al.*, 2007; Morosini *et al.*, 2016; Pinho & Leite, 2014; Santiago *et al.*, 2003).

Science Context

The importance that both researchers and institutions feel in creating impact is justified (and even legitimized) by the pressure of research agendas; those agendas are now driven not only by the requirements of pursuing scientific excellence, but also by the expectations of multiple (and demanding) stakeholders (Brannback, 2003; Derrick & Samuel, 2016; Gibbons *et al.*, 1994).

Traditionally research evaluation practices seen as part of a system to ensure accountability and manage a resource allocation system, focus on research outputs. From knowledge Governance approach we see evaluation as a tool aligned with a learning function and a constantly improving knowledge valorization, knowledge integration and knowledge application, by knowledge transfer and sharing (Leite & Pinho, 2017a).

Innovation Context

At organizational level, Knowledge Governance is linked with knowledge Management (Pinho & Pinho, 2016). Here we adopt the knowledge Management definition advanced by Carla O'Dell & Jackson Grayson (1998) as “the conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that strive to improve organizational performance”. With this Knowledge Governance approach we can construct strategies of Knowledge creation that link Education and Research, at University context.

Quality Innovation front, is support by Knowledge Management (KM) inside organizations. Knowledge is a strategic asset necessary for competitive advantage and driver of growth and improved productivity (Argote *et al.*, 2003), but most knowledge management practices lack taken a holistic view (Pinho *et al.*, 2012; Sedighi & Jalalimanesh, 2014). Previous research KM has taken a variety of approaches and has focused on various environments (Pinho *et al.*, 2012). Despite the interest in research on KM, many organizations have a lack of expertise (Zhang *et al.*, 2016) and fail to capitalize its benefits (Szulanski *et al.*, 2016). In this innovation front we will extend our previous research, on barriers and facilitators knowledge processes (knowledge acquisition, knowledge creation, knowledge sharing and knowledge transfer) to identify knowledge Management models in use inside those organizations. Specifically, we need to know who are their users and suppliers and how they are being used. Additionally we want to identify the objectives and results that organizational knowledge management can provide.

The integration of those two previous fronts (Science and Innovation) through the lens of Governance will be the basis for the development of a Research and Innovation knowledge Governance that take into account its potential users and their needs.

Ecosystem Policy Context

The use of knowledge governance concept is increased related to ecosystem-based management paradigm (EBM), where knowledge is an important tool for decision-makers to know, understand and evaluate the socio-ecological systems they intend to govern (Giebels et al., 2016).

Theory Context

Polanyi (1962) divided the human knowledge in two dimensions: explicit (written, codified and easy to transfer) and tacit knowledge (internalised, personal and highly difficult to communicate). This division help to simplify our approach to knowledge, but we must remember that explicit knowledge and tacit knowledge are complementary and its conversion creates chances for the knowledge creation (Nonaka & Takeuchi, 1995)

Another knowledge approach is to associate with knowledge processes (Alavi & Leidner, 2001). Knowledge flows across people, organizations, institutions, places and networks involve creation, sharing, transfer and application of knowledge. In order to improve knowledge-flow processes it is useful to identify the barriers and facilitators (Pinho et al., 2012; Rego et al., 2009). Other approaches from theory of the firm, use the stakeholder concept, with several types of stakeholders (Grandori, 2018).

4.2 Towards Knowledge Governance mode~

Building on prior studies, this article aims to go further by improving our empirical understanding of the interconnection of Education, Science and Innovation systems that added value to knowledge resource. In doing so, we adopt an overarching “Knowledge Governance” model to frame and contextualize our main argument: Knowledge Governance can be implement at each ontological level and additionally this implementation must be aligned across all levels for improving knowledge flows and collaboration to increase economic and societal impacts. Drawing on the gaps in literature this conceptual framework (see Figure 12) aims provides synergies by following objectives need to be reached:

1. Quality Education-Focus on Educational Evaluation
2. Quality Science-Focus on Research Impact
3. Quality Innovation- Focus on Organizational Knowledge Management
4. Quality Ecosystem Policy- Focus on Policy cycle evaluation
5. Quality Theory-Focus on Theoretical development

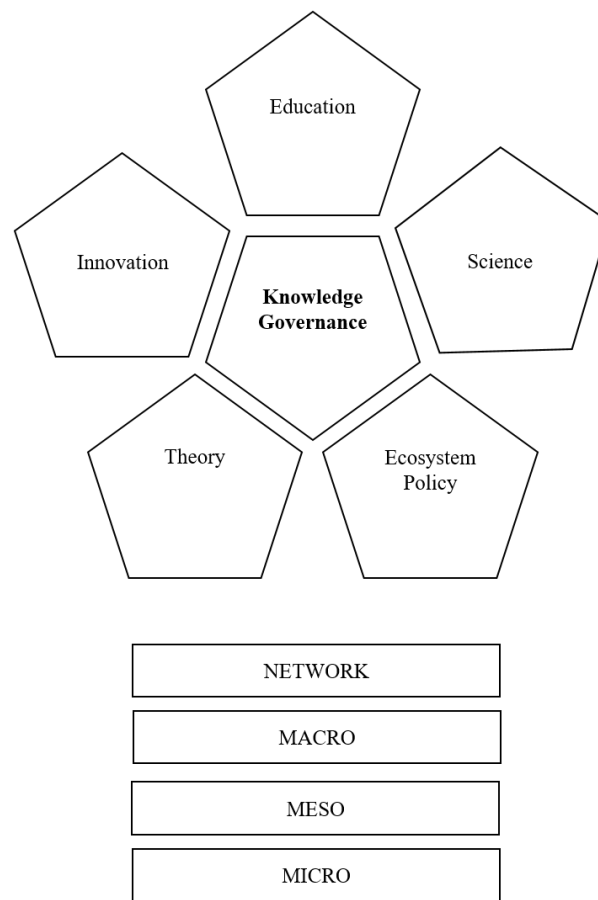


Figure 12 - Knowledge Governance Conceptual model

Taken the perspective of the Italian researcher Anna Grandori, that defend the connection of Knowledge Governance Mechanisms and the Theory of the Firm (Grandori, 2001), it seems there is a lack of understanding of what Knowledge Governance is and how Knowledge Governance implementation can improve knowledge integration from multi-level systems, not only at firm context but also several social spaces where organisations, institutions, networks, cities, regions, countries and global knowledge society interact, by mechanisms competition of collaboration. Although this study have an exploratory nature, its main result - the Knowledge Governance Conceptual Model - contributes to the development of the theory on this topic. We can consider that Conceptual Model is also an important input of integrative review (Torraco 2005).

5 Conclusions

In the last years, the economic and management literature has largely stressed the importance of knowledge assets for firm's competitiveness.

Knowledge governance can be a way from moving the management of hierarchical spaces to self-organizing networks with multi-level governance scales. Connecting knowledge and people is a great challenge and requires the integration of macro, meso and micro social spaces.

This means creating environments that facilitate knowledge sharing, by understanding individuals, groups and the larger systems within which they operate.

Through the interactions of knowledge governance mechanisms and knowledge management processes it is possible to create value and improve organization performance.

Starting by an exploratory review we build a conceptual model that can support the implementation of knowledge governance. This give a new and promising avenue of debate, research and practice, which can be a catalyst for academia, science, industry and government.

This article can be a starting point for further theoretical, empirical and practical research. At political issue we also defend that policy makers must provide a global and local mindset and if they turn knowledge workers they will value this public good: the knowledge. Looking Knowledge Governance as a catalyst, catalyst that can leverage the power of global and local systems across all levels (micro, meso, macro and network), seems to be a useful metaphor to communicate and convey its potentialities and synergies as well as be a facilitator in its transversal implementation.

References

- Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: conceptual foundations and research issues. *Mis Quarterly*, 25(1), 107-136.
- Alvesson, M. (1993). Organizations as Rhetoric-knowledge-intensive firms and the Struggle with Ambiguity. *Journal of Management Studies*, 30(6), 997-1015.
- Antonelli, C. (2006). The business governance of localized knowledge: An information economics approach for the economics of knowledge. *Industry and Innovation*, 13(3), 227-261.
- Antonelli, C., Amidei, F. B., & Fassio, C. (2014). The mechanisms of knowledge governance: State owned enterprises and Italian economic growth, 1950-1994. *Structural Change and Economic Dynamics*, 31, 43-63.
- Argote, L., McEvily, B., & Reagans, R. (2003). Managing Knowledge in Organizations: An Integrative Framework and Review of Emerging Themes. *Management Science*, 49(4), 571-582.
- Bontis, N. (2001). Assessing knowledge assets: a review of the models used to measure intellectual capital. *International Journal of Management Reviews*, 3(1), 41.
- Brannback, M. (2003). R&D collaboration: role of Ba in knowledge-creating networks. *Knowledge Management Research & Practice*, 1(1), 28-38.
- Charmaz, K. (2006). *Constructing grounded theory: a practical guide through qualitative analysis.*: Sage.

- Cross, R., Laseter, T., Parker, A., & Velasquez, G. (2006). Using Social Network Analysis to Improve Communities of Practice. *California Management Review*, 49(1), 32-60.
- Cross, R., Nohria, N., & Parker, A. (2002). Six myths about informal networks - and how to overcome them. *MIT Sloan Management Review*, 43(3), 67-75.
- Derrick, G. E., & Samuel, G. N. (2016). The Evaluation Scale: Exploring Decisions About Societal Impact in Peer Review Panels. *Minerva*, 54(1), 75-97.
- El Hussein, M. T., Kennedy, A., & Oliver, B. (2017). Grounded Theory and the Conundrum of Literature Review: Framework for Novice Researchers. *The Qualitative Report*, 22(4).
- Fornari, L. F., Pinho, I., & Costa, A. P. (2019a). *Revisão da Literatura com Apoio do Software webQDA* 14a Conferência Ibérica de Sistemas e Tecnologias de Informação (CISTI), Coimbra, Portugal,
- Fornari, L. F., Pinho, I., de Almeida, C. A., & Costa, A. P. (2019b). *Literature Review with Support of Digital Tools (in press)*. 9th IEEE Symposium on Computer Applications & Industrial Electronics (ISCAIE 2019) Kota Kinabalu, Malásia,
- Foss, N. J. (2007). The Emerging Knowledge Governance Approach: Challenges and Characteristics. *Organization*, 14(1), 29-52.
- Foss, N. J., Husted, K., & Michailova, S. (2010). Governing Knowledge Sharing in Organizations: Levels of Analysis, Governance Mechanisms, and Research Directions. *Journal of Management Studies*, 47(3), 455-482.
- Foss, N. J., & Mahoney, J. T. (2010). Exploring Knowledge Governance. *International Journal of Strategic Change Management* 2(2-3), 93-101.
- Foss, N. J., & Michailova, S. (2009). *Knowledge governance: Processes and perspectives*: Oxford University Press.
- Gallagher, M. (2001). *Modern university governance: A national perspective*. The idea of a university: Enterprise or academy?, Australian National University, september.
- Gerritsen, A. L., Stuijver, M., & Termeer, C. J. A. M. (2013). Knowledge governance: An exploration of principles, impact, and barriers. *Science and Public Policy*, 40(5), 604-615.
- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage.
- Giebels, D., van Buuren, A., & Edelenbos, J. (2016). Knowledge governance for ecosystem-based management: Understanding its context-dependency. *Environmental Science and Policy*, 55, 424-435.
- Grandori, A. (1997). Governance structures, coordination mechanisms and cognitive models. *Journal of Management & Governance*, 1(1), 29-47.
- Grandori, A. (2001). Neither hierarchy nor identity: Knowledge-governance mechanisms and the theory of the firm. *Journal of Management and Governance*, 5(3-4), 381-399.
- Grandori, A. (2018). The Firm In Search Of Its Nature. *European Management Review*, 15(3).
- Inkpen, A. C., & Tsang, E. W. K. (2005). Social capital, networks, and knowledge transfer. *Academy of Management Review*, 30(1), 146-165.
- Latour, B. (1996). A few clarifications plus more than a few complications. *Soziale Welt*, 47(4), 369-381.
- Leite, D., Leite, M. C. L., Genro, M. E. H., Polidori, M. M., Edelwein, M. P., Escott, C., Félix, G., Pires, R. C. M., Machado, R. S., & Reis, M. (2007). Avaliação participativa online e off-line. *Avaliação: revista da rede de avaliação institucional da educação superior. Campinas. Vol. 12, n. 3 (set. 2007), p. 445-460.*
- Leite, D., & Pinho, I. (2017). Research Collaboration Networks: What Do Researchers Say and What Networks Show? *Evaluating Collaboration Networks in Higher Education Research: Drivers of Excellence* (pp. 41-56). Cham: Springer International Publishing.

- Morosini, M. C., Fernandes, C. M. B., Leite, D., Franco, M. E. D. P., Cunha, M. I. D., & Isaia, S. M. A. (2016). Quality of higher education and the complex exercise of proposing indicators. *Revista Brasileira de Educação*, 21, 13-37.
- Morta, A. R. T., Rafer, J. M. E., & Diño, L. M. F. (2016). Knowledge-Based Development and Governance: Challenges and Recommendations to the Duterte Administration, 2016-2022.
- Newman, M. E. J. (2001a). Scientific collaboration networks - I. Network construction and fundamental results. *Physical Review E*, 64(1), 1-8.
- Newman, M. E. J. (2001b). Scientific collaboration networks. II. Shortest paths, weighted networks, and centrality. *Physical Review E*, 64(1), 7.
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14-37.
- Nonaka, I., & Takeuchi, H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford: Oxford University Press.
- Nooteboom, B. (2000). Learning by Interaction: Absorptive Capacity, Cognitive Distance and Governance. *Journal of Management and Governance*, 4(1), 69-92.
- Peltokorpi, V., & Tsuyuki, E. (2006). Knowledge governance in a Japanese project-based organization. *Knowledge Management Research and Practice*, 4(1), 36-45.
- Pemsel, S., & Müller, R. (2012). The governance of knowledge in project-based organizations. *International Journal of Project Management*, 30(8), 865-876.
- Pemsel, S., Wiewiora, A., Müller, R., Aubry, M., & Brown, K. (2014). A conceptualization of knowledge governance in project-based organizations. *International Journal of Project Management*, 32(8), 1411-1422.
- Phelps, C., Heidl, R., & Wadhwa, A. (2012). Knowledge, Networks, and Knowledge Networks: A Review and Research Agenda. *Journal of Management*, 38(4), 1115-1166.
- Pinho, I., & Leite, D. (2014). *Doing a literature review using content analysis - Research Networks Review*. Poster CIAIQ 2014- Congresso Ibero-Americano em Investigação Qualitativa, Badajoz, Espanha, 4 - 16 de Julho.
- Pinho, I., & Pinho, C. (2016). Aligning Knowledge Management with Research Knowledge Governance. In J. T. Martins & A. Molnar (Eds.), *Handbook of Research on Innovations in Information Retrieval, Analysis, and Management* (pp. 489-504). Pennsylvania: IGI Global.
- Pinho, I., Rego, A., & Cunha, M. P. (2012). Improving knowledge management processes: A hybrid positive approach. *Journal of Knowledge Management*, 16(2), 215 - 242.
- Polanyi, M. (1962). *Personal knowledge: Towards a Post-Critical Philosophy*. Chicago: University of Chicago.
- Rafols, I. (2014). Knowledge Integration and Diffusion: Measures and Mapping of Diversity and Coherence. In Y. Ding, R. Rousseau & D. Wolfram (Eds.), *Measuring Scholarly Impact: Methods and Practice* (pp. 169-190). Cham: Springer International Publishing.
- Rego, A., Pinho, I., Pedrosa, J., & Cunha, M. P. (2009). Barriers and facilitators to knowledge management in university research centers: an exploratory study. *Management Research*, 7(1), 33-47.
- Rhodes, R. A. W. (1996). The new governance: Governing without government. *Political Studies*, 44(4), 652-667.
- Santiago, R., Leite, D., Polidori, M., Leite, M. C. L., & Sarrico, C. (2003). Modelos de governo, gerencialismo e avaliação institucional nas universidades. *Revista Portuguesa de Educação*, 16(1), 75-99.
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, 14(3), 207-222.
- van Kerkhoff, L. (2013). Knowledge governance for sustainable development: a review. *Challenges in Sustainability*, 1(2), 82.

- Watts, D. J. (2004). The "new" science of networks. *Annual Review of Sociology*, 30, 243-270.
- Wiliam, D. (2011). What is assessment for learning? *Studies in Educational Evaluation*, 37(1), 3-14.
- Zyngier, S. (2012). Governance of knowledge management *Organizational Learning and Knowledge: Concepts, Methodologies, Tools and Applications* (pp. 2072-2084): IGI Global.

Positive Emotions Influence on Multi Business Model Innovation Competencies - Strengthening Individuals' Positive Emotions to Increase Creativity in the Innovation and Conceptualization Phase

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Abstract

The purpose of this paper is to examine how positive emotions might influence on innovative competencies in the Multi Business Model Innovation (MBMI). Strengthening of the participating individuals' positive emotions such as happiness, gratitude, joy, love, optimism, hope, mindfulness seems to be important to higher the level of creativity during the business model innovation process in the MBMI conceptualization phase. The paper is based on a combination of the MBMI cube process conceptualization (Lindgren, 2018), and the positive psychology's stressing of positive emotions (Garland et al, 2010; Fredrickson, 2001, 2004a, 2004b, 2009, 2013; Fredrickson & Losada, 2005; Flarup & Wivel, 2013, 2018, Flarup et al, 2017, Lyubormirsky, 2007; Sheldon & Lyubormirsky, 2007); and how this wellbeing influences on the will to create and the will to learn (Seligman, the PERMA Model, 2014; Knoop, the Wellbeing Model in Education, 2013, 2017) in the business model (Valter, 2018).

The evidences of the paper is based on a research project on 41 mechanical engineering students at the Aarhus School of Engineering, Aarhus University, which for the first examine whether it is possible to strengthen positive emotions and how. Secondly, whether this strengthening of positive emotions influences on the students' positive experience of teamwork; thirdly, how these results can be transferred on MBMI processes. Findings from this research project illustrate that 1) it is possible to strengthen positive emotions by simple individual exercises. The choice of gratitude and mindfulness techniques points out that in particular gratitude exercises seem to have a stronger impact on positivity in comparison to mindfulness exercises. 2) Positivity leads to several

positive emotions (joy, happiness, creativity, gratitude, mindfulness, love etc.), which finally has an impact on the students' positive experience of a challenging teamwork. 3) There are highly relevant implications for MBMI innovative processes, since they draw on positive emotional competencies such as creativity, hope, optimism, courage and others. Thus, the paper suggests that further research has to be elaborated in the field of positivity and creativity as individual competencies, together with gratitude exercises, and in the framework of MBMI.

Keywords – Multi Business Model Innovation, Positive emotions, Multi Business Model innovation competencies, Multi Business Model Innovation creativity.

1 Introduction

Research indicates that there is a relationship between happiness and innovative competencies, as unhappiness, however, often shows a lower degree of creativity and innovative competencies (Isen, 1987; Valter, 2018). This means that positive thinking and the displaying of creativity is absolutely essential in the MBMI process and for the innovative quality:

If the participants are happy, they have an increased capability to be creative and solve problems that would positive effect the BMI process and the probability for success. However, if the participants are unhappy, they have a decreased capability to be creative and solve problems that would negatively affect the BMI process and the probability for success (Valter, 2018, p. 6).

During MBMI experiments the participants are asked to develop new and very strong innovative solutions to complex MBMI challenges. The MBMI working process is asking for elements that demands a special courageous attitude by the participants – “to think out of the box thinking”. This process can be heavily frightening for human beings in general, but by focusing on how to strengthen the participants’ inner feelings of positive emotions it is possible to encourage them to stay in the process and feel well-being even in very unclear and unconceptualized situations.

2 Concept of MBMI

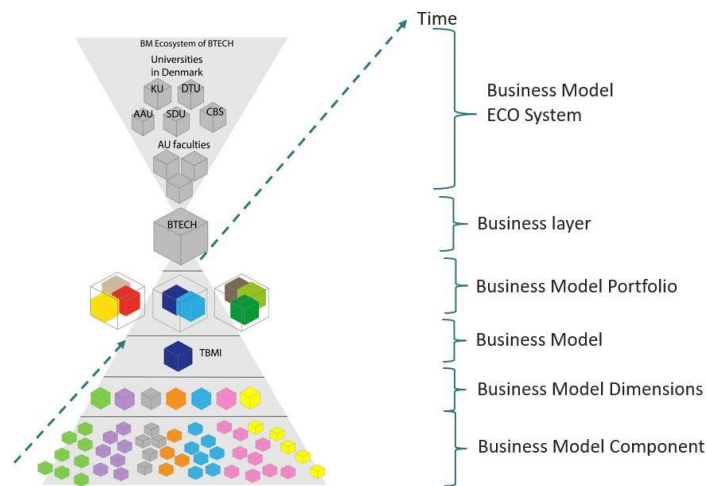
The reason for MBMI curriculum is described in Aarhus University’s course catalogue (University of Aarhus, 2019c):

Modern engineering is continuously faced with issues of and need for rapid MBMI and business model engineering. Knowledge of new support tools and technologies for business models and MBMI is increasingly important. Engineers must know how to develop strategic, tactical and operational approaches to technology-based business model innovation to enhance the business opportunity of achieving a strategic position and strategic advantage.

The curriculum is based on the MBMI concept (Lindgren 2018), which for one thing argues, that a business has more than one business model, most often the business has a multitude of Business Models AS IS and TO BE BMs.

The MBMI concept propose 7 levels of MBMI available to any business as illustrated in the Vertical butterfly model inspired by Horn Rasmussen and Lindgren (2016), see figure 1.

According to the concept we have the *Business* core business (the large grey box) and below, the business's business models grouped into different *Business Model Portfolios*. Each BM portfolio can be unfolded and each BM in the portfolios can be analysed one by one in *Business Model*, *Business Model Dimensions* and *Business Model Components*. Above the Business exists the Business Model Ecosystem (BMES) where the Business propose its BM's and finally, as none of these BM levels are stable, the *MBMI process* (*MBMI Time*) operates.



Own figure 1. The 7 different BM levels in BMI

The Multi Business Model Innovation process concept was inspired by Theory U (Scharmer, 2009) and therefore, the processes when working with MBMI is inspired by his 'U', in the sense, that a business constantly must overview and analyze the existing BMs in the BMES (AS IS). The Business must also continuously do MBMI i.e. change AS IS BM and innovate new bubbles and new BMs (TO BE) to fill in the Gap of existing BM when they begin to leave or have left the BMES. The 'U' inspiration for the MBMI ongoing process cause 7 phases with different activities as illustrated in the MBMI process model beneath:

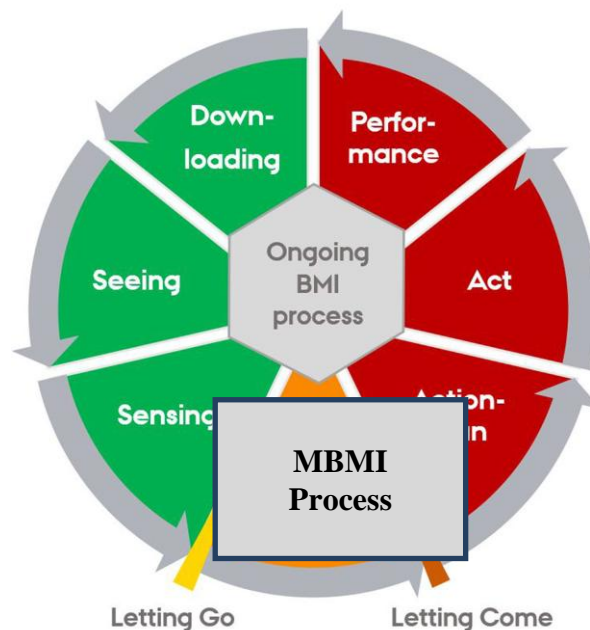


Figure 2. Inspired by Scharmer (2009), Andersen and Lindgren (2019), and Model of Business Model Innovation process, based on Lindgren (2012) and Lindgren and Jørgensen (2012).

The basic for all MBMI and to make this 7 level MBMI process happen is learning, knowledge creation and knowledge capturing. Therefore, it is important to optimize the MBMI participants learning environment and “mood” to learn.

3 How do positive emotions fit into MBMI?

From the theory of positive psychology it is solid described that there are a relationship between creativity and positivity (Knoop, 2013, 2017; Seligman, 2014). As concluded in the quote:

In other words, inducing positive emotions (such as joy, love, or appreciation) enlarges cognitive perspectives and enhances the ability of individuals to attend to more information, make richer interpretations, and experience higher levels of *creativity and productivity* (Isen, 1987; *our italics*).

The theory of positive emotions also suggests that resilience is a healthy side effect of positive thinking; whereas, negativity leads to lack of resilience, and finally to unpleasant emotional and unhealthy states such as depression, stress and survival strategies such as fight, flight, and freeze (Garland et al, 2010; Seligman, 2014).

Instead of letting the negative feelings of fear, fight or freeze flow freely and unconstructively we propose that the participants in the MBMI working process have to be trained to think positive and feel well-being, and by that: to generate an individual

resilience which we want to test in an experiment to see if this lets the creative power flow. Our hypothesis is:

H1 - The creativity in a MBMI process will be affected positively if participants in the MBMI process have received training in positive emotions in beforehand.

H2 - The level of innovative success in a MBMI process is closely linked to strengthening of the participants' resilience and development of positive emotions.

H3 - Positive emotions cause inner positive states in the participants, and this well-being influences on the will to create and the will to learn (Seligman, the PERMA Model, 2014; Knoop, the Wellbeing Model in Education, 2013, 2017) in the MBMI process – particularly the ideation and conceptualization process (Valter, 2018).

Thus, the paper is based on a combination of the MBMI process conceptualization (Lindgren, 2018; Andersen, 2018), and the positive psychology's theory about positive emotions and the concept of broaden-and-build positive emotions (Cameron, 2012; Garland et al, 2010; Fredrickson, 2001, 2004a, 2004b, 2009, 2013; Fredrickson & Losada, 2005; Flarup & Wivel, 2013, 2018; Flarup et al, 2016; Flarup et al, 2017; Flarup, 2018; Lyubomirsky, 2007; Sheldon & Lyubomirsky, 2007; Stephens et al, 2011).

4 Positive and negative emotions

While positive emotions such as joy, happiness, love, hope, creativity, gratitude, optimism extend the subject's palette and imply in "various thought-action tendencies" (Fredrickson, 2004b, p. 147; Fredrickson, 2004a), negative emotions have the opposite effect in the way that the subject experiences a kind of tunnel vision (Young & Hutchinson, 2012, p. 105). The individual's reaction pattern is reduced to a "specific action tendency" (Fredrickson, 2004b, p. 147) as for example the above mentioned intense negative emotions 'fight, flight, freeze' in what the person experiences as dangerous and threatening situations.

Negative emotions is about quick reaction 'by fear' (survival), whereas, positive emotions stimulate to broaden and build the individuals urge to creativity and a joyful living (Garland, 2010). It seems like these competencies to act 'by fear' and 'by joy' are inherited from our ancestors to our days as competencies to live with danger, negativity and even limitations, e.g. learned helplessness (Seligman & Maier, 1967); and the opposite competence to build relations, to find a mate and to reproduce themselves (Fredrickson, 2013). In that perspective positive emotions have an 'undoing' (dissolving) effect on negativity, which creates renewable "effects of positive emotions [that] appear to accumulate and compound over time" so that the subject is given to flourish and prosper (Fredrickson, 2004b, p. 158; Keyes, 2002; Garland et al, 2010; Fredrickson & Joiner, 2002; Seligman, 2014). Negative emotions make the subject languishing (Keyes, 2002; Seligman, 2014).

Thus, positive and negative emotions are diametrically in two different spiral cognitive and behavioral processes: an upward (positive emotions that broaden and build), and a downward (negative restricting emotions). The processes are not each other's

mirror images; however, they are contradictions (i.e. incompatible opposites) and fundamentally incompatible functions (Garland et al, 2010; Fredrickson & Joiner, 2002). The broaden-and-build mechanism of ‘undoing’ extend the subject’s vision and expand the person's action repertoire in situations; whereas restriction reduces to a very few patterns of action (anger calls for battle; fear of flight; Cohen, 2006). Negative emotions such as fear and anger, stress and disease-causing (Garland et al, 2010, p. 850) are:

neural, cardiovascular, endocrine, and muscular changes [and] co-occur with dysfunctional social interactions, which can perpetuate psychophysiological reactivity and trigger destructive behavior against self and others.

Whereas the positive emotions has the opposite effect (Garland et al, 2010, p. 850):

broadened cognition in turn creates behavioural flexibility that over time builds personal resources, such as mindfulness, resilience, social closeness, and even psychical health.

An upward movement of positive emotions strengthens the subjects’ mental and emotional well-being (Fredrickson & Joiner, 2002, p. 172). And not only that: Positive emotions have the ability to remove or blur the negative emotions (Garland et al, 2010, p. 852). The subject may not depressed, stressed or in conflict (Fredrickson, 2004a, 2004b) while feeling a positive emotion such as creativity, gratitude, joy, hope, happiness, love, optimism. The subject cannot feel, for example, gratitude to other people or success in the teamwork or innovation process, and at the same time feel guilt, shame, anger, disgust, dissatisfaction, envy and compare unfavorably with others (McCullough et al, 2002, p. 114). Positive emotions is increasing a sense of well-being and resilience, which is the opposite of a stressful emotional state, and the decisive factors in the individual's will to learn and will to create (Seligman, the PERMA Model, 2014; Knoop, the Wellbeing Model in Education, 2013, 2017) and in the business innovation model.

Below illustrates the process of an upward and downward movement.

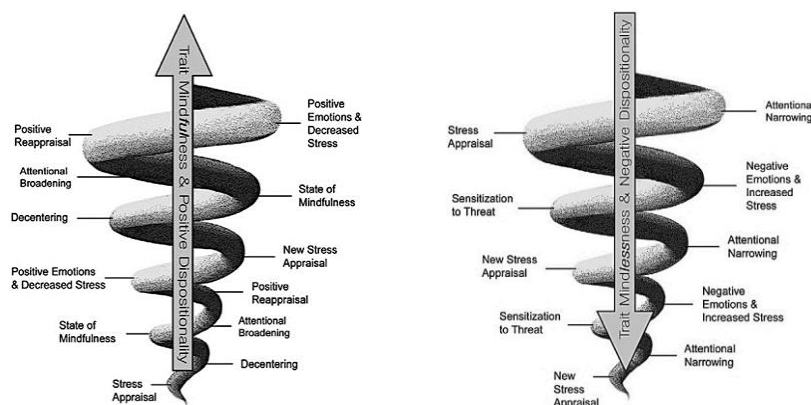


Figure 3. The process of broadening and building up resilience and positive emotions (left side), and the process of narrowing and restricting (right side) (Garland et al, 2010, p. 855, 857).

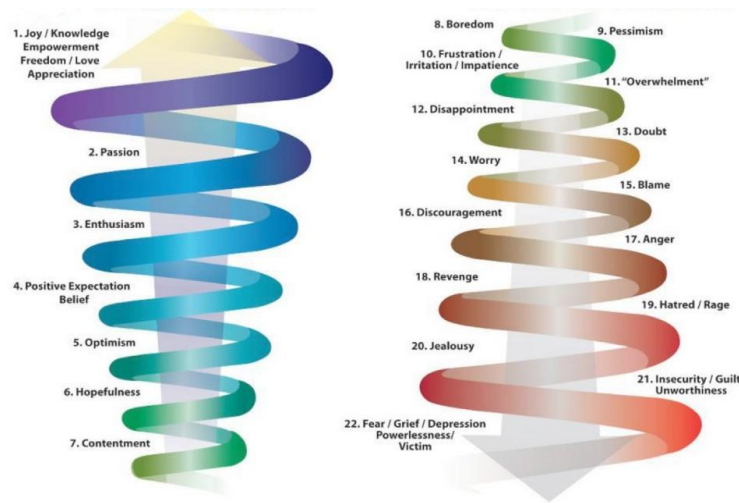


Figure 4. The upward and downward emotional spiral movement. On the top of the positive emotions spiral we find joy, love, freedom, knowledge, empowerment etc. At the bottom of the negative emotions we find fear, grief, depression, powerlessness. Illustration: <https://wiredatheart.com/how-emotion-is-energy-in-motion/>

5 The issue of emotional attachments

In a business context it is important to study the degree of emotional attachment to the change processes that is implied in the MBMI model. The core issue here is that the stronger the feeling of attachment to the organizational values and goals are the stronger is the commitment, loyalty and individual experience of the attachment (Srivastava, 2013; Srivastava & Thakur, 2017). In the perspective of the acronym “VUCA” (Volatile, Uncertainty, Complexity, Ambiguity) change processes have become even more challenging (Hall & Rowland, 2016) together with the rapidly changes in the organizational environment. In a VUCA environment it is necessary for organizations to act agile and to be ready and able to response quickly to change in order to maintain their position. Therefore, it is important to develop a positive mindset so that people are able to work and behave positive in an unclear setting. Developing a good feeling of the values and goals that is part of the process, provides the participants an emotional attachment and commitment to add positive and intense efforts creating a new or strengthen the existing business model of an organization. In short:

Resistance to change can due to the feeling of insecurity of loosing something or a hesitance to in coming out of one’s comfort zone (Srivastava & Thakur, 2017, p. 241).

Thus, the BMI model is a change model which implicit predicts that all participants have a positive attitude to the change which is asked for. However, this is a problem, as not all people feel positive attached to the idea of change. Negative emotions might be the reason why some people are against the whole BMI process. Fear of loosing face,

powerlessness, feelings of uncertainty, lack of insecurity, self-efficacy and self-incompetence (Garland et al, 2010).

In our research of the MBMI processes it is evident that the participants must be strengthened in their positive emotional states. This has led us to the following:

6 Research question

The research project aims to investigate:

How to strengthen the participants' positive emotions in Business Model Innovation Processes?

7 Design/research methodology

The paper is preliminary in the sense that the theoretical foundation is explored in a quantitative and qualitative test design in relation to a cohort of 41 students at the 2nd semester mechanical engineering study at the Aarhus School of Engineering, Aarhus University. The research experiment examined whether it is possible to strengthen positive emotions and how; and secondly, whether this affected the students' positive experience of the project work in teams.

See the research design below:

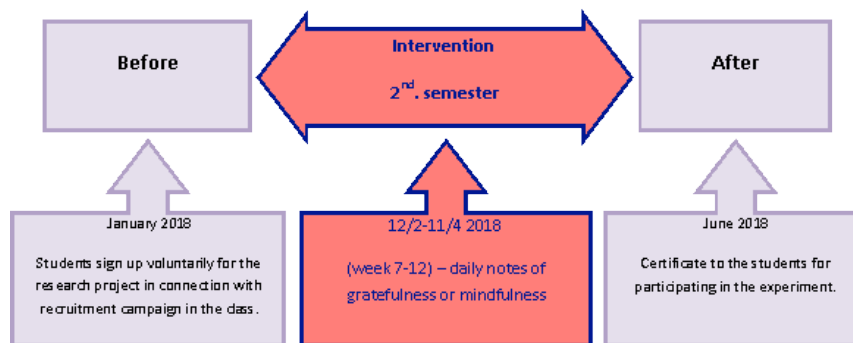


Figure 5: Research design.

The cohort of 41 students consisted of 2 groups – two research groups, and each group consisted of 3 student teams.

To test the impact of emotional intervention the two groups worked with two different types of positive emotions. The one group worked with gratefulness; the other group with mindfulness. Both are positive emotions as shown in figure 3 and 4, and they can be used as 'emotional intervention techniques' in reducing negative emotions like anxiety, stress, sadness and depression. Examples are counting grateful blessings and burdens (Emmons & McCullough, 2003; Emmons & Mishra, 2011; Emmons & Stern, 2013) or mindful meditation techniques (Kabat-Zinn, 2012; O'Leary & Dockray, 2015; Bamber, 2016, 2019). Gratitude and mindfulness might both lead to well-being (Cameron, 2012; Knoop,

2013, 2017; Seligman, 2014). On the contrary, gratitude (and the positive emotion of love, as well; Fredrickson, 2013) is a positive emotion, in contrast to joy, optimism, creativity, hope, mindfulness etc., that includes ‘otherness’ and the strengthening of social relations between benefactors, benefits and beneficiaries (Emmons, 2004; Fredrickson, 2004b; Kini et al, 2015; Flarup, 2018). In this perspective gratitude techniques are highly relevant for the MBMI processes as the basic working methods and strengthening of teamwork affects the quality of the innovative business model (Andersen, 2018; Flarup et al, 2016; Valter, 2018). In contrast, mindfulness is a positive, subjective feeling which also leads to a state of well-being but not (maybe not at all) to the social relations in a team.

During the intervention the participants wrote at least three observations per day as they felt gratitude for (the first group) or which brought them into a state of mindfulness (the second group). Journaling on daily basis seems to be effective and easy for the participants in comparison to, for example gratitude letters, meditation on daily basis or other positive emotional techniques (Kaczmarek et al, 2015). Each participant received a small notebook (pocketsize) for the daily journaling notes.



Figure 6. Diaries for the gratefulness and mindfulness notes on daily basis.

As gratefulness and mindfulness is related to positivity the participants answered a positivity test before and after the intervention.. The test is based on the comprehensive positivity research of Barbara Fredrickson (see www.positivityratio.com) which summarizes the degree of positivity in a ratio (Fredrickson & Losada, 2005). In addition a questionnaire for personal comments was distributed to all students.

8 Findings

On the basis of the positivity test we have calculated the following:

Table 1. Positivity test. The gratitude group before and after the intervention. The average increases.

<i>Positivity Ratio</i>			
<i>Gratitude group</i>	<i>Before (N=20)</i>	<i>After (N=18)</i>	<i>Difference</i>
2.1.	14,24	19,98	
2.3.	12,75	13,15	
2.16.	15,43	12,65	
Average	2,12	2,54	+ 0,42

Table 2. Positivity test. The mindfulness group before and after the intervention. The average falls.

<i>Positivity Ratio</i>			
<i>Mindfulness group</i>	<i>Before (N=21)</i>	<i>After (N=20)</i>	<i>Difference</i>
2.2.	13,38	10,98	
2.10.	14,72	10,38	
2.14	11,60	12,30	
Average	1,89	1,68	÷ 0,21

A degree of positivity ratio between 1 and 3 (before the intervention) in both groups corresponds to 80 per cent of the adult population (American) and is a low positivity (Fredrickson, 2010, p. 153). Over 3 is a high positivity. After the intervention the gratitude group has a direction towards a higher level of positivity in comparison with the mindfulness group which has a downward positivity ratio direction.

According to the comments in the questionnaire the gratitude group experiences a growing well-being whereas the mindfulness group does not seem to reflect the same level of well-being as shown in the examples of quotations in the figure below:

Table 3. Selected comments in the questionnaire for both groups related to keywords from positive psychology.

<i>Keywords</i>	<i>Gratitude group</i>	<i>Mindfulness group</i>
Growth and well-being	"Really good project, which I think everyone should be a part of."	"You learn to be aware of feelings and experiences. It provides plenty of self-insight."
Positivity and reciprocity to other people	"Thank you for the process – it has helped me to meet the challenges more positively and made them more manageable for me. Thank you. "	"I have come in a group who appreciate me and my skills." "It's been nice and sometimes interesting."
Social bonds	"I can feel that it has worked to some extent-it has tied the Group closer together." "Gratitude creates closer ties with your relations."	"It's good to get to know each other." "You will be forced to relate to others in a way that does not contain monosyllables (sweet, nice, stupid, etc. - not saying much). You see yourself from a new angle."

Teamwork	<p>"The project has helped me, both in relation to our group work, where we all have become much more tolerant of each other, and communication in the group is great. The [intervention] exercises have done that we have become closer to each other - and this has strengthened our project work. "</p> <p>"It helps the project work."</p>	<p>"I think it is difficult to see how this has impacted the group work."</p> <p>"Difficult to get started. Disagreements. Not everyone contributes equally."</p>
Positivity exercises help to get out of the negative spiral movement	"I have had a disease process which has been hard for morale and satisfaction, but I get to improve my quality of life and the study/direction."	"I find it hard to concentrate enough about the exercises, as I have been a lot of pressure of my study situation."
Concept of gratitude or mindfulness in general	"Done deeds that make others happy, because it makes me happy."	"It has been a fun and strange topic, 'mindfulness', it is an unpredictable but also a thing you can [learn to] master. It is not something you can measure as such, or collect. It is a feeling you get when you meet or are in a familiar and safe environment."

Findings from this research project illustrate that 1) it is possible to strengthen positive emotions by simple individual positive emotional exercises; 2) the exercises seem to create a stronger connection between positivity and gratitude than between positivity and mindfulness; 3) both gratitude and mindfulness seem to increase the impact on the students' positive experience of teamwork and social relationships. Finally, 4) the gratitude group members comment more positively that they feel better in the team and the project work has been strengthened by the exercises; a similar positive attitude towards teamwork is not evident in the mindfulness-group.

9 Strengths and weaknesses

However, these results should be assessed with caution, as it is difficult to point to a clear statistical significance in the measurement; moreover, the population of students is too small and the research design is not conducted in a MBMI setting but in a student teamwork in general. Differences are highlighted the greater the population concerned. The uncertainties are great for small populations, because it is difficult to know if there is a real difference or chance (Rothman, 2002, s. 11, 19).

Statistically, the result indicates that there is a difference, but that should be subject to uncertainties. These uncertainties may be other causes, which can lead to the result-either issues, which simply amplify the cause, or independent reasons for the result. Despite this, the measurement tend to have had a positive effect on the gratitude group, whereas the mindfulness do not report the same effect.

Another weakness to mention is that there is only two positive emotions involved in the research design. Nevertheless, we believe that there is evidence that the strengthening

of positive emotions, in casu gratitude, can have a decisive influence on participants' experience of well-being in the stressful situation that a MBMI process may cause. And even more when the change process is related to VUCA issues where there is a greater pressure on the organisation and its members to find viable business models.

Finally, it may be a weakness that the research design is not carried out in connection with a MBMI process, but at a population of mechanical engineering students in connection with their innovative project work.

Apart from these weaknesses, however, we believe that we can conclude the following:

10 Conclusion

According to our hypothesis we see in the quantitative and the qualitative part of the research that it is possible to affect the participants' level of positivity by an intervention of either mindfulness or gratitude, even though the compound is most evident between gratitude and positivity than between mindfulness and positivity (H1). This leads us to conclude that gratitude might be an efficient tool when strengthening the positive emotions in order to stimulate other positive emotions like creativity. Further research should examine the impact on creativity by gratitude exercises.

From the comments in the questionnaire we find tendencies that supports hypothesis 2 that both groups express a higher well-being and a more efficient teamwork after the intervention in general, but it appears that the gratitude group is the most positive of the two. Further research should examine the specific innovative success in a MBMI workshop at a deeper level. Finally, hypothesis 3 draws on research in general in positive psychology focusing on well-being as a creator of resilience, learning and innovative processes, and from the comments in the questionnaire it appears that the participants in the gratitude group feel a greater well-being in the project work situation than the mindfulness group. This aspect has to go through a deeper research in accordance to MBMI processes as well.

In general, we find the data in the paper promising as they elicits the relationship between strengthening of positive emotions and the quality of well-being on the one hand, and gratitude exercises as a tool on the other hand. We also find that the above mentioned research is highly relevant for the further research in the MBMI working processes as innovation is linked closely to positive emotional states such as joy, happiness, gratitude, creativity, love. In particular, simple positive emotional tools from the research in gratitude seem to be crucial for the intentions in the innovative MBMI process. Gratefulness is conceptualized as: "a positive, prosocial, and altruistic upward spiraling reciprocity" (Flarup, 2018, p. 21, not yet published), and so it illustrates that the hard and strenuous of any innovation process can draw on the building up of resilience and gratitude to what works in the MBMI team process. Focusing on well-being through positive emotions such as gratitude the result of the MBMI process might be of a higher innovative quality (Valter, 2018).

11 Originality/value – further research

This paper puts in evidence in how to facilitate a strategic perspective collaborating on MBMI for the purpose of “creating, capturing and delivering more ‘TO Be’ Business Models (BM) of high quality, effectiveness and efficiency as the lifetime of the Business BM’s and their related BMI investment continuously diminishes” (Andersen et al., 2018; Gartner, 2018).

As demonstrated in the paper there are fruitful implications for the MBMI process by the link to positivity. We aim to investigate this topic in a larger experiment and in connection with real businesses. This will take place later in 2019.

Another perspective seen in this paper could be how to frame grateful organizations and how to develop and implement gratitude as a part of the communication and organizational strategy (Emmons & McCullough, 2004; Cameron, 2012).

References

- Andersen, G. K., Flarup, J., & Lindgren, P. (2018). *Business Model Innovation Coaching in a three-dimensional continuum*. Paper presented at the The 6th Global Wireless Summit (GWS - 2018), Thailand. Award Winning Paper.
- Bamber, M.D. & Kraenzle Schneider, J. (2016). Mindfulness-based meditation to decrease stress and anxiety in college students: A narrative synthesis of the research. *Educational Research Review*, Bind 18, Side 1 - 32
- Bamber, M.D & Morpeth, E. (2019). Effects of Mindfulness Meditation on College Student Anxiety: a Meta-Analysis. *Mindfulness*, 10, 2, p. 203 - 214.
- Emmons, R. A. (2017). Is Gratitude Queen of Virtues and Ingratitude King of Vices? *Conference paper for Yale Center for Faith and Culture Consultation on “Joy, Gratitude, and Complaint.”* September 8-9, Yale University.
- Emmons, R. A. & McCullough, M. E. (2003). Counting Blessings Versus Burdens: An Experimental Investigation of Gratitude and Subjective Well-Being in Daily Life. IN *Journal of Personality and Social Psychology*, 84(2), 377-389.
- Emmons, R. A., & Mishra, A. (2011). Why gratitude enhances well-being: What we know, what we need to know. In Sheldon, K., Kashdan, T. & Steger, M. F. (Eds.). *Designing the future of positive psychology: Taking stock and moving forward* (248–264). New York, NY: Oxford University Press.
- Emmons, R. A. & Stern, R. (2013). Gratitude as a Psychotherapeutic Intervention. IN *Journal of Clinical Psychology: In Session*, 69(8), 846-855.
- Flarup, J. (2018). *Thank you is not only a poor words. Action Research project on gratitude with mechanical engineering students at Aarhus School of Engineering*. Thesis, Aarhus University. (Not yet published)
- Flarup, J. & Wivel, H. (2013). *Designing Process Enablers to Strengthen Engineering Reasoning and Problem Solving*. CDIO Proceedings of the 9th International CDIO Conference. MIT/Harvard, Boston.
- Flarup, J. & Wivel, H. (2018). *Training the Staff – How to Develop Personal and Interpersonal Competencies at Faculty Level*. CDIO Proceedings of the 14th International CDIO Conference. Kanazawa Institute of Technology, Kanazawa, Japan.
- Flarup, J., Stagstrup Jensen, S. & Lindgren, P. (2016). Business Model Innovation Competencies. *Conference proceedings GWS conference*.

- Flarup, J., Stagstrup Jensen, S. & Lindgren, P. (2017). Competences of Business Model Innovation - "The DNA of BMI". *Conference proceedings IFKAD*.
- Flarup, J., Munk, C. & Wivel, H. (2017). *Designing Process Enablers to Strengthen Personal Skills in Project Work 2.0*. CDIO Proceedings of the 13th International Conference. Calgary University.
- Fredrickson, B. L. (2001). The Role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, 56(3), 218-226.
- Fredrickson, B. L. (2004a). The Broaden-and-Build Theory of Positive Emotions. *Philosophical Transactions of the Royal Society of London: Biological Sciences*, 359(1449), 1367-1377.
- Fredrickson, B. L. (2004b). Gratitude, Like Other Positive Emotions, Broadens and Builds. In Emmons, R. A. & McCullough, M. E. (Eds.). *The Psychology of Gratitude*. Oxford, New York: Oxford University Press.
- Fredrickson, B. L. (2009). *Positivity*. New York: Three Rivers Press.
- Fredrickson, B. L. (2013). *Love 2.0 - How Our Supreme Emotion Affects Everything We Feel, Think, Do, and Become*. New York: Hudson Street Press.
- Fredrickson, B. L. (2013). Updated Thinking on Positivity Ratio. *American Psychologist*, 68(9), 814-822.
- Fredrickson B. L. & Joiner, T. (2002). Positive emotions trigger upward spirals toward emotional well-being. *Psychological Science*, 13(2), 172-175.
- Fredrickson, B. L., Cohn, M. A., Coffey, K. A., Pek, J. & Finkel, S. M. (2008). Open Hearts Build Lives: Positive Emotions, Induced Through Loving-Kindness Meditation, Build Consequently Personal Resources. *American Psychological Association*, 95(5), 1045-1062.
- Garland, E. L., Fredrickson, B. L., Kring, A. M., Johnson, D. P., Meyer, P. S. & Penn, D. L. (2010). Upward spirals of positive emotions counter downward spirals of negativity: Insights from the broaden-and-build theory and affective neuroscience on the treatment of emotion dysfunctions and deficits in psychopathology. *Clinical Psychology Review*, 30(7), 849-864.
- Gartner. (2018). Top 10 Strategic Technology Trends for 2018: A Gartner Trend Insight Report. Retrieved from <https://www.gartner.com/doc/3865406/top--strategic-technology-trends>.
- Hall, R.D. & Rowland, C.A. (2016). Leadership development in turbulent times. *Journal of Management Development*, 35, 8, p. 942-955.
- Horn Rasmussen, O. & Lindgren, P. (2016). Two Black Boxes: Understanding the Coherence between Business Models & Business Model Eco Systems – A Contribution toward a Definition of the Object for Business Model Innovation and the Question of “Where to Look”? *Journal of Multi Business Model Innovation and Technology*, 3, 87-132.
- Isen, A.M. (1987). Positive affect, cognitive processes, and social behavior. *Advances in Experimental Social Psychology*, 20, p. 203-253.
- Kabat-Zinn, J. (2012). *Mindfulness for Beginners: reclaiming the present moment--and your life*. Boulder, Colorado: Sounds True, Inc.
- Kaczmarek, L., Kashdan, T.B., Draczowski, D., Enko, J., Kosakowski, M., Szäefer, A. & Bujacz, A. (2015). Why do people prefer gratitude journaling over gratitude letters? *Personal and Individual Differences* 75, p. 1-6.
- Kini, P., Wong, J., McInnis, S., Ganana, N., & Brown, J.W. (2016). The of gratitude and neural activity. *Neuralmage* 128, p. 1-10.
- Knoop, H. H. (2013). Positive Education, or just Education. In Proctor, C. & Linley, P. A. (Eds.). *Research, Application at Interventions for Children and Adolescents – A Positive Psychology Perspective*. Dordrecht: Springer Science + Business Media.
- Knoop, H. H. (2017). The Eudaimonics of Education. In Vittersø, J. (ed.) *Handbook of Eudaimonic Wellbeing*. Dordrecht: Springer Science + Business Media.

- Lindgren, P. (2016). The Business Model Ecosystem. *Journal of Multi Business Model Innovation and Technology*.
- Lindgren, P. (2018). *The Multi Business Model Innovation Approach: Part 1 The Multi Business Model Approach* (1 ed. Vol. 244). River Publishers Lange Geer 44 2611 PW Delft The Netherlands: River Publishers.
- Lyubomirsky, S. (2007). *The How of Happiness*. New York: Penguin Press.
- Morris, M., Schindehutte, M. and Allen, J. (2005), The entrepreneur's business model: toward a unified perspective, *Journal of Business Research*, Vol. 58(6).
- O'Leary, K. & Dockray, S. (2015). The Effects of Two Novel Gratitude and Mindfulness Interventions on Well-being. *The Journal of Alternative and Comparative Medicine*, p.243-245.
- Rothman, K. (2002). *Epistemology*. Oxford, New York: Oxford University Press. Seligman, M. E. P. (2014). *Flourish*. New York: Free Press.
- Seligman, M. E. P. & Maier, S. F. (1967). Failure to Escape Traumatic Shock. *Journal of Experimental Psychology*, 74(1), 1-9.
- Seligman, M. E. P. & Peterson, C. (2004). *Character Strengths and Virtues: A Handbook and Classification*. New York: Oxford University Press.
- Sharmer, C. O. (2009). *Theory U : learning from the future as it emerges : the social technology of presencing*, San Francisco, Calif., Berrett-Koehler Publishers, Inc.
- Sheldon, K. M. & Lyubomirsky, S. (2007). How to increase and sustain positive emotion: The effects of expressing gratitude and visualizing best possible selves. *The Journal of Positive Psychology*, 1(2), 73-82.
- Scrivastava, S. (2013). Job Satisfaction and Organizational Commitment Relationship: Effect of Personality Variables. *Vision*, 17, 2, 159–167.
- Spieth, P. & Schneider, S. (2015): Business model innovativeness: designing a formative measure for business model innovation. *Journal of Business Economics*. Vol. 86(6).
- Stephens, J.P., Heaphy, E. & Dutton, J. (2011). High quality connections. IN Cameron, K. & Spreitzer, G. (Eds.) *Handbook of positive organizational scholarship*. New York: Oxford University Press.
- Thakur, R.R. & Srivastava, S. (2018). From resistance to readiness: the role of mediating variables. *Journal of Organizational Change Management*, 31, 1, p. 230-247.
- Valter, P., Lindgren, P. & Prasad, R. (2018). Valters Seven Forces; a Model for Analyzing the Forces Affecting the Business Model Innovation Process. *Journal of NBICT*, 1, 47-64.
- University of Aarhus, 2019. TBMI Course Catalogue [Online]. AU.DK: STUDYSERVICE.BSS@AU.DK. Available: <http://kursuskatalog.au.dk/en/course/81201/Technological-Business-Model-Innovation> [Accessed 19.03 2019].

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Collaborative Knowledge Sharing and Knowledge Generation in Multi Business Model Innovation Processes - a Three-Dimensional Knowledge Ecosystem

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Abstract

This paper is part of a series of papers aimed at creating knowledge about Multi Business Model Innovation (MBMI) Process Management in a special designed Business Lab with the purpose to develop a framework for facilitating university students (and Businesses) in doing Multi Business Model Innovation according to the MBMI concept developed by professor Peter Lindgren (Lindgren & Jørgensen, 2012); (Lindgren & Rasmussen, 2013); (Lindgren, 2016, 2017, 2018).

The research includes Master Engineering students at Aarhus University Herning doing MBMI in three Business Labs during a business case competition. Twenty students worked in three mixed teams with their business cases for three days in the Labs and were observed by 360-degree cameras to explore what kind of interpersonal verbally and non-verbally communication processes appear and could be relevant for a Process Manager.

The Process Managers seem to facilitate the MBMI processes and the students team work in a three-dimensional guidance continuum by communicating through different types of comments, e.g. comments regarding their work processes, provocative comments, and investigating, praising and guiding comments. Yet mostly through open and investigative

questions. Moreover, the Process Managers use body language in an active, smiling and happy way that creates a positive, comfortable atmosphere with positive emotions in the Labs. Finally, the Process Managers use the MBMI B-Lab and tools to show the students how the infrastructure and the tools can help them structure, analyse and create knowledge (new BM's) through the BMI case work.

Keywords: Multi Business Model Innovation, Knowledge creation, Process Management of Business Model Innovation, Business Model Innovation communication.

Paper type – Academic Research Paper

1 Introduction

The Department of Business Development and Technology at Aarhus University in Herning, Denmark, offers students a cross disciplinary Master of Science in Engineering programme. Part of this is the 10 ECTS course: *Technological Business Model Innovation (TBMI)* course bridging Engineering Technology with Multi Business Model Innovation (MBMI) with the purposes to develop the students' competences in doing MBMI.

The research *Centre for TeleInfrastruktur Global Capsule (CGC)* at BTECH, facilitates interdisciplinary research and educational activities among others teaching and research in the TBMI course (University of Aarhus, 2019a). The course catalogue arguments for MBMI as curriculum (University of Aarhus, 2019b) due to the increasing, physical and digital globalization and thereby business competition. Today Businesses must be agile and increase their Business Model Innovation (BMI) capacity faster than previously to survive in the business environment - the Business Model Eco System (BMES) (Lindgren, 2018).

The TBMI curriculum is based on the MBMI concept developed by Professor Peter Lindgren which argues, that a business has more than one business model, most often a multitude of Business Models (Lindgren & Jørgensen, 2012); (Lindgren & Rasmussen, 2013); (Lindgren, 2016, 2017, 2018). Due to the course syllabus the TBMI students work in teams to share existing knowledge and construct new knowledge and skills through activities: reading, listening, writing, drawing and conversation (University of Aarhus, 2019b). They do rapid BM prototyping (artefacts) which is inspired by the IDEO innovation approach (IDEO, 2019) and analyse, investigate and develop MBMI solutions by working with real life business cases in a collaborative way (Bang & Dalsgaard, 2005).

This paper is a part of papers building up knowledge about the MBMI Process Management in the *B-Lab* (section 2.1) with the purpose to develop a framework for facilitation of university students (and Businesses) in doing Business Model Innovation processes according to the developed MBMI concept (Lindgren & Jørgensen, 2012); (Lindgren & Rasmussen, 2013); (Lindgren, 2016, 2017, 2018).

There is much knowledge about BMI (Zott, Amit, & Massa, 2011) (Osterwalder, Pigneur, & Tucci, 2005; Taran, 2011; Teece, 2010) and some knowledge about general

Business Model Coaching (Blackman, Moscardo, & Gray, 2016), but Blackman et al. recommend to do further investigation in communication skills regarding facilitation of BMI. In line with the recommendation right now Aarhus University – CGC has selected few MBMI certified Process Managers to facilitate participants in doing MBMI Processes in the B-Lab. And according to MBMI concept (Gade, 2018; Lindgren, 2018), there seems to be no accepted description of expected competencies and communications skills to fill the position as Process Manager in the B-Lab. As researcher Per Valter noticed when preparing the TBMI 2017 B-Labs in Skive: "As it is now we really don't know very much about the performing inside this innovation cubes, so we are measuring [...] this [digital monitoring] will give more knowledge about what is going on in the cube and how good the tools are working to help the participants overcome their problems" Drobe video interview (Valter, 2017).

In general, the MBMI Process Manager are viewed as coaches even though the MBMI glossary does not define this function. The word 'coach' seems to be marked by numerous connotations (Blackman et al., 2016; Stelter, 2002) and therefore, in this article we use the term 'MBMI Process Manager' as an overall term for the person in charge of facilitating the participants in the B-Lab, inspired by Benedicte Madsen describing 'process' as how the content (tasks and relations) will be organized (Madsen, 2016). And Based on the MBMI concept (Lindgren, 2018) we use the following acronyms:

TBMI = Technological Business Model Innovation

MBMI = Multi Business Model Innovation.

BMI = Business Model Innovation

BMES = Business Model Ecosystem

2 Multi Business Model Innovation as curriculum and didactical framework

The MBMI concepts research is, among others, based on the works by (Chesbrough, 2007, 2010; Gassmann, Frankenberger, & Csik, 2014; Osterwalder et al., 2005; Teece, 2010; Zott et al., 2011). According to the concept a business has more than one BM, often a BM portfolio and therefore, the students must learn the distinction between the 7 BM levels (including the time level) as illustrated in the Vertical butterfly model (figure 1) inspired by (Horn Rasmussen & Lindgren, 2016)

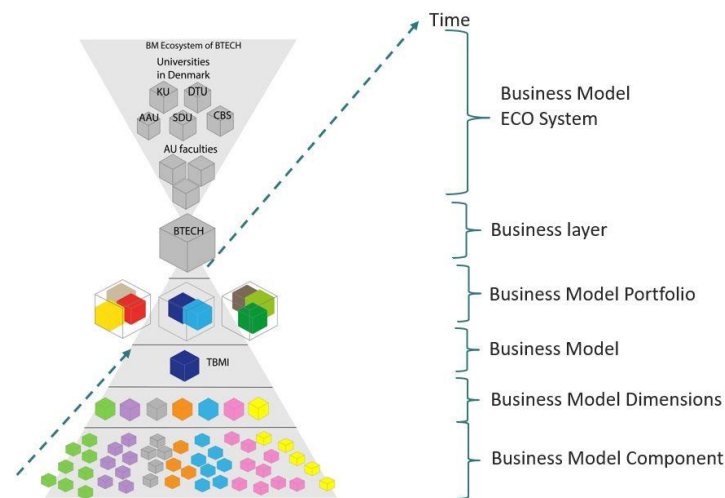


Figure 1. Own figure shows the 7 BM levels in MBMI.

According to the MBMI concept, a Business Model consists of seven BM dimensions (Lindgren and Rasmussen, 2013):

1. *The Value Propositions i.e. products, services processes*
2. *User or Customer in B2B or B2C*
3. *Primary or secondary Value Chain Functions*
4. *Competences as Technology, Staff Resources, Organisation, and Culture*
5. *Network as Physical, Digital or Virtual*
6. *Value Formula as Turnover or Other Values*
7. *Relations as physical or non-physical cords/channels that create contact and carry the values between the dimensions.*

(Lindgren and Rasmussen, 2013).

In the TBMI course, the students participate in a BMI case challenge, where they receive a real business case a business wants to be analysed and ‘innovated’. Therefore, the students visit ‘their’ business and work in here for three days 24/7. Back at the university they continuously work with the cases, participate in a challenge, and finalise their cases to a report and do their oral exam defence.

In this BMI process, the MBMI theoretical approach is a part of the TBMI didactical framework. When doing BMI, the students work in a circular process inspired by Theory U (Scharmer, 2009) where it is important to begin with analysing the existing BM, the case, before thinking in how to change or do a new BMs. This process is illustrated in Figure 2

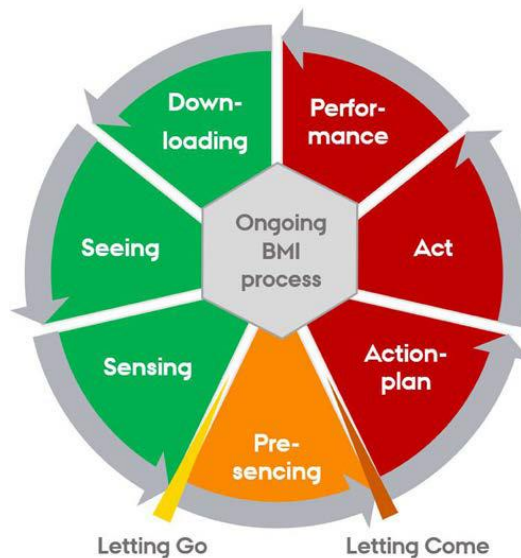


Figure 2. Model of Business Model Innovation process based on Lindgren and Jørgensen (2012); Lindgren, Rasmussen, and Saghaug (2013)

The students begin with the AS IS phase, the *Downloading* process where they must listen, observe and ask questions to understand and map the Business Components on the *B-Star* (Figures 3a and 3b) by writing what they hear regarding the seven BM dimensions. This is followed by the *Seeing* process where the students observe, discuss and reflect all the case's BM components from an outside-in view, by drawing lines (relations in Figure 4) between the components and finally assess the BM, components, and relations.

Now the students are ready to do the *Sensing* process: changed or innovate new BM's by combining the previous 'downloaded' knowledge with knowledge and competences of the students, business employees or the external network. In this process, the students again map and consider how one or more new BM's fit into the existing Business and BM portfolio. The students finally select the BM in *Letting Go*, *Stop and Investigate further*, *No Go* or *Park*. In the TBMI Challenge and further work at the university, the student does not do the last part of the TO BE phase in praxis, because this part must be decided by the business. The students can do the last part of the process theoretically and present the recommendations in their report.



Figure 3a. Small six-pointed B-Star.



Figure 3b. The large B-Star table with hexagons.

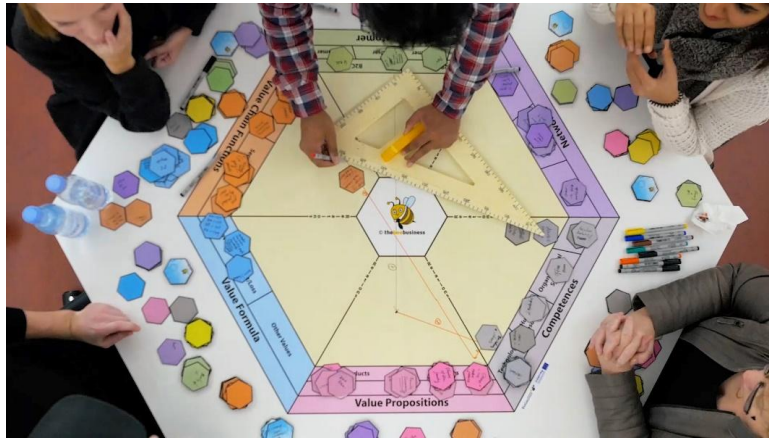


Figure 4. Students draw relations between the BM components.

When on or more BM's are found suitable to go through the *Presencing* phase and the business accept the changed or the new business models in the *Letting Come* phase, there is a new connection between the existing BM and the new upcoming TO BE BM. The process now shifts to the Act do phase and in this process the participants adapt a new mindset in the MBMI process inspired by Scharmers theory U. They must close their minds, focus on fulfilling vision, mission, objectives and implementation plan to “make” the BM happen. Energy to do the *Action planning*, implement (*Act*) the BM in the BMES and measure the BM by selecting KPI's to evaluate the BM's *Performance* have to be created and captured, to make the pink TO BE BM - A1 in figure 5 move from ideation phase to implementation phase an into the BMES.

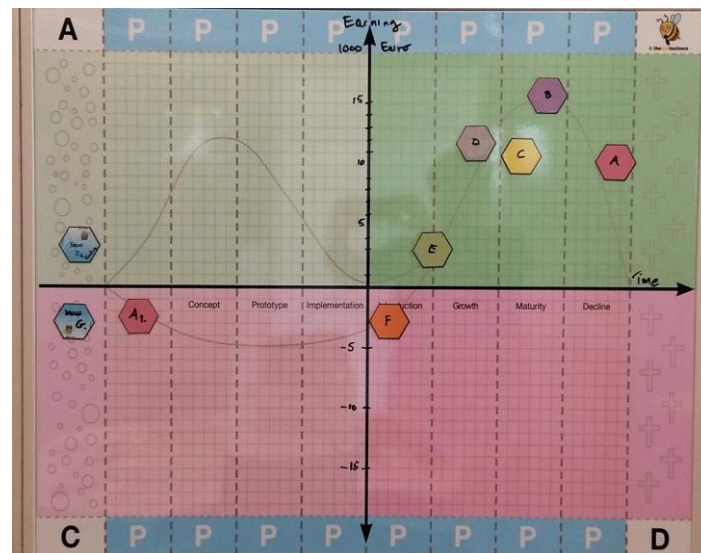


Figure 5. An example. Different BM's KPI 'Earning' measured on the B-Board.

2.1 The B-Lab in the MBMI process

In the TBMI course the student teams are invited to work in a special ‘MBMI room’ named the *B-lab*.

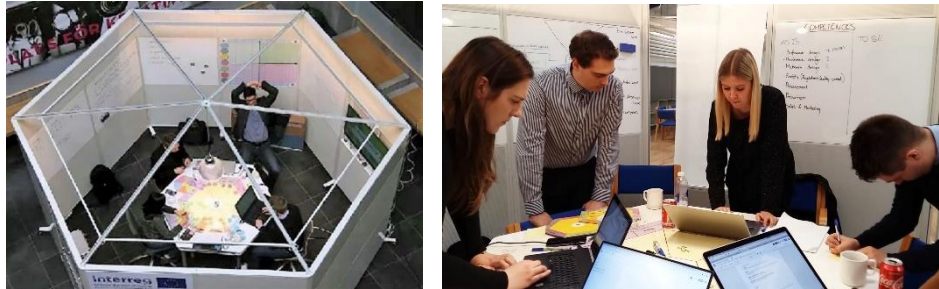


Figure 6a and 6b. Students work in the B-Lab.

The *B-Lab* is a hexagonal team room in the BM seven dimensions. The students sit across each other around the B-Star table and work with their business case, analysing and innovating by the aforementioned BM process and tools. The room is soundproof and has a nice atmosphere which supports the BM work. In order to strengthen the students' human relations and hereby teamwork processes (Tuckman & Jensen, 1977), the student's sit across each other around the B-Star table and communicates while working physical with the BM tools to analyse and share knowledge, create and capture new knowledge through the collaborative work process (Bang & Dalsgaard, 2005).

3. Research purpose and question

When doing MBMI in the B-Lab there are several environmental and tool-related forces that influence the MBMI processes. The forces are: 1) Environment and tools, 2) The Process Manager (Coach), 3) Group force also mentioned Team forces (Tuckman & Jensen, 1977), 4) Individual Forces e.g. culture and personal competencies by the participants, 5) Competition Space force 6) BMI Process Space forces e.g. time affecting the process, 7) and Emotion forces by the participants (Valter, Lindgren, & Prasad, 2018).

As our focus is on developing an MBMI Process Manager Framework for facilitating the participants in doing MBMI processes in the B-Lab, we are examining the Process Manager, force nr. 2.

In a previous paper (Andersen, Flarup, & Lindgren, 2018) we found that MBMI processes seem to take place in a kind of three-dimensional guidance continuum over time - a kind of Multi Business Model Knowledge Ecosystem (Järvi, Almpantopoulou, & Ritala, 2018) where the MBMI Process Manager with advantage to the MBMI process must be flexible and try to manage and facilitate the MBMI work in a non-linear process to heighten the outcome quality of the MBMI processes. Inspired by Løw (2009) we illustrated the continuum in Figure 7.

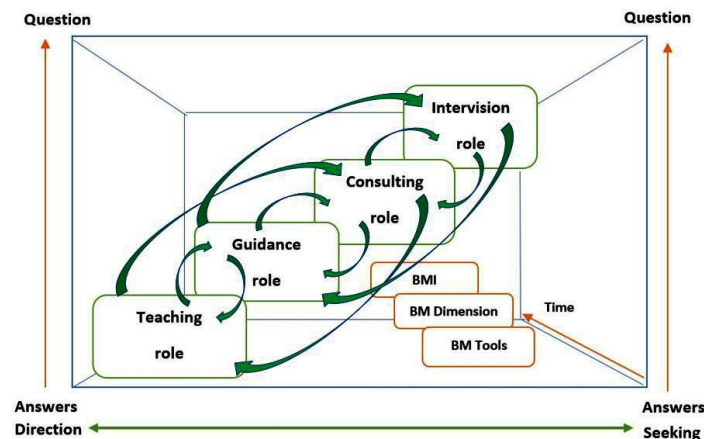


Figure 7. The three-dimensional guidance continuum. Inspired by Løv (2009, p. 97)

The Process Manager must be able to balance his/her perspective among four roles/positions: *teaching*, *guidance*, *consulting* and *inter-vision* between ‘direction’ the answers and ‘seeking’ the answers by questions, appropriated to the participants BMI work processes in the B-Lab. Additionally, the Process Manager must master different kinds of communication when facilitating the participants' knowledge generation and knowledge transfer (Mezirow, 2009) with the BM Tools, BM dimensions and the BMI process in the B-Lab. A vital condition regarding the knowledge transfer is that once the MBMI process is completed the Process Manager (and the participants) can apply the new experience and knowledge in his/her own practices.

In order to develop current understanding, we try to identify the tacit knowledge of being a Process Manager which is more or less conscious for the Process Managers him - or herself (Nonaka & Takeuchi, 1996). We investigated the executive role as an MBMI Process Manager motivating and facilitating collaborative knowledge generation and knowledge sharing in the three-dimensional continuum - what kind of process activities and interpersonal verbally and non-verbally communication processes seems to appear and be necessary by the Process Managers in the four aforementioned positions - more specifically:

1. What type of comments, answers, and questions seems to appear in the BMI process?
2. What are the Process Manager's body language and actions during the process?
3. How seems the BMI tools to support the communication and BMI process?

4 Research frameworks

Our research position is based on Participatory design (Simonsen & Robertson, 2013) and interpersonal communication processes (Jensen, 2004) between: a) participants in the B-Lab, b) between participants and the Process Managers and c) between researcher's in

their interpretation of examination research results. Interpretation is thereby the basis for the knowledge that the processes and experience will produce in a continuous, hermeneutic process based on pre-appreciation and appreciation. Our epistemological position is the philosophical hermeneutic in which each participant come with pre-appreciation and prejudices, which influence the interpretative interaction between the participants among these, researchers and Process Managers (Højberg, 2014). By the interpersonal communication approach (Jensen, 2004) the participants have the possibility to gain insight into the others participants' respective pre-appreciation and prejudices, and thereby the prejudices are revised, and new common knowledge can be developed.

Communication is the cornerstone of the interaction processes in the B-Labs. Without communication no changes, it's that simple - and yet that difficult. In this paper our research is based on the third communication paradigm, the *Co-paradigm* also referred to as the Interaction-paradigm (Due, Asmuf, Nielsen, & Gravengaard, 2016) in which communicating is and acting process between participants with a focus on creating new meaning and knowledge by interaction and interpersonal communication (Jensen, 2004). The communication processes take place in the 3 MBMI B-Lab, where the participants' interpersonal communication is supported by the Process Manager, and by physical analogue and/or digital artefacts. 'MBMI communication' is therefore understood as both verbal and non-verbal activities in order to facilitate participants BMI processes. And to analyse and categorise questions by the Process Managers we use Wichmann-Hansen & Jensen's *Interview model for supervision, inspired by Karl Tomm's four types of questions* (TOMM, 1988; Wichmann-Hansen & Jensen, 2013)

4.1 Research methodology

In 2017 the CGC research centre did a minor TBMI course challenge at the Biogas 2020 conference in Skive, Denmark. CGC invited 20 students from Denmark, Norway, and Sweden to participate in a 3-day-long TBMI business challenge during the conference (Drobe, 2017). The students worked in three mixed teams with their business cases for three days in three B-Labs according to the MBMI concept described in section 2. The students were supported by two Process Managers. During the challenge, the Process Managers and the students were observed in the B-labs by a 360-degree camera on each B-Lab table, and the students were observed by face-monitoring sensors in camera-caps and heart read monitor fixed on the chest as well (Lindgren et al., 2019; Lindgren, Valter, & Andersen, 2018). All students were informed about the research and have given their signed accept to participate in the research Labs. According to signed agreement, the data will be deleted after the IFKAD conference 2019. Face and heart measuring are not a part of this paper but will delete as well.

According to our research question, we have extracted examples of respectively: Answers, Questions, Comments, Body language and BMI Activities in the B-labs, from each ‘content log’ – summarised in Appendix 1.

5 Preliminary Findings

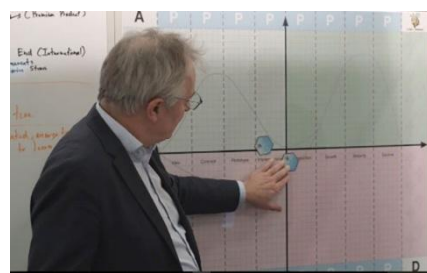
With our current examples of data from 3 B-Labs our preliminary findings seem to show that it is possible to analyse and categorize the Process Managers verbal and non-verbal communication in the B-Labs – being aware that Appendix 1 does not contain all comments and questions from the transcriptions.

Summary: <i>No. of the four different types of Open Questions:</i>	PM Comments: <ul style="list-style-type: none"> ➤ On MBMI process and tools ➤ On Students work process ➤ Provocative ➤ Investigating ➤ Guiding/ Advising ➤ Summarize: ➤ Praising ➤ Interesting ➤ Including language by using the word ‘We’ 	Type of questions by PM: <ul style="list-style-type: none"> ➤ ‘Meta’ questions ➤ Process questions (push the students) ➤ Rhetorical questions ➤ Detailed case questions due to the case ➤ Open questions (see below) Four different types of Open Questions <ol style="list-style-type: none"> 1. Clarify/concrete questions: e.g. What are the needs, expectations and objectives? (5 questions) 2. Investigative questions e.g.: Examine the knowledge, understanding and argumentation (17 questions) 3. Challenging questions e.g.: motivate to reflecting, see new perspectives, new way to solve the problem (9 questions) 4. Evaluating questions e.g.: summarize, highlight knowledge, draw conclusions and look at future goals/perspective. (4 questions) 	Body Language by Process Manager: <ul style="list-style-type: none"> ➤ Reflecting students body language ➤ Listen instead of talking ➤ Nods and signs of listening. ➤ Smiling ➤ Laughing ➤ Ask questions ➤ Says something fun ➤ Intentionally break ➤ Use the body to stress a point ➤ Step forward - step backward 	PM activities with BMI tools: <ul style="list-style-type: none"> ➤ Draw on the walls in B-Lab. ➤ Point dimension in B-Star / B-Table ➤ Points to the different (edges) of the B-Star ➤ Pointing at B-Board & ➤ Place the hand and move BMI on B-board.
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Figure 10. Extract from Appendix 1.

5.1 Answers, comments and questions

The MBMI Process Managers did *Lecturing* the first evening just before the challenge. The students were taught the MBMI concept and associated tools, as well as team theory. The lecturing was followed by a team activity, a collaborative work process building a LEGO figure.



Figures 10a and 10b. Students are taught in MBMI concepts processes and tools.

During the TBMI challenge the Process Managers did a kind of *teaching* in the B-Labs when they repeated or made comment on the MBMI concept processes, dimensions, BMES, and the tools.

The students were *guided* and *consulted* by different type of comments e.g. comments regarding their Work Processes, Provocative comments, Investigating, Praising and Guiding comments as well ; by different types of *Open questions* e.g. *Clarifying* questions: “You have something you wanted to discuss”, and “are you beginning to understand the process of the whey-product?”; *Investigative* questions e.g.:” so...is it right, that I feel, that you don’t have an overview or?” and “so, are you trying to use these tools [BMI] to go around?”; *Challenging* questions e.g.: “but it seems that you are very stocked around product thinking?” and “so why are you not thinking out of the box? you have the opportunity now”; and *Evaluating* questions e.g.:” because, what I hear, I don’t know whether it is right, but I think you are at little bit disappointed as well” and “it is hard to the brain?”. With the current transcriptions is it difficult to place all the comments and questions in the respective phases Downloading and Sensing why there is no line between the two columns in the appendix (Appendix 1).

5.2 Process Manager's body language

One of the Process Managers seem to have a very positive and lively body language. It is characterized by reflecting on the students’ body language, listen and ask questions instead of talking, nods and make signs of listening, smiling and laughing a lot, use conscious breaks, use the body to stress a point, step forward when talking and step backward when the students need to talk, and make a little laughing when asking challenging questions or make provocative comments, as illustrated in the following pictures.





These more or less consciously body gestures by the Process Manager seem to be an active, sympathetic way of communicating, a way to create a positive, comfortable atmosphere with positive emotions (Valter et al., 2018); (Graziotin, Wang, & Abrahamsson, 2014) in order to motivate and help the students developing new BM in the intensive and demanding work processes they undergo. In that sense, the MBMI Process Manager seems to have some influence on several of the seven forces: Emotions, team dynamics and environments and tools (Valter et al., 2018).

5.3 Process Manager and the BMI tools

The Process Managers use the B-Labs and tools when facilitating the students e.g.: Draw on the whiteboard-walls, move BM hexagons on the B-Board, take the B-Star in the hand and points when speaking, point on the B-Star table, i.e. trying to get the students to use BMI tools as guiding and helping process tool in their Downloading and Sensing phases.



Figures 11a. and 11b. Process Manager uses the MBMI tools in the B-lab.

6 Discussion

We are aware that our preliminary findings are biased and do not show the full picture of MBMI Process managers extensive work in B-Labs. Certain respective video and sound recordings from one day are missing due to technical problems with recordings. All the monitoring was technically a brand-new setup with quite new 360-degree recording equipment that sound and video was recorded separately. It has made the analyse process complicated, as the audio and video codes don't match! And in some of the recording, it is very difficult to hear the communication due to background noise from Conference activities. These challenges are described in detail as the *Environment and tools force* in

Valter (2018) and evaluated with proposals for improvements. The results are also biased in the sense that we as researchers assessed and classified the comments and questions based on our interpretation of Guiding, Consulting and the type of questions. In order to accommodate this, similar research in the future must be transcribed and categorized by for example, a psychologist, so that researchers from different professions interpretation underlying the categorisation of the communication.

7 Conclusions

In this paper, we have initiated the second part of our research to develop a Framework for MBMI Process Management of participants in the B-Lab.

An MBMI Process Manager seems to work in a three-dimensional guidance continuum over time - a kind of Multi Business Model Knowledge Ecosystem where the Process Manager must be flexible and try to facilitate the MBMI work in a non-linear process. The Process Manager facilitates the MBMI processes and team work by communicating in very different comments and by most Open, investigative questions rather than giving the answers. The Process Managers seem to use the body language in an active, smiling and happy way that creates a positive, comfortable atmosphere with positive emotions (Graziotin et al., 2014) in the B-Labs. The Process Manager uses conscious the MBMI B-Lab and tools to show the students how tools can help them structure, analyse a create knowledge (new BM's) by the BMI case work.

8 Further Research

We are aware that this preliminary study regarding the Process Manager's communication must be followed by several research initiatives. Now a new course in MBMI processes in 3 B-Labs are planned to be completed in June-July 2019. Each B-Lab will be equipped with the second generation of the video monitoring equipment less intimidating for the participants, partly technically better with audio and included in the same file. And based on this paper it will be possible to encode all communication according to the different types of comments, answers, and questions found in this paper, in order to verify our initial data.

References

- Andersen, G. K., Flarup, J., & Lindgren, P. (2018). *Business Model Innovation. Coaching in a Three-Dimensional Continuum*. Paper presented at the IFKAD 2018, Delft. <https://www.ifkad.org/previous-editions/ifkad-2018/>
- Bang, J., & Dalsgaard, C. (2005). Samarbejde - Kooperation eller Kollaboration? (Teamwork-cooperation or collaboration?). *Videndeling og samarbejde på nettet*, (Journal, Electronic). Retrieved from http://www.forskningsnettet.dk/sites/forskningsnettet.dk/files/File/LOM/bang_dalsgaard_5.pdf

- Blackman, A., Moscardo, G., & Gray, D. E. (2016). Challenges for the Theory and Practice of Business Coaching : A Systematic Review of Empirical Evidence. *Human Resource Development Review*, 15(4), 459-486. doi:10.1177/1534484316673177
- Chesbrough. (2007). *Open business models : how to thrive in the new innovation landscape*. Boston, Mass.: Harvard Business School.
- Chesbrough. (2010). Business Model Innovation: Opportunities and Barriers. *Long Range Planning*, 43(2), 354-363. doi:https://doi.org/10.1016/j.lrp.2009.07.010
- Drobe. (2017). Promo Video for TBMI Challenge 2017 Biogas 2020 in Skive. VIMEO <https://vimeo.com/320340659>: CGC, Aarhus University.
- Due, B. L., Asmuß, B., Nielsen, M. F., & Gravengaard, G. (2016). *Kommunikation i internationale virksomheder 1 (Communication in international Businesses)*. Viborg, Danmark: Samfundslitteratur.
- Gade, M. (2018). theBeeBusiness. Retrieved from <http://thebeebusiness.com/>
- Gassmann, O., Frankenberger, K., & Csik, M. (2014). Revolutionizing the Business Model. In O. Gassmann & F. Schweitzer (Eds.), *Management of the Fuzzy Front End of Innovation* (pp. 89-97). Cham: Springer International Publishing.
- Graziotin, D., Wang, X., & Abrahamsson, P. (2014). Happy software developers solve problems better: psychological measurements in empirical software engineering. *PubMed PeerJ*, 11;2:e289. doi:10.7717/peerj.289
- Horn Rasmussen, O., & Lindgren, P. (2016). Two Black Boxes: Understanding the Coherence between Business Models & Business Model Eco Systems – A Contribution toward a Definition of the Object for Business Model Innovation and the Question of “Where to Look”? *Journal of Multi Business Model Innovation and Technology*, 3(3), 87-132. doi:https://doi.org/10.13052/jmbmit2245-456X.331
- Højberg, H. (2014). Hermeneutik. Forståelse og fortolkning i samfundsvidenskaberne (Hermeneutics. Understanding and interpretation in the social sciences). In L. Fuglsang, P. Bitsch Olsen, & K. Rasborg (Eds.), *Videnskabsteori i samfundsvidenskaberne : på tværs af fagkulturer og paradigmer* (3. ed., pp. 320). Frederiksberg: Samfundslitteratur.
- IDEO. (2019). IDEO. Retrieved from <https://www.ideo.com/about>
- Jensen, I. (2004). The practice of intercultural communication - reflections for professionals in cultural meetings6(Journal, Electronic). Retrieved from rucforsk.ruc.dk website: <https://rucforsk.ruc.dk/ws/files/57416906/jensen-practice.pdf>
- Jordan, B., & Henderson, A. (1995). Interaction analysis: Foundations and practice. *The Journal of the learning sciences*, 4(1), 39-103.
- Järvi, K., Almpantopoulou, A., & Ritala, P. (2018). Organization of knowledge ecosystems: Prefigurative and partial forms. *Research Policy*, 47(8), 1523-1537. doi:https://doi.org/10.1016/j.respol.2018.05.007
- Launsø, L., Rieper, O., & Olsen, L. f. (2017). *Forskning om og med mennesker : forskningstyper og forskningsmetoder i samfundsforskning* (7 ed.). Kbh.: Munksgaard.
- Lindgren. (2016). The Business Model Eco – System. *Journal of Multi Business Model Innovation and Technology*, 4(2), 1-50.
- Lindgren. (2017). Advanced Business Model Innovation. *Wireless Personal Communications*, 95(1).
- Lindgren. (2018). *The Multi Business Model Innovation Approach: Part 1 The Multi Business Model Approach* (1 ed. Vol. 244). River Publishers Lange Geer 44 2611 PW Delft The Netherlands: River Publishers.
- Lindgren, & Jørgensen. (2012). Towards a Multi Business Model Innovation Model *Journal of Multi Business Model Innovation and Technology*, 1-21.
- Lindgren, & Rasmussen. (2013). The Business Model Cube. . *Journal of Multi Business Model Innovation and Technology*, 1(3). Retrieved from River Publishers website:

- Lindgren, Rasmussen, & Saghaug. (2013). *Business models relations to Intellectual Capital - How to release Intellectual Capital* Paper presented at the IFKAD, Zagreb Croatia
- Lindgren, Valter, Tonchev, Manolova, Neshov, & Poulkov. (2019). Digitizing Human Behavior with wireless sensors in Biogas 2020 Technological Business Model Innovation challenges. *In press; Wireless Personal Communications*.
- Lindgren, Valter, P., & Andersen, G. K. (2018). Sensing Multi Business Model Innovation via Advanced Sensor Technology. *Nordic and Baltic Journal of Information and Communications Technologies*, 2018(1), 1-18. doi:<https://doi.org/10.13052/nbjict1902-097X.2018.002>
- Løw, O. (2009). *Pædagogisk vejledning : facilitering af læring i pædagogiske kontekster (Educational guidance: facilitation of learning in educational contexts)*. Kbh.: Akademisk Forlag.
- Madsen, B. (2016). *Processer & procesledelse. Håndbog for konsulenter, vejledere, undervisere & ledere (Processes & process management. Manual for consultants, supervisors, teachers & managers.)* (1 ed.). Denmark: Dansk Psykologisk Forlag A/S.
- Mezirow, J. (2009). *Transformative Learning in Practice : Insights from Community, Workplace, and Higher Education*. San Francisco, Calif.: Jossey Bass.
- Nonaka, I., & Takeuchi, H. (1996). The knowledge-creating company: How Japanese companies create the dynamics of innovation. *Long Range Planning*, 29(4), 592. doi:[https://doi.org/10.1016/0024-6301\(96\)81509-3](https://doi.org/10.1016/0024-6301(96)81509-3)
- Osterwalder, A., Pigneur, Y., & Tucci, C. (2005). Clarifying Business Models: Origins, Present, and Future of the Concept. *Communications of the Association for Information Systems*, 16. doi:10.17705/1CAIS.01601
- Scharmer, C. O. (2009). *Theory U : learning from the future as it emerges : the social technology of presencing*. San Francisco, Calif.: Berrett-Koehler Publishers, Inc.
- Simonsen, J., & Robertson, T. (2013). *Routledge International Handbook of Participatory Design*. London, UNITED KINGDOM: Routledge.
- Stelter, R. (2002). *Coaching - Læring - Udvikling (Coaching-Learning Development.)* (R. Stelter Ed.). Copenhagen: Psykologisk Forlag A/S.
- Taran, Y. (2011). Rethinking it All.
- Teece, D. J. (2010). Business Models, Business Strategy and Innovation. *Long Range Planning*, 43(2), 172-194. doi:<https://doi.org/10.1016/j.lrp.2009.07.003>
- TOMM, K. (1988). Interventive Interviewing: Part III. Intending to Ask Lineal, Circular, Strategic, or Reflexive Questions? *Family Process*, 27(1), 1-15. doi:10.1111/j.1545-5300.1988.00001.x
- Tuckman, B. W., & Jensen, M. A. C. (1977). Stages of Small-Group Development Revisited. *Group & Organization Studies (pre-1986)*, 2(4), 419.
- University of Aarhus, B. (2019a). Introduction to the programme: Master of Science in Engineering - Technology-Based Business Development
- Retrieved from <http://kandidat.au.dk/en/technologybasedbusinessdevelopment/>
- University of Aarhus, B. (2019b). TBMI Course Catalogue. Retrieved from <http://kursuskatalog.au.dk/en/course/81201/Technological-Business-Model-Innovation>
- Valter, P. (2017, 6-9 Nov. 2017) *Interview at Biogas 2020 conference/Interviewer: D. Video*. CGC, Aarhus University Vimeo online <https://vimeo.com/320340659>.
- Valter, P. (2018). *Engineering setup & Laboratory Experiments in: Novelty of Laboratory Measurement Tools in Multi Business Model Innovation*. (PhD dissertation), Aarhus University, Department of Business Development and Technology (BTECH), Denmark.
- Valter, P., Lindgren, P., & Prasad, R. (2018). Valter's Seven Forces; a Model for Analyzing the Forces Affecting the Business Model Innovation Process. *Nordic and Baltic Journal of*

Information and Communications Technologies, 2018(1), 47-64.
doi:<https://doi.org/10.13052/nbjict1902-097X.2018.004>

Wichmann-Hansen, G., & Jensen, T. W. (2013). Kapitel 5.1. Processtyring og kommunikation i vejledning. . In L. Rienecker, P. S. Jørgensen, J. Dolin, & G. H. Ingerslev (Eds.), *Universitetspædagogik* (1 ed., pp. 329-338). Denmark: Samfundslitteratur.

Zott, C., Amit, R., & Massa, L. (2011). The Business Model: Recent Developments and Future Research. *Journal of Management*, 37(4), 1019-1042. doi:10.1177/0149206311406265

Studying the Role of Knowledge Sharing Practices for Augmenting Business Model Innovation via Innovation Speed and Innovation Quality: a Study on IT Companies in Pakistan

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Abstract

The study seeks to investigate the impact of explicit and implicit knowledge sharing on business model innovation of IT Companies in Lahore (Wu et al., 2013), Pakistan through intervention of innovation speed and innovation quality. Based on the tentative deductions derived from Knowledge Based View (KBV) of information technology companies, this paper employs Partial Least Square for Structured Equation Modeling in order to investigate these hypotheses. Sample in the intended cross-sectional study contains empirical analysis performed on primary data collected from knowledge workers employed in IT companies. This envisioned investigation highlights the vivacious role of knowledge sharing within IT based firms that with the sharing of both implicit and explicit knowledge capital entrenched in the form of hidden intangible experiences, perceptions, behaviors, attitudes and as well as coded information in the documents and systems promote the strengthening of innovation capability of their existing business models. Thus, it has been found that business model innovation of IT companies can only be achieved when these firms quickly and more effectively come up with novel and breakthrough ideas, develop and launch new products & services, design and adopt new

business processes and solve business problems as compared to their competitors supported by critical knowledge sharing comprising of explicit and implicit knowledge. This study has significant practical implications for the knowledge workers working in IT based firms committed to increase the innovation capacity of their business model and process through common perspectives of shared experiences and information platforms. Knowledge sharing will thus help them utilize the integrated and collective information capital in order to produce effective, efficient, high speed and superior quality driven innovation in their IT services to reach and equally meet their customers' demands. Thus through resultant innovation in their firms' business model, IT managers can help their organizations gain sustained edge ahead of their competitors. Customer satisfaction and long-standing competitive advantage can be evidently achieved through sharing of innovation building explicit and implicit critical knowledge throughout the organization.

Key Words - Knowledge Based View, Knowledge Sharing, Explicit Knowledge, Implicit Knowledge, Innovation Quality, Innovation Speed, Business Model Innovation, Information Technology

Paper type – Academic Research Paper

1 Introduction

Business Model Innovation signifies an unusual, novel and further holistic idea of organizational innovation that requires for theory testing and analysis. According to the former research studies and data collected from executives of different organizations, Business Model Innovation (BMI) has been considered to be an integral source of continual value creation of the business and long term competitive advantage for the organization (IBM Global Business Services, 2006; Economist Intelligence Unit, 2005). Resultantly Business Model Innovation has considerably positive impact on the performance of the firms under ever changing external business environmental circumstances (Zott & Amit, 2007; Cucculelli & Bettinelli, 2015). Innovation in firms' business models and architectures with their remarkable positive outcomes on their performance warrant for studying the role of knowledge management practices for supporting BMI taking into account both empirical and conceptual research for generating better apprehension.

Various research studies in recent past have defined Business Model Innovation as the replacement in business model of the company to offer entirely novel and innovative products and services to the customers (Mitchell & Coles, 2004); the process of discovering a new business mode in already surviving business of the company (Markides, 2006); reconfiguring existing business model activities toward new product or service market (Santos et al., 2009), challenging current BMs, roles and responsibilities of a company for establishing innovative and unique worth of the business (Aspara, Hietanen & Tikkanen, 2010), involves an organization adopting new approach to making business profits utilizing company's principal assets (Gambardella & McGahan, 2010), discovering and creating new profit sources exploring unique value proposition

arrangements (Yunus et al., 2010), bringing change in existing norms of business model retailing thus changing organizing sense of the retailers for creating business value (Sorescu et al., 2011), re-conceptualizing the material content, authority and structure of the company to revolutionize its existing business model (Amit & Zott, 2012).

Similarly other research have defined BMI as the method or practice of intentionally altering the fundamental elements of the company and its operational logic (Bucherer et al., 2012), the process that involves changing and improving at the minimum of a company's value scopes (Abdelkafi et al., 2013), a transformation in the alleged reasoning of creating value for the business (Aspara et al., 2013), generating business commercial value by introducing a novel business model (Berglund & Sandstrom, 2013), creating and seizing new value proposition for a business' stakeholder by exploring new firm's judgments to institute new ways for profit orientation (Casadesus-Masanell & Zhu, 2013) and activities heading from making gradualist change in singular components of business model, extending existing or announcing new adjacent business models, disrupting previous business model or substituting existing with an entirely new business model through bringing fundamental change in the organization's product and service offerings and processes (Khanagha et al., 2014).

Likewise, a more comprehensive definition of Business Model Innovation has been introduced by Foss and Saebi (2017) that defines BMI as the process of bringing novel, planned and unique changes in the fundamental features of the business model of the firm and its holistic architecture under the commitment and support from top management under the theoretical foundations of Complexity Theory. Former researchers tried to sort out Business Model Innovation (BMI) in diverse terms such as operational, economic and strategic intent of the business innovation (Morris, Schindehutte & Allen, 2005) describe three categories – economic, strategic and operational. Major chunk of the research in Business Model Innovation has been focused on domain of IT and strategic concerns in innovation management and IT Management (Zott et al., 2011). Business model usually echoes key themes such as narratives of resource based view (RBV), transactive configurations, the landscape of the future opportunities, nature of innovation process, organizational design and sense making (George & Bock, 2011). Business Model Innovation has been characterized under three distinct research streams that hold as rudiments of BMI, fundamental elements and procedure of BMI and the outcomes achieved through BMI execution (Schneider & Spieth, 2013; Spieth, Schneckenberg & Ricart, 2014).

Based on a quantitative survey conducted on 138 KM managers from sixty eight technological enterprises in Pakistan, this study capitalizes upon structure equation modelling (SEM) to examine the tentative hypotheses. This research paper differs from earlier research works in three different ways. Primarily, none of studies have related knowledge sharing with business model innovation directly, in this case, current study would be an essential contribution toward closing this gap. Besides, the attempt of this paper is to additionally explore the working of the mechanism of knowledge sharing practices and business model innovation by analyzing the mediating or intervening role of innovation capacities to ensure the affirmance of the theoretical model. Lastly, through

deliberating the effect of categorical and implicit/implied knowledge sharing processes on innovation quality and innovation speed which as a result lead to higher business model innovation, the intended study attempts to offer that when confronted with varied uncertain business requirements and work situations in the future in long term the managers and employees must put emphasis on key processes and behaviors of implicit and explicit knowledge sharing so as to devise consistent strategies in the organization.

2 Literature Review

Exaggerated by the unclear and imprecise understanding of the connotation of business model and mislaid theoretical foundation for this concept itself, the newfangled research field focusing on Business Model Innovation (BMI) bears dearth of foundation for studying its characterization and its antecedents that lack in a structured theoretical base (Morris et al., 2005; O'Connor & Yamin, 2011; Zott et al., 2011). Parallel to this, the interaction based and relational research studies for business model innovation appear to be scarce across wide range in multidisciplinary perspective due to its conceptual isolation and keeping it in silos (Zott et al., 2011). Diverse other literature based studies such as strategic management, innovation management and entrepreneurship provide support to researching the nature and configuration of business model innovation and these researches are still scarce in nature. Resultantly, it can be inferred that the domain of BMI carries insufficiency in terms of large scale systematic and theory driven scientific support of literature, and therefore this is an important need to develop greater apprehension of the given occurrence (Bock, Opsahl, George & Gann, 2010).

Organizations in contemporary business arena consider it vital to actively respond to the changes occurring in the external business environment and use business model innovation as an integral component of creating business value under extreme business turbulence (Pohle & Chapman, 2006). Moreover, this lack of interactions and relational research studies are important need of time in understanding the key enablers of business model innovation, this underpinning of novel BMI idea necessitates the need for develop an advanced understanding of this impression and drives the elevated interest for researching this topic. In concern of this call for research, the requirement for taking a gestalt orientation of the existent literature on BMI and basing upon the prevailing patterns of researches conducted and contributions made, here comes the time to realize the relational edifice guiding the roadmap for prospective research on BMI under the support of knowledge based view.

Massive rise in emerging trends of globalization in business arena, transformations in behaviors of people representing diverse cultural backgrounds and breakthrough advancement in technology are some of the significant triggering elements for organizations to bring innovation in their business models (Lee et al., 2012; Wirtz et al., 2010). Based on the premise of Knowledge Based View (KBV), it is important to conceptualize the existing research agenda based on the role of knowledge management practices in facilitating business model innovation (Malhotra, 2000). The knowledge base and cognitions of knowledge workers are important in stigmatizing the business

transformation and innovation processes (Aspara et al., 2010). According to the strong argument posed by Doz and Kosonen (2010) 'Strategic Agility' has been considered as a vital player for stimulating business model innovation, which claims that inertia and inaction rising as a result of shielding the existing business process constantly in practice, brings elevated challenges while incurring innovation and revolution in existing business models of the firms. Strategic Agility thus denotes the capacity of an organization to proactively anticipate and foresee the external business complexities and turbulence and quickly respond to these unpredictable vicissitudes occurring in the environment (Yusuf et al., 1999; Sambamurthy et al., 2003; Li et al., 2009; Sull, 2009).

Strategic Agility is one of the important prerequisites of business model innovation and must therefore contain three primitive capabilities including unity of leadership, strategic understanding and resource flexibility (Doz & Kosonen, 2008, 2010). Companies thrive for innovating their existing business models rapidly, recurrently, and more comprehensive than their previous practices. Idea generation is also a strong pillar for business model innovation that is driven by the knowledge sharing practices promoted through individual employee inputs and efforts (Björk, 2012). Knowledge sharing supports a collaborative environment supportive of innovation in business model by novel idea generation (Eppler et al., 2011). Business model innovation is an evolutionary continuous learning process that entails innovation made as a result of ongoing external environmental changes (Dunford et al., 2010; Sosna et al., 2010; Chantal & Caron-Fasan, 2010; McGrath, 2010; Demil and Lecocq, 2010). This evolutionary business model innovation is contingent upon double-loop erudition (Moingeon & Lehmann-Ortega, 2010).

Knowledge ecosystems play a contributory role toward support business model innovation (Valkokari, 2015). Knowledge ecosystems are main drivers of novel knowledge creation and innovation under collaboration knowledge sharing, research and development in the organization. More focused toward 'Knowledge Exploration', knowledge ecosystems adhere to the aim of new knowledge generation that is commonly supported by tech-entrepreneurs (Valkokari, 2015).

Businesses can essentially drive their value and effectively realize their potential through adopting a customer-centric approach. This requires them to deliver high customer value and make huge profits by appealing the customer to pay higher for the value they get (Teece, 2010). One other important element for business model innovation and value creation is to manage the knowledge resource of the customers (Rollins & Halinen, 2005). For this, the firms need to interact more with their customer and share their knowledge and ideas. Hence, a two-way interaction between firms and customer promotes enhanced and value-focused sharing of knowledge among the users. (von Hippel, 1994; Franke & Shah 2003; Baldwin et al., 2006). It is therefore important to accomplish the flow and sharing of knowledge within the organization as well as between the firm and its customers and is considered as one of the critical teamsters of business model innovation in IT companies (Novo, 2004; Smith & McKeen, 2005).

Previous research studies reveal a dearth of literature and empirical support toward understanding the link between knowledge dissemination and sharing practices and

business model innovation. Despite of former researches discussing the role of technology oriented support for knowledge administration and business model innovation, the relationship, process and mechanism between implicit and explicit knowledge sharing for result oriented innovation in business models of firms (Amit & Zott, 2001; Rowley, 2002; Zott et al., 2011). Technology platforms provide strong impetus for promoting access and sharing of critical business and customer knowledge and hence, remain supportive for raising the value capture and delivery. As a result, business model innovation supported by value creation, capture and delivery eases the organization in increasing the streams of revenue streams through rigorous reduction in cost (Wu et al., 2013).

Based on the logic of Knowledge Based View (KBV), the knowledge capital and related resources act as levers of an organization's strategic assets to increase organization's long term performance and accomplish sustained competitive advantage in times of high dynamism, competition, complexity and external environmental uncertainty (Grant, 1996; Donate & Guadamillas, 2015; Obeidat et al., 2016; Obeidat et al., 2016). Knowledge Based View in addition also advocates that any organization's ability of value creation and innovation depends upon its capability to generate, share and apply the information (Martelo-Landroguez & Cepeda-Carrión, 2016). Capacity for amplified innovation and performance of knowledge intense firms depends upon effective knowledge management practices (Obeidat et al., 2016).

Knowledge intensive IT based firms have basic involvement in advanced learning, creating, designing, retaining and sharing of knowledge through all the organizational levels. Hence, these play a significant role in financial development and financial growth of a nation through continuous innovation and improvements in their business models (Ahmad et al., 2015; Fullwood & Rowley, 2017). According to various distinguished research studies, knowledge management processes and practices have been referred to as the set of activities relevant to the acquirement, generation, sharing and effective application or utilization of the knowledge resources. These practices ultimately lead toward higher innovation in business model and competitiveness of the organizations (Nonaka & Takeuchi, 1995; Darroch, 2005; Obeidat et al., 2016). IT companies are characterized as knowledge intensive organizations as they help their knowledge workers share their explicit and implicit knowledge capital in in order to achieve exceeded Return on Investment (ROI) in terms of amplified innovation in business model and processes, business performance and value (Rodríguez-Gómez and Gairín, 2015; Fullwood & Rowley, 2017; Yasir et al., 2017; Masa'deh et al., 2017).

Knowledge sharing is describes as one of the key enablers of implementing a successful and effective change in the organization in order to bring breakthrough transformations in business model on continuous basis (Imran et al., 2017). Several researches conducted by preeminent authors such as Gold et al. (2001), Ho (2009), Zack (2009), Ngah et al. (2016), Martelo-Landroguez & Capeda-Carrión (2016) and Valaei et al. (2017) cogently claimed that enabling factors and practices of knowledge management supported by a coherent and an integrated strategy for knowledge management are vital for the sustenance of effective and efficient sharing of implied and codified knowledge,

thus resulting in superior quality and speed of innovation processes which ultimately lead to higher business model innovation.

Majority of former literature studies discussed and stressed upon incremental/radical or competence/structural innovations in products, services and process, yet a very little emphasis has been laid on business model innovation (María Ruiz-Jiménez & del Mar Fuentes-Fuentes, 2013; Chahal & Bakshi, 2015). Nevertheless, a few research studies in addition have been conducted studying the impact of knowledge sharing practices on business model innovation with intervening role of innovation quality and speed (Wang, Sharma & Cao, 2016; Wang et al., 2016). The capability of an organization to accelerate and fast-track the advancement and commercialization of company's products and services for gaining and sustaining long term competitive advantage is known as Innovation Speed (Allocca & Kessler, 2006). Contrary to this, Innovation Quality enabled by knowledge sharing practices refers to process performance responsible for bringing business innovation and long term competitiveness (Haner, 2002).

It has been found that innovation speed and innovation quality, both play key mediating roles in accelerating the mechanism of business innovation when knowledge sharing incurs a positive impact on them (Wang & Wang, 2012; Wang, Wang, Cao & Ye, 2016; Wang, Sharma & Cao, 2016). Therefore, it has been supported that knowledge sharing both innovation quality and speed both can prove to be the crucial mechanisms in boosting the BMI and performance of the company. Still there exists a blur view of the intervening role of innovation quality and speed with respect to the impact that knowledge sharing practices have on business model innovation in IT industry upon reviewing the past literature studies. Alongside much stress have been focused toward developing a strong understanding on the relationship of KM practices and capabilities on driving innovation and performance of the companies. These practices involve attaining, sharing disseminating and applying the knowledge resources of the organization effectively and efficiently for accomplishing breakthrough achievements and boosting organizational performance (Asiaei & Jusoh, 2015; Ramadan et al., 2017).

According to Yang et al. (2005), a mechanism, tool or the process that enables the distribution or dissemination of knowledge base and information capital inside the organization is known as knowledge sharing (Yang et al., 2005). Knowledge sharing provides important source for establishing collaboration among the individual stakeholders of the organization (Tan & Md Noor, 2013). Knowledge sharing comprising of both explicit and tacit knowledge within the organization promotes the inclination of an organization toward unique idea creation and implementing those novel ideas, discoveries and inventions in their business model in order to devise new strategies or managerial procedures and develop & launch new products and services, new ways of doing things and innovative technology (María Ruiz-Jiménez & del Mar Fuentes-Fuentes, 2013; Chahal & Bakshi, 2015). Given the dynamics and complexities of contemporary business era and external business environment, there is a fundamental necessity for realizing the role of innovation quality and speed supported through sharing of critical knowledge within the organization to bring consistent innovations in the business models

(Wang, Sharma & Cao, 2016; Wang, Z., Wang, Cao & Ye, 2016; Iqbal, Latif, Marimon, Sahibzada & Hussain, 2019).

The rate at which the process ranging from generation of novel idea to ultimately commercializing or the capability of an organization to accelerate or fast-track the process of designing new products or processes fast analogous to its rivals in the given sector of industry is known as Innovation Speed (Allocca and Kessler, 2006; Wang et al., 2016; Wang, Sharma and Cao, 2016). It stems from the team based aptitude and competence that assists a firm in responding actively and promptly to the ever-changing needs and demands of the customers (Slater & Mohr, 2006). Innovation speed within the context of information technology based organizations entails the capability or competency of IT firms to lead launch of new IT solutions, tech advancements, software and customer services that are fitting enough to efficiently and effectively meet the requirements and face complex challenges in turbulent technological and economic environment external to their business.

Contrary to this Innovation Quality pertains to the nature of processes and action along with the end outcomes and results of innovation process (Haner, 2002). The value added to the customer, product & service flexibility and aesthetics, dependability, cost and process effectiveness (Haner, 2002; Wang & Wang, 2012). Referring to the context of IT based companies, quality of innovation is characterized by its capability to offer and deliver innovation IT solutions and tech-enabled services more competitive relative to the competitors and appropriately aligned with the global, economic and social needs of society at large.

‘Knowledge’ is referred to as an information that enables decision making and action in an organization (Beccaera-Fernandez, 2004). Cooper (2007) defined “knowledge” as an information that is organized and structured in nature after the detailed validation and cognition process. Knowledge major comprises of two forms i.e. tacit and explicit knowledge (Nonaka, 1994). Tacit or implicit knowledge pertains to the routines or processes in an organization that stem from the practices and experiences retained through action and learning from performing those processes or actions (Choi & Lee 2003). Contrary to this, explicit knowledge is characterized as the information that can be easily created, picked, followed and stored (Keskin, 2005). The strategy of knowledge management involves both the personalization and codification of the knowledge base of critical organizational knowledge based on the type of knowledge been focused (Burn et al., 2012). Codification of knowledge involves ‘people to documents’ plan that entails acquiring and retaining the explicit or written knowledge in form of databank or record for providing an ease of accessibility and usage to other people (Hansen et al., 1999). On the other hand, the other KM strategy is known as ‘Personalization’ strategy that involves ‘person to person’ plan for providing tailored services to the internal and external stakeholders. Majority of focus is emphasized upon the discussion and negotiations among the individual employees rather than storing the knowledge and information in written record forms. (Greiner et al., 2007).

Sharing of explicit and implicit knowledge has two intervening outcomes before it leads toward eventual business model innovation and higher business performance

(Allocca & Kessler, 2006), higher innovation efficiency (swiftness) and effectiveness (excellence). 'Innovation Speed' has been demarcated as the eventual commercialization of some novel services and products in the market. It echoes the capability of a firm to accelerate or fasten the actions, processes or activities and responsibilities for gaining and sustaining long term competitive advantage comparative to company's competitors in the given industry having most squeezed product life cycles (Allocca & Kessler, 2006). Innovation Quality involves higher customer value, higher degree of innovation, process and product complexity, reliability, time effectiveness, and value addition. This comprises of creating sense regarding accumulated innovation performance in each of the domains within the organization. The innovation outcomes are compared with potential and bearing in mind the procedure on how have the results been accomplished (Lanjouw & Schankerman, 2004; Haner, 2002).

Knowledge sharing in organizations helps them capitalize upon new opportunities for providing breakthrough solutions to the customers and efficiently solving business problems in order to realize competitive advantage in industry (Reid, 2003). Earlier research studies by Hogel et al. (2003) defined knowledge sharing as a culture based on social interfaces involving the give-and-take of knowledge, skills, abilities, and experiences of employees throughout the organization. The process of knowledge sharing can occur at multiple organizational tiers such as individual or organizational level. With respect to the context of an organization, the sharing of knowledge comprises of seizing, shaping, reprocessing and transmitting experience based explicit and tacit knowledge existing within the organization and making it readily available to all the concerned individuals in the organization. Concerning the connotation of knowledge sharing at individual level involves interacting and discussing with the organizational employees in order to facilitate them perform more efficiently, effectively and productively. Former research studies have proven that knowledge sharing acts as one of the key enablers of enhanced innovation and performance of the firm through efficient resource utilization in the company (Calantone et al., 2002; Scarbrough, 2003).

Ever since, business model innovation results in redesigning the competitive atmosphere and exploring and shaping new opportunities in the market; several drivers and precursors have been proposed using multiple approaches based on the groundings of Knowledge Based View (KBV) of the organization (Chandy & Tellis, 1998; Smith & Tushman, 2005). The elementary premise of Knowledge Based View (KBV) entails that innovation and new product development are chiefly the function of an organization's capability to manage, retain and generate new knowledge (Grant, 1996). Similarly, research studies conducted by Bierly and Chakrabarti (1996) and DeCarolis and Deeds (1999) greatly emphasized the effect of knowledge based approaches on innovation in the organization. Latest developments in research have advocated that the knowledge base of a firm is considered as its chief unique asset and a distinct resource that stimulates drastic innovation based developments in the company (Hill & Rothaermel, 2003; Subramaniam & Youndt, 2005; Miller, Zhou & Wu, 2010; Fern & Cardinal, 2007).

Nevertheless, existent literature studies propose contradictory views concerning the ways by which speed and quality of the innovation produced in terms of explicit and

implicit knowledge sharing affect business model innovation. It has been advocated that the organizations with more knowledge sharing either explicit or implicit fairly promote innovation in business characterized by integrating new components of knowledge and generating pioneering and radical ideas in the organization (Taylor & Greve, 2006). Existence of broad and rich knowledge base comprising of diverse, gathered observations facilitates the understanding of novel information and need for required changes. This in turn enhances an organization's ability to sense isolated market or technological opportunities in order to execute its thorough innovation (Chesbrough, 2003).

In contemporary business era characterized by knowledge-based and highly dynamic economy, the competencies and resources are considered as integral factors of companies to survive in highly dynamic, competitive and turbulent environment (Teece, Pisano, & Shuen, 1997; Subramaniam & Youndt, 2005). The competitive advantage gained and sustained by companies in their future will depend upon the resources of essential and critical knowledge held by the workers that will actively replace their factors of production, or what is known as knowledge workers. Knowledge therefore must be considered as one of the key intangible assets of an organization managed elaborately. Keeping in view this expansive concern towards the essentiality of the knowledge, researchers and industry experts have put maximum emphasis on organizations to develop and enhance their capability toward knowledge identification, capturing, creation, sharing and accumulation (Nonaka & Takeuchi, 1995; Kogut & Zander, 1996; Jang et al., 2002; Michailova & Husted, 2003).

The effectiveness of highly innovative business models of the organizations chiefly depends on the content and process of knowledge sharing among different levels of an organization (Pentland, 1995; Huseman & Goodman, 1998; Argote & Ingram, 2000; Alavi & Leidner, 2001). Behaviors and processes of knowledge sharing have been identified to be the key contributors toward generating a wide range of firm's capabilities and competencies for instance innovation and consequently enhanced performance of the company (Kogut & Zander, 1996). Nevertheless, being a very difficult process, yet has marvelous positive outcomes in terms of reducing costs of production (Hansen, 2002; Cummings, 2004; Hansen, Mors, & Lovas, 2005; Arthur & Huntley, 2005), fast paced development of new products, improved company's performance with increased growth in sales and revenues, and high innovation outcomes (Lin, 2007; Collins & Smith, 2006; Mesmer-Magnus & DeChurch, 2009).

Speed and quality of knowledge sharing activities always have been identified as the intervening variables between knowledge sharing and performance of the companies, since the practices of sharing knowledge among employees (Davenport & Prusak, 1998) in the organizations never directly result in improving and enhancing any company's performance unless some intermediary outcomes are involved (Choi & Lee, 2003; Hsu, 2008; Law & Ngai, 2008). Based on premise of KBV of firms, the drive of current study is to pose that business model innovation is not directly supported by knowledge sharing practices unless they promote effective speed and quality of innovation (Liebowitz & Chen, 2001). Based on the literature of Knowledge Based View (KBV), the major argument of this paper is that practices of knowledge sharing involving both implicit and

explicit knowledge do not merely have a direct positive relation business model innovation but they also encourage superior quality and speed of innovation processes that resultantly support business innovation (Liebowitz & Chen, 2001). Nonetheless, practitioners and researchers have hardly tried to design and execute an integrative and comprehensive model that with a holistic outlook aims to discover the effectiveness and value of knowledge sharing practices. Moreover, very little pragmatic research with empirical testing has been earlier conducted to examine the antecedents and enablers of business model innovation on the premise of Knowledge Based View (KBV) of the organization (Davenport & Prusak, 1998). Therefore, in order to fill this fissure, this research develops a theoretical model to link knowledge sharing practices, intervening processes, and eventually business innovation. This research study examines the effect of knowledge sharing processes on superior business model innovation with mediating intervention of innovation speed and quality (Liebowitz & Chen, 2001).

According to Wang and Noe (2010), sharing of knowledge must be considered as knowledge centered approach, a chief source of assisting employees in shared exchange of their information and knowledge base. This is consequently instrumental to application or execution of knowledge in an effective and efficient manner, ultimately resulting in business innovation and long standing competitive edge of the firm (Wang & Noe, 2010). Based on the conceptualization of Polanyi (1966), Nonaka and Takeuchi (1995) proposed SECI model of knowledge spiral based on “Socialization, Externalization, Combination, and Internalization” of critical knowledge resources both explicit and implicit during the entire process of knowledge creation within the organization. From one angel, the course of both internalization & socialization involves the active role of knowledge sharing in converting the knowledge based capital into individual employee or group based knowledge. Contrary to this, the other side of the coin shows that, the processes of externalization and combination entail the role of knowledge sharing in translating the individual level and group level knowledge into organizational level knowledge (Nonaka & Takeuchi, 1995).

Innovating the existing business models and initiating fresh and novel work situation within the organization are key results of knowledge sharing rehearses and practices (Law & Ngai, 2008) throughout the organization that importantly help in conserving treasured heritage of the organization, alongside learning innovative techniques, solving unique problems through new approaches, and increasing innovation in the organization by developing core competences (Hsu, 2008;; Hu, Horng, & Sun, 2009). Both tacit or implicit and explicit or codified knowledge play instrumental and significant roles in initiating the socialization process and executing combination process respectively within the organization. Similarly the significant roles of implicit and explicit knowledge in knowledge sharing for internalization and externalization of knowledge capital must be acknowledged (Huang, Chen, & Stewart, 2010).

All the noticeable forms of sharing organizational knowledge that are entrenched with any organization come under explicit form of knowledge sharing. Since, explicit knowledge is acquired, codified and disseminated easily in the organization, therefore such visible and evident knowledge circulation practices are seen commonly around the

workplace (Coakes, 2006;). All the organizational mechanisms involving important operations such as formal business processes and procedures, employee or staff handbooks, official business language and IT systems provide considerable support and assistance in sharing the explicit, written or codified knowledge (Huang, Davison, & Gu, 2010). Contrary to this, sharing of tacit, implied or implicit knowledge base is characterized by one-t-one interactions and shared practices of employees in the organization. For effective tacit knowledge sharing, the capabilities and willingness of individual employees to deliver and use the knowledge are chiefly instrumental (Megan et al., 2007; Lin, 2007; Holste & Fields, 2010). Nonaka and Takeuchi (1995) and Polayni (1966) advocated that the basic foundation of the tacit knowledge rests in individual human experiences, this is due to the fact that an individual human being with the help of already within him built in 'social software' can capitalize upon new knowledge.

A lack of willingness or awareness for sharing and using the tacit knowledge might become one of the other cause of difficulties arising in this process. Moreover, employees may also lead to ineffective and inefficient tacit knowledge allotment due to them finding difficulty in articulating this implied knowledge tangled to mental cognitions and bodily movement, as well as coming across absence of relating and executing context defined implicit knowledge in different settings (Holste & Fields, 2010). The problem may result in hindering the quality and speed of the innovation processes within the organization. Nevertheless, these barricades can be seized by developing credulous relationships among individual employees of organization in the process of knowledge sharing (Spender & Grant, 1996; Spender, 1996; Koskinen et al., 2003; Lucas, 2005).

The quality and speed of the innovation process are intervening consequences of the explicit and implicit knowledge sharing processes. Speed of innovation in any organization is characterized by the time lapse or gap between the preliminary development of innovation or novelty comprising its idea generation and delineation and the ultimate launch and commercialization of an innovative product or service in the market (Allocca & Kessler, 2006). Innovation speed redirects an organization's competence to fast-track the tasks and activities for constructing and sustaining a long term competitive edge comparative to its rivals in related businesses condensed product life phases (Kessler & Chakrabarti, 1996; Kessler & Bierly, 2002).

The foundations of innovation speed supports an exemplar swing from more old fashioned and traditional cradles of advantage toward a preemptive strategic positioning that is well suited with present contemporary briskly changing external business environment (Carbonell & Rodriguez, 2006). Innovation speed is considered as vital component for competing in market for it can lead toward greater performance. Previous studies have exposed an optimistic affiliation amid the speed of innovation and modernization of business products & services (Carbonell & Rodriguez-Escudero, 2009; Carbonell & Escudero, 2010). Innovation speed of an organization entails its dependence on socially imbricated capabilities and team synergies that are highly unique and cannot be simply designed or imitated by the competitors (Slater & Mohr, 2006). Therefore, innovation speed resulting in high business model innovation and successful product launch promotes organizations in keeping in close connection with their customers and

appropriately meeting their demands (Tatikonda & Montoya-Weiss, 2001). Likewise, it has been found that fast paced technological advancements, rising competitive rivalry and smaller product life cycle force innovative firms to innovate at fast pace so as to outperform in the competition (Heirman & Clarysse, 2007; Lynn, 2008).

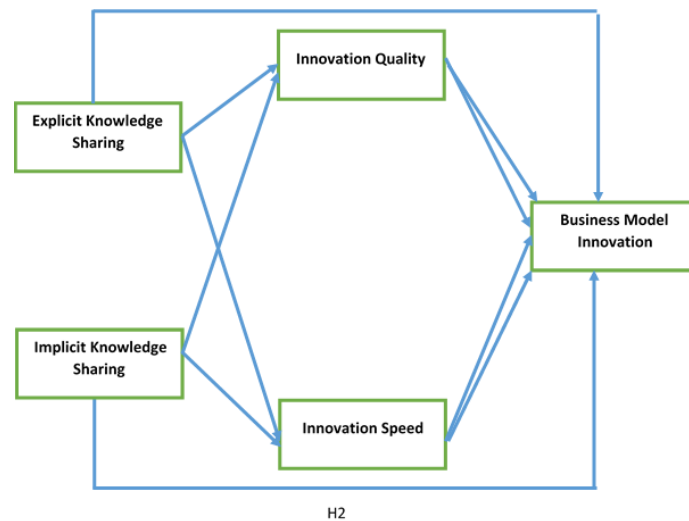
Another important conception in innovation promoted by innovated organizations is the innovation quality (Lin, 2006; Haner, 2002). Innovation quality deals with aggregated performance in product or service innovation through comparative analysis of the consequences on taking account of the process of achieving the results. (Lanjouw & Schankerman, 2004). Since, innovation pertains to a robust link with the creativity or newness of products or services in terms of their quality managed by standardization or customization, adherence to standard operating procedures, and zero tolerance to defects. Therefore, innovation quality with respect to the development of products and services is concerned with effectiveness, aesthetics, features, quantity, reliability, cost, timing, complexity, customer value and extent of innovation (Tseng & Wu, 2007). The quality of innovation is considered as one of the key contributing factors for a company's innovation strategies that assist in achieving competitive advantage. Determining this strategy is very difficult due to augmented process complexity, challenges in determining the catalysts that stimulate innovation, and integrating measurements such as innovation scope, comparative citation ratio, discipline knowledge and citation weighted copyrights and many more (Ng, 2009; Lahiri, 2010).

In context of Knowledge Based View (KBV), there is still an important need for re-conceptualizing the idea of knowledge sharing as facilitator and enabler of business model innovation (Malhotra, 2000). Knowledge sharing is a strategic approach, hence, the business model of the organization defines the rationality of entire system of a business (Al-Debei & Avison 2010). According to Malhotra (2000) and Lin (2006), the extent of organizations' business model innovation is determined by their capability to exploit, create and share knowledge. Organizations when utilize their knowledge sharing capabilities, swift problem solving skills and agile response to external changes may result in business model innovation. Similarly, previous research scholars also have stressed the significance of knowledge sharing in enhancing business model innovation capability (Liebowitz, 2002; Lin, 2006). Effective knowledge management and increased business innovation richly depend on their employees' readiness to share knowledge (Davenport & Prusak, 1998).

The pile stock of knowledge capital is aggregated in through active knowledge sharing that in turn promotes business model innovation when innovation speed and quality play an intervening instrumental role in making knowledge sharing a determining factor for business model innovation. Employees working in groups and at organizational level when share explicit and tacit knowledge, they are more prospective toward innovative idea generation and explore new and innovative business opportunities with high product and service innovation and at fast pace thus resulting in enhanced business model innovation (Darroch & McNaughton, 2002). According to Hansen (1999), knowledge gathering and sharing signify the successful completion of any business innovation project. Business innovation, high absorptive capacity and performance innovation can be

improved by quality and speed ridden innovation promoted through shared knowledge sharing practices (Jantunen, 2005). Unambiguously, any business organization with high aptitude in integrating and sharing organizational knowledge will have more likely chances to encompass rare, unique and inimitable resources, and therefore will have great potential to speedily innovate and produce innovation quality, ultimately endure with maximum business innovation model capability. This study, therefore aims to study the impact of clear and inferred knowledge sharing on sustaining business model innovation of IT companies with an intervening role of innovation quality and innovation speed thus better positioning these firms for longstanding competitive advantage (Lin, 2006).

3 Theoretical Framework



3.1 Methodology

Based on the tentative deductions derived from Knowledge Based View (KBV) of Information Technology Companies, this paper employs Partial Least Square for Structured Equation Modeling for investigating these tentative hypotheses. The sample in current cross-sectional research study comprises of empirical investigation performed on firsthand data gathered from knowledge workers employed in IT based firms using simple random sampling.

3.2 Population of Study and Sampling Technique for Data Collection

The study sample comprises of IT firms in Lahore, Pakistan. According to He and Wong (2004) firms having extensive technology based setup and functioning enjoy the value of knowledge exploring and exploiting activities. Moreover, championing in the innovation entrenched practices through entrepreneurial intentions is also their representative characterization that are vital to gaining and sustaining long standing

competitive advantage by resulting in business model innovation (Grant, 2002; Jansen et al., 2009; Allocca & Kessler, 2006). Technology based organizations take in account a long range of strategies focused on managing knowledge resources including both tacit (routine based) and explicit (codified) knowledge (Yahya & Goh, 2002). Likewise, the influential role of innovation quality and innovation speed should not be undervalued at all as these are fundamental extension to the guidance to steer energy and enthusiasm of employees in pursuit of managing knowledge distinctively in order to support business model innovation (Zott et al., 2011).

The population comprises of Information Technology firms in Lahore, Pakistan, selected as per the specific purposeful bounds having applicability aligned with the aim of this study. An entire list of IT firms 68 in total from Lahore, Pakistan has been chosen according to the practices of Information Technology companies that operate in the domains of business model innovation, information security, customer relationship, knowledge sharing and dissemination to strategically support commercialization of innovative products and services with efficient acceleration and effectiveness through transforming raw information into meaningful one and IT governance and strategy to align IT approaches with the corporate strategy using knowledge management practices for the sustained performance and BMI of these firms (Pakistan Software Export Board).

Primary data will be collected using self-administered survey based questionnaires disseminated in the selected companies recognized as acquiescent with the requirements of this research.

4 Measuring Instruments

The items of the measuring instruments have been adapted from present scales as found in the literature. Some alterations and adjustments have been made in them in order to sync these scales with the Pakistani context. The face validity of all instruments has been obtained from a board of four industry experts currently working at executive and senior management positions in the information technology based companies. Respondents will be requested to label the level of agreement or disagreement across a 5-point Likert Scale denoting 1 = Strongly Disagree and 5 = Strongly Agree. Survey items for each of the constructs are itemized at the end of this study.

The 30 item scale on Business Model Innovation has been adapted from the scale developed by Clauß (2017). The 3 key extents of business model innovation comprise of 'value creation innovation' inquiring about the firms' positioning toward development of new capabilities, technological advancement, partnerships, and processes; 'new proposition innovation' that focuses on asking questions regarding new offerings, markets and customers, networks, and customer dealings and 'value capture/seizure innovation' deals with the organizations' intentions towards introducing new revenue generating models and value cost arrangements.

Likewise, the measuring instrument of Explicit Knowledge Sharing comprises of 6 items pertaining to collection and use of organizational formal documents and reports; information technology systems, and training and development systems. A 7 items scale

for measuring Tacit Knowledge Sharing has been adapted by Wang and Wang (2012) that involves asking respondents on the experiences shared by the employees, their expertise, professional aptitude and learning from the past job experiences.

Innovation Speed has been scaled using 5 items adapted by Liao et al. (2010) and Wang and Wang (2012) that mirror the quickness and speed of IT companies toward generating novel and breakthrough ideas, innovating in launching new products, services, offerings, processes and providing real times competitive solutions to the customer that key rival cannot Liao et al., 2010). The measuring instrument of Innovation Quality comprises of 5 items and has been adapted from Haner (2002), Lahiri (2010) and Wang and Wang (2012) The statements inquire about the inventiveness, novelty and ingenuity of new ideas and concepts, products, services, practices, management and processes currently run with these IT companies.

5 Path Analysis

Cross-Validation Communalities & Redundancy

The authenticity of model strength and fit are determined through cross-validation communalities and redundancy indexes as shown in Table 2.

Correlation Analysis

Table 1 shows the correlation analysis for the model and shows positive correlations among the latent constructs or variables.

Path Analysis or Multiple Regression

The results of first hypothesis (H₁) divulge that explicit knowledge sharing practices hold an insignificant impact on business model innovation in information technology firms. The results of the analysis authorize the presence of an insignificant relationship between explicit knowledge sharing and business model innovation ($\beta = -0.009$, p-value > 0.05). This insignificance vividly declares the non-supporting role of explicit knowledge sharing practices for inculcating effective robustness in innovation of business model of the IT based companies. Besides, path coefficient (β) and the p - value of influence of implicit knowledge sharing on BMI of these companies have been examined. The results grounded on the basis of statistical consideration also do not legalize or support the presence of any considerably impact of implicit knowledge sharing (H₂) ($\beta = 0.023$, p-value > 0.05), on business model innovation of the companies working within the context of technology supported services. Thus, this leads toward the interpretation that that implicit knowledge sharing practices also bear a direct insignificant influence or role in snowballing the innovation in business models of Info-Tech companies.

The results of third hypothesis (H₃) declare that innovation quality does not mediate the impact of explicit knowledge sharing practices on business model innovation in information technology firms. The results of the analysis also do not authorize the presence of any significant mediating role of innovation quality between the relationship of explicit knowledge sharing and business model innovation ($\beta = 0.037$ p-value > 0.01). This insignificant mediating role of innovation quality for making explicit knowledge sharing accelerating BMI obviously states the non-supporting intervening role of quality

of the innovation processes for explicit knowledge sharing practices to inculcate effective robustness in innovation of business model of the IT based companies. Besides, path coefficient (β) and the p - value of mediating influence of innovation speed between explicit knowledge sharing and business model innovation for the IT companies have also been examined. The results grounded on the basis of statistical consideration validate the presence of considerably significantly positive mediating impact of innovation speed in between explicit knowledge sharing (H4) ($\beta = 0.463$, p-value < 0.05), and business model innovation of the companies working within the context of technology supported services. Thus, this leads toward the interpretation that that explicit knowledge sharing practices bear an indirect significant and a positive influence on BMI when with time innovation speed plays an intervening role in cumulating the innovation in business models of Info-Tech companies.

Furthermore, the significant mediating roles innovation quality and innovation speed for assumptions (H₅) and (H₆) respectively have also been supportively confirmed i.e. both innovation quality and innovation speed significantly mediate the relationship between implicit knowledge sharing practices and innovation outcomes of the business models of information technology based businesses ($\beta = 0.687$, p-value < 0.05, $\beta = 0.432$, p-value < 0.05). The estimated results of the path or structured model analysis show the significance of indirect positive effect of implicit knowledge sharing on BMI through the respective intervening connection established by innovation quality and innovation speed.

Table 1: Convergent Validity, Discriminant Validity and Descriptives

Constructs	Mean	S.D.	Series of Loadings	AVE	CR	<i>EKS</i>	<i>IKS</i>	<i>IQ</i>	<i>IS</i>	<i>BMI</i>
Explicit Knowledge Sharing	3.85	1.03	0.60-0.70	0.61	0.68	0.64				
Implicit Knowledge Sharing	4.76	1.86	0.50-0.60	0.50	0.55	0.25	0.56			
Innovation Quality	4.35	1.75	0.81-0.90	0.84	0.82	0.49	0.63	0.85		
Innovation Speed	3.92	1.32	0.65-0.80	0.69	0.71	0.66	0.72	0.23	0.77	
Business Model Innovation	4.59	1.98	0.50-0.80	0.72	0.75	0.11	0.12	0.61	0.54	0.59

All of these item loadings possess p-values significance values < 0.05. Average Variance Explained that is the square root of the variance present among all the variables has been shown as bold highlighted in diagonal.

Table 2: Structured Model Analysis

	Cross-Validation Redundancy	Cross-Validation Communality
Explicit Knowledge Sharing	0.23	0.41
Implicit Knowledge Sharing	0.39	0.28
Innovation Quality	0.48	0.31
Innovation Speed	0.50	0.36
Business Model Innovation	0.49	0.48

Table 3: Path Estimation for Structured Model

Path		t-values (Standardized β Coefficients)		
		<i>Total Effect</i>	<i>Direct Effect</i>	<i>Indirect Effect</i>
Explicit Knowledge Sharing Innovation	→ Business Model	0.39(4.51**)	-0.009(2.10)	
Implicit Knowledge Sharing Innovation	→ Business Model	0.28(3.12**)	0.023(1.98)	
Explicit Knowledge Sharing Innovation	→ Business Model			0.037(1.21)
Explicit Knowledge Sharing Innovation	→ Business Model			0.463(6.41**)
Implicit Knowledge Sharing Innovation	→ Business Model			0.687(5.61*)
Implicit Knowledge Sharing Innovation	→ Business Model			0.432(6.38*)

* p - value < 0.05

** p - value < 0.01

6 Conclusion

This research highlights and puts emphasis on one of the concerning issues being faced by the IT companies today. Current research study is significantly important IT based firms in recognizing the criticality and implications of knowledge sharing practices in boosting their business model innovation. Both explicit and implicit knowledge sharing activities are instrumental to refurbish the innovation capabilities of business models of info-tech companies. Although both explicit and implicit knowledge sharing functions alone do not have a significant impact on business model innovation. However, innovation quality and speed when intervene in between the relationship, implicit knowledge sharing practices are proven to be useful drivers and triggers of business model innovation. Whereas, explicit knowledge sharing plays a key role in assisting IT based firms maximize their speed of innovation in process and hence, lead to have a positive influence on business mode innovation. Implicit knowledge sharing practices are extremely appreciated for technology enabled organizations due to the fact that they provide assistance in maintaining the superior quality of innovation as well as keep it with fast face and up-to-date, thus enhancing the capability of their business models to innovate in highly competitive business market. Business model innovation information technology companies can be assured by using explicit and implicit knowledge sharing in order to capitalize upon the speedy, timely, and competitive and value driven innovation that ultimately drives superb BMI. This research study is in certain an enlightenment for

growing firms in the field of providing technology driven solutions and services to the end users with main focus on business model intensely focused at ensuring quality and timeliness of their innovation through exercising rigorous implicit and explicit knowledge sharing performs.

References

- Abdelkafi, N., Makhotin, S., & Posselt, T. (2013). Business model innovations for electric mobility—what can be learned from existing business model patterns?. *International Journal of Innovation Management*, 17(01), 1340003.
- Ahmad, N., Lodhi, M. S., Zaman, K., & Naseem, I. (2017). Knowledge management: a gateway for organizational performance. *Journal of the Knowledge Economy*, 8(3), 859-876.
- Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS quarterly*, 107-136.
- Al-Debei, M. M., & Avison, D. (2010). Developing a unified framework of the business model concept. *European Journal of Information Systems*, 19(3), 359-376.
- Allocca, M. A., & Kessler, E. H. (2006). Innovation speed in small and medium-sized enterprises. *Creativity and Innovation Management*, 15(3), 279-295.
- Amit, R., & Zott, C. (2012). Creating value through business model innovation. *MIT Sloan Management Review*, 53(3), 41-49.
- Amit, R., & Zott, C. (2001). Value creation in e-business. *Strategic management journal*, 22(6-7), 493-520.
- Argote, L., & Ingram, P. (2000). Knowledge transfer: A basis for competitive advantage in firms. *Organizational behavior and human decision processes*, 82(1), 150-169.
- Arthur, J. B., & Huntley, C. L. (2005). Ramping up the organizational learning curve: Assessing the impact of deliberate learning on organizational performance under gainsharing. *Academy of Management Journal*, 48(6), 1159-1170.
- Aspara, J., Hietanen, J., & Tikkanen, H. (2010). Business model innovation vs replication: financial performance implications of strategic emphases. *Journal of Strategic Marketing*, 18(1), 39-56.
- Aspara, J., Lamberg, J. A., Laukia, A., & Tikkanen, H. (2013). Corporate business model transformation and inter-organizational cognition: The case of Nokia. *Long Range Planning*, 46(6), 459-474.
- Baldwin, C., Hienerth, C., & Von Hippel, E. (2006). How user innovations become commercial products: A theoretical investigation and case study. *Research policy*, 35(9), 1291-1313.
- Berglund, H., & Sandström, C. (2013). Business model innovation from an open systems perspective: structural challenges and managerial solutions. *International Journal of Product Development*, 18(3-4), 274-285.
- Björk, J. (2012). Knowledge domain spanners in ideation. *Creativity and innovation management*, 21(1), 17-27.
- Bierly, P., & Chakrabarti, A. (1996). Generic knowledge strategies in the US pharmaceutical industry. *Strategic management journal*, 17(S2), 123-135.
- Bock, A. J., Opsahl, T., George, G., & Gann, D. M. (2012). The effects of culture and structure on strategic flexibility during business model innovation. *Journal of Management Studies*, 49(2), 279-305.
- Bucherer, E., Eisert, U., & Gassmann, O. (2012). Towards systematic business model innovation: lessons from product innovation management. *Creativity and innovation management*, 21(2), 183-198.

- Calantone, R. J., Cavusgil, S. T. & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance, *Industrial Marketing Management*, 31(6), 515-24.
- Carbonell, P., & Rodríguez Escudero, A. I. (2010). The effect of market orientation on innovation speed and new product performance. *Journal of Business & Industrial Marketing*, 25(7), 501-513.
- Carbonell, P., & Rodríguez, A. I. (2006). The impact of market characteristics and innovation speed on perceptions of positional advantage and new product performance. *International journal of research in marketing*, 23(1), 1-12.
- Carbonell, P., & Rodríguez-Escudero, A. I. (2009). Relationships among team's organizational context, innovation speed, and technological uncertainty: An empirical analysis. *Journal of Engineering and Technology Management*, 26(1-2), 28-45.
- Casadesus-Masanell, R., & Zhu, F. (2013). Business model innovation and competitive imitation: The case of sponsor-based business models. *Strategic management journal*, 34(4), 464-482.
- Chahal, H., & Bakshi, P. (2015). Examining intellectual capital and competitive advantage relationship: Role of innovation and organizational learning. *International Journal of Bank Marketing*, 33(3), 376-399.
- Chandy R. K. & Tellis G. J. (1998). Organizing for radical product innovation: the overlooked role of willingness to cannibalize. *Journal of Marketing Research*, 35(4), 474-487.
- Chanal, V., & Caron-Fasan, M. L. (2010). The difficulties involved in developing business models open to innovation communities: the case of a crowdsourcing platform. *M@ n@ gement*, 13(4), 318-340.
- Chesbrough, H. W. (2006). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business Press.
- Choi, B., & Lee, H. (2003). An empirical investigation of KM styles and their effect on corporate performance. *Information & Management*, 40(5), 403-417.
- Coakes, E. (2006). Storing and sharing knowledge: Supporting the management of knowledge made explicit in transnational organisations. *The Learning Organization*, 13(6), 579-593.
- Collins, C. J., & Smith, K. G. (2006). Knowledge exchange and combination: The role of human resource practices in the performance of high-technology firms. *Academy of management journal*, 49(3), 544-560.
- Cucculelli, M., & Bettinelli, C. (2015). Business models, intangibles and firm performance: evidence on corporate entrepreneurship from Italian manufacturing SMEs. *Small Business Economics*, 45(2), 329-350.
- Cummings, J. N. (2004). Work groups, structural diversity, and knowledge sharing in a global organization. *Management science*, 50(3), 352-364.
- Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Harvard Business Press.
- Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of knowledge management*, 9(3), 101-115.
- Darroch, J., & McNaughton, R. (2002). Examining the link between knowledge management practices and types of innovation. *Journal of intellectual capital*, 3(3), 210-222.
- Demil, B., & Lecocq, X. (2010). Business model evolution: in search of dynamic consistency. *Long range planning*, 43(2-3), 227-246.
- Donate, M. J., & Guadamillas, F. (2015). An empirical study on the relationships between knowledge management, knowledge-oriented human resource practices and innovation. *Knowledge management research & practice*, 13(2), 134-148.
- Doz, Y., & Kosonen, M. (2008). The dynamics of strategic agility: Nokia's rollercoaster experience. *California Management Review*, 50(3), 95-118.
- Doz, Y. L., & Kosonen, M. (2010). Embedding strategic agility: A leadership agenda for accelerating business model renewal. *Long range planning*, 43(2-3), 370-382.

- Dunford, R., Palmer, I., & Benveniste, J. (2010). Business model replication for early and rapid internationalisation: The ING direct experience. *Long Range Planning*, 43(5-6), 655-674.
- Economist Intelligence Unit. (2005). *Business 2010: Embracing the challenge of change*. New York: Author.
- Eppler, M. J., Hoffmann, F., & Bresciani, S. (2011). New business models through collaborative idea generation. *International Journal of Innovation Management*, 15(06), 1323-1341.
- Foss, N. J., & Saebi, T. (2017). Fifteen years of research on business model innovation: How far have we come, and where should we go?. *Journal of Management*, 43(1), 200-227.
- Franke, N., & Shah, S. (2003). How communities support innovative activities: an exploration of assistance and sharing among end-users. *Research policy*, 32(1), 157-178.
- Fullwood, R., Rowley, J., & Delbridge, R. (2013). Knowledge sharing amongst academics in UK universities. *Journal of knowledge management*, 17(1), 123-136.
- Gambardella, A., & McGahan, A. M. (2010). Business-model innovation: General purpose technologies and their implications for industry structure. *Long range planning*, 43(2-3), 262-271.
- George, G., & Bock, A. J. (2011). The business model in practice and its implications for entrepreneurship research. *Entrepreneurship theory and practice*, 35(1), 83-111.
- Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of management information systems*, 18(1), 185-214.
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic management journal*, 17(S2), 109-122.
- Haner, U. E. (2002). Innovation quality—a conceptual framework. *International Journal of Production Economics*, 80(1), 31-37.
- Hansen, M. T. (2002). Knowledge networks: Explaining effective knowledge sharing in multiunit companies. *Organization science*, 13(3), 232-248.
- Hansen, M. T., Mors, M. L., & Løvås, B. (2005). Knowledge sharing in organizations: Multiple networks, multiple phases. *Academy of Management journal*, 48(5), 776-793.
- Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative science quarterly*, 44(1), 82-111.
- Heirman, A., & Clarysse, B. (2007). Which tangible and intangible assets matter for innovation speed in start-ups?. *Journal of Product Innovation Management*, 24(4), 303-315.
- Hill, C. W. & Rothaermel, F. T. (2003). The performance of incumbent firms in the face of radical technological innovation. *Academy of Management Review*, 28(2), 257-274.
- Ho, C. T. (2009). The relationship between knowledge management enablers and performance. *Industrial Management & Data Systems*, 109(1), 98-117.
- Hogel, M., Parboteeah, K. P. & Munson, C. L. (2003). Team-level antecedents of individuals' knowledge networks. *Decision Sciences*, 34(4), 741-70.
- Holste, J. S., & Fields, D. (2010). Trust and tacit knowledge sharing and use. *Journal of knowledge management*, 14(1), 128-140.
- Hsu, I. C. (2008). Knowledge sharing practices as a facilitating factor for improving organizational performance through human capital: A preliminary test. *Expert Systems with applications*, 35(3), 1316-1326.
- Huang, T. T., Chen, L., & Stewart, R. A. (2010). The moderating effect of knowledge sharing on the relationship between manufacturing activities and business performance. *Knowledge Management Research & Practice*, 8(4), 285-306.
- Hu, M. L. M., Horng, J. S., & Sun, Y. H. C. (2009). Hospitality teams: Knowledge sharing and service innovation performance. *Tourism management*, 30(1), 41-50.
- Huseman, R. C., & Goodman, J. P. (1998). *Leading with knowledge: The nature of competition in the 21st century*. SAGE publications.

- IBM Global Business Services. (2006). *Expanding the innovation horizon: The Global CEO Study 2006*. Retrieved from http://www-07.ibm.com/sg/pdf/global_ceo_study.pdf.
- Imran, M. K., Bilal, A. R., Aslam, U., & Rahman, U. U. (2017). Knowledge management strategy: an organizational change prospective. *Journal of Enterprise Information Management*, 30(2), 335-351.
- Iqbal, A., Latif, F., Marimon, F., Sahibzada, U. F., & Hussain, S. (2019). From knowledge management to organizational performance: Modelling the mediating role of innovation and intellectual capital in higher education. *Journal of Enterprise Information Management*, 32(1), 36-59.
- Jang, S., Hong, K., Woo Bock, G., & Kim, I. (2002). Knowledge management and process innovation: the knowledge transformation path in Samsung SDI. *Journal of knowledge management*, 6(5), 479-485.
- Jantunen, A. (2005). Knowledge-processing capabilities and innovative performance: an empirical study. *European Journal of Innovation Management*, 8(3), 336-349.
- Kessler, E. H., & Bierly, P. E. (2002). Is faster really better? An empirical test of the implications of innovation speed. *IEEE Transactions on Engineering Management*, 49(1), 2-12.
- Kessler, E. H., & Chakrabarti, A. K. (1996). Innovation speed: A conceptual model of context, antecedents, and outcomes. *Academy of Management Review*, 21(4), 1143-1191.
- Khanagha, S., Volberda, H., & Oshri, I. (2014). Business model renewal and ambidexterity: structural alteration and strategy formation process during transition to a C loud business model. *R&D Management*, 44(3), 322-340.
- Kogut, B., & Zander, U. (1996). What firms do? Coordination, identity, and learning. *Organization science*, 7(5), 502-518.
- Koskinen, K. U., Pihlanto, P., & Vanharanta, H. (2003). Tacit knowledge acquisition and sharing in a project work context. *International journal of project management*, 21(4), 281-290.
- Lahiri, N. (2010). Geographic distribution of R&D activity: how does it affect innovation quality?. *Academy of Management Journal*, 53(5), 1194-1209.
- Lanjouw, J. O., & Schankerman, M. (2004). Patent quality and research productivity: Measuring innovation with multiple indicators. *The Economic Journal*, 114(495), 441-465.
- Law, C. C., & Ngai, E. W. (2008). An empirical study of the effects of knowledge sharing and learning behaviors on firm performance. *Expert systems with applications*, 34(4), 2342-2349.
- Lee Endres, M., Endres, S. P., Chowdhury, S. K., & Alam, I. (2007). Tacit knowledge sharing, self-efficacy theory, and application to the Open Source community. *Journal of knowledge management*, 11(3), 92-103.
- Li, X., Goldsby, T. J., & Holsapple, C. W. (2009). Supply chain agility: scale development. *The International Journal of Logistics Management*, 20(3), 408-424.
- Liebowitz, J., & Chen, Y. (2001). Developing knowledge-sharing proficiencies. *Knowledge Management Review*, 3, 12-15.
- Liebowitz, J. (2002). Facilitating innovation through knowledge sharing: a look at the US Naval Surface Warfare Center-Carver Division. *Journal of Computer Information Systems*, 42(5), 1-6.
- Lin, C. P. (2007). To share or not to share: Modeling tacit knowledge sharing, its mediators and antecedents. *Journal of business ethics*, 70(4), 411-428.
- Lin, H. F. (2007). Knowledge sharing and firm innovation capability: an empirical study. *International Journal of manpower*, 28(3/4), 315-332.
- Lucas, L. M. (2005). The impact of trust and reputation on the transfer of best practices. *Journal of Knowledge Management*, 9(4), 87-101.
- Lynn, L. H. (2008). Recovering from success: Innovation and technology management in Japan.

- Malhotra, Y. (2002). Knowledge management and new organization forms: A framework for business model innovation. In *Intelligent Support Systems: Knowledge Management*, 177-199. IGI Global.
- Markides, C. (2006). Disruptive innovation: In need of better theory. *Journal of product innovation management*, 23(1), 19-25.
- Martelo-Landroguez, S., & Cepeda-Carrión, G. (2016). How knowledge management processes can create and capture value for firms?. *Knowledge Management Research & Practice*, 14(4), 423-433.
- Masa'deh, R. E., Shannak, R., Maqableh, M., & Tarhini, A. (2017). The impact of knowledge management on job performance in higher education: The case of the University of Jordan. *Journal of Enterprise Information Management*, 30(2), 244-262.
- María Ruiz-Jiménez, J., & del Mar Fuentes-Fuentes, M. (2013). Knowledge combination, innovation, organizational performance in technology firms. *Industrial Management & Data Systems*, 113(4), 523-540.
- McGrath, R. G. (2010). Business models: A discovery driven approach. *Long range planning*, 43(2-3), 247-261.
- Mesmer-Magnus, J. R., & DeChurch, L. A. (2009). Information sharing and team performance: A meta-analysis. *Journal of Applied Psychology*, 94(2), 535.
- Michailova, S., & Husted, K. (2003). Knowledge-sharing hostility in Russian firms. *California management review*, 45(3), 59-77.
- Miller, D. J., Fern, M. J. & Cardinal, L. B. (2007). The use of knowledge for technological innovation within diversified firms. *Academy Management Journal*, 50(2), 308-326.
- Mitchell, D. W., & Bruckner Coles, C. (2004). Business model innovation breakthrough moves. *Journal of business strategy*, 25(1), 16-26.
- Moingeon, B., & Lehmann-Ortega, L. (2010). Creation and implementation of a new business model: a disarming case study. *M@ n@ gement*, 13(4), 266.
- Morris, M., Schindehutte, M., & Allen, J. (2005). The entrepreneur's business model: toward a unified perspective. *Journal of business research*, 58(6), 726-735.
- Ngah, R., Tai, T., & Bontis, N. (2016). Knowledge management capabilities and organizational performance in roads and transport authority of Dubai: The mediating role of learning organization. *Knowledge and Process Management*, 23(3), 184-193.
- Ng, P. T. (2009). Relating quality and innovation: an exploration. *International Journal of Quality and Innovation*, 1(1), 3-15.
- Nonaka, I., & Takeuchi, H. (1996). The knowledge-creating company: How Japanese companies create the dynamics of innovation. *Long range planning*, 4(29), 592.
- Nonaka, I., & Takeuchi, H. (1996). The knowledge-creating company: How Japanese companies create the dynamics of innovation. *Long range planning*, 4(29), 592.
- Novo, J. (2004). Drilling down: turning customer data into profits with a spreadsheet.
- Obeidat, B. Y., Al-Suradi, M. M., Masa'deh, R. E., & Tarhini, A. (2016). The impact of knowledge management on innovation: An empirical study on Jordanian consultancy firms. *Management Research Review*, 39(10), 1214-1238.
- Pentland, B. T. (1995). Information systems and organizational learning: the social epistemology of organizational knowledge systems. *Accounting, Management and Information Technologies*, 5(1), 1-21.
- Pohle, G., & Chapman, M. (2006). IBM's global CEO report 2006: business model innovation matters. *Strategy & Leadership*, 34(5), 34-40.
- Polanyi, M. (1968). Personal knowledge, Chicago (The University of Chicago Press) 1968.
- Reid, F. (2003). Creating a knowledge sharing culture among diverse business units. *Employment Relations Today*. 30(1), 43-9.

- Rodríguez-Gómez, D., & Gairín, J. (2015). Unravelling knowledge creation and management in educational organisations: barriers and enablers. *Knowledge Management Research & Practice*, 13(2), 149-159.
- Rollins, M., & Halinen, A. (2005, January). Customer knowledge management competence: Towards a theoretical framework. In *System Sciences, 2005. HICSS'05. Proceedings of the 38th Annual Hawaii International Conference on* (pp. 240a-240a). IEEE.
- Rowley, J. (2002). Eight questions for customer knowledge management in e-business. *Journal of knowledge management*, 6(5), 500-511.
- Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms. *MIS quarterly*, 237-263.
- Scarbrough, H. (2003). Knowledge management, HRM and innovation process, *International Journal of Manpower*, 24(5), 501-16.
- Schneider, S., & Spieth, P. (2013). Business model innovation: Towards an integrated future research agenda. *International Journal of Innovation Management*, 17(01), 1340001.
- Slater, S. F., & Mohr, J. J. (2006). Successful development and commercialization of technological innovation: Insights based on strategy type. *Journal of product innovation management*, 23(1), 26-33.
- Smith, H. A., & McKeen, J. D. (2005). Developments in practice XVIII-customer knowledge management: Adding value for our customers. *Communications of the Association for Information Systems*, 16(1), 36.
- Sosna, M., Trevinyo-Rodríguez, R. N., & Velamuri, S. R. (2010). Business model innovation through trial-and-error learning: The Naturhouse case. *Long range planning*, 43(2-3), 383-407.
- Spender, J. C., & Grant, R. M. (1996). Knowledge and the firm: Overview. *Strategic management journal*, 17(S2), 5-9.
- Spender, J. C. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic management journal*, 17(S2), 45-62.
- Spieth, P., Schneckenberg, D., & Ricart, J. E. (2014). Business model innovation—state of the art and future challenges for the field. *R&d Management*, 44(3), 237-247.
- Subramaniam, M & Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal*, 48(3), 450–463.
- Sull, D. (2009). How to thrive in turbulent markets. *Harvard Business Review*.
- Tan, C. N. L., & Md. Noor, S. (2013). Knowledge management enablers, knowledge sharing and research collaboration: a study of knowledge management at research universities in Malaysia. *Asian Journal of Technology Innovation*, 21(2), 251-276.
- Tatikonda, M. V., & Montoya-Weiss, M. M. (2001). Integrating operations and marketing perspectives of product innovation: The influence of organizational process factors and capabilities on development performance. *Management Science*, 47(1), 151-172.
- Taylor, A. & Greve, H. R. (2006). Superman or the Fantastic Four? Knowledge combination and experience in innovative teams. *Academy of Management Journal*, 49(4), 723–740.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, 18(7), 509-533.
- Tseng, C. Y., & Wu, L. Y. (2006). Innovation quality in the automobile industry: measurement indicators and performance implications. *International Journal of Technology Management*, 37(1-2), 162-177.
- Valkokari, K. (2015). Business, innovation, and knowledge ecosystems: how they differ and how to survive and thrive within them. *Technology Innovation Management Review*, 5(8).

- Valaei, N., Nikhashemi, S. R., & Javan, N. (2017). Organizational factors and process capabilities in a KM strategy: toward a unified theory. *Journal of Management Development*, 36(4), 560-580.
- Von Hippel, E. (1994). "Sticky information" and the locus of problem solving: implications for innovation. *Management science*, 40(4), 429-439.
- Wang, S., & Noe, R. A. (2010). Knowledge sharing: A review and directions for future research. *Human resource management review*, 20(2), 115-131.
- Wang, Z., Sharma, P. N., & Cao, J. (2016). From knowledge sharing to firm performance: A predictive model comparison. *Journal of Business Research*, 69(10), 4650-4658.
- Wang, Z., & Wang, N. (2012). Knowledge sharing, innovation and firm performance. *Expert systems with applications*, 39(10), 8899-8908.
- Wang, Z., Wang, N., Cao, J., & Ye, X. (2016). The impact of intellectual capital-knowledge management strategy fit on firm performance. *Management Decision*, 54(8), 1861-1885.
- Wirtz, B. W., Schilke, O., & Ullrich, S. (2010). Strategic development of business models: implications of the Web 2.0 for creating value on the internet. *Long range planning*, 43(2-3), 272-290.
- Wu, J., Guo, B., & Shi, Y. (2013). Customer knowledge management and IT-enabled business model innovation: A conceptual framework and a case study from China. *European Management Journal*, 31(4), 359-372.
- Yang, J., Lai, F., & Yu, L. (2005). Harnessing value in knowledge acquisition and dissemination: strategic sourcing in product development. *International Journal of Technology Management*, 33(2-3), 299-317.
- Yasir, M., Majid, A., & Yasir, M. (2017). Nexus of knowledge-management enablers, trust and knowledge-sharing in research universities. *Journal of Applied Research in Higher Education*, 9(3), 424-438.
- Yusuf, Y. Y., Sarhadi, M., & Gunasekaran, A. (1999). Agile manufacturing:: The drivers, concepts and attributes. *International Journal of production economics*, 62(1-2), 33-43.
- Zack, M., McKeen, J., & Singh, S. (2009). Knowledge management and organizational performance: an exploratory analysis. *Journal of knowledge management*, 13(6), 392-409.
- Zhou, K. Z. & Wu, F. (2010). Technological capability, strategic flexibility, and product innovation. *Strategic Management Journal*, 31(5), 547-561.
- Zott, C., & Amit, R. (2007). Business model design and the performance of entrepreneurial firms. *Organization science*, 18(2), 181-199.
- Zott, C., Amit, R., & Massa, L. (2011). The business model: recent developments and future research. *Journal of management*, 37(4), 1019-1042.

Model of Knowledge Management for Public Organizations of Science Technology and Innovation in Health

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Abstract

The present research aims to propose a Knowledge Management Model for the Oswaldo Cruz Foundation, seeking, from its structure, to characterize its importance to support the innovation process both in the Institution and in Organizations of Science, Technology and Innovation in Health, due to its similar characteristics. In the development of the work, it is sought to understand if there is a relationship between knowledge management (KM) and innovation management (IM), what the difference is among data, information, knowledge and intelligence, if the implementation of a knowledge management model can help achieving the organizational innovation objectives and some existing KM models. At the end, it is proposed to identify the main critical success factors, benefits and challenges for a KM implementation in public institutions of Science, Technology and Innovation and the main steps of a model that meets the requirements of the ISO Norm 30401: 2018 that supports an Innovation Policy.

Keywords – knowledge management. Management. Models of the management. organizational innovation. ISO Norm 30401:2018

Paper type – Academic Research Paper

1 Introduction

The article has the objective to propose guidelines for Knowledge Management Model in Health – considering the context of Oswaldo Cruz Foundation, but characterizing the importance to support the innovation process. In addition, it is intended that the Knowledge Management (KM) is understood as a function even more common and as a mean to help the governmental organization to have a vision on how to incorporate it and transform it in a competitive advantage.

During the 18th century until middle of the 19th century, the society went through evolutionary economic cycles and after the agricultural and industrial eras, we are currently at the Information and Knowledge era. According to CASTELLS (1999), the information and knowledge are the source of productivity and generated product, and in

which the development, the technology innovation incorporation and knowledge will continue changing the world, interfering in the economy and industry in the next years.

Based on this context, the source data, the information and the knowledge have a crucial role in organizational environments because all implemented activities from the planning to the execution of the stages are based on these elements. As knowledge is formed by a constant mixture of contextualized experiences incorporating the elements above mentioned that when gathered with the professional interpretation and creativity it will provide transformations and innovations.

In Brazil, the government has sought to verify with a major focus of expanding the potential of some organizations that operates in the processes of generation, acquisition and sharing developed knowledge. Among them, we can list (I) o Governo Aberto¹, which is an international initiative that intends to spread and motivate globally governmental practices related to the transparency of the government, to the access of governmental information and to the social participation; (II) Law no. 12.527/2011² that regulates the right of accessing governmental information that is active since 2012, and (III) Open Science that has an objective of motivating the promotion of open research data.

Among this context, there are Science, Technology, and Innovation Institutions in Health (S, T, & I), focusing on administrative principles of legality, impersonality, morality, publicity and efficiency as the maximums of public administration according to the (PNCTIS, 2005) and, this knowledge appropriation contributes to the reduction of social inequality in health, and for the development of science and innovation in the organizations.

Thus, an institution such as the Oswaldo Cruz Foundation, under the Ministry of Health, is one of the Institutions responsible for the driving forces of the National Policy on Science, Technology and Innovation in Health (PNCTIS). It encourages the fulfillment of its mission by sharing the knowledge generated in its various areas of activity with the society, in a systemic and organized way and that can produce new approaches and innovations that favor Brazilian science.

It is important to emphasize that the guidelines of the presented model are not limited, but point out dimensions that can be addressed by the Institution and in future research, such as Governance for the implementation of a model based on knowledge, the need for good data and information infrastructure, its own importance of Knowledge Management to support a Policy of Innovation and open science.

2 Methodology

The research method defined for this paper is the field research, under the qualitative approach, because it is concerned with the understanding of the organization studied, i.e., in aspects of reality that cannot always be quantified. Regarding its nature, the research is

¹ <http://governoaberto.cgu.gov.br/>

² http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2011/lei/112527.htm

applied, since it aims to generate knowledge for practical implementation, directed to solving specific problems.

In order to conduct the research, the method of work followed the steps as below.

2.1 Problem Definition

The reason to continue the study done during the MBA on the Diagnosis Model of Knowledge Management in Public Administration implemented at Fiocruz has resulted in a problem definition because despite the fact the Institution had Knowledge and Information Management as fundamental resources for Innovation Management, the institution did not have an integrated model that could be considered as fundamental phases at the Institution.

2.2 Literature Revision

In order to start the research, it was made a literature revision based on Scopus data that is a multidisciplinary basis through kew words (*models of knowledge management*" OR *"models of knowledge management in the public sector"*) and (*model**) AND (*"knowledge management"*) AND (*"public health sector"* OR *"public health"* OR *organizations* OR *"focus on innovation"* OR *"Health Research"* OR *"Management Practice"*).

After, it was done a bibliography research of the main authors in Knowledge Management, the main models of Knowledge Management, Knowledge Management in public organization to fund the study preparation, and probably the application in organizations of S, T, & I in health with focus on innovation.

2.3 Definition of theoretical reference

The referential analysis related to the KM and IM and the relation of these both managements and the ISO Norm 30.401 was essential for the research. It was also important a documentary research of the institution that registered the development of KM at Fiocruz since 2012 as a strategic map of the Institution, the model of governance and the document elaborated by a formal strategic Committee.

2.4 Field Research Planning

During this stage, there was a selection of the analysis units with a view of the data collection in an institutional level.

2.5 Definition of Data Collection Tools

The data collection methods that were used to give basis to the research has included the following techniques: bibliography research, documentation, interviews and questionnaire.

2.6 Questionnaire Application

It was applied a qualitative questionnaire with 10 Managers in which the purpose was to understand the comprehension in relation to the relevance of KM practices for the development of the innovation capacities in the Units.

2.7 Interviews

The study was based on the content through the interviews with 15 managers who have strategic and tactical levels and who work in Innovation and Knowledge Management at Fiocruz.

The method of analysis of this research was based on the study of BARDIN (1997) and had the following steps for its conduction: a) organization of the analysis; b) categorization; c) Inference and interpretation of results. The methodology required a deepening of both the interviews and the theoretical reference, since it served as a basis for interpretations and inferences.

3 Theoretical Context

With the purpose of strengthening the perspective that the Knowledge Management can support the improvement of the efficiency and effectiveness in the public service and support the innovation management in these organizations in favor of the Brazilian society, it was researched in both international and national references that confirm a model of knowledge management in public organizations can interfere in the performance and in their results. (WIIG, 2002), (NONAKA, TAKEUCHI, 1997), (SVEIBY, 1998), (SSYED-IKHSAN, & ROWLAND, 2004), (DAVENPORT E PRUSAK (1998) (BATISTA, 2012).

Among other models, we can highlight the following ones: innovative organization (GALBRAITH, 1997); Organization (NONAKA e TAKEUCHI, 1997); Intellectual Capital (SVEIBY, 1998); Model of Knowledge Chain (HOLSAPPLE AND SINGH, 2002), American Productivity & Quality Center (APQC, 2007), (SOCIEDADE BRASILEIRA DE GESTÃO DO CONHECIMENTO, 2013), Ronald Young and Asia Organization for Productivity (APO, model of Knowledge Management for Brazilian Public Administration – MGCAPB (BATISTA, 2012).

4 Critical Elements for a model of Knowledge Management

Among the models we can highlight Frame Break (MITROFF et al, 1994); Innovative Organization (GALBRAITH, 1997); Organization in hypertext (NONAKA e TAKEUCHI, 1997); Intellectual Capital (SVEIBY, 1998); Individual organization (GOSHAL e BARTLETT, 2000) and Model of Knowledge Chain (HOLSAPPLE AND SINGH, 2001).

The model proposes to fulfill the requirements of ISO Norm 30.401 that was released recently and elaborated by specialists in the implementation of KM in Europe, in Asia and in the USA. The norm established a pattern in relation to the knowledge management.

In order to follow the changes, the knowledge should be treated as an intangible active that needs to be made as any other and consciously produced, used and reutilized for a better flexibility in the processes and speed of answers that are being required even more from the organizations.

The elements of the proposed models are results of the composed conceptual review, of the comparative analysis among existing models and of the thematic context at the institution, the interview analysis, the state of art of the current norm on Knowledge Management.

Composed by critical elements such as: (i) Governance, (ii) KM macroprocesses, (iii) conductors/enablers, (iv) the steps of KM implementation and (v) practices of KM related especially for a better innovation development at the institution.

4.1 Governance

Due the fact the proposed governance in the model is a transversal area, it should go through all managerial levels of the institution in a way that helps the institution to conduct the public institution, its processes, regulations and the relation among many of the players involved and the organizational sustainability development.

In case of Fiocruz, it should be a collaborative management that has the capacity to implement as KM policy in the organization, in the awareness of the topic for all the departments of the institution and in the executions of actions and practices of KM in a way that the institution implements it in a more effective and systemized way.

What is being proposed is a system of governance that brings together: (1) Strategic Level through existing instances in the institution's cronogram, by the deliberative Council of Fiocruz that according to BUSS e GADELHA (2002) has the objective of operationalize the macropolicies defined by the internal Congress that also discusses and approves programs and respective budgeting of the Institution; by the Presidency and by Fiocruz Communication and Information Technical Chamber, all instances already within the Institution; (2) Tactical Level formed by a strategic Committee; (3) Operational Level by the Executive Committee.

4.2 KM Macroprocesses

According to DE SÁ FREIRE et al. (2013), there is not a consense regarding the numbers of phases of KM macroprocesses. Some (MURRAY E MEYERS, 1997) cite three phases: creation, dissemination and use. Other authors (SALMAZO, 2004; SVEIBY, 1997) mention four phases such as creation, sharing and use, or development phases, preservation, use and knowledge sharing. The transfer of knowledge once generated is of paramount importance to organisational knowledge management (MONAVVARIAN & KASAEI, 2007).

This research uses Macroprocesses of KM established in the Knowledge Management Brazilian Society Model that are: (1) Create/Acquire/Develop; (2) Share/Disseminate/Organize; (3) Use/Access/Apply and (4) Retain/Preserve/Guarantee.

4.3 Conductors/Enablers

Usually, most common conductors¹³ in the Knowledge Management Models and also proposed by BATISTA (2012) in KM Model for Public Administration are: Technology, Personnel, Processes and Leadership.

But Public Institutions need to prioritize the data because according to GUANAES et al. (2018) in the near future the Data Opening Policy will be implemented in which the results and data obtained, especially the financed ones or the ones financed by public incentives, are seen as a common interest that should be returned to the society in a secure and organized way. In order to meet this demand, it is important that the proposed model makes a critical reflexion to fulfill the specific norms in an immediate future. It is in this sense the inclusion is better conducted, specific to meet the new demands of open science and the organizations that do not have structured data such as:

1- *Technology*: accelerates the KM processes through effective practices, helping the knowledge management through information systems.

2- *Leadership*: has a key role in the KM implementation, approving the governance structure, resources.

3- *Personnel*: develops a key role in the main KM processes including the tactic knowledge sharing. SVEIBY (1998) and DRUCKER (1993) agree with the need to assign emphasis to the human resources in the organizations and argue in the sense that the power of production in the organizations concentrates in its intellectual ability, i.e., the knowledge generated by the professionals.

4- *Processes*: modeled and sistematic processes in an effective way can contribute to increase efficiency, enhance the quality and social affectiveness in addition to the law, impersonality, publicity and morality in the public administration and for the national development.

According to studied specificities in the context of the Institution and and result of the interviews that were done, it is proposed a conductor as a guideline in this model to enhance the data and information systemization according to what is shown below.

5- *Informational infratructure of data and information*: it refers to all the information and data systematization that are valued by the organization and decisive that need to be administered as other important activities in the organization that allow to promote new research in which there is a possibility of reuse, sharing and, as a consequence, support better decision making.

³ The KM facilitators constitute the mechanisms by which the organization stimulates the creation, sharing and protection of their knowledge (YEH et al., 2006) and defines the necessary infrastructure to improve the efficiency of knowledge management (SARVARY, 1999).

4.4 Phases of the development and implementation

According to the ISO Norm 30.401:2018 there is the need of minimum solid requirements that guide the organization when value the organizational knowledge. So the research proposes the following phases that will be implemented in the operational level according to the orientation of strategic and tactic levels. To SILVA(2019) the first phase consists in identifying and analysing the critical knowledge and existing practices with the purpose of mapping out the most critical knowledge of the institution;

1. After it is necessary to identify whether the critical knowledge is available or not, and the best ways of transference and gaps of knowledge.
2. An this phase, the public organization makes a diagnosis on the practices of Knowledge Management.
3. Consequently, it is necessary to identify the supporting technologies to the management, define the strategy, identify the management system of the organization, in addition to the evaluation strategy.
4. Define the project in which the knowledge management of the institution will be implemented, considering the identification and prioritization of the areas and strategic alignment.
5. During this phase the purpose is to present the benefits of the Knowledge Management implementation and the topic awareness.
6. Plan the trajectory to implement the practices in the processes of the chosen escape, in other words, the project elaboration.
7. Implement the practices that will be aligned to the vision, the objectives and the strategies of the organization, bearing in mind the cost and impact.
8. Define the means to keep the results to be obtained with the KM implementation for enhancements and measurable results.
9. This is a phase in which the organization should create an environment of collaboration to facilitate the exchange and co-creation of knowledge among the involved parts.
10. Evaluate the results.

5 Conclusions

This research analysed the context of applying a management model directed to Knowledge with the purpose to systematize the knowledge that will be appropriate at the Institution and that can support the generation, creation and appropriation of new knowledges.

This way the investigation intends to have contributed with a new proposal of guidelines of a Knowledge Management model that supports the acquisition, creation, preservation and use of knowledge encouraging the Innovation.

Considering that both innovation and KM go through the organizations as a whole and that the public institutions should develop and strength practices that help these institutions with a new way of thinking, with new mindsets, with a management of changing that contributes with the modernization in the implementation of public

institutions business models and, consequently, for the public services enhancement.

References

- Alvarenga Neto, R; Choo, C.W. (2010) Beyond the Ba: Managing Enabling Contexts in Knowledge Organizations. *Journal of Knowledge Management*, n. 4.
- APQC (2007)– International Benchmarking Clearinghouse.
- Bardin L.(1977) *L'Analyse de contenu*. Editora: Presses Universitaires de France.
- Bartlett, C. A., & Ghoshal, S. (2000). Going global. *Harvard Business Review*, 78(2), 132-142.
- Batista, F. F. (2012) *Modelo de Gestão do Conhecimento para a Administração Pública Brasileira: como implementar a gestão do conhecimento para produzir resultados em benefícios do cidadão*. Brasília: IPEA, 2012. Disponível em: <<http://www.ipea.gov.br/observatorio/destaques/71-modelo-de-gestao-do-conhecimento-para-a-administracao-publica-brasileira>>.
- Bennet, A., Bennet, D. (2007) The knowledge and knowing of spiritual learning. *Vine*, v. 37, n. 2, p. 150-168. Disponível em: <<http://dx.doi.org/10.1108/03055720710759937>>
- Bennet, D., Bennet, A. (2008) The depth of knowledge: surface, shallow or deep? *Vine*, v. 38, n. 4, p. 405-420, 2008. Disponível em: <<http://dx.doi.org/10.1108/03055720810917679>>.
- Bhatt, G. D. (2001) Knowledge management in organizations: examining the interaction between technologies, techniques, and people. *Journal of Knowledge Management*, v. 5, n. 1, p. 68-75. Disponível em: <<http://dx.doi.org/10.1108/13673270110384419>>.
- Buss, P.M.; Gadellha, P. (2002) *Fundação Oswaldo Cruz – Experiência centenária em biologia e saúde. São Paulo em Perspectiva*. São Paulo. <<http://dx.doi.org/10.1590/S0102-88392002000400012>>. Acesso em dez/2018>.
- Castels, M. (1999) *A era da informação: economia, sociedade e cultura*. São Paulo. Editora Paz e Terra.
- Choo, C. W. A. (2003) *Organização do Conhecimento: como as organizações usam a informação para criar significado, construir conhecimento e tomar decisões*. São Paulo: Editora Senac São Paulo, 2003.
- Dalkir, K. *Knowledge Management in Theory and practice*. Canada: Elsevier Inc. 2005.
- Davenport, T. H. and Prusak, L., (1998) *Working knowledge: How organizations manage what they know*, Harvard Business School Press, Boston.
- De Sá Freire, P et al. Ferramentas de avaliação de Gestão do Conhecimento: um estudo bibliométrico. *International Journal of Knowledge Engineering and Management (IJKEM)*, v.2, n.3, p.15-38, 2013. Disponível em: <http://stat.ijie.incubadora.ufsc.br/index.php/IJKEM/article/viewFile/2322/2655>
- Drucker, P.(1993) *A Nova Era da Administração*. São Paulo: Pioneira.
- Guanaes, P et al. (2018) Marcos legais nacionais em face da abertura de dados para pesquisa em saúde - Dados pessoais, sensíveis ou sigilosos e propriedade intelectual. <https://www.arca.fiocruz.br/bitstream/icict/28838/4/Guanaes_Paulo_Org_Marcos_Legais_Presid%C3%A2ncia_2018.pdf>
- Holsapple, C.W., Joshi, K.D. (2002) *Knowledge management: A threefold framework*. Information Society 18.
- Jarrar, Y., & Schiuma, G. (2007). Measuring performance in the public sector: challenges and trends. *Measuring Business Excellence*, 11(4), 4-8. -

- Monavvarian, A., & Kasaei, M. (2007). A KM model for public administration: the case of Labour Ministry. *Vine*, 37(3), 348-367. <https://doi.org/10.1108/03055720710825654>
- Murray, P.; Myers, A. (1997). The facts about knowledge. *Information Strategy* 2, no. 7, September, 29-33
- Nonaka, I., & Takeuchi, H. Criação de conhecimento na empresa: como as empresas japonesas geram a dinâmica da inovação. Rio de Janeiro: Campus, 1997.
- Nonaka, I., & Takeuchi, H. (2011). The wise leader. *Harvard Business Review*, v. 89, n. 5, p. 58-67, 2011. Disponível em: <<https://www.hbs.edu/faculty/Pages/item.aspx?num=40242>>. Acesso em: 22 novembro 2017.
- Omar Sharifuddin Syed-Ikhsan, S., & Rowland, F. (2004). Knowledge management in a public organization: a study on the relationship between organizational elements and the performance of knowledge transfer. *Journal of knowledge management*, 8(2), 95-111.
- Rubenstein-Montano, B. et al (2001) A systems thinking framework for knowledge management. *Decisions Support Systems Journal*, v. 31, n. 1, p. 5-16.
- Seleim, A., & Khalil, O. (2007). Knowledge management and organizational performance in the Egyptian software firms. *International Journal of Knowledge Management (IJKM)*, 3(4), 37-66.
- Silva, E.L. (2019) Elementos Críticos para um modelo de Gestão do Conhecimento: um olhar para o contexto Fiocruz. Theses Masters - University of Escola Nacional de Saúde Pública Rio de Janeiro.
- Sveiby, K. E. (1998) A nova riqueza das nações: gerenciando e avaliando patrimônios de conhecimento. Rio de Janeiro: Campus.
- Wiig, K. M. (2002). Knowledge management in public administration. *Journal of knowledge management*, 6(3), 224-239.

Managing Complexity and Interactions in an Emerging Innovation Ecosystem

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Abstract

This study aims to explore the emergence of an innovation ecosystem as a complex network of entities involved in innovation. After reviewing three ecosystem-based perspectives in the literature, we conduct a participatory and longitudinal action research study based on the analysis of a High Technology District for Cultural Heritage. Our analysis reveals three milestones in the establishment of an innovation ecosystem, which we identify as setting the context, establishing interdependence, and giving continuity.

The study contributes to the scholarly debate in that we analyse the dynamics through which an innovation ecosystem emerges as a co-created and co-evolutionary context that shapes actions, interests and rules among a multiplicity of actors and collectively fosters innovation. We further identify different salient tensions between opposing forces that characterize the relationships and interdependencies among actors. The appropriate structures, flexible institutions and negotiation opportunities are necessary for the design and development of the workability and viability of an innovation ecosystem.

Keywords – interactions, innovation ecosystem, ecosystem emergence.

Paper type – Academic Research Paper

1 Introduction

Scholars from different fields of science have dealt with investigations on the intrinsically complex and systemic nature of innovation (Ritter *et al.*, 2004; Chesbrough, 2006). Innovation is seen as a cumulative and broad collaborative activity in which ideas and knowledge are generated, integrated, developed, and applied through continuous interactions emerging at the boundaries of different firms and contexts (Carayannis, and Campbell, 2014; Carvalho and Gomes, 2017); this expanded the previous conceptualizations of inter-organizational or collaborative innovation (Möller and Rajala, 2007).

The complex nature of innovation has been recognised also by European Union in its programmes on innovation and by research companies in studies on the impossibility to understand where a valuable innovation can emerge (e.g., McKinsey, 2015). The focus of EU was addressed towards the R&D efforts, the role of technology, and the advantages in combining multiple actors in setting a suitable context to drive innovation (EU Science Hub, 2017).

Scholars are aligned to this idea as in the concept of innovation ecosystem (Ferretti and Parmentola, 2015; Adner and Kapoor, 2016) to provide much evidence of the importance of the mix of diversity and variety generated by a context of interconnected and wider set of relationships.

Innovation is caught up in a whole network of interdependencies, whereby changes in one part of the network can have far-reaching, and often unexpected, effects in other parts (Adner, 2006; Reynolds and Uygun, 2017). These effects have been demonstrated as mainly depending on the interdependencies among actors based on resource sharing, combination of capabilities and planned goals (Walrave *et al.*, 2018)

However, while the literature broadly discusses the role of multiple actors' interactions and their effects on innovation, less is still known about how an innovation ecosystem emerges and how actions and goals promoted by multiple actors are combined; a recent paper dealt with a literature review on the genesis of an innovation ecosystem (Dedehayir *et al.*, 2018), but the authors called for further empirical investigation on this topic.

The concept of the ecosystem carries many other aspects, like problems in balancing the tensions emerging in organizing interactions, when common actions have to be set to coalesce around unified aims the different interests and perspectives of multiple actors.

A study concentrating on the emergence of an ecosystem has been noted as still a relatively uncommon perspective (Heikkilä and Kuivanuemi, 2012; Russo Spina *et al.*, 2016), so this research deals with the issues of how innovation ecosystems concretely emerge, in particular on how diverse actors relate each other favouring participation in innovation, and how they engage to enable the workability of an ecosystem in a long range perspective.

In order to reach this aim, we firstly address the ecosystem perspective in innovation by discussing three different approaches, namely business, entrepreneurship, and the more recent service and social science literatures, then we adopt an action research approach within an emergent innovation district, namely DATABENC (High Technology District for Cultural Heritage).

2 Perspectives on innovation ecosystem

The literature analysis has showed how the metaphor of ecosystem was first of all used in the business literature (Moore, 1993; Iansiti & Levien, 2004) to better explain how actors interact in a business ecosystem, with a focus on strategy and resources. Within this perspective, an ecosystem has been viewed as having an internal and hierarchical organization orchestrated by a main actor that operates as a platform-sharing

resource (Gawer & Cusumano, 2002), with interacting parts depending on each other for access to resources on which all community members depend (Autio & Thomas, 2013). This business perspective emphasizes market-driven initiatives (Ritala & Almpantopoulou, 2017) where resource provision and adaptation are the fundamental driving forces of the ecosystem and the dynamic evolutionary processes sustain diversity through variation, selection, and retention processes (Iansiti & Levien, 2004).

Other scholars from entrepreneurship and economic thinking address their efforts to the understanding of the complex interplay of business and economic perspectives influencing innovation processes (Basole *et al.*, 2011; Carayannis & Campbell, 2012). In particular, Carayannis and Campbell (2012) debated the competitiveness of an innovation ecosystem determined by its creativity to combine and integrate different knowledge and innovation modes via co-evolution, co-specialization and collaboration and competition. The engine role of ecosystems is the main point of the entrepreneurship ecosystem concept (Isenberg, 2010), defined as environments that nurture and sustain entrepreneurship and innovation (Zahra & Nambisan, 2012); some of these scholars also put forward to entrepreneurs the role of peripheral actors and of high-tech SMEs (Mezzourh & Nakara, 2012) connecting the local and global levels as amplified factors of ecosystem and innovation growth.

The most recent perspective is a community view of the ecosystem with the focus of the service ecosystem conceptualization, as defined by Chandler and Vargo (2011) where the actors are held together by competences, relationships and information, and the actions and interactions sustain and reproduce the system continuously by socially constructing institutional logics or mental models that, in turn, influence activities and goals (Vargo & Lusch, 2011). In this sense innovation concerns how to find a better way to “serve”; that is, to better integrate resources and design systems for value co-creation involving all partners (Lusch *et al.*, 2010). The enduring rules, norms, values and beliefs – and institutional arrangements (Vargo *et al.*, 2015) – of sets of interrelated institutions contribute to the creation and evaluation of value among multiple actors. Thus, institutions become central to innovation, broadly conceptualized as the co-creation or collaborative recombination of practices that provide novel solutions (Vargo & Lusch, 2016; Koskela-Huotari *et al.*, 2016).

3 Methodology

Underpinning the findings presented in this paper is a qualitative and longitudinal action research study (Ramos, 2002) of an emerging innovation ecosystem. The case involves actors setting up a new technological district for cultural heritage named DATABENC (High Technology District for Cultural Heritage), a project launched at the end of 2011 to provide strategic support to the cultural heritage of Campania – a region in southern Italy – through innovation.

The research approach we chose in an action research, namely a process aimed at favouring knowing by bringing together theory and practice (Reason & Bradbury, 2001) through the support of actors involved in specific contexts. Due to interactions researchers

have and the multiple perspectives combined in combining theory and practice, action research is thought as a participatory method.

The research process consists of three phases in a sequence between theory and practice, with an increasing relevance of practical aspects as time goes by.

4 Findings

Findings show three main actions in the emerging of an innovation ecosystem, namely setting the context and connecting actors, establishing of interdependence, and giving continuity to interactions. Actors represent contrasting forces in running these actions and achieving ecosystem viability, thus actors' roles, their interactions, and their perception of a sense of relatedness are key in favouring the evolution of an innovation ecosystem and its viability.

We identified the focus on emergent ecosystems as essential for understanding the process by which a multiplicity of actors establish and enact relationships, and how they perceive each other and act collectively as members of an ecosystem. Negotiating roles and tasks, managing complex interactions, strategizing collaborations in a flexible way, and dealing with continuous tensions due to both internal and external changes are the key elements affecting the emergence and establishment of innovation ecosystems.

5 Discussion

The research opens up the underexplored concept of how an innovation ecosystem emerges; specifically, the existence of relations between actors' relationships and the emergence of an innovation ecosystem has been investigated.

The central contribution is grounded on 1) comparing perspectives on innovation ecosystem and how they address the emergence mechanisms, and 2) the development of an analytical framework to shed light on the processes and practices that are foundational to the formation and viability of ecosystem.

Through an extensive and longitudinal case study of a technology district project, the research links the dynamics of purposeful and emerging relationships and their implications for structuring and developing interdependencies in an innovation ecosystem (Vargo *et al.*, 2015). We identified three milestones in the establishment of an innovation ecosystem: 1) setting the context; 2) establishing interdependence; and 3) giving continuity. In each action, our research identified the different salient tensions between opposing forces that characterize the emergence of actors' relationships and interdependencies. The search for the composition of these differences allows ecosystems to emerge and become established.

6 Implications and Conclusion

This paper extends the discourse on interconnected relationship perspectives on innovation (Adner, 2006) and explicitly links the dynamics of purposeful and strategic

networks and their implications to structuring and developing the interdependencies that allow an innovation ecosystem to emerge.

Instead of assuming that an ecosystem already exists, as a large part of the literature does, the paper analyses the ongoing dynamics tied to innovation ecosystem emergence. Given that this is a substantially unexplored issue, this study offers a complementary framework for a better understanding of how innovation is generated and sustained in a networking context and how it generates incentives for actors to join and align their interests and aims and provides means of working towards shared goals. Explaining how mutual dependence among actors evolves and shapes an effective ecosystem for innovation is one of the hot topics to be addressed on researchers' agendas (Vargo *et al.*, 2015).

References

- Adner, R., (2006), "Match your innovation strategy to your innovation ecosystem", Harvard Business Review, Vol. 84, No. 4, pp. 98-107.
- Adner, R. and Kapoor, R., (2016), "Innovation ecosystems and the pace of substitution: Re-examining technology S-curves", Strategic Management Journal, Vol. 37, No. 4, pp. 625-648.
- Autio E. and Thomas, L.D. (2013), "Innovation ecosystems", in Dodgson, M., Gann, D.M. and Phillips N. (Eds.), The Oxford Handbook of Innovation Management, Oxford University Press, Oxford, pp 204-228.
- Basole, R.C., Rouse, W.B., McGinnis, L.F., Bodner, D.A. and Kessler, W. (2011), "Models of Complex Enterprise Networks", Journal of Enterprise Transformation, Vol. 1, No. 3, pp. 1-20.
- Carayannis, E.G. and Campbell, D.F. (2012), Mode 3 knowledge production in quadruple helix innovation systems, Springer, New York, NY.
- Carayannis, E.G. and Campbell, D.F., (2014), "Developed democracies versus emerging autocracies: arts, democracy, and innovation in Quadruple Helix innovation systems", Journal of Innovation and Entrepreneurship, Vol. 3, No. 1, 12.
- Carvalho, N. and Gomes, I., (2017), "Knowledge Sharing between Enterprises of the Same Group", International Journal of Knowledge Management, Vol. 13, No. 1, pp. 34-52.
- Chandler, J. D. and Vargo, S. L. (2011), "Contextualization and value-in-context: How context frames exchange", Marketing Theory, Vol. 11, No. 1, pp. 35-49.
- Chesbrough, H.W., (2006) Open innovation: The new imperative for creating and profiting from technology. Harvard Business School Press, Boston, MA.
- Dedehayir, O., Mäkinen, S. J. and Ortt, J. R., (2018), "Roles during innovation ecosystem genesis: A literature review", Technological Forecasting and Social Change, Vol. 136, pp. 18-29.
- EU Science Hub, (2017), "Current Challenges in Fostering the European Innovation Ecosystem". Retrieved from ec.europa.eu – last accessed January, 14th, 2019.
- Ferretti, M. and Parmentola, A., (2015), The creation of local innovation systems in emerging countries: the role of governments, firms and universities. Springer.
- Gawer, A. and Cusumano, M.A. (2002), Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation, Harvard Business School Press, Boston, MA.
- Heikkilä, M. and Kuivaniemi, L., (2012), "Ecosystem under construction: An action research study on entrepreneurship in a business ecosystem", Technology innovation management review, Vol. 2, No. 6, pp. 18-24.

- Iansiti, M. And Levien, R. (2004), *The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability*, Harvard Business School Press, Boston, MA.
- Isenberg, D.J. (2010), "How to start an entrepreneurial revolution", *Harvard Business Review*, Vol. 88, No. 6, pp. 40-50.
- Koskela-Huotari, K., Edvardsson, B., Jonas, J. M., Sörhammar, D. And Witell, L. (2016), "Innovation in service ecosystems—Breaking, making, and maintaining institutionalized rules of resource integration", *Journal of Business Research*, Vol. 69, No. 8, pp. 2964-2971.
- Lusch, R.F., Vargo, S.L. and Tanniru, M. (2010), "Service, value networks and learning", *Journal of the academy of marketing science*, Vol. 38, No. 1, pp. 19-31.
- Lusch, R.F. and Nambisan, S. (2015), "Service Innovation: A Service-Dominant Logic Perspective", *Mis Quarterly*, Vol. 39, No. 1, pp. 155-175.
- McKinsey, (2015) *The Eight Essentials of Innovation*, <https://www.mckinsey.com>, April 2015.
- Mezzourh, S. and Nakara, W.A. (2012), "New Business Ecosystems and Innovation Strategic Choices in SMEs", *The Business Review*, Vol. 20, No. 2, pp. 176-182.
- Möller, K. and Rajala, A., (2007) "Rise of strategic nets: New modes of value creation", *Industrial Marketing Management*, Vol. 36, No. 7, pp. 895-908.
- Ramos, J. M. (2002), "Action research as foresight methodology", *Journal of Future Studies*, Vol. 7, No. 1, pp. 1-24.
- Reason, P., and Bradbury, H. (2001), *Handbook of action research: Participative inquiry and practice*. London: Sage Publications.
- Reynolds, E.B. and Uygun, Y., (2017) "Strengthening advanced manufacturing innovation ecosystems: The case of Massachusetts", *Technological Forecasting and Social Change*, Vol. 136, pp. 178-191.
- Ritala, P., and Almpantopoulou, A. (2017), "In defense of 'eco' in innovation ecosystem", *Technovation*, Vol. 60, pp. 39-42.
- Ritter, T., Wilkinson, I. and Johnston, W., (2004) "Managing in complex business networks", *Industrial Marketing Management*, Vol. 33, No. 3, pp. 175-183.
- Russo Spena, T., Tregua, M. and Bifulco, F., (2016) "Knowledge practices for an emerging innovation ecosystem", *International Journal of Innovation and Technology Management*, Vol. 13, No. 5, 1640013.
- Vargo, S.L. and Lusch, R.F. (2016), "Institutions and axioms: an extension and update of service-dominant logic", *Journal of the Academy of Marketing Science*, Vol. 44, No. 1, pp. 5-23.
- Vargo, S.L., Wieland, H. and Akaka, M.A. (2015), "Innovation through institutionalization: A service ecosystems perspective", *Industrial Marketing Management*, Vol. 44, pp. 63-72.
- Walrave, B., Talmar, M., Podoynitsyna, K.S., Romme, A.G.L. and Verbong, G.P., (2018) "A multi-level perspective on innovation ecosystems for path-breaking innovation", *Technological Forecasting and Social Change*, Vol. 136, pp. 103-113.
- Zahra, S.A. and Nambisan, S. (2012), "Entrepreneurship and strategic thinking in business ecosystems", *Business Horizons*, Vol. 55, pp. 219-229.

Building pervasive Innovations in Destination: the Role of ICTs and Social Capital

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Abstract

Although the innovation phenomenon has been receiving increasing attention in the tourism and hospitality domain, it remains a buzzword extremely fragmented and ignored. Tourism research built on traditional forms of innovation emphasizes the key role of information and communication technologies (ICTs) in innovative processes. However, the technology-driven approach in innovation remains limited, neglecting the nature of destination, as a complex system of relationships between diverse public and private actors generating knowledge and innovation. The interpretation of the destination as a continuous process of innovation-based knowledge considers the innovation as a pervasive and holistic result of the interaction between destination public and private actors facilitated by the complementary role of ICT infrastructures and social capital. This paper aims to contribute to the debate on innovation in destination, overcoming the isolated technology-driven innovation and introducing the role of social capital and ICT infrastructures in nurturing diverse pervasive and holistic forms of innovations in destination. An initially exploratory multiple-case study was used to investigate six drivers and two forms of innovations, selecting Italian and international destinations. The discussion and conclusion design some preliminary theoretical implications and outline some managerial recommendations.

Keywords – Knowledge-based destination, pervasive innovations, ICTs tools, social capital, destination actors.

Paper type – Academic Research Paper

1 Introduction

Innovation as a key factor of destination competitiveness and sustainability (Gomezelj, 2016; Hjalager, 2010, 2015; Ozseker, 2018; Pikkemaat, Peters and Chan, 2018; Zach and Hill, 2017).

Although the innovation phenomenon has been receiving increasing attention in the tourism domain, the existing studies are fragmented (Gomezelj, 2016; Hjalager, 2010; Rodriguez, Williams and Hall, 2014) and tourism researches build upon the traditional forms of innovation, mainly based on the manufacturing paradigm and technology-driven innovation. Several papers emphasize on the critical role of information and communication technologies (ICTs) in innovative processes (Ali and Frew, 2014; Buhalis, 1998; Buhalis and Law, 2008; Sigala, 2018). Indeed, destination is a complex system of relationships among diverse actors, public and private, activating the process of knowledge sharing and conversion to nurture innovation in knowledge-based destination (Ozseker, 2018; Racherla, Hu and Hyun, 2008).

Thus, understanding the innovation phenomenon in knowledge-based destination requires a new paradigm including the social connections among the actors, based on the social capital concept. It capitalises as connections producing actors' participation and adoption of the ICT infrastructures, reinforcing the innovation process in destination.

This paper aims to contribute to the debate on innovation in knowledge-based destination. The theoretical framework proposes a new destination interpretation as the result of knowledge-driven innovations, assuming pervasive character, being the result of actors' interaction at multiple levels (DMO, institutions and political actors, local firms and local community).

It interprets ICTs as tools of enhancing innovativeness in conditions in which social capital facilitates technology acceptance, entrepreneurship, networking and co-creation between diverse destination actors.

Building upon the multidisciplinary literature on knowledge-destination, tourism innovation, ICTs and social capital, the paper investigates drivers and pervasive innovations in destination.

An exploratory multiple-case study (Yin, 2014) was used to investigate technology-driven and social-driven innovations, an unexplored phenomenon and thus it provides preliminary insights (Creswell, 2007) for future research. The discussion and the conclusion propose theoretical advances to explore the innovation forms in destination, suggesting future research and challenges for academics, policy makers and destination managers.

2 Theoretical background

2.1 Innovation in knowledge-based destination

The destination is a complex social system of actors, creating and transforming knowledge into rewarding products and forms of innovation (Racherla et al., 2008;

Sheehan, Vargas-Sánchez, Presenza and Abbate, 2016). It can be interpreted as an innovation ecosystem (Carayannis and Campbell, 2014; Ferretti and Parmentola, 2015) in which spatial dimension, tourism industry patterns, and public and private actors (including community and tourists) generate a co-evolutionary process of innovation. Specific local contexts matter in destination innovation assuming a repository role of spatial and cross-sectorial knowledge generation and dissemination (Roper and Love, 2018) and nurturing collective innovativeness and pervasive innovation (Boekema, Morgan, Bakkers and Rutten, 2000).

In knowledge-based destination, the shared and disseminated knowledge plays a critical role in generating continuous innovations and driving process of co-evolution in local context. Although the knowledge in destination – disseminated at spatial, sectorial and network level – is considered as public, many actors cannot access to it easily. Often this implication is relative to the limited capacity of knowledge access and management, but it can be resolved through the positive effects of spatial specificity, concentration, and geographical proximity. These effects encourage the incorporation of single actors into network structure, researching and activating social connections among diverse actors (Baggio and Cooper, 2010; Buffa, Beritelli and Martini, 2019; Roper and Love, 2018).

Networks improve actors' capacity to acquire knowledge, resources or technologies to open new opportunities of cooperation, and to attribute legitimation and power in the innovation management practices (Baggio and Cooper, 2010; Buffa et al., 2019; Roper and Love, 2018). They contribute to consolidate the social connections among actors through the homogenisation of common interests and goals alignment, encouraging new practice of knowledge sharing and dissemination based on personal and trusted relationships (Martínez-Pérez, Elche and García-Villaverde, 2019). Social connections facilitate and integrate the knowledge flows of different actors, transforming the destination in a dynamic system of learning, in which the innovation is the result of the dissemination of incubator and spill-over experiences (Asheim, Coenen and Vang, 2007).

In this perspective, the proposed framework interprets the destination as the result of knowledge-driven innovations, attributing pervasive and holistic character (Fig. 1). Destination drivers are the stakeholders engagement at multiple levels (DMO, institutions and political actors, local firms and local community), social capital, and ICT infrastructures to reinforce the strategies implementation. The two structures facilitate hard and soft connections at inter- and intra-actors' connections level, converting knowledge toward emerging forms of innovation. Finally, structures reinforce the destination vision to be an incubator and spill-over of collective innovations.

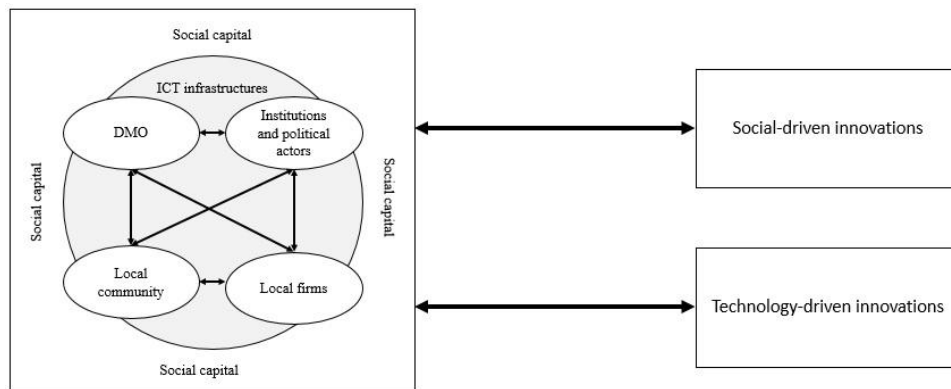


Fig. 1. Technology-driven and social-driven innovations in destination.

2.2 Social capital and innovation

Social capital is considered as a social structure function of different entities such as norms, values, beliefs, trust and alternative forms of interaction (Coleman, 1988; Nahapiet and Ghoshal, 1998; Putnam, 1993). It has received incremental attention, encouraging to analyse a wide range of research at various levels of analysis resulting in an interdisciplinary topic (Adler and Kwon, 2002), though it has not gained much attention in tourism context (Lee, 2015).

Social capital analysis in tourism, including tourism destination, requires application of alternative perspectives that identify actors in social structure – societies, organisations, networks and local contexts (Inkpen and Tsang, 2005; Macbeth, Carson and Northcote, 2018) – in which the resources are embedded in the relations based on the cooperation. It is a driver of the innovation capacity of local context, especially for destinations. It reinforces the traditional assumption of networks role (Macbeth et al., 2018) – based on the effects of geographical proximity, concentration and spatial specificity – to provide actors with access to the processes of sharing, transformation or integration of tacit and codified knowledge to generate new knowledge, implementing collective innovations (Inkpen and Tsang, 2005; Martínez-Pérez et al., 2019).

Encouraging the tie between social capital and innovation, it is possible to readapt the traditional social capital structure – structural, cognitive and relational (Nahapiet and Ghoshal, 1998) – as an analysis tool to define the participation level of destination actors (Go, Trunfio and Della Lucia, 2013; Liu et al., 2014) toward innovation, activating specific knowledge transfer processes.

The structural dimension analyses the network access as a source of knowledge flows and identifies the network role, configuration, and types of ties. The network configuration describes the innovation as the result of social actions subordinated and hierarchical or non-hierarchical. Furthermore, network ties express variety, quantity and nature of connections activated to knowledge sharing to nurture innovation.

The cognitive dimension identifies the elements to stimulate the process of knowledge sharing among the networks. The relational dimension describes the elements impact on

relational behaviour developed by network during connections with other actors. They are expressed in terms of identification, trust, norms and obligations.

2.3 ICTs infrastructure and innovation

ICTs have produced a disruptive change in the traditional paradigm of industry based on the intensive use of knowledge and removing traditional barriers of communication (Buhalis, 1998). The phenomenon includes different sectors, especially in tourism and destination (Buhalis, 1998; Buhalis and Law, 2008). Their continuous application have increased re-engineering process of knowledge-driven innovations in destination, reducing the environmental and market complexity through integration of traditional technologies with new ICTs-based infrastructure. They have opened new opportunities and challenges especially in information management (Sigala, 2018), including: strategic decision support, e-learning tool, alternative access to big data sources, co-gamification or co-creation in experiential platforms and the use of artificial intelligence tools. The main goal will be to transform the traditional destination to a digital and smart innovation ecosystem (Boes, Buhalis and Inversini, 2015; Buhalis and Amaranggana, 2015; Del Chiappa and Baggio, 2015).

The constant growth of ICT infrastructures demand, followed by the need of usability development have contributed to creation of specific ICTs-based tools to satisfy various actors' needs (Ali and Frew, 2014; Holden and Rada, 2011). Thus, ICT infrastructure can be considered as an umbrella, grouping tools with specific missions, such as sustainable tourism management, alternative marketing for destination development or informative systems of big data management (Ali and Frew, 2014).

Although ICTs promote numerous opportunities, they require significant considerations (Lee, 2015) in order to overcome the geographical borders. First, ICTs remove limits of networking derived by the effects of spatial specificity, concentration and geographical proximity. Second, they promote changes in the traditional structures of network in virtual community, amplifying interactions and exchanges of knowledge through the activation of new actors interdependences. Third, social capital plays an important role directing actors towards ICTs-based association forms. Fourth, transition processes often require attitude in the technology adoption, but it is underestimated by many actors, compromising their future possibility to participate to knowledge co-creation for innovation in destination.

3 Forms of pervasive innovations in destination

Our research framework proposes two forms of innovation, social-driven and technology-driven innovations. They are the results of the actors' participation and the use of two platforms (social capital and ICT infrastructures). The framework identifies social-driven innovation based on the social capital dimensions and technology-driven innovation based on the ICT infrastructures – in which social capital influences the technology acceptance and adoption – in the process of knowledge sharing and conversion to nurture innovation in destination.

3.1 Technology-driven innovation in destination

The technology-driven innovation in destination considers the ICTs as fundamental infrastructures to reinforce coordination and integration among diverse actors to innovate (Racherla et al., 2008). Although the research in tourism innovation is limited and fragmented, the concepts of technology and innovation have received increasing attention, emphasising the tourism a perfect place of ICTs application to drive the innovation (Buhalis, 1998; Buhalis and O'Connor, 2005).

The interconnection use of the ICT infrastructures in different processes of destination management opens new opportunities of intelligent knowledge sharing and conversion (Racherla et al., 2008; Sheehan et al., 2016), transforming the traditional social connections in a dynamic and technological system. Various destinations have embraced the power of ICT infrastructures, combining human capital, social capital, technology and innovation. In this perspective, they identify new forms of innovations to resolve and anticipate emerging urban and social problems: introducing new business models through the application of smartness concept (Buhalis and Amaranggana, 2015; Del Chiappa and Baggio, 2015; Gretzel et al., 2015); re-inventing the personalisation processes with forms of experience co-creation driven (Neuhofer, Buhalis and Ladkin, 2012; Stamboulis and Skayannis, 2003); engaging stakeholders in digital model of destination management (Cabiddu, Lui and Piccoli, 2013; Sigala and Marinidis, 2012; Trunfio and Della Lucia, 2019).

3.2 Social-driven innovation in destination

The phenomenon of social-driven innovation considers the social capital as a critical element to nurture innovation. It analyses the social structure of local context which are the local actors' motivations to create opportunity of social change.

In innovation literature, it has been often overlooked, presenting a strong focus at the innovation based on the technological approaches (van der Have and Rubalcaba, 2016). Some studies have attempted to provide explanations of the phenomenon analysing its effects with multi-disciplinary perspectives. Although they have identified its effects with the social innovation concept, they do not know exactly its causes and consequences, remaining an ambiguous concept.

Social innovation effects can be summarised as new social practices to revitalise the social structure of a local context, generating multi-level social changes (Swedberg, 2009), activating stakeholders engagement of unusual actors (Neumeier, 2017) and exploring new creative solutions (Caulier-Grice et al., 2012).

The effects are the result of a co-evolutionary process, in which the local actors externalise their social problems, expressing new interests, defining actions delineation and co-ordination. These moments are the expressions of the social capital dimensions. First, the problematisation reveals the structural dimension identifying the actors' integration capacity into a network or other forms of collaboration to represent their interests. Second, the shared of common interests concerns the cognitive dimension, networks define common interests to orient its vision, codes and languages. Third, the co-

ordination reflects the relational dimension, in which the elements of trust, identification, norms and obligations amplify the possibility of success or failure of social change. Indeed, the effects of social innovation do not always turn into co-created social value – expressed in terms of new product, service, process or business model, including also forms of social technology – but they can generate positive spill-over or incubator actions within the local context.

The analysis of social innovation effects identifies forms of bottom-up actors' participation, reshaping the social structure of the destination, and promoting new business models, typically of the destinations of community type or cities with a strong creative identity (Go and Trunfio, 2011).

4 Case study

4.1 Dolomiti Paganella in Trentino: a top-down approach in social-driven innovation

Dolomiti Paganella is a small Italian destination, situated in the province of Trento (TN) in Trentino. It includes the Paganella highland with its five locations – Andalo, Molveno, Fai della Paganella, Cavedago and Spormaggiore – the Pradel highland, the Alpine area of the Brenta Dolomites (UNESCO site), the Molveno lake and the Andamello-Brenta park. In 2015, Dolomiti Paganella was chosen as the first Italian destination for the application of St. Gallen Destination Management Model (Beritelli et al., 2015). In critical terms, it reshaped the architectural destination toward a management structure based on the experience co-creation between the system heads (offer) and market mavens (demand), attributing new indirect role of intermediation to the DMO with the use of ICTs-based tools. The new governance model revitalised the social structure of the destination including local firms and local community in projects co-creation, removing its maturity state (Reinhold, Laesser and Beritelli, 2018).

The co-evolution process was composed of different phases including diverse actors' roles and functions in different steps (institutions and political actors, DMO, local firms and local community).

Diverse social problems were: internal competition among local actors; absence of a common vision and strategy of destination development; fragmentation of the tourist supply; and finally, the requires of redefinition of the destination leadership.

Successively, the emergence and consolidation of social problems have encouraged the DMO to activate a coordination action on the interests of the local community and local firms. Local actors have participated tracing their personal strategic business area about the tourists movements in destination. In this mode, the DMO stimulated high levels of co-participation by the local community and local entrepreneurship, following management perspective of top-down approach (Go and Trunfio, 2011).

The process finished with the validation of common strategic business areas, defining new roles and responsibilities for divers actors, and re-organising the financial resources in three experiential projects of biking, family and trekking (Buffa et al., 2019). In particular, the DMO role was changed in an intermediation position in destination

management between local, institutional and political actors. It assumed the tasks of data collection and knowledge creation and sharing through the use of ICTs-tool (Ali and Frew, 2014; Sheehan et al., 2016). Its new intelligent role in knowledge management in destination helped to enrich the experiential products promoted by the local actors (Buffa et al., 2019).

4.2 Helsinki European Capital of Smart Tourism in 2019: a convergent approach in technology-driven innovation

Helsinki is the Finland capital (pop. c. 620.982), including over 300 beautiful green islands – in particular the fortress of Suomenlinna is a UNESCO World Heritage Site – bathed by a sea. The capital presents diversity of design, architectures and cultures, with a laid back city's rhythm. Its vivacity and creativity reflects more the entrepreneurial activity, in terms of both number and quality of restaurants and nightclubs. In general, it is a compact city easily explored on foot through all its angles and large park areas, forests, lakes, and the blue coastline. Originally it was an area occupied by Tavastian population during the Iron Age in the 14th century. Successively, the Swedes colonized the Helsinki region in the late 13th century with the defeat of the Tavastians.

In recent years, the institutional and political actors drove Helsinki toward an important tourism development with a smarter perspective. They were the key actors in this process contributing to the implementation of continuous investments in ICT infrastructures, creating digital services, opening big sets and building accessible experiences. This development action considered a new destination management model based on the accessibility approach. The success of the model is certified with the achievement of the leader position of European Capital of Smart Tourism in 2019. The title is an important opportunity for the future of the city, especially in term of reputation as an accessible city.

The DMO consolidated the smart integration process with MyHelsinki project. It is based on the use of ICTs to improve the functionalities and fruition of the city – in term of accessibility – for the local community and visitors. It is a digital and intelligent personal guide of the city, constituted by an APP-mobile. The ICTs recourse is the function of the capacity to satisfy the diverse actors' needs (local community, local firms and tourists).

Through the APP, the local firms could insert and integrate their information in three principal databases, about the activities, locations and events present in the city. The information were managed with systems of data integration (Ali and Frew, 2014).

Finally, local community and tourists could enjoy the APP through a structure with re-creative style and each resident could share and collect the tourism information, customizing and saving the contents and services, developing mini-programs to provide recommendation, mobility planning and purchase options for other actors.

In this mode, the continuous investments of institutional and political actors in the social and technological capital, co-ordinated with the help of DMO, have contributed to involve local community and local firms toward strategy forms of active co-participation of the city – following a convergent approach (Go and Trunfio, 2011) – and promoting a

continuous process of technology acceptance and adoption with processes of social re-organisation.

5 Discussion and conclusion

The paper attempts to explain the complexity of interpreting destination innovation phenomenon considering the continuous process of actors' connections among political and institutional actors, DMO, local community and local firms, to promote knowledge sharing and conversion. It presents some preliminary contributions to the theoretical debate of destination innovation.

First, the paper argues that the tourism destination is representative of specific innovation ecosystems, characterised by processes of knowledge sharing and conversion among diverse actors at multi-level (Ozseker, 2018; Racherla et al., 2008; Roper and Love, 2018). It proposes two perspectives, social-driven innovation and technology-driven innovation. Both innovation forms are the results of complex spiral of knowledge sharing and conversion activated by four actors and supported by two structures.

Local actors can promote networking, generating dynamical spiral of knowledge sharing and disseminating positive effects of spill-over experience in destination (Asheim et al., 2007; Baggio and Cooper, 2010; Roper and Love, 2018). Second, the framework reveals that diverse actors implement innovation in destination through continuous investments to re-shape and re-organise their two structures of support, social capital and ICT infrastructures. Both the structures reinforce the actors connections, in terms of knowledge sharing and conversion, contributing to innovate through forms of stakeholder engagement at multi-level, following a bottom-up or top-down approach (Go and Trunfio, 2011). They contribute to the destination innovation in different modes, e.g. stimulating goal alignment, common vision and strategies, relationships based on mutual elements, etc., contributing generally to the knowledge management.

Furthermore, the framework proposed represents an alternative model of thinking, identifying a different levels of support between social capital and ICT infrastructures (Lee, 2015). ICTs acceptance and adoption are the results of the process of knowledge sharing among actors involved, considering at the base of the interdependence relationships that shape the common social structure. In this perspective, ICTs infrastructures and social capital have both common actions of support but their role is not complementary.

Third, the ICT infrastructures offer new business models – in terms of accessibility, digitalisation, cultural heritage and creativity, and sustainability – of destination management. The ICTs application promotes high levels of stakeholder engagement, but it is required to prior widespread the feeling of technology acceptance and adoption driven by the social capital. Finally, it will be necessary to analyse the impact effects of the technology-driven innovations on the social capital, in terms of destruction or re-vitalise the culture, values and other elements of the destination identity.

The paper is not without limitations. First, the framework does not consider external pressure, especially that produced by tourists. Future research will include the tourists'

role in the destination innovation to provide a holistic framework. Second, the case studies are analysed with a desk analysis. Future research will consider more rigorous qualitative methods and tools to collect primary and secondary data from multiple sources of case evidence, collecting semi-structured interviews with destination managers.

References

- Adler, P. S. and Kwon, S.-W. (2002) "Social Capital: Prospects for a New Concept", *The Academy of Management Review*, Vol. 27, No. 1, pp. 17–40.
- Ali, A. and Frew, A. J. (2014a) "ICT for sustainable tourism: a challenging relationship?", *Journal of Hospitality and Tourism Technology*, Vol. 5, No. 1, pp. 2–16.
- Asheim, B., Coenen, L. and Vang, J. (2007) "Face-to-face, buzz, and knowledge bases: Sociospatial implications for learning, innovation, and innovation policy", *Environment and Planning C: Government and Policy*, Vol. 25, No. 5, pp. 655–670.
- Baggio, R. and Cooper, C. (2010) "Knowledge transfer in a tourism destination: the effects of a network structure", *The Service Industries Journal*, Vol. 30, No. 8, pp. 1–15.
- Beritelli, P., Reinhold, S., Laesser, C. and Bieger, T. (2015) *The St. Gallen model for destination management*, IMP-HSG.
- Boekema, F., Morgan, K., Bakkers, S. and Rutten, R. (2000) *Knowledge, innovation and economic growth*, Edward Elgar Publishing.
- Boes, K., Buhalis, D. and Inversini, A. (2015) "Conceptualising Smart Tourism Destination Dimensions", in *Information and communication technologies in tourism 2015* (pp. 391–403), Springer, Cham.
- Buffa, F., Beritelli, P. and Martini, U. (2019) "Project networks and the reputation network in a community destination: Proof of the missing link", *Journal of Destination Marketing & Management*, Vol. 11, pp. 251–259.
- Buhalis, D. (1998) "Strategic use of information technologies in the tourism industry", *Tourism Management*, Vol. 19, No. 5, pp. 409–421.
- Buhalis, D. and Amaranggana, A. (2015) *Smart Tourism Destinations Enhancing Tourism Experience Through Personalisation of Services*, in *Information and communication technologies in tourism 2015* (pp. 377–389), Springer, Cham.
- Buhalis, D. and Law, R. (2008) "Progress in information technology and tourism management: 20 years on and 10 years after the Internet-The state of eTourism research", *Tourism Management*, Vol. 29, No. 4, pp. 609–623.
- Buhalis, D. and O'Connor, P. (2005) "Information communication technology revolutionizing tourism", *Tourism Recreation Research*, Vol. 30, No. 3, pp. 7–16.
- Cabiddu, F., Lui, T. W. and Piccoli, G. (2013) "Managing Value Co-Creation In The Tourism Industry", *Annals of Tourism Research*, Vol. 42, pp. 86–107.
- Carayannis, E. G. and Campbell, D. F. (2014) "Developed democracies versus emerging autocracies: arts, democracy, and innovation in Quadruple Helix innovation systems", *Journal of Innovation and Entrepreneurship*, Vol. 3, No. 1, pp. 201–234.
- Caulier-Grice, J., Davies, A., Patrick, R. and Norman, W. (2012) *Defining social innovation. A deliverable of the project: The theoretical, empirical and policy foundations for building*

- social innovation, in Europe (TEPSIE), European Commission–7th Framework Programme, European Commission, DG Research, Brussels
- Coleman, J. S. (1988) “Social Capital in the Creation of Human Capital”, *The American Journal of Sociology*, Vol. 94, pp. S95–S120.
- Creswell, J. W. (2007) *Five qualitative approaches to inquiry. Qualitative inquiry and research design: Choosing among five approaches*, Sage Publications.
- Del Chiappa, G. and Baggio, R. (2015) “Knowledge transfer in smart tourism destinations: Analyzing the effects of a network structure”, *Journal of Destination Marketing & Management*, Vol. 4, No. 3, pp. 145–150.
- Ferretti, M. and Parmentola, A. (2015) *The creation of local innovation systems in emerging countries: the role of governments, firms and universities*, Springer.
- Go, F. M. and Trunfio, M. (2011) *E-Services Governance in Public and Private Sectors: A Destination Management Organization Perspective*, in *Information technology and innovation trends in organizations* (pp. 11–19), Physica-Verlag HD.
- Go, F. M., Trunfio, M. and Della Lucia, M. (2013) “Social capital and governance for sustainable rural development”, *Studies in Agricultural Economics*, Vol. 115, pp. 104–110.
- Gomezelj, D. O. (2016) “A systematic review of research on innovation in hospitality and tourism”, *International Journal of Contemporary Hospitality Management*, Vol. 28, No. 3, pp. 516–558.
- Gretzel, U., Sigala, M., Xiang, Z. and Koo, C. (2015) “Smart tourism: foundations and developments”, *Electronic Markets*, Vol. 25, pp. 179–188.
- Hjalager, A. M. (2010) “A review of innovation research in tourism”, *Tourism Management*, Vol. 31, No. 1, pp. 1–12.
- Hjalager, A. M. (2015) “100 Innovations That Transformed Tourism”, *Journal of Travel Research*, Vol. 54, No. 1, pp. 3–21.
- Holden, H. and Rada, R. (2011) “Understanding the Influence of Perceived Usability and Technology Self-Efficacy on Teachers’ Technology Acceptance”, *Journal of Research on Technology in Education*, Vol. 43, No. 4, pp. 343–367.
- Inkpen, A. C. and Tsang, E. W. (2005) “Social capital, networks, and knowledge transfer”, *Academy of Management Review*, Vol. 30, No. 1, pp. 146–165.
- Lee, B. C. (2015) “The impact of social capital on tourism technology adoption for destination marketing”, *Current Issues in Tourism*, Vol. 18, No. 6, pp. 561–578.
- Liu, J., Qu, H., Huang, D., Chen, G., Yue, X., Zhao, X. and Liang, Z. (2014) “The role of social capital in encouraging residents’ pro-environmental behaviors in community-based ecotourism”, *Tourism Management*, Vol. 41, pp. 190–201.
- Macbeth, J., Carson, D. and Northcote, J. (2018) “Social Capital, Tourism and Regional Development: SPCC as a Basis for Innovation and Sustainability”, *Current Issues in Tourism*, Vol. 7, No. 6, pp. 502–522.
- Martínez-Pérez, Á., Elche, D. and García-Villaverde, P. M. (2019) “From diversity of interorganizational relationships to radical innovation in tourism destination: The role of knowledge exploration”, *Journal of Destination Marketing and Management*, Vol. 11, pp. 80–88.
- Nahapiet, J. and Ghoshal, S. (1998) “Social Capital, Intellectual Capital, and the Organizational

- Advantage: Sociological and Economic Approaches to the Analysis of Social Structure”, *The Academy of Management Review*, Vol. 23, No. 2, pp. 242–266.
- Neuhofer, B., Buhalis, D. and Ladkin, A. (2012) “Conceptualising technology enhanced destination experiences”, *Journal of Destination Marketing and Management*, Vol. 1, pp. 36–46.
- Neumeier, S. (2017) “Social innovation in rural development: identifying the key factors of success”, *Geographical Journal*, Vol. 183, No. 1, pp. 34–46.
- Ozseker, D. B. (2018) “Towards a model of destination innovation process: an integrative review”, *The Service Industries Journal*, Vol. 39, No. 3–4, pp. 206–228.
- Pikkemaat, B., Peters, M. and Chan, C. S. (2018) “Needs, drivers and barriers of innovation: The case of an alpine community-model destination”, *Tourism Management Perspectives*, Vol. 25, pp. 53–63.
- Putnam, R. D. (1993) “The prosperous community: social capital and public life”, *The American Prospect*, Vol. 13, No. 4, pp. 35–42.
- Racherla, P., Hu, C. and Hyun, M. Y. (2008) “Exploring the role of innovative technologies in building a knowledge-based destination”, *Current Issues in Tourism*, Vol. 11, No. 5, pp. 407–428.
- Reinhold, S., Laesser, C. and Beritelli, P. (2018) “The 2016 St. Gallen Consensus on Advances in Destination Management methodology”, *Journal of Destination Marketing & Management*, Vol. 8, pp. 426–431.
- Rodriguez, I., Williams, A. M. and Hall, C. M. (2014) “Tourism innovation policy: Implementation and outcomes”, *Annals of Tourism Research*, Vol. 49, pp. 76–93.
- Roper, S. and Love, J. H. (2018) “Knowledge context, learning and innovation: an integrating framework”, *Industry and Innovation*, Vol. 25, No. 4, pp. 339–364.
- Sheehan, L., Vargas-Sánchez, A., Presenza, A. and Abbate, T. (2016) “The Use of Intelligence in Tourism Destination Management: An Emerging Role for DMOs”, *International Journal of Tourism Research*, Vol. 18, No. 6, pp. 549–557.
- Sigala, M. (2018) “New technologies in tourism: From multi-disciplinary to anti-disciplinary advances and trajectories”, *Tourism Management Perspectives*, Vol. 25, pp. 151–155.
- Sigala, M. and Marinidis, D. (2012) “E-democracy and web 2.0: a framework enabling DMOS to engage stakeholders in collaborative destination management”, *Tourism Analysis*, Vol. 17, No. 2, pp. 105–120.
- Stamboulis, Y. and Skayannis, P. (2003) “Innovation strategies and technology for experience-based tourism”, *Tourism Management*, Vol. 24, No. 1, pp. 35–43.
- Swedberg, R. (2009) *Principles of economic sociology*, Princeton University Press.
- Trunfio, M. and Della Lucia, M. (2018) “Engaging destination stakeholders in the digital era: The Best Practice Of Italian Regional Dmos”, *Journal of Hospitality & Tourism Research*, Vol. 43, No. 3, pp. 349–373.
- van der Have, R. P. and Rubalcaba, L. (2016) “Social innovation research: An emerging area of innovation studies?”, *Research Policy*, Vol. 45, No. 9, pp. 1923–1935.
- Yin, R. K. (2014) *Case Study Research Design and Methods* *The Canadian Journal of Program Evaluation* (5th Ed.), Sage, CA, Thousand Oaks.
- Zach, F. J. and Hill, T. L. (2017) “Network, knowledge and relationship impacts on innovation in tourism destinations”, *Tourism Management*, Vol. 62, pp. 196–207.

The Determinants of Winners and Losers in a Digitalized Eco-System

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Abstract

Recent advances in Information and Communication Technologies (ICT) have exploded the potential for value creation in a variety of innovation ecosystems (Vilhelmson, 2006). The vast increase in potential can be attributed to two distinct underlying factors. First, ICT has extended the reach of more possible actors to the point where nearly any actor can be connected to any other and, as a result, geographic proximity is becoming less and less relevant (Boschma, 2005). Second, the responsiveness of one party in a relationship (to the needs of existing parties or the opportunities from a nearly limitless number of other possible parties) has become almost instantaneous to the point where time has become compressed and essentially (a less differentiating factor (Nachira 2002, Boschma 2007). However, despite the vast size of the potential value that, ICT enables, we argue that it is likely that only a tiny fraction of this potential may be realized, unless and until relevant risks are anticipated and effectively managed (Fransman 2010).

In this paper, we consider risk at two levels of a prototypical digital ecosystem: First is the level of possible interacting actors. Second is the level of those actors who contribute to the design, organization and maintenance of the ecosystem (Doloreux 2002, Asheim 2002). In each case, extended reach and quicker responsiveness enhances opportunities for greater utilization and better experience of any asset among the parties it also exposes various parties to greater risk. (Adner 2006, Graca P. and Camarinha-Matos 2017).

Accordingly, we apply a value creation-appropriation theoretical framework to consider the managerial challenges that risks pose. We develop a number of scenarios to illustrate how various risk mitigation strategies can influence not only who wins and who loses but also the amount of value that is likely to be created by the digitalized ecosystem (Basole

2015). Some prominent features of the relative dynamics, that our theoretical framework highlights will be illustrated by an agent-based simulation model. This model will comprise multiple agents that can interact according to their level of reach and responsiveness (Leavy and Adner 2012). By manipulating the extent of reach and the degree of responsiveness afforded to agents (a proxy of the level of digitalization) The study seeks to contribute to innovation ecosystems by focusing on the risks that the digitalization of ecosystems (Baldassar 2016) gives rise to (as a direct result of the value potential that it enables) and the inherent managerial challenges that may require a rethinking of the role of eco-system actors and even of non-actors that could be positively or negatively impacted.

Keywords – Innovation ecosystem, reach, responsiveness, risk, digitalization

Paper type – Academic Research Paper

1 Introduction

Digitalization enables a vast increase in potential value (by dramatically enhancing reach and responsiveness) but also gives rise to significantly greater risk. ICT has extended the reach of more possible actors to the point where nearly any actor can be connected to any other and, as a result, distances are essentially shrinking and geographic proximity has become less and less relevant. The responsiveness of one party in a relationship (to the needs of existing parties or the opportunities from a nearly limitless number of other possible parties) has become almost instantaneous to the point where time has essentially become compressed and is a less differentiating factor.

The consequence of greater reach and responsiveness is an expansion of the value creating potential of the resource. When advances in technology have extended reach or enhanced responsiveness, they have greatly expanded the potential for value creation. Reach has been extended dramatically many times throughout history, to clarify the phenomenon we can compare the advent of IT tools to the development of technologies in the transport industry, for example, transcontinental shipping that allowed far greater distances to be spanned; canals, railways, highways and airplanes that have shortened travel times and/or lowered its cost; and refrigerated trailers that expanded the types and volumes of goods that can be transported. Greater reach brings more and different buyers and suppliers together. It has the effect of reducing the distance between service provider and user, thereby providing greater access to more potential users of a given service, from any resource, and of particular resources to more users. More recently, advances in information technology have contributed to extended reach. Specifically, digitalization has enabled and extended reach through the internet and virtual networks (like social media), which make it easier for more actors to connect.

While reach indicates the numbers and variety of potential exchange partners, responsiveness reflects how quickly, richly and efficiently they can understand each other and react/respond to changes in the situations of either (for example changes in supply,

demand, quality, quantity, timing of production/delivery, etc.). Such changes may present several opportunities. Quicker responsiveness has the effect of reducing the time required for the resource owner to interact with a user and communicate the value proposition or adapt it to the user's needs. Responsiveness increases with the speed, volume and immediateness of information transfer and with declining costs of data gathering, storing, access and transfer. In each case, extended reach and quicker responsiveness enhances opportunities for greater utilization and better experience of any asset among the parties it also exposes various parties to greater risk that other parties will appropriate value from them (a risk that may not even have existed for that party before) (Fransman 2010, Graca P. and Camarinha-Matos 2017). In this study we use a simulation model that allows us to create a predictive model, that analyzes the risk associated to reach and responsiveness increment within the ecosystem. The research question is: How does technology expose the actors of the innovation ecosystem to risks?

2 Theoretical background

2.1 The role of technology in innovation context: Digitalized Innovation Ecosystem

The process of creating value via leveraging the power of innovation ecosystems has become increasingly important in academic studies and in management practice. Recent advances in Information and Communication Technologies (ICT) have exploded the potential for value creation via a variety of innovation ecosystems. Technological advances have revolutionized the concept of the traditional value chain. Networked systems have replaced traditional linear production schemes. The concept of the digital innovation ecosystem, is an evolution of the typical business ecosystem. Nachira (2002) was among the first to introduce the idea of digital business ecosystems, focusing on the importance of technology and digital platforms as a tool for the exchange and aggregation of resources and information.

Digital technology has a crucial role on the relationships between actors within the network. A digital ecosystem is a network in which the evolution of relationships is moderate through the innovative development of software and hardware (Nachira et al. 2007). Digital technology endows the ecosystem with IT infrastructure, that dramatically expand the range of action of individual actors of a traditional network. The geographical ecosystem perimeter is radically re-conceptualized.

In our study, the Briscoe framework (2009; 2010) was used to further clarify the concept of the digital innovation ecosystem. The authors have identified eight key factors of a prototype ecosystem: multi-agent system, economy, business, ecology, population, community, innovation, technology. This framework is very clear and highlights the fundamental pillars of a digital innovation ecosystem. In our study we analyse how technology incrementation (in terms of "the multi-agent" feature) generates more risks with the other aspects of the framework (in terms of "innovation", "business" etc). According to Camarinha-Matos and Afsarmanesh, we can define a digitalized innovation ecosystem as "*a network consisting of a variety of entities (e. g. organizations and*

people) that are largely autonomous, geographically distributed, and heterogeneous in terms of their operating environment, culture, social capital and goals, but that collaborate to better achieve common or compatible goals, and whose interactions are supported by computer networks”(2008a).

2.2 Reach and responsiveness as a factor of interoperability within digitalized innovation ecosystem.

According to the Institute of Electrical and Electronics Engineers (1993), interoperability is defined as "*the ability of two or more systems or components to exchange information and to use the information exchanged*". Major definitions in the literature state that interoperability is the ability of a network to exchange information (Figay et al.2012) Previous studies have identified two main lines of research on interoperability: process interoperability, which concerns the technological study of interfaces and software (Jardim-Goncalves et al., 2006); and information/knowledge interoperability, which concerns the study of relationships between subjects within the ecosystem (Peltoniemi and Vuori, 2004). The knowledge interoperability strand analyses the processes of information exchange within systems, the absorption capacity of actors, the interconnection between developers and users of knowledge and the re-modulation of relationships throughout the life cycle of the system. The significant IT technology growth within ecosystems, has fostered the phenomenon of symbiosis. In agreement with Adner (2006) the use of digital technologies within ecosystems improves relations by raising the degree of interdependence, to the point where each individual entity cannot create higher value than the entire ecosystem outcome. Digital infrastructures impact on the degree of interoperability within ecosystems. The vast increase in connectivity can be attributed to two distinct underlying factors: reach and responsiveness. In our conceptual framework reach is measured by numbers and diversity of buyers and suppliers that have access to one another for exchange. Reach has been extended dramatically many times throughout history, largely by advances in transportation First, ICT has extended the reach of more possible actors to the point where nearly any actor can be connected to any other and, as a result, distances are essentially shrinking and geographic proximity has become less and less relevant.

The second factor is the responsiveness, that corresponds to the agility of one party in a relationship (to the needs of existing parties or the opportunities from a nearly limitless number of other possible parties) has become almost instantaneous to the point where time has essentially become compressed and is a less differentiating factor. IT technologies increase the degree of interoperability within the innovation ecosystem (Aulkemeier et al 2018). This happens thanks to the more agile relationships between the components of the network. The degree of agility is measured by the responsiveness of the actors. According to Koppius(2009), the speed of connection between the parties in a network reduces the costs of interacting inside and outside the network (van Hillegersberg et al. 2012)

2.3 The risk evaluation within digitalized innovation ecosystem

The risk management in a complex systems, is a heavy activity. Risk management traditionally focused on internal operational process, underestimates the importance of the risk related to the partners within the innovation ecosystem.(Calandro 2015). Possible threats to business profitability may come from the dynamics within the innovation ecosystems. In this study we operate a risk classification: by nature of the involved actor, and by risk typology. In terms of involved actor we consider risk at two levels of a digital prototypical ecosystem:

- First, is the level of possible interacting actors;
- Second, is the level of those actors who contribute to the design, organization and maintenance of the ecosystem.

In the first case, we analyse the risks faced by the actors present within the system, during the value creation process within the ecosystem. The major risk is that one of the component of the network could expose other parties to a greater risk that external entity will appropriate value from them (a risk, and level of exposure, that may not even have existed for that party before). The second level concerns an analysis of all those actors that contribute to structuring, organizing and reshaping the ecosystem(Letaifa,S. Rabeau, Y. 2013). At this level the risk could affect the relationship among actors.(Adner 2006) In fact, a problem that affects one of the components of the network could spread to other actors (Adner, 2006). In this study we analyze the types of risk from three different perspectives: performance risk coinnovation risk, relational risk. The performance risk in the innovation ecosystem is assessed in literature at individual and collective level. In the first case, the balanced scorecard(Kaplan and Norton 1996) method is widely used. This method uses four evaluation categories: financial, internal business processes, customer satisfaction, and learning and growth. In recent years, this method has been applied by some scholars to the analysis of digital innovation ecosystems. Welter et al.(2011) proposed an analysis tool called the IT Network Balanced Scorecard (ITNBSC), which changed the four perspectives of analysis by introducing four levels of investigation refocused on the network and the impact of technology: information technology financial, stakeholder orientation, future orientation, and network contribution (Graca P. and Camarinha-Matos 2017).According to Leavy and Adner (2012) innovation is the outcome of a process within an ecosystem. therefore the success of an actor depends not only on its management but on the success of the other components of the network. The most common risk is the snowball effect, typical of systems with a high degree of interdependence. Coinnovation risk and relational risk are linked to the possibility that part of the value created in the innovation ecosystem, is faded away along the process of interaction between the actors. Technology has a dramatic impact on the nature of relationships, so it is necessary to analyse the process of sharing information and knowledge between the digitised actors.

3 Methodology

We developed a number of scenarios to illustrate how various risks can influence not only who wins and who loses but also the amount of value that is likely to be created by a digitalized ecosystem. Some prominent features of the relative dynamics that our theoretical framework highlight will be illustrated by an agent-based simulation model. This model will comprise multiple agents that can interact according to their level of reach and responsiveness. By varying the extent of reach and the degree of responsiveness afforded to agents (a proxy of the level of digitalization) we expect the simulation to show the impact on the amount of value created and on the associated level of risk exposure.

The agent-based simulation model has been designed assuming that:

1. each interacting actor can control a fixed number of resources that can be modified in order to develop an innovation;
2. interactions are (for sake of simplicity) dyadic. This means that each actor can interact only with one other actor at a time;
3. each set of resources belonging to an actor creates a certain value. The combination of the resources of two actors creates an overall value that stems from the innovation that is realized through that specific combination;
4. a moderated complexity characterizes the interactions, in that the contribution of each set of resources to the overall value created by an interaction among two agents is not linear and additive. Through a Nkc model, the non-linear effect of the resource combinations on the total value has been simulated. Similarly, it has been simulated the effect of the changes in the resources under control of one agent on the value of that resources and on the value of those belonging to the other interacting agents.

In order to simulate different levels of reach, the number of agents reachable by the focal agent was increased from a minimum of 1 to the maximum of all existing agents. For each possible interaction, the total value created by the combination of the resources under the control of the interacting agents (without introducing any changes) was calculated, thereby estimating the value of the resulting innovation.

In this simulation setting, the total value created by each interaction was recorded. The risk was captured by the range from the maximum to the minimum value obtainable at different levels of reach and by the difference between the average value on an innovation and the minimum value. That is, the maximum loss to which an agent is exposed was calculated in order to have a proxy of the Value at Risk.

In order to simulate different level of responsiveness the focal agent was allowed to introduce a growing number of changes in the set of controlled resources in order to develop an innovation with increasing levels of value obtained by the interaction with another agent. The responsiveness was progressively increased from the minimum of 1 to the maximum of all possible changes available in the set of resources controlled by the focal agent. The risk here was evaluated measuring the total value and the value created by the two actors involved in an interaction at different level responsiveness. The balance

of the value between the actors was used as a proxy for the risk for the non-responsive actor to be expropriated of the value of an innovation.

Table 1 reports the key parameters of the simulation.

Variable	Parameter
<i>Number of resources available for all agents</i>	N=20
<i>Number of interdependencies among resources</i>	k=c=4
<i>Number of resources under the control of each agent</i>	Ncont=4
<i>Total number of agents</i>	Agents=1,820 one for each combination in groups of 4 of the 16 resources remaining by excluding the 4 under the control of the focal agent
<i>Number of runs</i>	Runs=100
<i>Rules for increasing reach</i>	Reach varying from 1 to 1,820 Value from each interaction is accepted by the focal actor (assuming that the focal actor cannot respond in any way) Minimum, Average and Maximum value obtained by the interactions available are recorded and then averaged over the 100 runs
<i>Rules for increasing responsiveness</i>	Responsiveness varying from 1 to 16 (assuming the possibilities to switch from 0 to 1 or vice versa for each resource under the control of the focal actor) Value from a change in one or more resources is accepted if the value created by the innovation through the interaction is higher than the value created before the change. Among the changes satisfying the previous condition the option creating the highest value for the focal agent is retained (assuming that responsiveness is employed to increase value creation and maximize value appropriation). Value from the interaction and for each actor is recorded and then averaged over 100 runs.

4 Results

The results of the simulation about the risks associated to increasing levels of reach, obtained by the digitalization of an innovation eco-system, are reported in Figure 1 and Figure 2.

Figure 1 highlights the minimum value created by an innovation through a dyadic relationship among the focal agent and the other agents reachable in the eco-system.

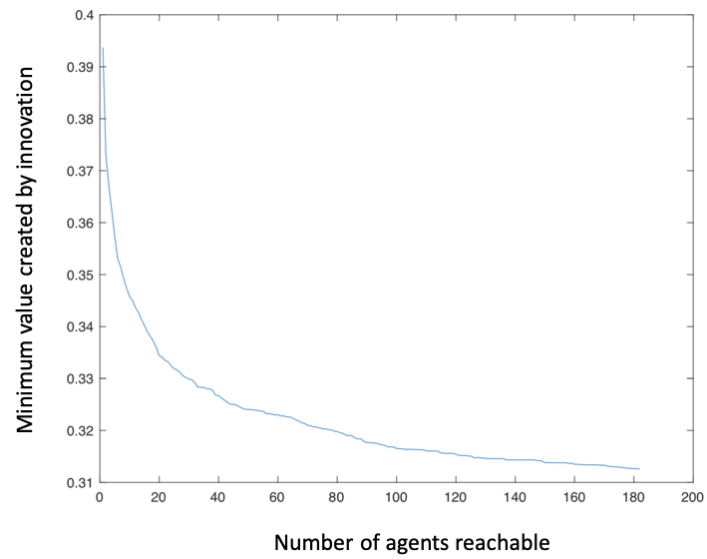


Figure 1: minimum value of innovation at different levels of reach

Figure 2 reports the maximum possible loss in terms of difference between the average value from an innovation and minimum value at different levels of reach.

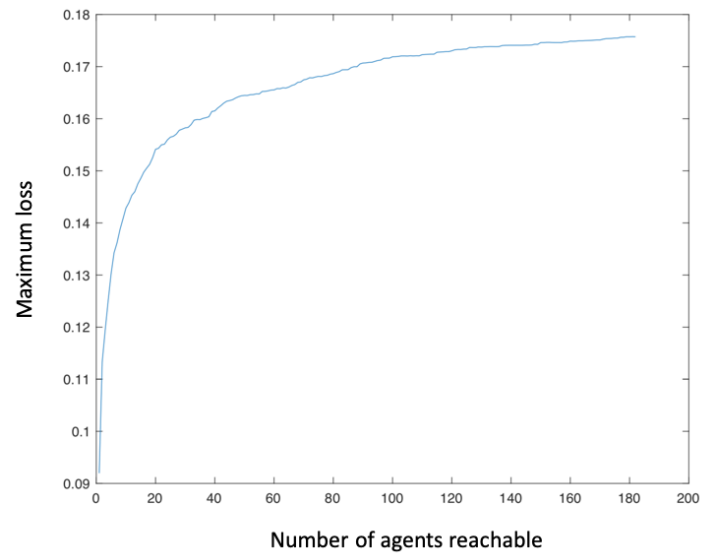


Figure 2: maximum loss of an innovation at different levels of reach

As can be observed in the Figures, the minimum value obtainable by an innovation realized through a dyadic relationship decreases sharply with increasing levels of reach (Figure 1). This implies that the risk of encountering very negative but rare events (a so-called black swan), that can be interpreted as disastrous innovations, grows with larger possibilities of reaching a bigger number of agents via digitalization. Accordingly, the average maximum loss (i.e., the loss calculated as difference between an average value of innovation and the lowest) increases rapidly (Figure 2). This means that an actor of an ecosystem that expands reach through digitalization is exposed to losses that largely exceeds those that can be encountered at lower levels of reach.

The results of the simulation about the risks associated to increasing levels of responsiveness are reported in Figure 3 and Figure 4.

Figure 3 shows the value created by an innovation realized through a dyadic relationship, at different levels of responsiveness of one of the two actors involved.

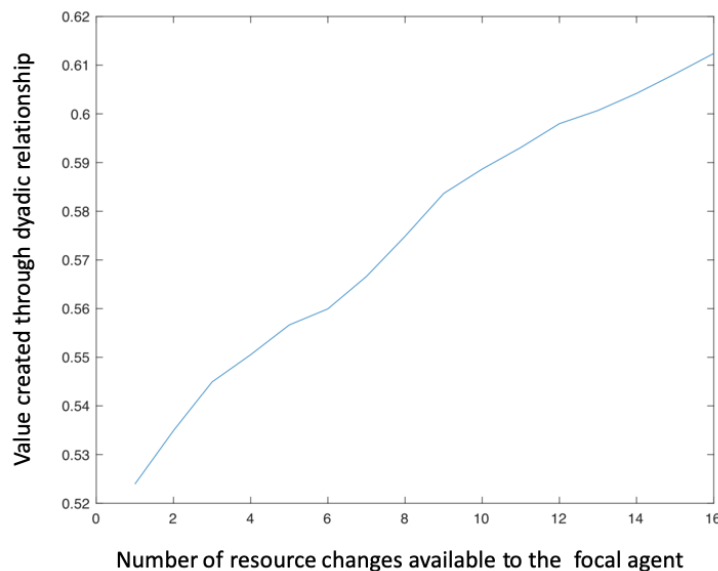
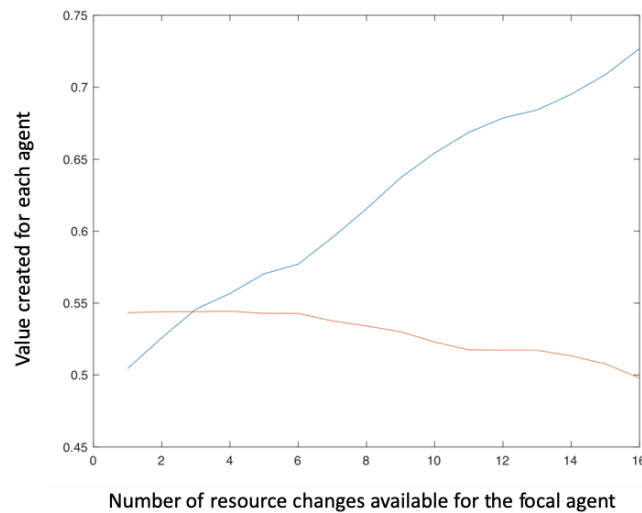


Figure 3: value created by innovation at different levels of responsiveness

Figure 4 illustrates the divergent trend of value for the parties involved in the dyadic relationship at different levels of responsiveness.



As can be noted increasing levels of responsiveness, allowed by digitalization, produce higher value obtainable by innovations realized through dyadic relationships (Figure 3). This means that the ability to immediately respond to other parties and accordingly adapt most of the controlled resources improves the possibilities of combining resources of different parties in valuable ways.

However, when one party has higher possibilities to respond than the other, increasing levels of responsiveness can produce higher inequalities in the distribution of the created value (Figure 4). This implies that the innovation's value, although higher, is mostly appropriated by the more responsive agent at the expenses of the other. This value disequilibrium creates two different risks: (a) for the less responsive agent, the risk of not benefiting from the innovation created through the relationship; (b) for the more responsive agent, the risk of being abandoned by unsatisfied partners and thus of losing all the value created. This second risk is even higher when an expanded reach, obtained by digitalization, make it easier to find new partners.

5 Discussion

To illustrate how digitalization affects both reach and responsiveness, consider the emergence of the sharing economy – a phenomenon made possible largely by digitalization. Unused services, like spare bedrooms in a house or empty seats in a car, have existed ever since there have been homes and automobiles. However, most of these services had remained unused for decades or longer, until digitalization effectively collapsed the time and distance that separated resource owners from prospective users. Digitalization makes it possible for the owners of these resources (i.e., houses and cars) to reach many more potential users in near real time. Airbnb allows hosts with available accommodation to reach and subsequently transact with prospective guests who can be

coming from any part of the world. Similarly, Uber extends the reach of passengers in need of a ride to far more available drivers than are usually available via conventional taxi services. Even more dramatically, Uber and similar ride sharing services have vastly enhanced responsiveness so that both driver and passenger know far more about the other. This knowledge includes: precise location, estimated time of pick-up and even their reliability. Because of ride hailing apps like Uber, Lyft Didi, and Grab, safer and more reliable rides are more widely available and rarely more than minutes away (The promise of 5G technology (to provide reliable data exchange with zero latency and huge bandwidth), will further enable reach to extend to and among inanimate objects (e.g., the promise of the ‘internet of things’) and responsiveness to be so quick that little or no human intervention will be needed (e.g., autonomous vehicles promise the service of ubiquitous, safe navigation without drivers). This extended reach and quicker/richer responsiveness enabled by digitalization vastly increases the potential for value creation by greatly enhancing the availability of a service to nearly all potential users who might be interested in the service and enhancing the resource owners’ ability to tailor a service to a prospective user with no or very little time delay. However, despite the vast size of the potential value that a digitalized ecosystem makes possible, the extent to which any of this potential is likely to be realized and who will benefit hinges on the concomitant proliferation of risks that always accompany any change (both in potential value and in the number and composition of possible players) and how those risks are managed. We argue that, regardless of the enormous increase in potential value that ICT enables, it is likely that only a tiny fraction of this potential may be realized, unless and until relevant risks are anticipated and effectively managed. To illustrate the need to consider risk, recall the early days of AirBnb. When it was first launched, the lion’s share of properties offered for sharing were relatively meager and many were made available only for guests willing to stay while the host also used the facilities. There were significant risks to the guest – that the accommodation wasn’t the same as advertised – and to the host – that the property could be misused. Indeed, in a well-publicized case, a host returned to her home to find it had been trashed by the guest and those he invited to a party he had held there. Initially AirBnb argued that they were merely matchmakers and not responsible for the behavior or reliability of the parties who used their platform. Over time, Airbnb, saw that by mitigating the risk for both parties many more prospective property-owners would be willing to offer to list and share their accommodation. Today, AirBnb lists moored yachts, castles and whole islands on their platform. This is only possible because AirBnb has found ways to reduce the risks to hosts and to convince prospective hosts that their property would not be misused. AirBnb did the same for the concerns of guests.

6 Implications and limitation

We consider some implications of this study for theory, practice and policy. The study seeks to contribute to a greater understanding of innovation ecosystems by focusing on the risks that the digitalization of ecosystems gives rise to (as a direct result of the value

potential that it enables) and the inherent managerial challenges that may require a rethinking of the role of eco-system actors and even of non-actors that could be positively or negatively impacted.

This study aims to provide a tool for scenario analysis. The phenomenon of digital innovation ecosystem is characterized by a high degree of complexity, due to the multitude of actors and factors present. In this predictive model we have isolated the aspect of technology, and simulated how it can impact on two crucial aspects such as reach and responsiveness. It was already clear in the literature that digital technology is positively related to the number and responsiveness of actors, but this study provides a conceptual tool to analyze the degree of risk associated with the increase of these two factors. This study could be increased by analyzing the degree of risk associated with the entry into the ecosystem of non-existing actors. following this line of research we could develop a new tool to predict the risk connected with new possible competitors or cooperators.

References

- Adner, R. (2006). Match your innovation strategy to your innovation ecosystem. *Harvard business review*, 84(4), 98.
- Afuah, A. (2000). How much do your co-opetitors' capabilities matter in the face of technological change?. *Strategic Management Journal*, 21(3), 397-404
- Aulkemeier, F., Paramartha, M. A., Iacob, M. E., & van Hillegersberg, J. (2016). A pluggable service platform architecture for e-commerce. *Information systems and e-business management*, 14(3), 469-489.
- Baldassar, L., Nedelcu, M., Merla, L., & Wilding, R. (2016). ICT based copresence in transnational families and communities: challenging the premise of face to face proximity in sustaining relationships. *Global Networks*, 16(2), 133-144.
- Basole, R. C., Park, H., & Barnett, B. C. (2015). Coopetition and convergence in the ICT ecosystem. *Telecommunications Policy*, 39(7), 537-552.
- Boschma, R. A., & Ter Wal, A. L. (2007). Knowledge networks and innovative performance in an industrial district: the case of a footwear district in the South of Italy. *Industry and Innovation*, 14(2), 177-199.
- Boschma, R., Frenken, K., (2010) The spatial evolution of innovation networks: a proximity perspective, *The handbook of evolutionary economic*
- Boschma, R., (2005) Proximity and innovation: a critical assessment, *Regional studies*, Taylor & Francis
- Calandro, J. (2015). A leader's guide to strategic risk management. *Strategy & leadership*, 43(1), 26-35.
- Carayannis, E. G., & Campbell, D. F. (2009). 'Mode 3' and 'Quadruple Helix': toward a 21st century fractal innovation ecosystem. *International journal of technology management*, 46(3-4), 201-234.
- Carayannis, E. G., et al., (2012) The Quintuple Helix innovation model: global warming as a challenge and driver for innovation, *Journal of Innovation and Entrepreneurship*, Springer
- Casadesus-Masanell, R., & Yoffie, D. B. (2007). Wintel: Cooperation and conflict. *Management Science*, 53(4), 584-598.
- Doloreux, D., (2002) What we should know about regional systems of innovation, *Technology in Society*

- Etzkowitz H., Leydesdorff, L., (2000): The dynamics of innovation: from National Systems and “Mode 2” to a Triple Helix of university-industry-government relations. *Research Policy*, Elsevier
- Figay, N., Ghodous, P., Khalfallah, M., & Barhamgi, M. (2012). Interoperability framework for dynamic manufacturing networks. *Computers in Industry*, 63(8), 749-755.
- Fransman, M. (2010). The new ICT ecosystem: Implications for policy and regulation. Cambridge University Press.
- Graça, P., & Camarinha-Matos, L. M. (2017). Performance indicators for collaborative business ecosystems—Literature review and trends. *Technological Forecasting and Social Change*, 116, 237-255.
- Jardim-Goncalves, R., Grilo, A., & Steiger-Garcia, A. (2006). Challenging the interoperability between computers in industry with MDA and SOA. *Computers in Industry*, 57(8-9), 679-689.
- Kaplan, R. S., & Norton, D. P. (1996). Linking the balanced scorecard to strategy. *California management review*, 39(1), 53-79.
- Asheim, T., Isaksen, A., (2002) Regional Innovation Systems: The Integration of Local Sticky and Global Ubiquitous Knowledge, *Journal of Technology Transfer*, Kluwer Academic Publishers
- Koppius, O. R., & van de Laak, A. J. (2009). The quick-connect capability and its antecedents. In *The network experience* (pp. 267-284). Springer, Berlin, Heidelberg.
- Leavy, B. (2012). Interview—Ron Adner: managing the interdependencies and risks of an innovation ecosystem. *Strategy & Leadership*, 40(6), 14-21.
- Letaifa, S. B., & Rabeau, Y. (2013). Too close to collaborate? How geographic proximity could impede entrepreneurship and innovation. *Journal of Business Research*, 66(10), 2071-2078.
- Moore, D., Hock, B., Greening, J. P., Kern, V. D., Frazer, L. N., & Monzer, J. (1996). Gravimorphogenesis in agarics. *Mycological Research*, 100(3), 257-273.
- Moore, G. E., & Baldwin, T. (1993). *Principia ethica*. Cambridge University Press.
- Nachira, F. (2002). Towards a network of digital business ecosystems fostering the local development.
- Nachira, F., Nicolai, A., Dini, P., Le Louarn, M., & Leon, L. R. (2007). Digital business ecosystems.
- Peltoniemi, M., & Vuori, E. (2004, September). Business ecosystem as the new approach to complex adaptive business environments. In *Proceedings of eBusiness research forum* (Vol. 2, pp. 267-281).
- Selander, L., Henfridsson, O., & Svahn, F. (2013). Capability search and redeem across digital ecosystems. *Journal of information technology*, 28(3), 183-197.
- Stanley, J., & Briscoe, G. (2010). The ABC of digital business ecosystems. *arXiv preprint arXiv:1005.1899*.
- van Hillegersberg, J., Moonen, H., & Dalmolen, S. (2012, March). Coordination as a service to enable agile business networks. In *International Workshop on Global Sourcing of Information Technology and Business Processes* (pp. 164-174). Springer, Berlin, Heidelberg.
- Vilhelmson, B., & Thulin, E. (2006) ICT, proximity, and the place of home: A time-use perspective. In *Fifth Proximity Conference: Proximity between Interactions and Institutions*, Bordeaux, France (pp. 28-30).
- Welter, F., Vossen, R., Richert, A., & Isenhardt, I. (2011). Network management for clusters of excellence—a balanced-scorecard approach as a performance measurement tool. In *Automation, Communication and Cybernetics in Science and Engineering 2009/2010* (pp. 195-207). Springer, Berlin, Heidelberg.
- Weterings, A. (2005). The spatial clustering of knowledge-intensive services: computing services in the Netherlands. In *Learning from Clusters* (pp. 275-302). Springer, Dordrecht.

Real-World Data in Healthcare: the Case of Post-ACL Rupture Rehabilitation Pathway

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Abstract

In the healthcare setting, real-world data (RWD) could be a useful support to measure the impact of disease-management interventions, in order to create a knowledge base, for the design of effective, efficient and satisfactory healthcare pathways.

The present paper aims at investigating the factors affecting patient rehabilitative pathway. Such factors make up the knowledge assets that might influence the design of a patient rehabilitative pathway (in terms of clinical outcomes, patients' satisfaction and economic resources' absorption), after the Anterior Cruciate Ligament (ACL) rupture, assuming the hospital wards perspective.

For the achievement of the above mentioned objective, a review on the topic is performed for revealing the principal rehabilitative pathway factors, impacting on clinical outcomes, patients' satisfaction and economic resources' absorption. An observational study was developed, in two private rehabilitative hospitals in Italy, in order to retrieve RWD with regard to the rehabilitative pathway, thus collecting information from 59 patients, on the factors determined by literature analysis.

Patients' data were analysed considering three methodological approaches. i) Relationships between variables, were investigated to test the existence of correlations among them. ii) A hierarchical sequential linear regression model was implemented to define the predictors of the three dependent variables (clinical outcomes, patients' satisfaction and economic resources' absorption). iii) A Qualitative Comparative Analysis – QCA, was implemented, in order to complement previous statistical approaches with a comparative-configurational one.

Results reported that rehabilitation effectiveness is well explained by patients' satisfaction ($\beta=0.368$, $p\text{-value}=0.007$) and compliance ($\beta=0.224$; $p=0.009$), reaching an Adjusted R2 equal to 0.211. Both the rehabilitation process effectiveness ($\beta=0.333$, $p\text{-value}=0.008$), and compliance ($\beta=0.269$, $p\text{-value}=0.035$) are required to achieve

patients' satisfaction (Adjusted $R^2=0.287$). Older age ($\beta=0.145$, $p=0.049$), higher sportiveness level ($\beta=0.169$, $p=0.022$), as well as the length of the rehabilitation clinical pathway ($\beta=0.550$, $p\text{-value}=0.000$) and the performance of threshold tests ($\beta=0.389$, $p\text{-value}=0.000$) are antecedents of higher management costs (Adjusted $R^2=0.703$ and $F=24.482$). Furthermore, summarizing QCA results, we can observe that the age and the level of sportiveness of patients, in combination with the compliance, play an important role in the emergence of the selected and analyzed outcomes.

Results of the study would be useful for the optimization of economic resources, as well as for the achievement of an adequate rehabilitative effectiveness, guaranteeing a personalisation of the process, thus becoming more efficient and effective, consistent with cost-containment strategies.

Keywords –Real-world data, healthcare sector, rehabilitative pathway, regression analysis, Qualitative Comparative Analysis

Paper type – Academic Research Paper

1 Introduction

The main scientific approach for generating knowledge in healthcare field is represented by randomized controlled trials (RCTs) and meta-analysis of RCTs. It is uncertain whether these methods are likely to lead to discovery of new treatments, identification of effective ones, or comparison and determination of the best of several approaches, for specific types of patients (Berguer et al., 2004).

In this view, the use of real-world data (RWD) in the healthcare setting, is currently achieving a greater strategic relevance. RWD could generate the opportunity to create new knowledge assets, recombining hospitals and patients' perspectives, with outcome and efficiency data (Celin et al., 2014; Garrison et al., 2007), contributing to improve the delivery of health products and optimizing outcomes (Holtorf et al., 2008).

RWD would be a useful support to measure the impact of disease-management interventions (Nguyen et al., 2016), in order to create a knowledge-based pathway, for the design of effective, efficient and satisfactory healthcare services. The use of RWD could support personalised decisions, based on treatment options, and healthcare delivery strategies, built on equity and coverage principles, quality and costs analyses.

Moving on from the above, the present paper aims at investigating the knowledge assets that might influence the design of a patient rehabilitative pathway, after the Anterior Cruciate Ligament (ACL) rupture, assuming the hospital wards perspective. Rehabilitation programs are designed to rebuild muscle strength, re-establish joint mobility and neuromuscular control, and to enable patients to return to pre-injury activity levels. Thus, the relevant assets for the design of the pathway are clinical outcomes, patients' satisfaction and economic resources' absorption (Justo et al., 2018). These assets are affecting by factors that make up the knowledge base for improvement of rehabilitative pathway.

Coherently to these premises, the study addressed the following two research questions.

1. Which are the main factors influencing the effectiveness (in terms of clinical outcomes), the patient satisfaction, or the efficiency of the rehabilitation process?
2. What configurations of such factors are sufficient to generate the emergence of a certain level of clinical outcome, or patient satisfaction, or efficiency, in the absorption of resources?

2 Research design and theoretical background

For the achievement of the above objectives, theoretical frameworks with independent variables, and their relationship with rehabilitation effectiveness, patients' satisfaction and rehabilitative pathway management costs, were accordingly developed.

2.1 Hypotheses development

A literature review revealed the principal rehabilitative pathway factors, impacting on clinical outcomes, patients' satisfaction and economic resources' absorption.

Age, compliance, length of the rehabilitation pathway, level of sportiness, number of physiotherapy sessions performed, number of muscle strength and threshold tests performed (De Valk et al., 2013; Wierike et al., 2013; Thomee et al., 2011; Czuppon et al., 2014; Christino et al., 2016), were considered as independent variables in the present analysis.

Age

De Valk *et al.*, (2013) declared that age is a fundamental factor for the achievement of a successful outcome of the rehabilitation pathway. In particular, younger patients present a higher probability to achieve a better clinical outcome, thus positively impacting on the satisfaction.

Since, in other settings, younger patients absorbed fewer economic resources (Duarte et al., 2018;), age could decrease the overall rehabilitation clinical pathway costs.

Based on the above considerations, the following hypothesis were displayed.

- HP 1.1: Younger age has a positive impact on effectiveness.
- HP 1.2: Younger age has a positive impact on satisfaction.
- HP 1.3: Younger age has a positive impact on rehabilitative pathway management cost.

Level of sportiness

De Valk et al. (2013) reported that healthy conditions and a higher level of sportiness (i.e. being professional athletes), would be antecedent factors of a successful rehabilitation program, improving the patient's clinical outcome. In particular, a patient with an athletic background presents a higher probability to reach the level of functionality of knee, antecedent the injury (Darain et al., 2015). Furthermore, such

patients are facilitated to complete a physiotherapy session, with more probability to accomplish the sessions (Darain et al., 2015). The level of sportiness impacts on rehabilitative pathway, thus having a role in the resources absorption and in the efficiency of the patients' rehabilitation. A higher level of sportiness, facilitating the functionalities recovery, could optimize the rehabilitative pathway, reducing the patients' management costs.

Different attitudes and level to play sport, could lead to different rehabilitation performance, in terms of outcomes, satisfaction and related costs.

According to these factors, the following hypotheses were formulated.

- HP 2.1: High level of sportiness, positively impacts on effectiveness.
- HP 2.2: High level of sportiness, positively impacts on satisfaction.
- HP 2.3: High level of sportiness, positively impacts on rehabilitative pathway management costs.

Compliance

Rehabilitation compliance and adherence are frequently challenges for the healthcare professionals. Despite clinicians schedule patients for rehabilitation sessions, not all patients keep their appointments and fully participate in the rehabilitation activities (Byerly et al., 1984).

Scientific evidence confirmed that adherence to a rehabilitative pathway is important for the achievement of the expected final clinical outcome (Wierike et al., 2013), thus positively impacting on patients' satisfaction (Rotter et al., 2010). Furthermore, if a patient completely adheres to the rehabilitative pathway, a fewer frequency on sessions could be suggested, with important economic advantages. Non-adherence to rehabilitation, leads to poor outcomes, could increase healthcare services utilization, and the overall healthcare costs (Iuga & McGuire et al., 2014).

Thus, the following hypotheses were proposed.

- HP 3.1: compliance has a positive impact on effectiveness.
- HP 3.2: compliance has a positive impact on patients' satisfaction.
- HP 3.3: compliance has a positive impact on rehabilitative pathway management costs.

Length of the rehabilitation clinical pathway

The length of the rehabilitation clinical pathway is strictly related to the above mentioned compliance. In this view, clinical outcomes could be positively influenced by the length of the program (Thomee et al., 2011). Conversely, in the hospital setting a shorter hospitalization as well as a shorter follow-up, would impact on patients' satisfaction and healthcare costs (Stuck et al., 2017; Lingsma et al., 2018), with a positive general impact. The same trend could be expected, in the rehabilitative setting. A simpler rehabilitative clinical pathway could encourage patients, with important advantages for both the patients, and the related caregiver satisfaction. In contrast, a longer rehabilitation program would increase the overall economic resources absorption.

The following hypotheses were defined.

- HP 4.1: the length of rehabilitation positively impacts on effectiveness.
- HP 4.2: the length of rehabilitation negatively impacts on satisfaction.
- HP 4.3: the length of rehabilitation negatively impacts on rehabilitative pathway management costs.

Number of physiotherapy sessions performed and number of muscle strength

The number of physiotherapy sessions, and the number of muscle strength tests performed, are related to the overall length of the rehabilitation program, scheduled for the patients, with specific healthcare needs. Risberg et al. (2004), highlighted the relationship between the prolonged rehabilitation and the improvement of the patient's physical conditions, and his/her earlier return to work, with a consequent increase in costs to support the intensive rehabilitative program.

According to this, the following hypotheses were displayed.

- HP 5.1: The number of physiotherapy sessions improves effectiveness.
- HP 5.2: The number of physiotherapy sessions negatively impacts on satisfaction.
- HP 5.3: The number of physiotherapy sessions negatively impact on rehabilitative pathway management costs.
- HP 6.1: The number of muscle strength tests improves effectiveness.
- HP 6.2: The number of muscle strength tests negatively impacts on satisfaction
- HP 6.3: The number of muscle strength tests negatively impact on rehabilitative pathway management costs.

With regard the potential relationship between the dependent and the independent variables, various possible interactions emerged.

In particular, a different level of clinical outcomes could influence the patients' psychological and functional factors (Winters et al., 2013). The achievement of better clinical outcomes, and higher levels of perceived satisfaction are strictly related (Kane et al., 1997; Hiraoka et al., 2009).

In this view, the following hypotheses were formulated.

- HP 7.1 The level of satisfaction positively impacts on effectiveness.
- HP 7.2 A better effectiveness positively impacts on satisfaction.

Furthermore, literature evidence (Fucai et al., 2005) declared that a long rehabilitation program could generate higher costs, thus decreasing the perceived satisfaction of the patients.

Moving on from this consideration, the following hypothesis was displayed.

- HP 8.1 The rehabilitative pathway management costs negatively impact on satisfaction.

2.2 Frameworks

A synthesis of the research frameworks developed is proposed in Figure 1, 2 and 3.

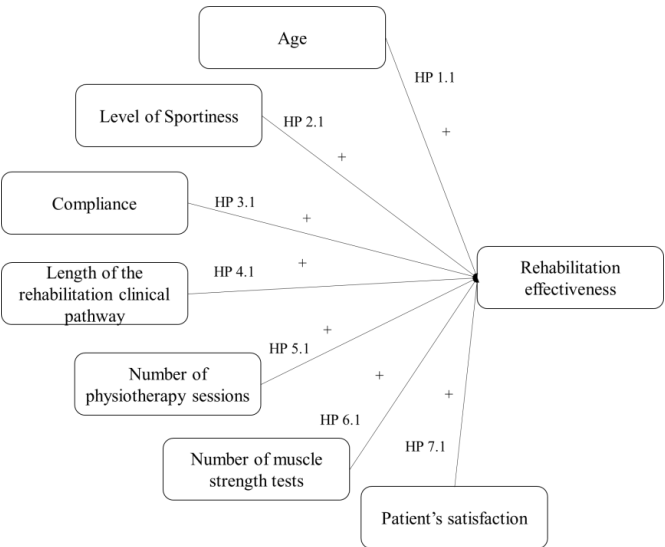


Figure 1: Conceptual framework for rehabilitation effectiveness

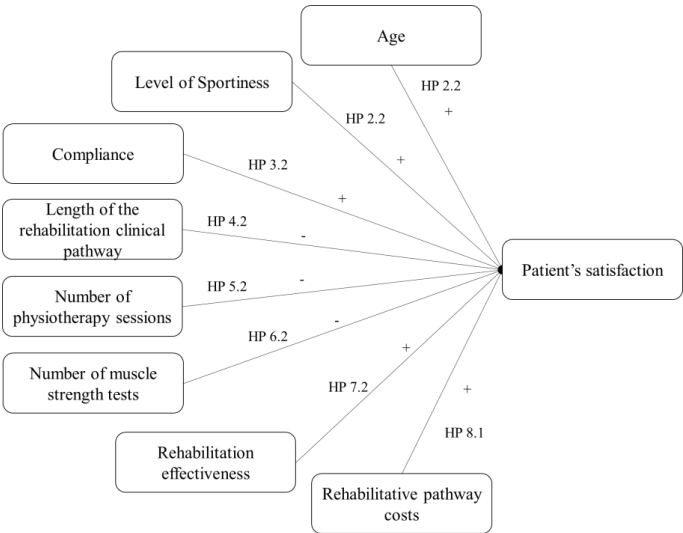


Figure 2: Conceptual framework for patient's satisfaction

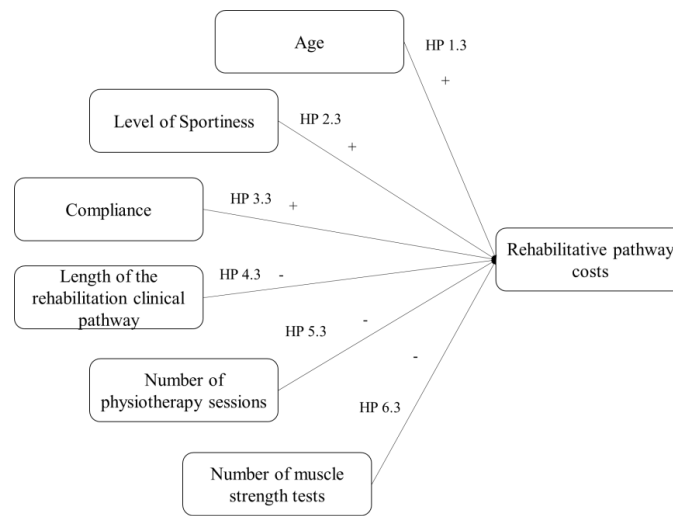


Figure 3: Conceptual framework for rehabilitative pathway costs

3 Methods

An observational study was developed in two private rehabilitative hospitals in Italy, in order to retrieve RWD with regard to the rehabilitative pathway, thus collecting information from 59 patients.

3.1 Definitions of the measures

According to the above mentioned hypotheses, the CRF was composed of the following variables, derived from RWD.

Dependent Variables

- Clinical outcome (effectiveness). The clinical outcome represents the effectiveness of the rehabilitation program, thus defining its overall quality. At the end of rehabilitation program, the patient undergoes a test that allows the calculation of the strength deficit, of the injured limb, compared with the healthy one, with the consequent estimate of a percentage difference, between the initial and final expected strength, from rehabilitative program. The result ranged from a minimum of -1 (higher strength deficit), to a value equal to 0 (perfect healing).
- Patient's satisfaction. The variables measured the patient-reported experiences during the rehabilitation program. *i)* Complete achievement of the therapeutic objectives shared with the clinician of reference, at the beginning of the rehabilitation program; *ii)* level of trust and confidence created with the clinicians; *iii)* attention received by the clinicians, the physiotherapist and the nurses; *iv)* evaluation of the organisational services (administrative support, website); and *v)* evaluation of the facilities. The

above items were evaluated, considering a scale ranging from 0 (complete dissatisfaction), to 1 (complete satisfaction).

- Costs. In order to estimate the rehabilitation program costs, the following health expenditure items were investigated: number of physiotherapy sessions and number of procedures/tests performed during the program. In particular, economic data were evaluated, in accordance with outpatient visits and tests Regional Reimbursement Tariffs.

Independent Variables

- Age. The age of the patient at the beginning of the rehabilitation program.
- Level of sportiness. The level of sportiness declared by the patient, at the beginning of the rehabilitation program, classified as follows: *i)* none; *ii)* practitioner; *iii)* amateur; and *iv)* athlete.
- Compliance. Adherence/compliance to the program was measured by attendance at and participation in scheduled rehabilitation session. In particular, patients were divided in compliant patients and not-compliant patients, on the basis of two characteristics. *i)* Patients who have completed the rehabilitative pathway prescribed by the clinicians, and *ii)* patients who have abandoned the rehabilitative pathway earlier.
- Length of the rehabilitation clinical pathway. The duration of the pathway referred to the number of days occurring between the beginning of the rehabilitation program (with the first physiotherapeutic session carried out), and the final medical examination, with the consequent discharge of the patient.
- Number of physiotherapy sessions performed and number of muscle strength. These variables referred to the number of sessions and tests performed by each patients, during the entire rehabilitation clinical pathway.

3.2 Statistical analyses

Data derived from the CRFs were analysed considering descriptive statistics, frequencies and distributions. Preliminary analyses were performed, in order to ensure no violation of the assumptions of normality, linearity and homoscedasticity.

Furthermore, three methodological approaches were used to answer the above research questions.

i) Relationships between variables, were investigated, to test the existence of correlations among them. In particular, the “person product-moment” correlation coefficient was assessed, to test the existence of small (from 0.10 to 0.29), medium (from 0.3 to 0.49), or large (from 0.5 to 1) correlations among variables (Cohen, 1988). The exact value equal to -1 or $+1$ indicated a perfect correlation among variables.

ii) A hierarchical sequential linear regression model (with enter methodology) was implemented to test the hypotheses proposed, defining the predictors of the above three dependent variables (clinical outcomes, patients’ satisfaction and economic resources’ absorption), useful in order to establish the independent variables impacts. In particular

the Adjusted R2 was examined, in order to control the explanatory power of each model (Tabachnick & Fidell, 2007). This approach allows to test the hypotheses, through incremental models, in order to establish the specific impact of each single input variable, on the dependent variables. The option “exclude case pairwise” was implemented, because was the preferable methodology, in particular for a small sample (as described in this research activity) and avoiding any kind of data exclusion.

All the statistical analyses, referring to the coefficients test, and the development of the hierarchical sequential regression model were performed using the Statistical Package for Social Science (IBM SPSS Statistics Viewer - Version 22).

iii) In order to complement previous statistical approaches with a comparative-configurational one, a Qualitative Comparative Analysis - QCA (Ragin, 1987, Ragin 2000) was implemented.

The QCA is a comparative case-oriented methodology (Marx et al., 2013), useful to find, through an in depth comparison of real-world cases, consistent configurations of causal conditions (the independent variables in our study), sufficient to determine the emergence of a specific outcome. In the QCA, a symmetric relationship is disarticulated into two asymmetric analyses formalized by set and sub-set relationships (Ragin 2008): one on the necessity of the conditions with respect to the outcome and the other on the sufficiency. This fact allows researchers to deal with the complexity of real phenomena. The QCA, in fact, assumes the non-linearity of phenomena under investigation and is based on the principle of causal complexity. This means that, in most cases, it does not make sense to isolate the effect (positive or negative), of a single independent variable on the outcome, but configurations of variables are identified, being related to the outcome. Moreover, several different configurations can be recognized as "causal recipes" of the same outcome (Ragin, 1987).

According to Vis (2009), that discusses the advantages of using QCA technique to complement regression analyses, for moderately large-n samples (between 50 and 100), we studied the 59 empirical cases collected in this research, through QCA, in order to better understand the relationships between the combinations of the independent variables (the complex interactions effects among the causal conditions) and the three outcomes (dependent variables) presented above.

In QCA approach, the variables can be considered crisp or fuzzy. The crisp set variant (csQCA) is the version in which the variables of the study are dichotomous and the empirical analysed cases are classified as alternatively “fully in” or “fully out” in the sets representing causal conditions and the outcomes. The fuzzy-set variant (fsQCA) is characterized by the fact that the empirical cases are classified in terms of membership degrees in the fuzzy sets of causal conditions, and of the outcome. In this preliminary analysis, we adopted the crisp set QCA.

Coherently with the research frameworks, three different QCA analyses are carried out, considering respectively as outcome rehabilitation effectiveness, patient’s satisfaction, and rehabilitative pathway costs, and as casual conditions, the independent variables taken in account in each research framework.

4 Results

4.1 The sample under assessment

The sample was composed of 59 patients, requiring a specific rehabilitative pathway after ACL rupture. Most part of the sample was composed of males (66%), with an average age of 34 years.

With regard to the level of sportiness, it emerged that only 3% of patients performed high-level professional sport, whereas 64% belong to the “practicing” category.

In general terms, the sample presented an economic resources absorptions equal to € 3,334.07±269.28 for the rehabilitative pathway, with an overall effectiveness of 0.84 ± 0.03 , and an overall satisfaction of 0.81 ± 0.02 . In particular, compliant patients require more economic resources’ absorption than non-compliant patients (€ 3,634.47 vs € 2,157.50 p-value=0.026), leading also to the achievement of a better clinical outcome (0.88 vs 0.67 , p-value = 0.026) and a higher patients’ satisfaction (0.85 vs 0.69 , p-value=0.000).

4.2 Hypotheses testing

Table 1 depicts that patients’ satisfaction (p-value = 0.021), age (p-value = 0.047), compliance (p-value = 0.026), the length of the rehabilitative pathway (p-value = 0.000) as well as the number of threshold tests (p-value = 0.000), significantly influenced the rehabilitative pathway costs. The significant relationship between the rehabilitative pathway costs, and the number of physiotherapy sessions ($\beta = 0.995$, p-value = 0.000) depict that the two variables present the collinearity phenomena, thus being two aspects explaining the same concept. For this reason, the variable number of physiotherapy sessions was not included in the regression model.

Satisfaction was positively related to the patients’ clinical outcome (p-value = 0.000), compliance (p-value = 0.000), and number of threshold tests (p-value = 0.000). The same trend emerged, considering the patient clinical outcome.

With regard to the independent variables, age, compliance and the length of the rehabilitative pathway, showing a significant p-value < 0.05. The same relationships emerged among the length of the rehabilitative pathway, the number of threshold tests and the number of physiotherapy sessions (p-value = 0.000).

Table 1 – Relationships between variables

	1	2	3	4	5	6	7	8	9
Rehabilitative pathway management costs (1)	1								
Satisfaction (2)	,299*	1							

Effectiveness (3)	,155	,461**	1						
Age (4)	,260*	,212	,107	1					
Compliance (5)	,290*	,444**	,381**	,565**	1				
Level of sportiness (6)	,244	,084	-,108	-,195	,015	1			
Length of the rehabilitative pathway (7)	,735**	,108	,058	-,265*	,252	,082	1		
Number of threshold tests (8)	,637**	,601**	,381**	,043	,373**	,062	,403**	1	
Number of physiotherapy sessions (9)	,995**	,245	,124	,477**	,270*	,259*	,738**	,559**	1

After having tested the correlation among variables, a regression analysis was conducted to test hypotheses, with regard to rehabilitation effectiveness (Table 2), patient satisfaction (Table 3) and rehabilitative pathway management costs (Table 4).

Rehabilitation effectiveness is well explained by patients' satisfaction ($\beta=0.368$, $p\text{-value}=0.007$), and compliance ($\beta=0.224$; $p=0.009$), reaching an Adjusted R^2 equal to 0.211 ($F=6,169$).

Table 2 – Regression model for rehabilitation effectiveness

	<i>Rehabilitation effectiveness</i>		
	Mod 1	Mod 2	Mod 3
Satisfaction	.461**	.364^	.368^
Compliance		.219^	.224^
Number of physiotherapy sessions			.026
R^2	.213	.251	.252
Adj. R^2	.199	.224	.211
F value	15.402**	9.390**	6.169*
ΔR^2	.213	.038	.001
F (ΔR^2)	15.402**	2.873^	.047

Both the rehabilitation process effectiveness ($\beta=0.333$, $p\text{-value}=0.008$), and compliance ($\beta=0.269$, $p\text{-value}=0.035$) are required to achieve patients' satisfaction (Adjusted $R^2=0.287$).

Table 3 – Regression model for patients' satisfaction

	<i>Patients' satisfaction</i>		
	Mod 1	Mod 2	Mod 3
Rehabilitation effectiveness	.461**	.425**	.333*
Rehabilitative pathway management cost		.233*	.170
Compliance			.269*
R^2	.213	.266	.323
Adj. R^2	.199	.240	.287
F value	15.402**	10.133**	8.767**
ΔR^2	.213	.053	.058
F (ΔR^2)	15.402**	4.042*	4.696*

Older age ($\beta=0.145$, $p=0.049$), higher sportiness level ($\beta=0.169$, $p=0.022$), as well as the length of the rehabilitative pathway ($\beta=0.550$, $p\text{-value}=0.000$), and threshold tests ($\beta=0.389$, $p\text{-value}=0.000$) are antecedents of higher rehabilitative pathway management costs (Adjusted $R^2=0.703$ and $F=24.482$).

Table 4 – Regression model for rehabilitative pathway management cost

	<i>Rehabilitative pathway management cost</i>				
	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5
Age	.260*	.239^	.230^	.172*	.145*
Compliance		-.271*	-.268*	-.104	.008
Level of sportiness			.231^	.180*	.169*
Length of the rehabilitative pathway				.675**	.550**
Number of threshold tests					.389**
R^2	.068	.141	.194	.615	.729
Adj. R^2	.051	.110	.150	.587	.703
F value	4.134*	4.587*	4.412*	21.576**	28.482**
ΔR^2	.068	.073	.053	.421	.114
F (ΔR^2)	4.134*	4.766*	3.632^	59.089**	22.208**

4.3 Configuration of factors through QCA

The QCA analysis requires a preliminary step for calibration of variables transforming them in crisp one (table 5).

Table 5: Calibration of the variables

Variable	Value in regression model	Calibration
Age	a) 50-60 years b) 30-49 years c) 20-29 years d) < 20 years	0: <30 years 1: 49-60 years
Level of sportiness	a) none b) practitioner c) amateur d) athlete	0: none and practitioner 1: amateur and athlete
Compliance	a) compliant b) not compliant	0: compliant 1: not compliant
Rehabilitation Effectiveness	a) effectiveness b) no effectiveness	0: no effectiveness 1: effectiveness
Patient Satisfaction	a) satisfaction b) no satisfaction	0: no satisfaction 1: satisfaction
Length of the rehabilitation clinical pathway	Number of Rehabilitation days	0: < 100 days 1: >= 100 days
Muscle strength test and threshold tests	Number of test	0: < 2 1: >= 2
Pathway Management Cost	Value of the pathway	0: < 3,360€ 1: >= 3,360€

After the calibration step, we assess the consistency and coverages of a configuration set of variables.

Consistency is the extent to which the results are in line with the statements of necessity or sufficiency. Coverage gives information, on the empirical importance of necessary and sufficient conditions.

Each configuration has a raw coverage value that “measures the relative importance of several combinations of causally relevant conditions” (Ragin 2006: p. 305): the proportion that a configuration covers the outcome. It is assessed by the sum of consistent scores of the configuration divided by the sum of outcome scores (Poveda and Martínez, 2013). In the QCA analysis, the crisp value 1 is reported in uppercase whereas the crisp value in reported in lowercase.

According to regression analysis, compliance is a variable present in all configurations, therefore it has a high impact on effectiveness. Concerning the configuration recipe, the effectiveness is greater if the whole treatment is performed (compliance) and the patients are young with a high level of sportiness.

Table 6: QCA analysis for rehabilitation effectiveness

OUTCOME: EFFECTIVENESS			
		Raw Coverage	Consistency
1	COMPLIANCE*age*SPORTINESS*length rehabilitation * STRENGTH TEST*SATISFACTION	0.097	1.00
2	COMPLIANCE*age * SPORTINESS * THRESHOLD TEST* STRENGTH TEST * SATISFACTION	0.161	1.00
3	COMPLIANCE*age* length rehabilitation * THRESHOLD TEST* STRENGTH TEST * SATISFACTION	0.097	1.00
4	COMPLIANCE* AGE*sportiveness * LENGTH REHABILITATION * THRESHOLD TEST* STRENGTH TEST	0.097	1.00
5	COMPLIANCE* SPORTINESS * length rehabilitation * THRESHOLD TEST* STRENGTH TEST * SATISFACTION	0.194	1.00
6	AGE* SPORTIVENESS * length rehabilitation * threshold test* strength test * satisfaction	0.032	1.00
7	COMPLIANCE*age* sportiveness ** LENGTH REHABILITATION * threshold test*strength test * satisfaction	0.032	1.00
Solution Coverage 0.613			
Solution Consistency 1			

Concerning the satisfaction outcome, we obtain only one optimal configuration. Also for this outcome, the compliance, young age and level of sportiness represent the main factors associated with a greater satisfaction.

Table 7: QCA analysis for patients' satisfaction

OUTCOME: SATISFACTION			
		Raw Coverage	Consistency
1	COMPLIANCE*age* SPORTINESS *effectiveness*rehabilitative cost	0.115	1.00

The compliance and length of rehabilitation are the variables that most affect management costs.

The most representative recipes show that level of sportiness associated with young age affects the management, as well as the length of rehabilitation, also for the patients with a lower level of sportiness.

Table 8: QCA analysis for rehabilitative pathway management cost

Modello_1_OUTCOME COST			
		Raw Coverage	Consistency
1	COMPLIANCE*age*SPORTINESS* REHABILITATION * strength test	0.154	1.00
2	COMPLIANCE*age *LENGTH REHABILITATION *SOGLIA*TEST DI FORZA	0.077	1.00
3	COMPLIANCE* sportiness * LENGTH REHABILITATION * THRESHOLD TEST* STRENGTH TEST	0.269	1.00
4	compliance * age * sportiness * LENGTH REHABILITATION * THRESHOLD TEST* strength test	0.038	1.00
5	COMPLIANCE*age* SPORTINESS * length rehabilitation * threshold test* STRENGTH TEST	0.038	1.00
6	COMPLIANCE*AGE* SPORTINESS* LENGTH REHABILITATION * threshold test* STRENGTH TEST	0.038	1.00
7	Compliance*AGE* SPORTINESS* LENGTH REHABILITATION * THRESHOLD TEST* STRENGTH TEST	0.038	1.00
	Solution Coverage 0.615		
	Solution Consistency 1		

5 Discussion and Conclusions

Regression analysis results, demonstrated that a high level of sportiness and a strong compliance could be considered antecedent of a higher total rehabilitative pathway management cost, for an ACL patient. A sport professional, since his urgent priority, is the recovery of normal daily and sportive activities, is expected to undergo to a more intense and onerous rehabilitative pathway (De Valk et al., 2003). The same trend emerged with regard to patients' compliance and satisfaction. This is consistent with literature evidence available on the topic, revealing: *i*) the importance of compliance in the achievement of a positive clinical outcome (Wierike et al., 2013), and *ii*) the relevance of a higher rehabilitative sessions and threshold test frequency, as a determinant of rehabilitation effectiveness (Czuppon et al., 2014).

The QCA complements these results identifying combinations of factors that are able to determine the emergence of a given outcome. For example, more consistent solutions of QCA analysis show that the compliance has a major impact on the absorption of economic resources by patients, but also higher levels of sportiness associated with the young age of patients determine in combination higher costs of the rehabilitation pathway.

When considering the effectiveness of the rehabilitative pathway, the compliance together with the young age, and the high level of sportiness is conducive to the best clinical outcomes. Another consistent and empirical relevant solution shows that a potential “recipe” to obtain a high effectiveness of the rehabilitation, also exists for younger patients: they need to be compliant and to exhibit high levels of sportiness. Finally, the patients' satisfaction in this sample is determined by the compliance in combination with the high level of sportiness.

The findings could contribute to enlarge the existing research, with regard to the use of real-world data in the healthcare sector, within the specific setting of the rehabilitation process. Despite this is particularly relevant because the concept of value is receiving

greater attention in rehabilitation and the broader healthcare environment, healthcare stakeholders, often lack sufficient information on outcomes to make well-informed decisions. In this view, the knowledge of some aspects that could positively or negatively impact on the patient's pathway, would be useful for the optimization of economic resources, as well as for the achievement of an adequate rehabilitative effectiveness, guaranteeing a personalisation of the process, thus becoming more efficient and effective, consistent with cost-containment strategies (Justo et al., 2018). This become even more important, given the recent Italian law "Legge di Stabilità" requirements (2016), where the optimization and the evaluation of the patient's clinical pathway, based on RWD, is becoming mandatory.

References

- Berguer R. The evidence thing. *Ann Vasc Surg* 2004;18:265-70.
- Celine M, Robin E, Horvath V, et al., (2014) "Health and Healthcare: Assessing the Real World Data Policy Landscape in Europe." Santa Monica, CA:RAND Corporation. Available from: http://www.rand.org/pubs/research_reports/RR544.html
- Christino, M., Fleming, B., Machan, J. and Shalvoy, R. (2016). "Psychological Factors Associated With Anterior Cruciate Ligament Reconstruction Recovery". *Orthopaedic Journal of Sports Medicine*. Vol. 4, No 3
- Czuppon, S., Racette, B., Klein, S. and Harris-Hayes, M. (2013). "Variables associated with return to sport following anterior cruciate ligament reconstruction: a systematic review". *British Journal of Sports Medicine*. Vol. 48, No 5, pp.356-364.
- de Valk, E., Moen, M., Winters, M., Bakker, E., Tamminga, R. and van der Hoeven, H. (2013). "Preoperative Patient and Injury Factors of Successful Rehabilitation After Anterior Cruciate Ligament Reconstruction With Single-Bundle Techniques." *Arthroscopy: The Journal of Arthroscopic & Related Surgery*. Vol. 29 No. 11, pp.1879-1895.
- Duarte A, Bojke C, Cayton Q, Salawu A, Case B, Bijke L, and Richardson G. Impact of specialist rehabilitation services on hospital length of stay and associated costs. *Eur J Health Econ*. 2018; 19(7): 1027–1034.
- Fucal H, Anirban B, Liang S. and Lingaraj K. Increased Compliance With Supervised Rehabilitation Improves Functional Outcome and Return to Sport After Anterior Cruciate Ligament Reconstruction in Recreational Athletes. *Orthop J Sports Med*. 2015 Dec; 3(12)
- Garrison Jr, L. P., Neumann, P. J., Erickson, P., Marshall, D., & Mullins, C. D. (2007) "Using real-world data for coverage and payment decisions: The ISPOR real-world data task force report." *Value in health*, 2007, 10(5), 326-335.
- Hiraoka T, Okamoto C, Ishii Y, Kakita T, Okamoto F, Takahashi H, Oshika T. Patient satisfaction and clinical outcomes after overnight orthokeratology. *Optom Vis Sci*. 2009 Jul;86(7):875-82
- Iuga AO and McGuire MJ. Adherence and health care costs. *Risk Manag Healthc Policy*. 2014; 7: 35–44.
- Justo N, Espinoza M, Ratto B, Rosselli D, Ovcinnikova O, García Martí S, Ferraz M, Langsam M, and Drummond M. (2018). "Real World Evidence in healthcare decision-making: Global trends and case studies from Latin America". White paper. Stockholm, Sweden.
- Kane RL, Maciejewski M, Finch M. The relationship of patient satisfaction with care and clinical outcomes. *Med Care*. 1997 Jul;35(7):714-30.
- Lingsma HF, Bottle A, Middleton S, Kievit K, Steyerberg EW, Marang-van de Mheen PJ. Evaluation of hospital outcomes: the relation between length-of-stay, readmission, and

- mortality in a large international administrative database. *BMC Health Serv Res.* 2018; 18: 116.
- Marx, A., Cambré, B., and Rihoux, B. (2013). "Chapter 2 crisp-set qualitative comparative analysis in organizational studies", In *Configurational theory and methods in organizational research*, pp. 23-47, Emerald Group Publishing Limited.
- Ragin, C. C., (1987). "The comparative method: Moving beyond qualitative and quantitative methods", Berkeley: University of California.
- Ragin, C. C., (2000). *Fuzzy-set social science*, University of Chicago Press.
- Rotter T, Kinsman L, James E, Machotta A, Gothe H, Willis J, Snow P, Kugler J. Clinical pathways: effects on professional practice, patient outcomes, length of stay and hospital costs. *Cochrane Database Syst Rev.* 2010 Mar 17; (3):CD006632.
- Thomeé, R., Kaplan, Y., Kvist, J., Myklebust, G., Risberg, M.A., Theisen, D., Tsepis, E., Werner, S., Wondrasch, B. & Witvrouw, E. (2011). "Muscle strength and hop performance criteria prior to return to sports after ACL reconstruction, Knee Surgery, Sports Traumatology." *Arthroscopy*. Vol. 19, No 11, pp. 1798-805.
- Wierike, S., van der Sluis, A., van den Akker-Scheek, I., Elferink-Gemser, M. and Visscher, C. (2012). "Psychosocial factors influencing the recovery of athletes with anterior cruciate ligament injury: A systematic review." *Scandinavian Journal of Medicine & Science in Sports*, Vol. 23, No. 5, pp.527-540.
- Poveda, A. C., & Martínez, C. I. P. (2013). Qualitative comparative analysis (QCA): an application for the industry. *Quality & Quantity*, 47(3), 1315-1321.

Monitoring Hospitals in the Kingdom of Saudi Arabia: an Approach Based on KPIs (Key Performance Indicators) and SMAA-2 (Stochastic Multicriteria Acceptability Analysis)

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Abstract

In the present paper we show the potentiality of the Stochastic Multicriteria Acceptability Analysis (SMAA-2) in evaluating 31 general hospital structures across the Kingdom of Saudi Arabia (KSA) in 2017.

The method allows for a global evaluation of each hospital beginning with a set of 41 key performance indicators (KPIs) that are computed monthly by the Saudi Ministry of Health (MoH).

The paper clearly shows the importance of this multi-criteria technique in supporting decision makers (DM).

Keywords: Key Performance Indicators (KPI), Stochastic Multicriteria Acceptability Analysis (SMAA), Healthcare, Decision Making, Kingdom of Saudi Arabia (KSA)

Proposed Paper: Academic Research Paper

1. Introduction

In line with the goals and strategic objectives outlined in Saudi Arabia's 2030 Vision, the Ministry of Health (MoH) has introduced Aadaa', a national improvement transformation program encapsulating the whole healthcare sector. This unprecedented program aims to improve the efficient utilization of available resources, enhance the efficiency and effectiveness of the healthcare sector leveraging the power of digital transformation and information technology, strengthen training and development, improve healthcare provisions before and during hospitalization, attain acceptable waiting times across all stages of service delivery, and improve governance in the health system in order to enhance the accountability with regards to quality issues and patient safety.

The Aadaa' program aims to build and initialize performance measurement processes in the public healthcare sector by providing the necessary support through the utilization of unified tools and models that assist MoH public hospitals in their ability and efficiency to deliver better performance. This program continuously monitors the delivery progress of strategic goals, initiatives and KPIs of MoH hospitals, tracking their development in achieving the Saudi MoH's mission 2020 in addition to measuring beneficiary satisfaction on public services.

Since its official launch in 2017, Aadaa' has monitored and tracked healthcare facilities on a monthly basis through a set of 41 KPIs and has had a positive impact on the quality of therapeutic care delivered to patients as well as the efficient utilization of available resources. The program also aims to enhance the skillset of health professionals so that they are better equipped to understand and interpret the indicators, and thus able to identify performance improvement opportunities.

The MoH is the regulator for all healthcare-related activities and services within the Kingdom and has played a dominant role in the provision of healthcare services in KSA. It is the largest provider of healthcare services in the Kingdom, providing over 60% of inpatient care. MoH facilities are established to provide free healthcare to the Kingdom's population of over 32 million nationals. Although the MoH is responsible for healthcare of all citizens, other public and private facilities play an important role in healthcare delivery, providing over 20% and 17% of the inpatient facilities health services, respectively. Accordingly, the main challenge faced by decision makers was in identifying the best performing hospitals as a function of the set of KPIs. Moreover, decision-makers faced difficulties conceptualizing selection models. The number of actors participating in the decision-making process is typically large and accordingly, it is often unclear whether the final DMs or those responsible for preparation should be considered the source of preferential information. In this framework simulating all the

possible preferences, that is all the possible weights assigned to the KPIs through the SMAA-2, should represent a valid aid in supporting DMs decisions. To the best of our knowledge, this is the first time that SMAA-2 is applied to rank hospitals with respect to a set of KPIs.

This paper is organised as follows: section 2 briefly describes the variables employed and existing data, and section 3 discusses the methodological approach. Section 4 outlines the main results. Section 5 provides conclusions.

2. Data and variables

From January 2017 to January 2018, we collected data for 31 general hospitals across the Kingdom around 7 key therapeutic aspects or domains, including: (emergency, clinics, surgeries, hospitalization, critical care units, radiology and labs). These 31 general hospitals are acute care hospitals that provide medical and surgical care, including diagnostic and treatment services. They are scattered across the Kingdom in which 7 are in central region, 5 are in eastern region, 8 are in the southern region, 11 hospitals in the western region and 7 are in the northern region. The average bed capacity is 323 bed units with a maximum of 575 bed units and a minimum of 150 bed units.

The presence of non-negligible variability in the monthly data has led us to consider the median value of each KPI. The complete list of KPIs is reported in Table 1.

Table 1. Hospital Aada set of KPIs

	KPI Abbreviation	KPI	Domains
1	ED 1	Door to Doctor	Emergency Department
2	ED 2	Doctor to Decision	
3	ED 3	Decision to Disposition (Admit or Transfer only)	
4	ED 4	% of Non-Urgent Patients	
5	RAD 1	Order to Scan (By X-Ray, CT and MRI)	Radiology Department
6	RAD 2	Scan to Release (By X-Ray, CT and MRI)	
7	LAB 1	Lab TAT (Turnaround Time)	Laboratory
8	OR 1	OR Utilization	Operating Rooms
9	OR 2	% First Daily Cases Start on Time	
10	OR 3	OR Cancellation Rate	
11	OR 4	Surgery Volume	
12	OR 5	% of Elective Surgeries	
13	OR 6	Day of Admission to Day of Surgery	
14	OR 7	% Day Surgery Compliance to Ministry of Health List	
15	OR 8	% Day Surgery Conversions to Admission	
16	OR 9	Nursing Staff with Certifications (BLS, ATLS, PALS)	
17	OR 10	Physicians with Certifications (BLS, ATLS, PALS)	
18	IP 1	% of Patients Seen by Consultant in First 24 Hours	Inpatient Department
19	IP 2	% EDD (Expected Days to Discharge) Compliance on Admission	
20	IP 3	Admission LOS (Length of Stay)	
21	IP 4	EDD to Actual LOS Comparison	
22	IP 5	Time from Clinical to Physical Discharge	
23	IP 6	% Weekend Discharges	
24	IP 7	Number of Long-Stay Patients	
25	IP 8	Mortality Rate (Inpatient & Critical Care)	
26	OPD 1	Waiting Time for Appointment (in Days)	
27	OPD 2	Surgical Conversion Rate	

28	OPD 3	% of New Patients	Outpatient Department
29	OPD 4	Patient Volume	
30	OPD 5	Patient's No-Show Rate	
31	OPD 6	Clinic Waiting Time	
32	OPD 7	Patient On-Time Arrival	
33	CC 1	ICU Length of Stay	Critical Care Department
34	CC 2	Nurse to Bed Ratio	
35	CC 3	Presence of Admission & Discharge Criteria	
36	CC 4	Adherence to Admission & Discharge Criteria	
37	CC 5	% Nursing Staff with ICU Certifications (ACLS, ATLS, PALS, NRP, FCCS)	
38	CC 6	% of Physicians with ICU Certification (ACLS, ATLS, PALS, NRP, FCCS)	
39	CC 7	Number of Long-Stay Patients	
40	Patsat	Patient NPS (Net Promotion Score)	Patient & Staff Satisfaction
41	Staffsat	Staff NPS (Net Promotion Score)	

The KPIs in bold are not included in the analysis since these variables may be affected by selection bias: severely ill patients may choose high quality hospitals (Gowrisankaran and Town, 1999); if the unobserved component of severity of illness affects a patient's choice of hospital, then the selection problem remains, and the evaluation of hospital will be incorrect. A possible solution is to employ the Case Mix Index (cmi) which measures the average complexity of a Diagnosis-Related Group (DRG) treated in the hospital compared with the average complexity of data from a set of reference hospitals. However, nowadays this kind of data is not consistent or readily available in the Saudi health system. Table 2 reports the descriptive statistics for the sample of 31 general hospitals considered in the analysis.

Table 2. Descriptive statistics

	KPI	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
1	ED1	5.912	11.284	16.355	18.390	21.783	47.831
2	ED2	8.102	42.889	62.758	73.161	94.547	199.477
3	ED3	0.7197	0.9696	75.7764	54.8708	94.5161	98.7483
4	RAD1	0.4256	1.2800	2.4601	3.0696	4.0848	8.2483
5	RAD2	0.07997	0.44078	0.77320	0.83106	1.20461	2.49291
6	LAB1	32.12	69.56	86.00	91.05	104.31	212.25
7	OR1	0.0000	0.2096	0.2965	0.2899	0.3811	0.5541
8	OR2	0.03342	0.11243	0.26884	0.31167	0.47138	0.83388
9	OR3	0.00000	0.04237	0.07677	0.09130	0.13569	0.22381
10	OR6	0.0000	0.5825	0.8953	1.3303	1.7475	5.9363
11	OR7	0.2837	0.5883	0.8169	0.7778	0.9556	1.0000
12	OR8	0.02089	0.05520	0.20144	0.28719	0.49569	1.00000
13	OR9 Nurs	0.3333	0.9751	1.0000	0.9853	1.0245	1.2727
14	OR10 Phy	0.8314	1.0000	1.0117	1.0483	1.0822	1.4670
15	IP1	0.03951	0.48967	0.65752	0.63240	0.88441	0.98732
16	IP2	0.0000	0.6826	0.8883	0.7825	0.9902	0.9989
17	IP3	2.209	3.000	4.021	4.443	5.046	9.851
18	IP4	1.043	1.760	2.315	2.629	2.970	5.861

19	IP5	0.837	2.365	2.965	3.104	3.641	8.089
20	IP6	0.003854	0.125531	0.165212	0.155418	0.189421	0.224830
21	OPD1	3.465	17.672	31.240	35.119	47.562	90.841
22	OPD2	0.000000	0.008539	0.017544	0.021895	0.029103	0.071038
23	CC1	3.207	5.151	6.368	6.999	7.648	20.275
24	CC2	0.05318	0.40153	0.51602	0.52054	0.61509	0.98580
25	CC4	0.0000	0.9636	1.0000	0.9448	1.0000	1.0000
26	CC5	0.03714	0.41711	0.83240	0.79505	1.06767	1.70290
27	CC6	0.1031	0.3745	0.6215	0.6250	0.8914	1.1656
28	patsat	-0.6162	0.1667	0.3409	0.2562	0.4276	0.9267
29	staffsat	-0.708333	-0.008333	0.241852	0.159553	0.348333	0.543333

What can be noticed in Table 2 is that the variables differ in the unit of measure as well as in their impact on the measurement of hospital performance. For example, low level in the LAB1 KPI -turnaround time- has a positive impact. On the contrary an increase of the KPI CC4 -adherence to admission & discharge criteria – indicates a rise of performance. Thus, to make the variables comparable we normalise them in [0,1], where 0 always indicate minimum and 1 the maximum, by employing the following formulas:

$$\xi_i^o = \frac{\xi_i - \xi_{max}}{\xi_{max} - \xi_{min}}; \text{for a KPI that indicates improvement when it increases}$$

$$\xi_i^o = \frac{\xi_{max} - \xi_i}{\xi_{max} - \xi_{min}}; \text{for a KPI that indicates improvement when it decreases} \quad (1)$$

3. Methodological approach

Stochastic Multicriteria Acceptability Analysis (SMAA-2) belong to the family of the so-called Multiple Criteria Decision Aiding (MCDA) methods which allow to choose, rank and sort a set of alternatives in terms of a set of criteria (Roy, 1966; Figueira et al., 2005). The SMAA-2 overcomes one of the main problems in the various MCDA methods (Lahdelma et al., 1998) which is related to the assignment by the Decision Makers (DM) of weights, even if in a nondeterministic, to the alternative criteria. For example, the Multi-Attribute Utility Theory (MAUT) employ a priori probability distribution, while the Elimination and Choice Expressing Reality (ELECTRE) method utilize thresholds. In the SMAA-2, the choice among alternatives is obtained by employing Montecarlo simulation in which the weights are randomly extracted from a convex polytope identified through a set of linear weight constraints. In the SMAA-2 the introduction of uncertainty to the weights space implies that the result is represented by a probability distribution of rankings rather than a single “representative” one (Tervonen and Ladhema, 2007; Tervonen and Figueira, 2008; Greco et al., 2018). Consequently, this characteristic of the method is suitable whenever:

- DMs are not able to assign any weights due to the complexity of the problem;
- DMs do not want to restrict themselves to some weights;
- DMs would like to obtain a preliminary system of weights.

Currently the MoH faces the above challenges in pursuing the broader objective of improving the quality of the healthcare outcomes through the analysis of the set of KPIs defined in section 2. In what follows we describe the employed methodology where, in accordance to the MCDA framework, the alternatives are the hospitals and the criteria are the KPIs. In a typical MCDA setting a set of m alternatives $A = \{a_1, a_2, \dots, a_i, \dots, a_m\}$ is evaluated on a set of n evaluation criteria $G = \{g_1, g_2, \dots, g_j, \dots, g_n\}$. In order to compare an alternative a_i respect to the m criteria an utility function u , which assigns a non-negative weight $w_j \in W$ - $W = \{(w_1, w_2, \dots, w_j, \dots, w_n) \in R^N: w_j \geq 0, j = 1, 2, \dots, n, \text{ and } \sum_{j=1}^n w_j = 1\}$ - to each criterion $g_j \in G$, is employed:

$$u(a_i, w) = \sum_{j=1}^n w_j g_j(a_i) \quad (2)$$

In a fortunate case in which the alternative criteria has been clearly defined, and they present equal importance for DM, equation (2) can take the form of a simple arithmetic mean. But in most of cases neither values of criteria nor the set of weights are clearly defined. In order to take into account such an uncertainty in the evaluation of the alternatives, the SMAA introduces two probability function on the weight space and on the evaluation space, χ , which is the space of the value that can be taken by criteria $g_i \in G$:

$$\begin{aligned} f_W: W &\rightarrow \mathcal{R}^+. \quad \sum_{i=1}^n f_W(w_i) = 1 \\ f_\chi: \chi &\rightarrow \mathcal{R}^+. \quad \sum_{i=1}^n f_\chi(\xi_i) = 1 \end{aligned} \quad (3)$$

Then the following ranking function, r_i , is introduced for each alternative a_i :

$$r_i(\xi_i, w) = 1 + \sum_{h \neq i} [\rho(u(\xi_h, w)) > u(\xi_i, w)] \quad i=1, 2, \dots, m \quad (4)$$

Where, ρ is an indicator function: $\rho(\text{false})=0$ and $\rho(\text{true})=1$. For each ranking r_i , each alternative a_i , for each evaluation of alternatives ξ SMAA-2 individuates the set of favourable rank weights:

$$W_i^r = \{w \in W: r_i(\xi_i, w) = r\} \quad (5)$$

which are employed in a set of indexes that describe the set of rankings obtained through the Montecarlo simulation. In particular, in what it follows we employ the rank acceptability index, b_i^r , to explore the alternative rankings of hospitals which measure the frequency that the alternative a_i gets rank r respect to the set of weights and evaluations of alternatives:

$$b_i^r = \sum_{\xi \in \chi} f_\chi(\xi) \int_{w \in W_i^r(\xi)} f_W(w) dw d\xi \quad i=1, 2, \dots, m \quad (6)$$

In other terms b_i^r allows to compare how different varieties of weights support each rank for each alternative (Lahdelma and Salminen, 2001).

4. Application to the general hospitals in Saudi MoH ranking

We apply the aforementioned SMAA-2 to rank the 31 general hospitals in KSA regions according to the set of the remaining 29 KPIs described in section 2, after the exclusion of the 11 KPIs in bold from the total of 41 KPIs as mentioned in section 2. The index has been obtained by mean of the R libraries *smaa* (Valkenhoef, 2018) and *hit and run* (Tervonen and Valkenhoef, 2019). Our explorative analysis begins by computing three naïve rankings which can easily obtained from the KPIs:

- Patient ranking (Patient Satisfaction KPI), r_{pat} ;
- Staff ranking (Staff satisfaction KPI), r_{staff} ;
- Average ranking (Simple arithmetic mean of the 27 KPIs), r_{avg} , excluding r_{pat} and r_{staff} ;
- In this first phase of the empirical analysis the objective is to simply assess the existence of differences in the perception of the hospitals among patients, employees (doctors and nurses) and a set of neutral indicators, e.g. the 27 KPIs. The results are shown in Tables 3, 4 and 5.

Table 3. Patient ranking (r_{pat}) vs Avg ranking (r_{avg}).

	Hospital Name	r_{pat}	r_{avg}	$r_{pat} - r_{avg}$	$\text{sign}(r_{pat} - r_{avg})$
H1	King Salman Riyadh	17	3	14	+
H2	King Saud Oneiza	11	2	9	+
H3	Dammam Medical Complex	10	28	-18	-
H4	Jubail General	7	6	1	+
H5	Qatif Central Hospital	28	14	14	+
H6	King Fahad Hofuf	27	18	9	+
H7	King Khalid Hafar Al Batin	4	1	3	+
H8	Asir Central	14	31	-17	-
H9	Khamis Mushyt General	5	27	-22	-
H10	Prince Mushari Bin Saud Beljurashi	2	11	-9	-
H11	King Fahad Baha	15	23	-8	-
H12	King Abdullah Central Bisha	19	15	4	+
H13	King Fahad Central Jizan	23	26	-3	-
H14	Sabia General Jizan	8	25	-17	-
H15	Prince Mohammed Bin Nasser Jizan	13	22	-9	-
H16	Heraa Hospital Makkah	24	4	20	+
H17	King Abdulaziz Makkah	9	24	-15	-
H18	Ohod Medina	26	19	7	+
H19	King Fahad Medina	12	30	-18	-
H20	Yanbu General	21	16	5	+
H21	King Faisal Medical Complex Taif	6	5	1	+

H22	Al Qunfudhah South Hospital	31	17	14	+
H23	King Khalid Tabuk	16	21	-5	-
H24	King Khalid Al Kharj	22	29	-7	-
H25	Prince Muteb Al Jouf	25	7	18	+
H26	Al Qurayyat General	29	10	19	+
H27	Arar Central Hospital	1	13	-12	-
H28	Rafha Hospital	20	8	12	+
H29	King Khaled Hail	18	12	6	+
H30	Hail General Hospital	3	20	-17	-
H31	Buraydah Central Hospital	30	9	21	+

Table 4. Staff ranking (r_{staff}) vs avg ranking (r_{avg})

	Hospital	r_{staff}	r_{avg}	$r_{staff} - r_{avg}$	$sign(r_{staff} - r_{avg})$
H1	King Salman Riyadh	4	3	1	+
H2	King Saud Oneiza	17	2	15	+
H3	Dammam Medical Complex	22	28	-6	-
H4	Jubail General	9	6	3	+
H5	Qatif Central Hospital	25	14	11	+
H6	King Fahad Hofuf	23	18	5	+
H7	King Khalid Hafar Al Batin	1	1	0	
H8	Asir Central	20	31	-11	-
H9	Khamis Mushyt General	10	27	-17	-
H10	Prince Mushari Bin Saud Beljurashi	15	11	4	+
H11	King Fahad Baha	7	23	-16	-
H12	King Abdullah Central Bisha	16	15	1	+
H13	King Fahad Central Jizan	21	26	-5	-
H14	Sabia General Jizan	3	25	-22	-
H15	Prince Mohammed Bin Nasser Jizan	18	22	-4	-
H16	Heraa Hospital Makkah	6	4	2	+
H17	King Abdulaziz Makkah	5	24	-19	-
H18	Ohod Medina	24	19	5	+
H19	King Fahad Medina	13	30	-17	-
H20	Yanbu General	29	16	13	+
H21	King Faisal Medical Complex Taif	8	5	3	+
H22	Al Qunfudhah South Hospital	31	17	14	+
H23	King Khalid Tabuk	19	21	-2	-
H24	King Khalid Al Kharj	28	29	-1	-
H25	Prince Muteb Al Jouf	26	7	19	+
H26	Al Qurayyat General	27	10	17	+

H27	Arar Central Hospital	14	13	1	+
H28	Rafha Hospital	2	8	-6	-
H29	King Khaled Hail	11	12	-1	-
H30	Hail General Hospital	12	20	-8	-
H31	Buraydah Central Hospital	30	9	21	+

Table 5. Staff ranking (r_{staff}) vs Patient ranking (r_{pat})

	Hospital	r_{staff}	r_{pat}	$r_{staff} - r_{pat}$	$sign(r_{staff} - r_{pat})$
H1	King Salman Riyadh	4	17	-13	-
H2	King Saud Oneiza	17	11	6	+
H3	Dammam Medical Complex	22	10	12	+
H4	Jubail General	9	7	2	+
H5	Qatif Central Hospital	25	28	-3	-
H6	King Fahad Hofuf	23	27	-4	-
H7	King Khalid Hafar Al Batin	1	4	-3	-
H8	Asir Central	20	14	6	+
H9	Khamis Mushyt General	10	5	5	+
H10	Prince Mushari Bin Saud Beljurashi	15	2	13	+
H11	King Fahad Baha	7	15	-8	-
H12	King Abdullah Central Bisha	16	19	-3	-
H13	King Fahad Central Jizan	21	23	-2	-
H14	Sabia General Jizan	3	8	-5	-
H15	Prince Mohammed Bin Nasser Jizan	18	13	5	+
H16	Heraa Hospital Makkah	6	24	-18	-
H17	King Abdulaziz Makkah	5	9	-4	-
H18	Ohod Medina	24	26	-2	-
H19	King Fahad Medina	13	12	1	+
H20	Yanbu General	29	21	8	+
H21	King Faisal Medical Complex Taif	8	6	2	+
H22	Al Qunfudhah South Hospital	31	31	0	
H23	King Khalid Tabuk	19	16	3	+
H24	King Khalid Al Kharj	28	22	6	+
H25	Prince Muteb Al Jouf	26	25	1	+
H26	Al Qurayyat General	27	29	-2	-
H27	Arar Central Hospital	14	1	13	+
H28	Rafha Hospital	2	20	-18	-
H29	King Khaled Hail	11	18	-7	-
H30	Hail General Hospital	12	3	9	+
H31	Buraydah Central Hospital	30	30	0	-

The three rankings clearly differ. Nonetheless, before applying a statistical test we can highlight the following empirical evidence emerging from the above tables:

1. The differences between patient ranking and average ranking is greater than the one between staff ranking and average ranking. In Table 3 there are only 2 changes in the ranking that are at least of 1 position against 6 in Table 4;
2. There is accordance between patient ranking and staff ranking for the hospitals that are ranked in the last position.

We employ the Cohen's kappa statistic to assess the statistical significance of differences in the above naïve rankings. Cohen's kappa statistic measures inter-rater reliability (sometimes called inter-observer agreement). Inter-rater reliability, or precision, happens when the data raters give the same score to the same data item. Like most correlation statistics, the kappa can range from -1 to $+1$. In Table 6 the test results are shown:

Table 6. Cohen's Kappa and associated p-value in parenthesis.

	r_{avg}	r_{pat}	r_{staff}
r_{avg}		-0.0333 (0.309)	0 (1)
r_{pat}			0.0333 (0.309)
r_{staff}			

The results in table 6 indicate the absence of agreement, or concordance, among the three rankings: values of Choen's Kappa close to 0. However, the associated probability to the Choen's Kappa coefficient suggest that the absence of agreement is due to chance instead of a "true" difference between rankings.

Therefore, it seems reasonable to apply SMAA-2 as a method offering a broader perspective to tackle the measurement of the general hospital's performance in KSA. Thus, according to the SMAA-2 approach, we introduce a uniform sampling of 10^6 of weights vector on the 27 KPIs, - the KPIs measuring staff and patient satisfactions has been excluded- which generate through, the rank acceptability index, b_i^r , the set of all possible rankings related to the 31-general hospitals. The index has been multiplied for 10^6 , obtaining absolute rank frequency, to facilitate the Table 7 readability.

Table 7. Rank Frequency: table shows the number of cases out of the 10^6 cases generated by different weights sets in which each hospital achieves a given rank from 1 to 31

rank	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12	H13	H14	H15	H16	H17	H18	H19	H20	H21	H22	H23	H24	H25	H26	H27	H28	H29	H30	H31
1	132905	165188	25	42491	307	397	367460	8	21	5382	42	150	45	14	12	9707	12	19	14	311	68396	239	525	39	92389	4568	6905	88719	685	1066	12401
2	104789	144032	167	121981	1294	957	228675	30	25	17153	148	691	65	187	160	44300	15	1037	98	1917	75335	2463	1671	34	106690	10837	23716	84470	2194	2510	27815
3	106397	124158	546	118804	3752	1788	145563	36	209	36666	258	1680	52	565	298	80669	233	2085	384	3718	73125	1845	4524	118	94653	18533	44279	85581	3738	4777	37997
4	95269	113767	724	108835	6412	3249	96533	44	347	49133	549	2794	161	834	767	109168	736	3325	576	7124	77991	10908	6429	238	82947	26810	51280	80462	4952	6743	49705
5	87966	100422	1312	100104	10395	3291	60267	146	604	60846	1334	5740	485	1281	1441	128491	1533	5079	619	12212	78891	15338	9084	332	77074	36673	50815	74009	8232	8712	64200
6	78946	83232	1485	87766	15599	4854	40250	250	1330	70630	2538	9733	759	1467	2530	127375	2514	6251	1363	17943	78935	18120	11523	573	73885	44341	57940	72525	11279	9021	76394
7	71329	69438	2303	75718	21855	7275	24441	327	2690	79036	4474	16749	1594	2851	4042	114251	4501	8515	1965	23185	75299	23609	13788	1008	68219	50608	65537	68351	15369	10837	87453
8	65773	55839	2803	65045	31340	9556	15280	506	4699	83503	7274	25242	2693	3377	6224	95472	7816	11425	2450	28074	71968	31456	17455	1814	64847	54241	70055	66068	19182	12908	93271
9	57132	43029	3699	56438	36926	11255	8885	745	6437	84550	10645	36336	3811	4771	9331	79421	11566	13749	2923	35131	67702	38998	22000	2731	19026	61381	71915	62566	25302	15829	94504
10	46959	31086	4704	48591	44202	17017	5099	1693	19428	81845	11544	49357	5115	6850	14491	64742	18674	17463	4209	41308	62400	42393	23838	3837	53016	69892	72762	59044	31965	18683	88222
11	40241	22982	5630	41516	52474	21875	2963	2012	15386	75476	23391	63996	6127	8538	20653	48829	26026	21600	9988	48220	56487	49862	27896	5151	43248	71983	71386	52296	37810	23421	81668
12	32780	16828	7394	34312	58570	21206	1575	3753	22598	70226	34507	79259	7925	11735	29232	35910	35119	24756	7158	53694	47909	57548	31112	7346	30530	69524	69947	44496	46914	28483	72066
13	24454	12491	6347	27067	67073	32475	642	7254	16793	60550	52137	92526	9213	15999	39237	24499	43187	30605	8919	61043	39814	62858	35405	9208	29199	66027	63587	35644	53633	33702	59355
14	17726	7794	9831	21559	71380	40078	236	14380	44802	50550	78621	97902	11545	23095	47938	16585	53230	32621	10425	63978	33186	64982	37634	12473	25613	60247	57286	28793	61507	39123	46894
15	13109	4944	10952	17011	73711	49028	120	37347	59073	41329	89100	96655	14958	27131	56220	9949	62555	40109	12254	69052	26920	63369	40590	17860	20731	53991	47626	22911	68791	42811	36263
16	7833	2686	12785	12459	73915	59508	20	128112	77982	32201	105097	91794	18329	32677	63145	5649	69787	45681	14143	69008	20965	59682	43559	19973	16636	47757	38136	18535	70885	44645	26423
17	4501	1894	16094	8577	71762	66774	1	803357	59600	25049	118415	82693	22492	38938	68321	2787	79174	49579	17068	66527	14106	56517	44672	21591	12343	41858	31120	14991	70407	45589	17558
18	2298	824	19173	4022	67592	76560			113933	15041	121718	70223	27146	44832	73746	1504	90782	53574	19368	61421	10918	51966	46586	23843	9816	36706	25963	11497	68049	44734	11755
19	1615	227	22845	2817	63870	85422			131189	15419	114820	55322	33786	50218	74955	529	102057	56176	21877	54474	8214	47783	47376	26152	8083	33449	19487	8854	61968	44636	6912
20	921	79	27321	1716	53223	87902			120487	11147	94246	40765	41035	57959	74727	137	109243	59422	25348	51799	5598	44493	46521	32817	6536	27994	15710	5975	56215	46812	3951
21	630	17	32514	859	44292	85796			106666	8787	66305	29704	50282	64907	71896	26	108512	61439	28071	47065	4020	40452	47606	39999	5431	22843	13017	4468	53480	46712	2190
22	342	14	37445	634	38444	77338			90361	6653	39977	21360	63040	71055	70870		82508	65052	32542	40087	2735	37882	48831	51674	4352	19306	10127	3497	50216	47770	1407
23	118	14	42962	823	31176	70168			54343	5222	18141	13520	80069	78775	64227		51166	66151	36395	35601	2156	35606	49419	60361	3225	16532	7552	2727	45908	48173	807
24	63	8	52387	450	24564	59560			987	3536	6520	8010	105397	80966	55771		28734	64219	44102	30767	998	32461	50630	77357	2606	14239	5550	1713	39849	51464	459
25	14	7	62890	157	18283	45291			1989	1707	4401	140956	94617	46313		11298	58636	54360	25641	443	25761	51230	98776	1631	11486	1932	936	33420	55600	126	
26	0		79232	33	11662	30011			1170	426	2428	158921	90162	37213		1212	57646	68607	19985	118	24089	51921	99281	1363	9673	2556	587	25447	56219	2	
27	0		102709	15	6224	16027			865	66	741	164613	71355	30272			52952	91099	14385	45	19107	50687	120174	828	7829	1585	314	16353	54870	1	
28	0		151539		1696	6224			999		181	21428	23521				44572	126181	10659	16	15085	49916	160358	556	5468	634	138	9188	51225		
29	0		189325		286	2191			269		48		44521	11854			37819	153498	4536		10879	43273	103882	224	4368	35	13	4065	46622		
30	0		102255		3	196			58							6311	792		5353	196060	1116		5682	39922	54	2494			1290	35986	
31	0		10272						40										14026	79		1719	8867		9	1142		7	20517		

Starting from the data in Table 7 we derive Table 8 which reports the SMAA-2 ranking, r_{SMAA-2} , obtained taking the highest absolute frequency, the green values in Table 6, reached by each hospital in the 10^6 cases generated by Montecarlo simulation.

Table 8. SMAA-2 ranking, r_{SMAA}

Hospital	r_{SMAA}
H1 King Salman Riyadh	1
H2 King Saud Oneiza	1
H7 King Khalid Hafar Al Batin	1
H28 Rafha Hospital	1
H4 Jubail General	2
H25 Prince Muteb Al Jouf	2
H16 Heraa Hospital Makkah	5
H21 King Faisal Medical Complex Taif	6
H10 Prince Mushari Bin Saud Beljurashi	9
H31 Buraydah Central Hospital	9
H27 Arar Central Hospital	10
H26 Al Qurayyat General	11
H12 King Abdullah Central Bisha	14
H22 Al Qunfudhah South Hospital	14
H20 Yanbu General	15
H5 Qatif Central Hospital	16
H29 King Khaled Hail	16
H8 Asir Central	17
H11 King Fahad Baha	18
H9 Khamis Mushyt General	19
H15 Prince Mohammed Bin Nasser Jizan	19
H6 King Fahad Hofuf	20

H17	King Abdulaziz Makkah	20
H18	Ohod Medina	23
H14	Sabia General Jizan	25
H13	King Fahad Central Jizan	26
H23	King Khalid Tabuk	26
H30	Hail General Hospital	26
H24	King Khalid Al Kharj	28
H3	Dammam Medical Complex	29
H19	King Fahad Medina	30

It is immediately observable that with respect to the previous ranking, the SMAA-2 ranking identifies a group of hospitals that are ranked with respect to the optimal value of the KPIs in the first position: H1 -King Salman Riyadh-, H2 -King Saud Oneiza-, H7 -King Khalid Hafar Al Batin-, H28 -Rafha Hospital-, H4 -Jubail General- and H25 -Prince Muteb Al Jouf-. To appreciate the difference between the naïve rankings we compare the r_{SMAA} with the previous ones: r_{avg} , r_{staff} and r_{pat} . The results are reported in Tables 9, 10, 11 and 12.

Table 9 Average ranking (r_{avg}) vs SMAA-2 ranking (r_{SMAA})

Hospital		r_{avg}	r_{SMAA}	$r_{avg} - r_{SMAA}$	sign ($r_{avg} - r_{SMAA}$)
H1	King Salman Riyadh	3	1	2	+
H2	King Saud Oneiza	2	1	1	+
H3	Dammam Medical Complex	28	29	-1	-
H4	Jubail General	6	2	4	+
H5	Qatif Central Hospital	14	16	-2	-
H6	King Fahad Hofuf	18	20	-2	-
H7	King Khalid Hafar Al Batin	1	1	0	
H8	Asir Central	31	17	14	+
H9	Khamis Mushyt General	27	19	8	+
H10	Prince Mushari Bin Saud Beljurashi	11	9	2	+
H11	King Fahad Baha	23	18	5	+
H12	King Abdullah Central Bisha	15	14	1	+
H13	King Fahad Central Jizan	26	26	0	
H14	Sabia General Jizan	25	25	0	
H15	Prince Mohammed Bin Nasser Jizan	22	19	3	+
H16	Heraa Hospital Makkah	4	5	-1	-
H17	King Abdulaziz Makkah	24	20	4	+
H18	Ohod Medina	19	23	-4	-
H19	King Fahad Medina	30	30	0	-
H20	Yanbu General	16	15	1	+
H21	King Faisal Medical Complex Taif	5	6	-1	-

H22	Al Qunfudhah South Hospital	17	14	3	+
H23	King Khalid Tabuk	21	26	-5	-
H24	King Khalid Al Kharj	29	28	1	+
H25	Prince Muteb Al Jouf	7	2	5	+
H26	Al Qurayyat General	10	11	-1	-
H27	Arar Central Hospital	13	10	3	+
H28	Rafha Hospital	8	1	7	+
H29	King Khaled Hail	12	16	-4	-
H30	Hail General Hospital	20	26	-6	-
H31	Buraydah Central Hospital	9	9	0	

Table 10. Staff ranking (r_{staff}) vs SMAA-2 ranking (r_{SMAA})

	Hospital	r_{staff}	r_{SMAA}	$r_{staff} - r_{SMAA}$	sign ($r_{staff} - r_{SMAA}$)
H1	King Salman Riyadh	4	1	3	+
H2	King Saud Oneiza	17	1	16	+
H3	Dammam Medical Complex	22	29	-7	-
H4	Jubail General	9	2	7	+
H5	Qatif Central Hospital	25	16	9	+
H6	King Fahad Hofuf	23	20	3	+
H7	King Khalid Hafar Al Batin	1	1	0	
H8	Asir Central	20	17	3	+
H9	Khamis Mushyt General	10	19	-9	-
H10	Prince Mushari Bin Saud Beljurashi	15	9	6	+
H11	King Fahad Baha	7	18	-11	-
H12	King Abdullah Central Bisha	16	14	2	+
H13	King Fahad Central Jizan	21	26	-5	-
H14	Sabia General Jizan	3	25	-22	-
H15	Prince Mohammed Bin Nasser Jizan	18	19	-1	-
H16	Heraa Hospital Makkah	6	5	1	+
H17	King Abdulaziz Makkah	5	20	-15	-
H18	Ohod Medina	24	23	1	+
H19	King Fahad Medina	13	30	-17	-
H20	Yanbu General	29	15	14	+
H21	King Faisal Medical Complex Taif	8	6	2	+
H22	Al Qunfudhah South Hospital	31	14	17	+
H23	King Khalid Tabuk	19	26	-7	-
H24	King Khalid Al Kharj	28	28	0	
H25	Prince Muteb Al Jouf	26	2	24	+
H26	Al Qurayyat General	27	11	16	+

H27	Arar Central Hospital	14	10	4	+
H28	Rafha Hospital	2	1	1	+
H29	King Khaled Hail	11	16	-5	-
H30	Hail General Hospital	12	26	-14	-
H31	Buraydah Central Hospital	30	9	21	+

Table 11. Patient ranking (r_{pat}) vs SMAA-2 ranking (r_{SMAA})

	Hospital	r_{pat}	r_{SMAA}	$r_{pat} - r_{SMAA}$	sign ($r_{pat} - r_{SMAA}$)
H1	King Salman Riyadh	17	1	16	+
H2	King Saud Oneiza	11	1	10	+
H3	Dammam Medical Complex	10	29	-19	-
H4	Jubail General	7	2	5	+
H5	Qatif Central Hospital	28	16	12	+
H6	King Fahad Hofuf	27	20	7	+
H7	King Khalid Hafar Al Batin	4	1	3	+
H8	Asir Central	14	17	-3	-
H9	Khamis Mushyt General	5	19	-14	-
H10	Prince Mushari Bin Saud Beljurashi	2	9	-7	-
H11	King Fahad Baha	15	18	-3	-
H12	King Abdullah Central Bisha	19	14	5	+
H13	King Fahad Central Jizan	23	26	-3	-
H14	Sabia General Jizan	8	25	-17	-
H15	Prince Mohammed Bin Nasser Jizan	13	19	-6	-
H16	Heraa Hospital Makkah	24	5	19	+
H17	King Abdulaziz Makkah	9	20	-11	-
H18	Ohod Medina	26	23	3	+
H19	King Fahad Medina	12	30	-18	-
H20	Yanbu General	21	15	6	+
H21	King Faisal Medical Complex Taif	6	6	0	
H22	Al Qunfudhah South Hospital	31	14	17	+
H23	King Khalid Tabuk	16	26	-10	-
H24	King Khalid Al Kharj	22	28	-6	-
H25	Prince Muteb Al Jouf	25	2	23	+
H26	Al Qurayyat General	29	11	18	+
H27	Arar Central Hospital	1	10	-9	-
H28	Rafha Hospital	20	1	19	+
H29	King Khaled Hail	18	16	2	+
H30	Hail General Hospital	3	26	-23	-
H31	Buraydah Central Hospital	30	9	21	+

Table 12. Cohen's Kappa and associated p-value in parenthesis.

	r_{avg}	r_{staff}	r_{pat}
r_{SMAA}	0.133 (3.58e-05)	0.0333 (0.301)	0 (1)

Looking at Table 9 it can be noticed that the differences between the r_{SMAA} and the r_{avg} rankings are moderate except for H8 - Asir Central - and of H9 -Khamis Mushyt General-: they moved 14 and 8 positions respectively. However, the Cohen's Kappa coefficient, Table 12, shows only a slight level of concordance between rankings which is not due to chance. For the two remaining comparisons between r_{SMAA} , r_{staff} and r_{pat} rankings, Tables 10 and 11 respectively, we obtain quite a different ranking even if "SMAA ranking" seems to be aligned with the extreme positions in the ranking. However, the Cohen's Kappa, Table 12, shows absence of any form of concordance; even this result can be due to chance.

5. Concluding remarks

In the present paper we apply the SMAA-2 techniques to generate a possible ranking of 31 general hospitals with respect to a set of 29 KPIs collected and calculated monthly by the KSA Ministry of Health, as part of the Adaa' national improvement transformation program.

The SMAA-2 through the Montecarlo simulation mimic different class of individuals with different preferences and consequently with different weights for the alternatives.

The paper clearly shows the potentiality of this multi-criteria technique to support the MoH in comparing the general hospital facilities without recurring to a system of a-priori weights.

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References

- Cohen J., (1960) "A coefficient of agreement for nominal scales", *Educational and Psychological Measurement*, 20: pp. 37–46.
- Colton, D., (2000) "Quality improvement in health care: conceptual and historical foundations", *Evaluation & the Health Professions*, vol.23, pp.7-42.
- Figueira, J., Greco, S., Ehrgott, M. (Eds.), 2005. Multiple Criteria Decision Analysis: State of the Art Surveys. Springer Science+Business Media, Inc., New York.
- Gowrisankaran G, Town R.J., (1999) "Estimating the quality of care in hospitals using instrumental variables.", *Journal of Health Economics* 18, pp. 747-767.

- Lahdelma, R., Hokkanen, J. and Salminen, P., (1998) "SMAA-stochastic multi-objective acceptability analysis", *European Journal of Operational Research* vol.106, pp. 137–143.
- Lahdelma, R., Salminen, P., (2001) "SMAA-2: Stochastic Multicriteria Acceptability Analysis for Group Decision Making". *Operations Research* Vol. 49, No. 3 (May - Jun. 2001), pp. 444-454.
- McIntyre, D., Rogers, L. and Heier EJ., (2001) "Overview, history, and objectives of performance measurement", *Health Care Finance Review*, vol. 22, pp. 7–21.
- Roy, B., (1996) "Multicriteria Methodology for Decision Analysis. Kluwer Academic Publisher.
- Saudi MoH National Transformation Program 2020. "Saudi MoH Vision 2030 – NTP: National Transformation Program 2020", available at <https://www.moh.gov.sa/en/Ministry/nehs/Pages/vision2030.aspx>.
- Tervonen, T. and Figueira J., (2008) "A survey on stochastic multicriteria acceptability analysis methods", vol.15, pp.1-14.
- Tervonen, T. and Valkenhoef van G., (2019). "'Hit and Run" and "Shake and Bake" for Sampling Uniformly from Convex Shapes", <https://cran.r-project.org/web/packages/hitandrun/hitandrun.pdf>
- Valkenhoef van G. (2018) Stochastic Multi-Criteria Acceptability Analysis, <https://cran.r-project.org/web/packages/smaa/smaa.pdf>

Exploiting Administrative Data for Enhancing “LAST MILE” Logistic in Hospitals

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Abstract

This work reports preliminary outcomes from the project LINFA, whose aim is to develop a technological, information and organizational system to support the procurement process of medicines and medical devices within healthcare organizations. Such system integrates simulation and optimization algorithms and forecasting models along with advanced logistic practices and traceability technologies by exploiting the increasing availability of historical information about drugs and patients. Accordingly, the paper presents a real case study within an Italian Hospital where the project team has gone through-out the phases of process discovery, use-cases identification and analysis to devise an integrated tool for supporting logistic operation. Results provide a complete identification and formalization of the drug management process, primary process users and functional requirements of such tool for supporting pharmaceutical last-mile logistic including simulation utilities within a hospital or hospital network setting. Final expected benefits from the project include the minimization of stocks and the effective and efficient management of medicines, with a consequent reduction in healthcare expenditure.

Keywords – Healthcare; Pharmaceutical Logistics; Hospital Information System; Simulation; LINFA project.

Paper type – Academic Research Paper

1 Introduction

Logistics function has gained a strategic role in the management of hospitals. As a matter of fact, hospital material management has been identified as one key cost driver to cope with steadily increasing healthcare costs in industrialized countries (Volland et al., 2017). This is particularly true for pharmaceutical logistics where supply chain management has become more and more complex in the last decades since it has to meet life-saving interests at sustainable costs. Solving this trade-off requires to enable the collaboration of different stakeholders such as pharmaceutical manufacturers, wholesalers, distributors, customers, information service providers and regulatory agencies.

‘Last-mile’ of logistics in this context refers to the challenge of the final movements of goods and services to the delivery or consumption point. The ‘last-mile’ of pharmaceutical goods tends to be less efficient and most problem-prone. On one side this is due to the variability and unpredictability of the patient’s needs and the rising demand for care (Wieser, 2011; Bourlakis et al., 2011), on the other to the high process fragmentation and the increasing touch-points that are often related to additional costs and complications. Nevertheless, emerging IT tools (such as Radio Frequency Identification, Enterprise Resource Planning, etc.), vertical organizations as well as the new disruptive technologies for last-mile logistics solutions (e.g., automatic guided vehicles) have risen consistent expectations of reducing the costs of distribution while guaranteeing adequate service levels.

In such an evolving context, scholars and practitioners widely agree that information systems and ICTs used to manage hospitals’ daily operations represent an important knowledge source (Kritchanchai et al., 2017) and possibly a prominent opportunity of improvement for the hospital practices (Mazzocato et al., 2010). Definitely, exploiting evidence from real-world data can enable effective support to demand planning with related purchasing decision-making process, internal/external communication and process coordination (e.g. supporting the information sharing between medical departments, hospital pharmacy, administrative office, external logistic partners, suppliers, etc.).

This work reports the experience gained during the project LINFA, whose aim is the development of a technological, information and organizational system to support the procurement process of medicines and medical devices within healthcare organizations. Such system integrates simulation and optimization algorithms and forecasting models along with advanced logistic practices and traceability technologies by exploiting the increasing availability of historical information about drugs and patients. Accordingly, the paper presents a real case study within an Italian Hospital where the project team has gone through-out the phases of process discovery, use-cases identification and analysis to

devise an integrated tool for supporting logistic operation. Results provide a complete identification and formalization of the drug management process, primary process users and functional requirements of such a tool for supporting pharmaceutical last-mile logistic including simulation utilities within a hospital or hospital network setting.

2 Background

Literature evidence shows that logistics is an interesting and much-debated field in healthcare. Nowadays, several strategic decisions related to logistics are constantly evaluated and implemented by hospital organizations, such as the centralization, decentralization and outsourcing of purchasing and supply management, sterilization, stock management or intra and inter-site transport, etc. Significant results in reducing errors, improving process quality and reducing wait times (Mazzocato et al., 2010), e.g. by implementing various tools for information management and methods of lean management allowing a continuous improvement approach, are available in the literature.

Past studies have analysed the circulation of physical flows by focusing on the management of pharmaceutical flows (Narayana, Pati, and Vrat 2014). Kim and Schniederjans (1993) identified three types of materials management systems traditionally used in healthcare: conventional, just in time, and stockless. The conventional approach coincides with the inventory-based structure and reorder-point logics and results in high costs of operations since the high involvement of hospital staff, the obsolescence costs, and the considerable space to devote to stocks. The widely spread pull-based JIT policy uses Kanban containers while the stockless system, also called "hybrid stockless", combines the "no-stock" logic with the conventional approach. In line with this approach, the distributor must supply high-volume items directly to departments while low-volume ones are delivered through the pharmacy or the central storage point. In so doing, the central warehouse is responsible for distributing these items to the final requiring departments in the due time and quantity (Rivard-Royer et al., 2002). Such a method has been implemented in a pilot project in Canada with contrasting results: it has led to a reduction in costs, improving inventory management and the efficiency of nursing activities, but it has also increased the workload of distributors (Rivard-Royer et al., 2002). Despite this evidence, authors worldwide seem to broadly agree that the introduction of JIT logics in hospitals can lead to significant reductions in general costs and costs related to the provision of services (Lai and Cheng, 2016; Law, 2016; Heinbuch, 1995; Aptel and Pourjalali, 2001; Bruno et al., 2018).

Aptel and Pourjalali (2001) compared French and American hospitals based on selected logistical parameters. Their study found differences in stock management and type of alliances between hospitals and between hospital and vendor. They observed that although hospitals provide critical services and require unexpected stock levels, JIT deliveries can be adopted to minimize inventory costs. Hospital wards, with tangible and high-volume products, represent the ideal terrain for the adoption of JIT systems in materials management, but problems may emerge in case of rural environments characterized by long distance distributor-hospital. It is easy to understand that stock-outs

of critical supplies could have catastrophic consequences in the hospital context (Lapierre and Ruiz, 2007; Pasquet et al., 2010).

One of the main problems of health logistics remains the information deficiency and scarce information exchange between subjects of the supply chain. This evidence has accelerated the need to make the healthcare SC more demand-driven, improving the standardization of processes and collaboration between all the involved parties (Krichanchai and MacCarthy, 2017). Indeed, the collaboration between different subjects was the starting point for the many optimization initiatives implemented in the inventory management area (Krichanchai and MacCarthy, 2017).

Miroslava et al. (2017) propose an empirical SCM classification in healthcare based on different characteristics of Hospital Supply Chain Management (HSCM). Evidence shows that establishing strategic alliances similar to the CPFR - Collaborative Procurement Forecasting Replenishment - and the VMI - Vendor Managed Inventory - is a relevant and investigated topic in healthcare literature. As a matter of fact, given the potential benefits of VMI, the approach has rapidly risen the attention of pharmaceutical companies, medical distributors and health providers including hospitals, which have started to implement it (Haavik, 2000; Bertolini et al., 2015; Turhan and Vayvay, 2009; Sari, 2008). While shifting the responsibility for the decision-making process to the supplier or another deputy, adequate information sharing on the demand and consumption is required to hospitals in order to support the central decision maker in defining the inventory management policy (Govindan, 2013; Mustaffa and Potter, 2009). Differently from VMI, CPFR extends the partnerships to several supply chain parties called to jointly manage the sales forecasting process. This multiplicity in responsibilities has so far tended to subordinate it to the VMI in the healthcare sector since the central decision-making process avoids the duplication of functions and allows the increase in organizational productivity of hospital staff allowing them to focus specifically on the core management of patient care. However, VMI is not a standard model in supply chain operations and its adoption is not obvious (Niranjan et al., 2012). Implementing this technique does not guarantee that the organization will attain the recognized benefits and the main challenges in the VMI adoption tend to differ significantly depending on the application context (Waller et al., 1999; Sari, 2008; Niranjan et al., 2012).

Although the difficulty in its implementation, the successful application of VMI in hospitals are relatively numerous in the literature (Sari, 2008). Haavik (2000) considered the implementation of VMI in US hospitals suggesting that its optimal use requires improvements in data collection and joint work with suppliers to establish an electronic communication system. Mustaffa and Potter (2009), on the other hand, analysing the Malesya health SC where this technique was adopted, have stated that, due to transport restrictions, the VMI can be an appropriate solution for the pharmaceutical industry and preferable in respect to other collaborative approaches, such as JIT and stockless approach.

3 The LINFA project and related objectives

LINFA is a research project funded by the Region Tuscany and carried out jointly by companies and research organizations with a focus on the regional drug logistics at the hospital level. The idea originating the project is to provide decision support tools to facilitate the activities of operators, who deal with the replenishment orders and inventory management in hospital departments while developing methodologies, practices and cooperation tools oriented to their extension and scale up.

Exploiting the availability of historical information about drugs and patients, the development of forecasting methods, together with optimization algorithms integrated into a shared technological platform, the project aims to deliver a technological, information and organizational system for improving the procurement process of medicines and medical devices within healthcare organizations. In so doing, it will make possible to move towards the minimization of stocks and the effective and efficient management of medicines, with a consequent reduction in healthcare expenditure.

Specifically, the LINFA system aims to integrate demand forecasting models and process optimization systems with advanced logistics practices and increased traceability with the use of RFID technologies by exploiting health and administrative data flows. To this purpose, LINFA would make available and shares information about departmental stocks, hospital stocks and the actual availability of drugs at regional central warehouses. LINFA also proposes an innovative approach for managing safety stocks by enabling a unitary virtual warehouse based on the real stocks stored in the several hospital departments and permitting the transfer of drugs between them.

Summarizing, LINFA aims to provide a tool:

- To monitor the current drugs stock and the expiring date of drugs;
- To support more efficient reorders thanks to the demand forecasting and optimization algorithms;
- To share stock information among the different hospital departments to deal with emergency orders;
- To record drugs withdrawals and exchanges between different departments.

4 Method

To discover and formalize functional requirements for the LINFA system and to fully understand the hospital staff needs, we accomplished a case study within an Italian Hospital. It goes through the following four phases:

1. **Analysis of the drug management process:** This phase aimed at understanding the current procedures of drugs procurement and inventory management and identifying potential criticalities and bottlenecks within the process. The analysis was carried out within an Italian Hospital by means of field observations and interviews with hospital staff. The resulting process model was represented through the BPMN language - see Chinosi & Trombetta (2012) for methodological details about this notation - and validated with hospital staff.

2. **Primary users' and functional requirements identification:** The aim of this phase was to identify LINFA system primary users within the hospital and to collect key information from their field experience. Identifying who will be involved in the information gathering process is important due to the input these individuals can provide regarding technological needs. The collection of functional requirements was conducted through interviews and focus groups with hospital staff. In so doing, we focused on two main questions: (i) How can the LINFA system contribute to the operational goal of each user? (ii) What features are desirable for achieving such result? The main outcome of this step was a list of functional requirements written in natural language.

3. **Formalization of functional requirements for the LINFA system:** In this step, we formalized the functional requirements previously identified, by using the UML (Unified Modelling language) language (Rumbaugh et al., 2017). In so doing, it was possible to automatize the traceability of requirements in the subsequent phases of LINFA system development. Specifically, we translated functional requirements into UML use case diagrams representing the relationships between primary users and system functionalities. Each use case was accompanied by text explaining its main purpose as well as what functionality is accomplished when it is executed. The use cases can capture the intended behaviour of the system being developed without specifying how the behaviour is implemented.

4. **Creation of a simulation environment to support decision making:** One of the most important features of the LINFA system is that it will embed forecasting and optimization models. The former, based on the actual drugs consumption, will allow forecasting the drugs needed for the incoming days. The latter, instead, will support the drug replenishment process, suggesting the type and quantity of drugs that should be ordered, in order to minimize inventory cost while at the same time achieving a satisfying service level. The optimization models will support periodic and continuous (s, S) inventory review policies, both in settings where wards do not exchange drugs each other's and in settings where the lateral transshipment of drugs across wards is allowed. The development of forecasting and optimization models is a complex and time-consuming process that usually involves several trials and error iterations. Given the criticality of the setting under study - hospital wards - it is clearly not advisable to implement inventory models without an accurate ex-ante assessment of the effects of their implementation. Such an assessment is most needed especially when the optimization inventory models used are deterministic (i.e. mixed integer programming models, as it this case). Replacing stochastic parameters with deterministic ones allows simplifying the model formulation but can create problems in terms of robustness of the solutions. In fact, when the actual value of the parameters (e.g. the amount of drug being consumed) significantly differ from the expected one, the optimization model's solution turns out to be sub-optimal. To overcome these problems and create a testing environment where the inventory models could be tested prior to implementation we developed a simulation environment. The simulation environment was developed in Rockwell Arena. The optimization and forecasting models were coded in Python and embedded in Arena via VBA.

5 Results

5.1 Analysis of the drug management process

The drug management process includes the following sub-phases: inventory management, drug procurement, drug receipt and storage, and control and reporting (reported in fig 1). Each sub-phase is detailed below.

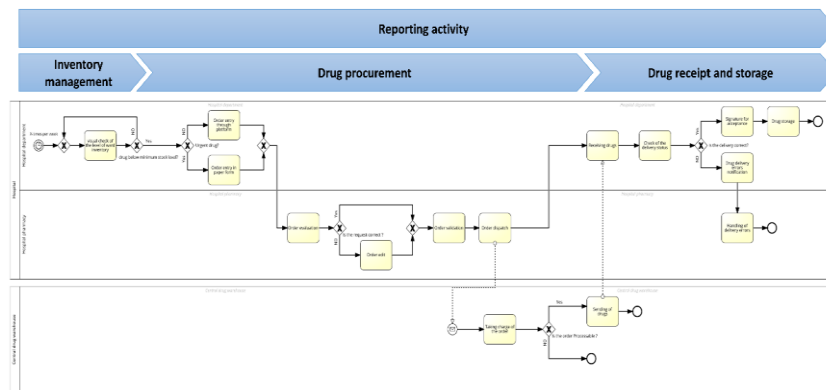


Figure 5: Drug management process: a BPMN diagram

- **Inventory Management:** At fixed intervals and independently by prescription, the head nurse or the nurses check the ward inventory level, manage drug's expiration dates, and quantify the drug needs. Such monitoring is usually carried out by a visual check. In addition, the evaluation of the number of drugs to be reordered is based on nurse personal experience and knowledge;
- **Drug procurement:** Regular requests for drugs are executed by the head nurse through a specific IS platform. On the other hand, urgent drug requests are drawn up in paper form. Each type of request is validated by the hospital pharmacy and sent to a central drug warehouse;
- **Drug receipt and storage:** Once drugs arrive in the ward, the head nurse checks the delivery status and signs for acceptance on the bill of delivery. Specifically, each incoming delivery is checked against the relevant purchase order and each container physically verified, e.g. by the label description, batch number, type of material or pharmaceutical product and quantity. The storage of drug packages on the appropriate shelves is handled by nurses and nursing assistants. The drug packs order criteria may vary from department to department. In the case of incomplete or incorrect delivery, the hospital pharmacy has to define a new replenishment request;
- **Control and Reporting:** The hospital pharmacy periodically monitors and measures the performance of hospital departments as concerning drugs management.

Interview and focus groups with process owner and participants have shown that the drug management process suffers from several criticalities. The lack of control over actual consumptions, together with the unpredictability of the demand for healthcare

services, causes high levels of ward inventory and, then, considerable holding costs, obsolescence risk, and a negative effect on the hospital service level. In addition, drug replenishment requests are usually independent from real needs and quantities are determined based on nurse personal experience. This often results in oversized and too frequent orders. Drugs are often stocked without a standard codification and may be placed in different positions, thus determining an inefficient space utilization and code retrieval. Consequently, applying a First-In-First-Out (FIFO) picking rule is also difficult. Accordingly, nurses and nursing assistants tend to be overly involved in logistics duties, reducing the time available for medical activities.

5.2 Primary users' and functional requirements identification

Primary users within the hospital who will be using the LINFA system include:

- *Hospital pharmacy*, which validates, sends to, and reminds the central warehouse the drug requests (regular requests, urgent requests, and requests for drugs not included in the hospital therapeutic handbook) elaborated by each hospital department. In addition, the pharmacy evaluates and monitors the performance of the drug procurement process of all hospital departments. It periodically analyses purchased drugs;
- *Doctor*, which takes care of the prescription of the patient therapy in the medication record. In addition, he sends to the pharmacy requests for drugs not included in the hospital therapeutic handbook;
- *Head nurse*, which is responsible for the procurement, storage, and preservation of pharmaceutical products at the departmental level;
- *Nurse*, which is deputy to check the availability of the prescribed drugs on the medication cart and notify the missing ones from the ward inventory. Nurse usually manage the drug delivery and administration to patients. Also, they periodically check the level of ward inventory and manage expiration dates of drugs. If delegated by the head nurse, they can take care of the storage and preservation of pharmaceutical products.

We defined a set of 17 functional requirements according to the primary users. For the sake of brevity, table 1 shows just an excerpt of such list.

Table 3: An excerpt of the functional requirements list

Functional requirement	Description
<i>Drug stocks visualization</i>	The system must provide real-time information about the quantity and type of drugs in stock, keeping track of the batch number and the expiration date.
<i>Drug stocks update</i>	The system must allow the updating of the drugs in stock, as a result of drug loading (storage of drugs) and unloading (administration to patients).
<i>Notification of a drug new availability</i>	The system must notify the unavailability of the requested drug and the failure to process the order, indicating a potential date for drug availability.
<i>Order status display</i>	The system must allow the tracking of the order, providing information about its status (e.g., the complete or partial execution of the order)

5.3 Formalization of functional requirements for the LINFA system

The overall use case diagram including all functional requirements identified in the previous step is shown in figure 2. Some use cases, such as *drug stocks update* and *order status display*, incorporate the behaviour of other use cases as fragments of their own behavior. Others (e.g., *order edit*) are an incremental extension to a base use case (e.g., *order validation and dispatch*).

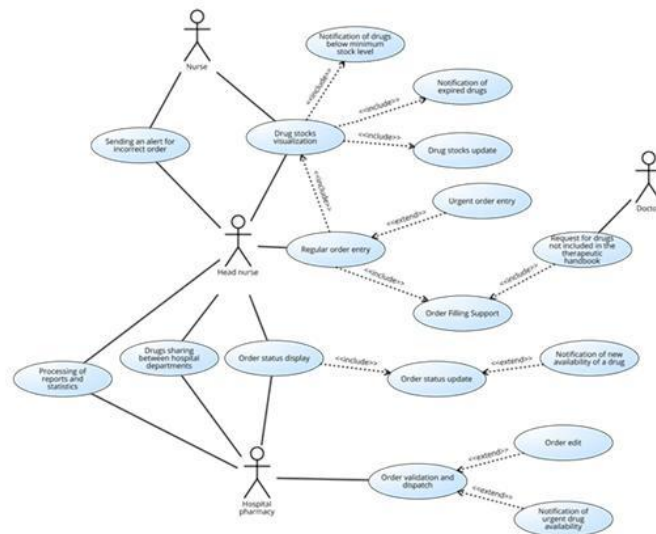


Figure 6: Overall use case diagram

Each use case was also translated into structured textual specification format to identify the temporal sequence of behaviors and the state of the system and of the actors before and after the execution of that use case. As an example, the textual specification of the use case "*Notification of urgent drug availability*" (Table 2) is given below.

Table 4: Textual specification of the use case "Notification of urgent drug availability"

Use case name	Notification of urgent drug availability
Actor	Hospital Pharmacy
Pre-conditions	The operator must be logged into the system. The system must have notified an urgent order
Basic flow of events	<ol style="list-style-type: none"> 1. The operator displays order items; 2. The operator selects the drug code and enters it in the search field; 3. The system shows the list of departments where the drug is available with the related quantity;
Extensions	<ol style="list-style-type: none"> 2.a The system is not able to find any correspondence with the parameters entered <ol style="list-style-type: none"> 2.a.1. The operator checks the text correctness in the search field. 3.a The system shows a null result for the search <ol style="list-style-type: none"> 3.a.1 The system shows the appropriate message and terminates the operation.
Post-conditions	The system shows the list of hospital departments with drug availability

5.4 Creation of a simulation environment to support decision making

The simulation model reproduces the operations of one of more hospital wards and it is subdivided into three sub-models.

The first one replicates the patients' arrival process. For each simulated day, it creates a certain number of patients and assigns to each patient several attributes, including their therapy. The therapy defines the patient's length of stay and the type and quantity of drugs she needs for each day of her stay. Upon arrival, patients are accommodated in a ward and seize a bed, which is released at the end of the patient's stay.

The second sub-model replicates the administration process. In this sub-model, a nurse entity carries out a "patient tour" and administers each patient the drugs she needs. Upon administration, the stock level of the administered drug automatically decreases. If a drug is not available, the nurse issues a rush order, which will be fulfilled with a short lead time. If later transshipment is allowed, before issuing a rush order, the nurse will try to borrow the drug from another ward, and in case of success she will issue a regular order and give back the borrowed drug as soon as it becomes available. In case of continuous (s, S) inventory review policies, following the tour, the nurse issues (regular) orders to restore a stock level of S for each drug whose stock level went below s. The levels (s, S) are determined at the beginning of the simulation run by means of an optimization model and can be updated during the run based on the actual drugs consumption.

The third sub-model allows simulating the implementation of periodic review policies. In this sub-model, an auxiliary entity, every d days, instantiates an optimization model that, based on the current stock levels and on a forecast of the drugs that will be needed in the short term, determines for each drug the number of boxes to order and the day when the order should be placed. The simulator allows to keep track of the number of stockouts, the number of orders issued, the stock level, the number of transshipment and so on. Hence, it will be used to select the more promising optimization models and to refine them prior to implementation.

6 Conclusions

This work reports some preliminary outcomes from the LINFA project. Specifically, we discovered and formalized a set of functional requirements for the LINFA system that fully meet the needs of the hospital staff. In so doing, we conducted field observations and interviews with the hospital staff of an Italian hospital to collect key information from their field experience. In addition, given the criticality of the setting under study - hospital wards – we developed a simulation environment to allow an ex-ante assessment of the effects of the implementation of optimization and forecasting models supporting the drug replenishment process. Final expected benefits from the LINFA system include:

- Reduction of errors and times for drugs reorders;
- Reduction of delivery time;
- Reduction of expiring drugs in hospital departments;

- Improvement of the overall procurement and cost awareness at every level of the supply chain;
- Support to monitoring and quick identification of anomalous situations;
- Optimization of transit points from the central warehouse to the hospital departments;
- Reduction of drugs stock costs and needed space in hospital departments.

Future project steps will concern the design and test of demand forecasting models and optimization algorithms, the conceptual architecture design, the design of the interfaces, the development of a test version, and the field testing.

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References

- Aptel, O., & Pourjalali, H. (2001). "Improving activities and decreasing costs of logistics in hospitals: a comparison of US and French hospitals". *The international journal of accounting*, 36(1), 65-90.
- Bertolini, M., Bevilacqua, M., Ciarapica, F. E., & Postacchini, L. (2015). "Business process reengineering of drugs storage and distribution: A case study". *International Journal of Procurement Management*, 8(1/2), 44-65.
- Bourlakis et al. 2011 Bourlakis, M., F. Clear, and L. Patten. 2011. "Understanding the UK Hospital Supply Chain in an Era of Patient Choice." *Journal of Marketing Management* 27 (3-4): 401-423. doi:10.1080/0267257X.2011.547084.
- Bruno, G., Diglio, A., Piccolo, C., & Cannavacciuolo, L. (2018). "Territorial reorganization of regional blood management systems: Evidences from an Italian case study". *Omega*.
- Chinosi, M., & Trombetta, A. (2012). "BPMN: An introduction to the standard". *Computer Standards & Interfaces*, 34(1), 124-134.
- Govindan, K. (2013). "Vendor-managed inventory: a review based on dimensions". *International Journal of Production Research*, 51(13), 3808-3835.
- Haavik, S. (2000). "Building a demand-driven, vendor-managed supply chain". *Healthcare Financial Management*, 54(2), 56-56.
- Heinbuch, S. E. (1995). "A case of successful technology transfer to health care: total quality materials management and just-in-time". *Journal of Management in Medicine*, 9(2), 48-56.
- Kim, G. C., & Schniederjans, M. J. (1993). Empirical comparison of just-in-time and stockless materiel management systems in the health care industry. *Hospital materiel management quarterly*, 14(4), 65-74.
- Krichanchai, S., & MacCarthy, B. L. (2017). "The adoption of vendor managed inventory for hospital pharmaceutical supply". *The International Journal of Logistics Management*, 28(3), 755-780.
- Kritchanchai, D. & Hoeur, S. & Engelseth, P. (2017). "Develop a strategy for improving healthcare logistics performance". *Supply Chain Forum: An International Journal*. 19. 1-15.
- Lai, K. H., & Cheng, T. E. (2016). *Just-in-time logistics*. Routledge.

- Lapierre, S. D., & Ruiz, A. B. (2007). "Scheduling logistic activities to improve hospital supply systems". *Computers & Operations Research*, 34(3), 624-641.
- Law, K. M. (2016). "How schedule issues affect drug logistics operations: An empirical study in hospitals in China". *Industrial Management & Data Systems*, 116(3), 369-387.
- Mazzocato et al., 2010 Mazzocato, P., C. Savage, M. Brommels, H. Aronsson, and J. Thor. 2010. "Lean Thinking in Healthcare: A Realist Review of the Literature." *Quality and Safety in Health Care* 19 (5): 376–382.
- Miroslava A. Rakovska & Stilyana V. Stratieva (2018) "A taxonomy of healthcare supply chain management practices", *Supply Chain Forum: An International Journal*, 19:1, 4-24
- Narayana, S. A., R. K. Pati, and P. Vrat. 2014. "Managerial Research on the Pharmaceutical Supply chain—A Critical Review and Some Insights for Future Directions." *Journal of Purchasing and Supply Management* 20 (1): 18–40. doi:10.1016/j.pursup.2013.09.001.
- Niranjan, T. T., Wagner, S. M., & Nguyen, S. M. (2012). "Prerequisites to vendor-managed inventory". *International Journal of Production Research*, 50(4), 939-951.
- Pasquet, A., Messou, E., Gabillard, D., Minga, A., Depoulosky, A., Deuffic-Burban, S., ... & Yazdanpanah, Y. (2010). Impact of drug stock-outs on death and retention to care among HIV-infected patients on combination antiretroviral therapy in Abidjan, Côte d'Ivoire. *PloS one*, 5(10), e13414.
- Rivard-Royer, H., Landry, S., & Beaulieu, M. (2002). "Hybrid stockless: A case study: Lessons for health-care supply chain integration". *International Journal of Operations & Production Management*, 22(4), 412-424.
- Rumbaugh, J., Booch, G., & Jacobson, I. (2017). *The unified modeling language reference manual*. Addison Wesley.
- Sari, K. (2008). "On the benefits of CPFR and VMI: A comparative simulation study". *International journal of production economics*, 113(2), 575-586.
- Turhan, S. N., & Vayvay, Ö. (2009). "Modeling of VMI implementation via SOA in a HEALTHCARE SUPPLY CHAIN". In *European and Mediterranean Conference on Information Systems* (pp. 1-14).
- Volland, J., A. Fügener, J. Schoenfelder, and J. O. Brunner. 2017. "Material Logistics in Hospitals: A Literature Review." *Omega* 69: 82–101.
- Waller, M., Johnson, M. E., & Davis, T. (1999). "Vendor-managed inventory in the retail supply chain". *Journal of business logistics*, 20, 183-204.
- Wieser, P. 2011. "From Health Logistics to Health Supply Chain Management." *Supply Chain Forum: An International Journal* 12 (1): 4–13.

Investigating the Impact of the Reconfiguration of the Hospital Network on Users' Accessibility to the primary Care: an Empirical Analysis and Alternative Reorganization Approaches

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Abstract

In Italy, the healthcare sector is the one that absorbs the largest economic resources, immediately after Social Security, and, hence, it has been coping with an enduring reforming process. The latest health reform, namely DM 70/2015, suggested the adoption of the Hub & Spoke model for the redesign of regional hospital networks. The aim of this intervention was to have a capillary presence of less specialized disciplines, concentrated at the Spokes, in order to improve users' accessibility conditions. In this paper, we deal with a particular case study concerning the STEMI (ST-Elevation Myocardial Infarction) network of the province of Naples, in Southern Italy. In particular, we perform a spatial analysis in order to assess the impact on users' accessibility determined by the occurred reconfiguration. Moreover, we also propose a mathematical programming model aiming at producing alternative reorganization scenarios to improve spatial accessibility. Our results confirm that users effectively benefit from the reorganization process but also that further, and significant improvements, are possible. In particular, our computational experiments reveal that a strategic intervention oriented at redistributing capacities, i.e. the supply of hospital beds, among the existing facilities could lead to averagely better and even more equitable accessibility conditions.

Keywords – Service accessibility, Capacity management, Territorial reorganization, Health care sector, Equity.

Paper type – Academic Research Paper

1 Introduction

Health care access is concerned with the timely and safe entry process of persons to the health-care delivery system and with the factors influencing it. Penchansky and Thomas (1981) defined health care access as a multi-faceted concept expressing the "degree of fit" between the clients and the health care system according to five dimensions: availability, accessibility, accommodation, affordability and acceptability. In particular, accessibility refers to the relationship between the location of health suppliers and the location of clients, involving both spatial (e.g. travel times, distances) and non-spatial factors (e.g. demographic and socioeconomic variables). In this paper, we are interested in spatial accessibility, which, according to Wang (2012), can be defined as the relative easiness of a client to reach health care facilities from a given location.

Research on this topic has been flourishing along the years. In the extant literature, a significant number of scientific papers have been devoted to propose methodological approaches to measure spatial accessibility to health services with applications to real case studies. Yin et al. (2018) employed a geographically weighted regression model involving social, economic and natural factors, to assess inequalities in the spatial accessibility to health care facilities in China. Shin and Lee (2018) analysed the spatial accessibility to the case of the Korean emergency system proposing an improvement of the floating catchment area method by including patients' inherent resistance to travel. Mayaud et al. (2019) deployed a hybrid competition-based approach to assess future pressures in accessibility to essential services in the case of Surrey, a growing city in Canada. Higgs et al. (2019), instead, used a GIS-based approach to integrate temporal availability of services in assessing spatial accessibility to primary health care in Wales. For an extensive review on the topic, interested readers may refer to Neutens (2015).

As Wang (2012) highlights, measurement is not the only issue at hand when dealing with spatial accessibility. In fact, as the same author argue, decision-makers can benefit of optimization models for the strategic siting of health care facilities. Spatial accessibility is typically embedded in optimization models by means of median or covering objectives. The former seeks to minimize the average users-to-facility distances. The latter aims at maximizing the total demand captured within predefined distances from the located facilities. Examples can be found in the studies by Burkey et al. (2012) and Smith et al. (2013). Alternatively, when the focus is on the total management costs, accessibility conditions can be translated in to specific constraints to be satisfied. This is, for instance, the case of the reorganization of existing networks, as in the works by Guerriero et al. (2016) and Bruno et al. (2018).

In this paper, we perform an analysis of the effects produced on users' spatial accessibility due the reorganization of an existing hospital network in the province of Naples, in Southern Italy. Moreover, we also propose a mathematical model aiming at optimally redistributing the capacities, i.e. the supply of hospital beds, among the hospitals of the network to show which interventions could be planned to further improve users' accessibility conditions.

Notably, Ahmadi-Javid et al. (2017) argue that only few papers considered these type of decisions. These studies, however, either show numerical examples to validate their model (Chu and Chu, 2000) or solve the problem at the level of municipalities (Oliveira and Bevan, 2006; Mestre et al. 2012) thus making use of aggregated data. Hence, there is no evidence of studies focused on municipalities' census tracts, where the effects in terms of accessibility can be better highlighted and even measured, and that are at the core of the developments we present in this work.

The remainder of the paper is organized as follows. In Section 2 we describe our problem. In Section 3, we present our case study and the results of the performed spatial analysis. In Section 4 we present the mathematical model we propose for the reorganization of the network while, in Section 5, we discuss the main findings of the realized computational experiments. Conclusions and directions for further research follow in Section 6.

2 Description of the problem

In Italy, the healthcare sector is the one that absorbs the largest economic resources, immediately after Social Security (OECD, 2017). Hence, in recent years, it has been coping with an enduring reforming process. Interventions adopted by the Central Government, mainly oriented to reshape or introduce new ceilings to the overall spending in health services, positively affected the regional deficits, being reduced by 80% in the time span 2007--2016 (Italian Ministry of Economy and Finance, 2018). As a consequence, the latest health reform, namely DM 70/2015 (Italian Ministry of Health, 2015), marked a significant shift towards a rationalization paradigm. In particular, it required Regions to gradually reduce two main parameters: the hospitalization rates and the hospital beds-to-population ratio. Moreover, it suggested the adoption of the Hub & Spoke model for the redesign of the time-dependent (emergency) hospital networks. This model shapes the network according to a two level hierarchical structure: the Hub concentrates all the major technologies and specialized teams to deal with high and medium complexity cases referring to all medical specialties; the Spoke, instead, offers medium and low complexity treatments for the main medical and surgical disciplines.

In this paper, we analyse a specific problem concerning the case of the STEMI (ST-Elevation Myocardial Infarction) network in the province of Naples, in Southern Italy, where a significant reconfiguration process began due to the introduction of the regional decree DCA n.33/2016 (Official Bulletin of the Campania Region, 2016). that implemented DM 70/2015. According to the above regulations, hospitals belonging to the STEMI network are differentiated on the basis of the offered disciplines: i) *Spokes*, offering only Coronary Intensive Care Unit (CICU); ii) *First-level Hubs* (HUB-I), offering CICU and Hemodynamic; iii) *Second-Level Hubs* (HUB-II), which, in addition to the previous mentioned services, include cardiac surgery specialization (CS).

The adoption of the Hub & Spoke model is supposed to contribute in twofold manner: on the one hand, this model envisages the centralization of the most complex health services into fewer facilities, thus fostering the achievement of economies of scale and a

greater appropriateness of care; on the other, it allows a more capillary diffusion of lower complexity services to improve users' accessibility conditions.

In this paper we try to investigate whether this latter objective was accomplished. Therefore, our scope is to perform an accessibility analysis of users to the Spokes of the network that is, in practice, evaluating the spatial accessibility to the lowest level discipline of the network (CICU). To this end, some notation is required. With reference to a given study area, we consider a set I of nodes where potential users are located and a set J of hospitals. Each hospital j has a limited number of available beds, which we denote by Q_j . We also indicate by a_i the demand at node i and by c_{ij} the distances between pairs of nodes i and j . Finally, in order to describe the allocation mechanism of users to hospitals we introduce the binary coefficient α_{ij} , equal to 1 if demand coming from node i is served by facility j (0 otherwise). In particular, considering that we are dealing with an emergency service and relying upon the existing literature (Neutens, 2015), it is reasonable to assume that demand coming from node i , namely a_i , is served by the closest facility. Mathematically, we have:

$$\alpha_{ij} = \begin{cases} 1 & \text{if } c_{ij} = \min_{k \in J} \{c_{ik}\} \\ 0 & \text{otherwise} \end{cases}$$

The application to the selected case study is discussed in the next section.

3 Case study

In this section, we report on the spatial analysis performed on the selected case study. First, we describe the data test used. Afterwards, we discuss the main results obtained.

3.1 Test data

In Italy, at the regional level, the organization of the STEMI network is delegated to local bodies, named Aziende Sanitarie Locali (ASL), whose competence areas coincide with the single provinces. Hence, we select the province of Naples, the chief-town of the Region, as an appropriate case study to our problem. To this end, we discretized the location space, comprising 92 municipalities, into 10,711 territorial units, corresponding to the provincial census tracts (ISTAT, 2011) and we assumed that all users located in a census tract are concentrated in its centroid (Figure 1).

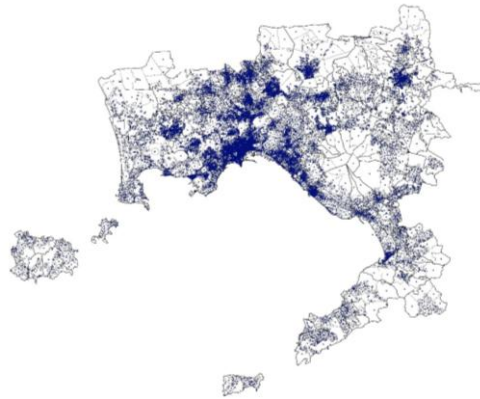


Figure 1 – Province of Naples: Census tracts' centroids

Since our goal is to assess the impact on users' accessibility conditions determined by the occurred changes in the network, hereinafter we present a comparison between the configurations of the STEMI network before and after the introduction of DCA n. 33/2016, which we denote, respectively, by Scenario 1 and Scenario 2. The characteristics of the two scenarios are summarized in Table 1. For each facility, labelled with a unique ID code, we report the number of beds per discipline. Since Hemodynamic (H) does not require any bed, we just highlight its presence (✓) at the considered hospitals. In order to enhance an easier comparison with the current configuration, the last column reports the "Type" of each hospital (S, HUB-I, HUB-II) according to the guidelines set by DCA n. 33/2016. As it is shown in the Table the reorganization process involved an increase in the number of hospital beds for both CICU (from 117 to 146) and CS (from 56 to 79) and in the number of hospitals offering Hemodynamic (from 7 to 10), as well as an increase in the total number of activated hospitals (from 16 to 19). In both the scenarios, demands a_i are assumed to be proportional to the population p_i living in each census tract by means of a standard demand rate δ , whose value is indicated in DCA n. 33/2016. The latter is expressed in terms of the need of hospital beds per 1,000 inhabitants. In particular, $\delta = 0.0392$.

Finally, distances c_{ij} between the centroids and the hospitals are determined as the shortest paths on the road network.

Table 1 – Characteristics of Scenarios 1 and 2

ID	Name	Scenario 1				Scenario 2			
		CICU [no. of beds]	H [presen ce]	CS [no. of beds]	Ty pe	CICU [no. of beds]	H [presen ce]	CS [no. of beds]	Ty pe
1	AO 'A. CARDARELLI'	8	✓	-	HU B-I	8	✓	-	HU B-I
2	AO DEI COLLI (OSP. MONALDI)	16	✓	33	HU B-II	24	✓	42	HU B-II
3	AOU 'FEDERICO II' DI NAPOLI	8	✓	8	HU B-II	8	✓	14	HU B-II
4	CDC CLINICA MEDITERRANEA SPA	15	✓	15	HU B-II	10	✓	-	HU B-I

5	CDC OSPEDALE FATEBENEFRATELLI	4	-	-	S	6	-	-	S
6	PO SAN GIOVANNI BOSCO	6	✓	-	HU B-I	6	✓	-	HU B-I
7	PO DEI PELLEGRINI	6	-	-	S	6	-	-	S
8	PO S. MARIA DI LORETO NUOVO	8	✓	-	HU B-I	-	-	-	-
9	CDC VILLA DEI FIORI SRL	6	✓	-	HU B-I	6	✓	-	HU B-I
10	OSPEDALE RIZZOLI	4	-	-	S	4	-	-	S
11	OSPEDALE S.M. DELLE GRAZIE	8	-	-	S	8	✓	-	HU B-I
12	OSPEDALE SAN GIULIANO	4	-	-	S	6	-	-	S
13	PO MARESCA	6	-	-	S	-	-	-	-
14	PO S. MARIA DELLA PIETA'	6	-	-	S	6	✓	-	HU B-I
15	PO S. MARIA LA MISERICORDIA	6	-	-	S	6	-	-	S
16	PO SAN LEONARDO	6	-	-	S	8	✓	-	HU B-I
17	FONDAZIONE EVANGELICA BETANIA	-	-	-	-	6	-	-	S
18	OSPEDALE DEL MARE	-	-	-	-	10	✓1	23	HU B-II
19	PO SAN PAOLO	-	-	-	-	6	-	-	S
20	OSPEDALE CIVILE S. GIOVANNI DI DIO	-	-	-	-	6	-	-	S
21	PO S. ANNA	-	-	-	-	6	-	-	S
TOTAL		117	7	56	16	146	10	79	19

3.2 Analysis of the results

In order to assess the impact of the described reconfiguration on users' accessibility, we calculate the cumulative distributions of users' distances from their closest hospital in the two scenarios. In practice, we define an accessibility function $\gamma = f(c) \rightarrow [0,1]$, representing the percentage of users γ having a distance from their closest facility not exceeding c . Conversely, $c = f^{-1}(\gamma)$ represents the accessibility condition of a given percentage γ of users, i.e. the distance c at which these users have at least one facility. Figure 2 depicts the distributions obtained in the considered scenarios. By setting, for instance, $\gamma = 0.80$ we observe that, in Scenario 1, 80% of users have the closest hospital within 5.66 km, while in Scenario 2 this value is reduced to 4.54 km. In general, we observe that the distribution yielded by Scenario 2 "dominates" the one yielded by Scenario 1. This, in fact, reveals an average improvement in accessibility (see also Table 2). However, despite the increased number of hospitals in the network, the maximum accessibility distance, i.e. $c(\gamma = 1)$, remains equal to 17.67 km. Therefore, we can deduce that the transition towards Scenario 2 did not really affect the accessibility conditions of the least well served users, i.e. those already having the worse accessibility conditions in Scenario 1.

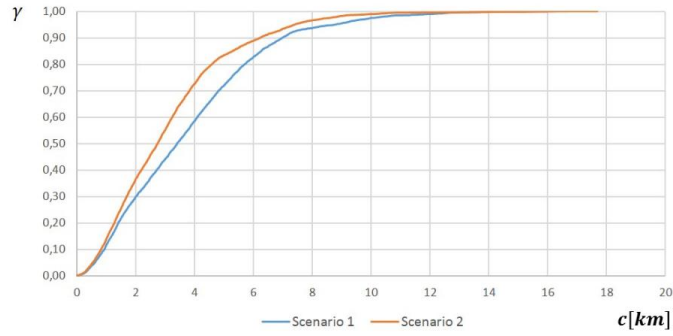


Figure 2 – Comparison of accessibility function between the two scenarios.

Table 2 – Accessibility distances by the percentile of users

γ		0,00	0,10	0,20	0,30	0,40	0,50	0,60	0,70	0,80	0,90	1,00
c [km]	Scenario 1	0,02	0,91	1,40	1,99	2,69	3,39	4,07	4,79	5,66	6,90	17,67
	Scenario 2	0,02	0,80	1,26	1,68	2,17	2,72	3,23	3,80	4,54	6,14	17,67

Moreover, it is worth noting that the above improvement is just potential rather than actual. In fact, our allocation mechanism does not consider the capacity of the hospitals. In Table 3, we calculate the differences between the estimated demand A_j ($\sum_{i \in I} \alpha_{ij} a_i$, $j \in J$) and the capacity Q_j per hospital in the considered scenarios, where A_j expresses the total number of beds needed by hospital j to satisfy its nearest users. Hence, if positive, the above difference indicates the number of hospital beds (Δ_j) to be activated at each hospital in order to guarantee all the users the best accessibility conditions. The penultimate row of the Table reports on the total estimated demand, the total number of available beds, i.e. the actual capacity of the network, and the difference between these two indicators. If positive, the latter indicates the number of hospital beds (Δ_{tot}) needed to serve the overall demand. These values are reported at the bottom of the Table.

Table 3 – Supply (capacity) vs. demand of hospital beds in the analysed scenarios

ID	Scenario 1				Scenario 2			
	A_j	Q_j	$A_j - Q_j$	Δ_j	A_j	Q_j	$A_j - Q_j$	Δ_j
1	4	8	-4	0	4	8	-4	0
2	5	16	-11	0	3	24	-21	0
3	1	8	-7	0	1	8	-7	0
4	4	15	-11	0	2	10	-8	0
5	3	4	-1	0	1	6	-5	0
6	15	6	9	9	11	6	5	5
7	7	6	1	1	8	6	2	2
8	6	8	-2	0	-	-	-	-

9	14	6	8	8	9	6	3	3
10	3	4	-1	0	3	4	-1	0
11	7	8	-1	0	7	8	-1	0
12	16	4	12	12	12	6	6	6
13	15	6	9	9	-	-	-	-
14	8	6	2	2	7	6	1	1
15	3	6	-3	0	3	6	-3	0
16	10	6	4	4	7	8	-1	0
17	-	-	-	-	5	6	-1	0
18	-	-	-	-	13	10	3	3
19	-	-	-	-	5	6	-1	0
20	-	-	-	-	11	6	5	5
21	-	-	-	-	9	6	3	3
TOTAL	121	117	4	45	121	146	-25	28
Δ_{tot}	-	-	4	-	-	-	0	-

Our findings show that, in Scenario 2 the activation of new hospitals and the increase in the total available capacity rendered the network able to satisfy all the potential users. In fact, differently from Scenario 1, it now results $\Delta_{tot} = 0$. However, 9 out of 19 hospitals (hospitals 6, 7, 9, 11, 12, 14, 18, 20, 21) would require the activation of new hospital beds to serve their closest users. Although this value turns out to be globally reduced from 45 to 28, thus denoting a positive impact of the undertaken reorganization actions, it should be noted that the oversupply of hospital beds exhibited by the remaining facilities could have called for an adequate capacity redistribution. In this regard, it is particularly explanatory the case of hospital 2, where both the increase of the capacity and the redistribution of the demand determined an excessive oversupply of hospital beds (from 11 to 21) that might be adequately spread among the other hospitals according to the estimated demands. Similar considerations can be drawn for Scenario 1.

In conclusion, our analysis reveals that obtaining better accessibility conditions underpins the adoption of strategic decisions aiming at reconfiguring the existing capacities of the network. To this end, we propose solving a mathematical programming model that we present in the next section.

4 A mathematical model for the reorganization of the hospital network

To formulate the model, in addition to the already introduced parameters, the following notation is required:

- Q_{min} minimum capacity, in terms of hospital beds, to be offered at any hospital;
- Q_{max} maximum capacity, in terms of hospital beds, to be offered at any hospital;

Q_{tot}	current total capacity of the network;
f_{ij}	ost for allocating a unit of demand in i to hospital j ;
g_j	cost for reconfiguring, i.e. expanding or shrinking, a unit of capacity at hospital j .

The decision variables are as follows:

x_{ij}	binary variable equal to 1 if demand in i is allocated to hospital j , 0 otherwise;
z_j^+	binary variable equal to 1 capacity at hospital j is expanded, 0 otherwise;
z_j^-	binary variable equal to 1 capacity at hospital j is shrunk, 0 otherwise;
Δ_j^+	non-negative integer variable indicating the increase in the capacity at hospital j ;
Δ_j^-	non-negative integer variable indicating the shrinkage of the capacity at hospital j .

The model is then formulated as follows:

$$\begin{aligned}
\text{minimize} \quad & \sum_{i \in I} \sum_{j \in J} f_{ij} a_i c_{ij} x_{ij} + g_j (\Delta_j^+ + \Delta_j^-) & (1) \\
\text{subject to} \quad & \sum_{j \in J} x_{ij} = 1 & \forall i \in I & (2) \\
& z_j^+ + z_j^- \leq 1 & \forall j \in J & (3) \\
& \sum_{i \in I} a_i x_{ij} \leq Q_j + \Delta_j^+ - \Delta_j^- & \forall j \in J & (4) \\
& Q_j + \Delta_j^+ - \Delta_j^- \geq Q_{min} & \forall j \in J & (5) \\
& Q_j + \Delta_j^+ - \Delta_j^- \leq Q_{max} & \forall j \in J & (6) \\
& \Delta_j^+ \geq z_j^+ & \forall j \in J & (7) \\
& \Delta_j^+ \leq (Q_{max} - Q_j) z_j^+ & \forall j \in J & (8) \\
& \Delta_j^- \geq z_j^- & \forall j \in J & (9) \\
& \Delta_j^- \leq (Q_j - Q_{min}) z_j^- & \forall j \in J & (10) \\
& \sum_{j \in J} Q_j + \Delta_j^+ - \Delta_j^- = Q_{tot} & & (11) \\
& x_{ij}, z_j^+, z_j^- \in \{0,1\} & \forall i \in I, j \in J & (12) \\
& \Delta_j^+, \Delta_j^- \in \mathbb{N} & \forall j \in J & (13)
\end{aligned}$$

The objective function (1) minimizes the sum of the allocation costs, weighted by the demands a_i and of the costs occurring for the reorganization of hospital beds. Constraints (2) guarantee every demand to be served by exactly one hospital. Constraints (3) assure that capacity at each hospital j can be either expanded or shrunk. Constraints (4) ensure that the total demand served by each hospital j does not have to exceed the available capacity of the hospital itself, given by initial capacity therein installed, net of the occurred expansion or shrinkage. Constraints (5)-(6) set, respectively, a lower and an upper bound to the available capacity at each hospital. Constraints (7)-(8) impose that, if an expansion decision is taken at hospital j , the number of hospital beds to be added can be, at most, equal to $Q_{max} - Q_j$, i.e. the residual capacity to reach the upper bound Q_{max} . Similar considerations apply to shrinking decisions, as it is ensured by Constraints (9)-(10). Constraint (11) guarantees the invariance of the total available capacity of the

network. Finally, Constraints (12) – (13) define the domain of the introduced decision variables.

5 Experimental results

Model (1)-(13) is, in fact, a bi-objective model as it requires the combined minimization of two inherent but, at the same time, conflicting goals: allocation costs and capacity reconfiguration costs. Therefore, the adequate setting of parameters f_{ij} and g_j is a critical issue as it implies a priority system between the considered objectives.

We first solve the model by imposing $f_{ij} = 1, g_j = 0, \forall i \in I, j \in J$. With this setting, we are implicitly assuming the attitude of a decision maker interested in optimizing only one objective, i.e. the allocation costs and, hence, the average users' accessibility. Accordingly, our model returns in output the maximum number of hospital beds Δ^* to be reconfigured in order to optimize the latter objective. In our case, we obtain $\Delta^* = 52$.

Of course, a decision maker who is careful about the occurring reconfiguration costs might be interested in alternative reorganization scenarios representing trade-off solutions between the two objectives. Hence, our goal is to produce a range of feasible reorganization scenarios that may allow the decision maker to evaluate the obtainable improvement in accessibility conditions against a fixed proxy cost for capacities redistribution. To this end, we add the following Constraint:

$$\sum_{j \in J} \Delta_j^+ + \Delta_j^- \leq \Delta \quad (14)$$

and solve model (1)-(14) for different values of Δ , with $\Delta < \Delta^*$. In particular we progressively reduce Δ from 52 to zero with a pace equal to two. Clearly, we keep considering the already introduced setting for cost parameters. As an example, we report in Table 4 information on the distributions of the accessibility distances yielded by a sample of values of Δ .

Table 4 – Accessibility distances by the percentile of users for different values of Δ

γ	0,00	0,10	0,20	0,30	0,40	0,50	0,60	0,70	0,80	0,90	1,00	\bar{c} [km]
$\Delta = 52$	0,98	2,20	2,59	3,33	4,08	4,87	5,44	6,67	7,68	9,46	16,01	6,23
$\Delta = 40$	0,98	2,20	2,59	3,33	4,28	4,87	5,99	6,73	8,17	9,46	16,01	6,34
$\Delta = 30$	0,98	2,23	2,59	3,33	4,34	5,06	6,07	6,79	8,45	10,55	16,01	6,64
$\Delta = 20$	0,98	2,23	2,59	3,33	4,34	5,13	6,48	7,43	8,74	11,11	21,82	6,95
$\Delta = 10$	0,98	2,20	2,59	3,33	4,87	5,80	6,79	8,43	9,46	12,06	24,52	7,50
$\Delta = 0$	0,98	2,20	3,03	4,06	5,13	6,31	6,82	8,45	9,45	12,65	23,14	7,65

Solution obtained with $\Delta = 0$ represents the status quo. Hence, one can notice how the current accessibility conditions could be improved by means of capacities redistribution. The average accessibility distance (\bar{c}) results to be reduced by almost 1.40

km for $\Delta = \Delta^* = 52$. However, significant reduction in the average accessibility distance could be obtained also for lower values of Δ . For instance, we can find an improvement of about one km, i.e. 13.07 % less than the status quo, by setting $\Delta = 30$. Interestingly, relevant results are obtained in the improvement of the accessibility conditions of the least well served users. Indeed, the maximum accessibility distance, i.e. $c(\gamma = 1,00)$ presents a strong decreasing trend with the increase of Δ , being potentially reducible by 30.81% (from 23.14 km to 16.01 km). Similar trends are found for other values of γ , although they tend to be less intense as γ decreases. This result is consistent with the fact that the performed reconfiguration of the network did not really affect the accessibility conditions of the least well served users, as we showed in Section 3. In Figure 3 we summarize the overall computational experience by showing, for each value of Δ , the quartiles of the distributions of the accessibility distances. In the context of the analysed case study, our consolidated recommendation to the decision maker would be to adopt the solution obtained by setting $\Delta = 30$. Indeed, looking for a trade-off solution between the considered objectives and beyond the average improvement already discussed, this solution corresponds to the lowest value of Δ which minimizes the maximum accessibility distance.

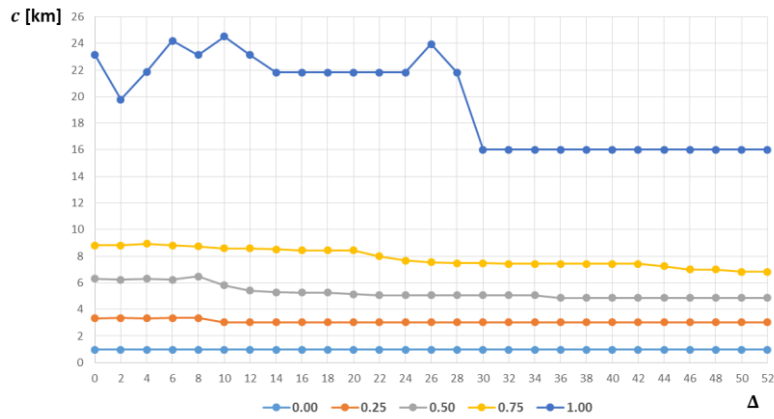


Figure 4 – Quartiles of the distributions of the accessibility distances by Δ

6 Conclusions

In this paper we analysed the case study of the STEMI network of the province of Naples, in Southern Italy, where a significant reorganization process occurred after the introduction of DM 70/2015. The main aim of this reform, which led to an increase of the number of hospitals in the network as well as of the total supply of hospital beds, was to improve users' accessibility conditions. Hence, we performed a spatial analysis to investigate whether this objective was accomplished. Our results show that, although the average accessibility conditions were actually improved, these effects were rather limited for the least well served users, i.e. those that were already far from the closest hospital

before the occurred changes. Moreover, we also find out that further improvements could have been obtained by adequately redistributing capacities among the hospitals of the network. Therefore, we proposed solving a mathematical programming model aiming at finding a trade-off solution between two opposing needs: improving accessibility and containing reconfiguration costs. Based on the realized computational experiments, we can conclude that, with equal resources (i.e. with the same number of facilities and with the same number of newly activated hospital beds), it would be possible to modify the current configuration of the network obtaining a considerable improvement of the users' accessibility conditions.

Further developments of the work suggest the adoption of different spatial interaction models to reproduce users' behaviour and to assess spatial accessibility. Furthermore, the hierarchical structure of the considered network may also call for a more comprehensive analysis extended to all its disciplines. Finally, comparative studies with other provinces could also represent promising research directions.

References

- Bruno, G., Diglio, A., Piccolo, C., & Cannavacciuolo, L. (2018). Territorial reorganization of regional blood management systems: Evidences from an Italian case study. *Omega*. [Forthcoming]
- Burkey, M. L., Bhadury, J., & Eiselt, H. A. (2012). A location-based comparison of health care services in four US states with efficiency and equity. *Socio-Economic Planning Sciences*, 46(2), 157-163.
- Chu, S. C., & Chu, L. (2000). A modeling framework for hospital location and service allocation. *International transactions in operational research*, 7(6), 539-568.
- Guerriero, F., Miglionico, G., & Olivito, F. (2016). Location and reorganization problems: The Calabrian health care system case. *European Journal of Operational Research*, 250(3), 939-954.
- Higgs, G., Langford, M., Jarvis, P., Page, N., Richards, J., & Fry, R. (2019). Using Geographic Information Systems to investigate variations in accessibility to 'extended hours' primary healthcare provision. *Health & social care in the community*.
- Italian Ministry of Economy and Finance (2018). Il monitoraggio della spesa sanitaria. URL: <http://www.rgs.mef.gov.it> [accessed on December 12, 2018].
- Italian Ministry of Health (2015). Ministerial Decree 2 April 2015: Regulation defining the qualitative, structural, technological and quantitative standards related to hospital assistance. Official Journal of the Italian Government.
- Italian Ministry of Health (2018). List of local health authorities and hospitalization facilities. URL: www.salute.gov.it [Accessed on December 12, 2018]
- Mayaud, J. R., Tran, M., Pereira, R. H., & Nuttall, R. (2019). Future access to essential services in a growing smart city: The case of Surrey, British Columbia. *Computers, Environment and Urban Systems*, 73, 1-15.
- Mestre, A. M., Oliveira, M. D., & Barbosa-Póvoa, A. (2012). Organizing hospitals into networks: a hierarchical and multiservice model to define location, supply and referrals in planned hospital systems. *OR spectrum*, 34(2), 319-348.
- Neutens, T. (2015). Accessibility, equity and health care: review and research directions for transport geographers. *Journal of Transport Geography*, 43, 14-27.

- OECD (2017). Health at a Glance 2017. URL: <http://stats.oecd.org> [Accessed on December 12, 2018]
- Official Bulletin of the Campania Region (2016). Piano regionale di programmazione della rete ospedaliera ai sensi del DM 70/2015. URL: <http://www.burc.regione.campania.it> [accessed on December 12, 2018]
- Oliveira, M. D., & Bevan, G. (2006). Modelling the redistribution of hospital supply to achieve equity taking account of patient's behaviour. *Health care management science*, 9(1), 19-30.
- Penchansky, R., & Thomas, J. W. (1981). The concept of access: definition and relationship to consumer satisfaction. *Medical care*, 127-140.
- Shin, K., & Lee, T. (2018). Improving the measurement of the Korean emergency medical System's spatial accessibility. *Applied geography*, 100, 30-38.
- Smith, H. K., Harper, P. R., & Potts, C. N. (2013). Bicriteria efficiency/equity hierarchical location models for public service application. *Journal of the Operational Research Society*, 64(4), 500-512.
- Yin, C., He, Q., Liu, Y., Chen, W., & Gao, Y. (2018). Inequality of public health and its role in spatial accessibility to medical facilities in China. *Applied geography*, 92, 50-62.
- Wang, F. (2012). Measurement, optimization, and impact of health care accessibility: a methodological review. *Annals of the Association of American Geographers*, 102(5), 1104-1112.

Development of a Fuzzy Logic Algorithm for the Definition of the Proper Level of Contrast Agent and Hydration in Patients with Reduced Renal Functioning

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Abstract

“Healthcare is a knowledge driven process” (Shahmoradi et al 2017) and “the effective exploitation of knowledge in building decision-making tools” (Patel et al, 2009) is gaining attention. To this respect, both artificial intelligence and the use of specific algorithms may play a key-role. The present paper aims at discussing the potential use of fuzzy logic algorithm, to be a supportive tool in the clinical decision-making process, in particular with regard to patients with renal impairment.

After a literature review, which enable to make allowance for the principal factors involved in a clinical decision-making process led by artificial intelligence, and by fuzzy logic approach specifically, two questionnaires were administered to clinicians, working in an Italian Hospital. Two algorithms were built. Algorithm 1 (ALG 1) was implemented to perform “conservative” decision-making whilst the Algorithm 2 (ALG 2) was thought to simulate a less cautious decision-making process. Inferential analyses were performed: i) the existence of correlations among variables were investigated; ii) a regression model was implemented in order to test the hypotheses and reveal the predictors of the dependent variable (i.e. degree of diagnostic accuracy). Both algorithms showed that only information quality (algorithm 1: $\beta=0.389$; $p<0.001$; algorithm 2: $\beta=0.370$; $p<0.001$) was required to approximate the diagnostic accuracy of a decision-making process supported by artificial intelligence tools (Algorithm 1: Adjusted $R^2 = 0.346$; Algorithm 2: Adjusted $R^2 = 0.407$).

Keywords – Fuzzy logic, contrast medium, reduced renal functioning, heuristic models, decision-making process

Paper type – Academic Research Paper

1 Introduction

Taking rational and adequate decisions, according to the literature suggestions (Von Neumann, 2007), thus maximizing the expected utility of such decision, represents the major challenge of the real-life decision-making processes. Risk and decision analyses are central tools of contemporary healthcare governance, in contexts ranging from the appraisal of novel healthcare technologies, to climate change adaptation and mitigation planning (MacGillivray, 2017).

On the one hand, when individuals make decisions, their rationality is limited by the tractability of the decision problem, the cognitive limitations of their minds, and the time available to make the decision (Simon, 1955), seeking a satisfactory solution rather than an optimal one. On the other hand, Kahneman and Tversky (2013) demonstrated that individuals would take decisions on the basis of heuristic models, that are simple and efficient rules which people often use to form judgments and make decisions. In particular, they are mental shortcuts that usually involve focusing on one aspect of a complex problem and ignoring other. Both artificial intelligence and the use of specific algorithms, play a key-role in the decision-making process.

Artificial intelligence “aims to mimic human cognitive function” (Jiang et al, 2017), such as “the ability to reason, discover meaning, generalize, or learn from past experience” (Bali et al 2018). In this view, medicine in general, is one of the most promising application area (Yu et al, 2008; Dilsizian & Siegel, 2013).

“Healthcare is a knowledge driven process. Thus, knowledge management, and the tools to manage knowledge in healthcare sector, are gaining attention” (Shahmoradi et al 2017). Knowledge management refers to the “exploitation and development of knowledge assets of an organization” (Metaxiosis et al, 2003), and the so-called “real world data” could be new sources of information. To this respect, in their position paper Patel et al (2009) recognize that “the effective exploitation of knowledge in building decision-making tools and in extracting information from the data” is an important point, in the field.

According to Wahl et al (2018), a classification of subfields of artificial intelligence regarding health’s domain lacks. Nevertheless, the authors put forward five main areas of interest, such as expert systems, machine learning, natural language processing, automated planning and scheduling, image and signal processing. The areas acknowledged as most frequent or powerful in the checked literature area fuzzy expert systems, image and signal processing and machine learning (Yu et al, 2018; Jiang et al, 2017; Pannu, 2015; Gürsel, 2016; Ramesh et al, 2004; Chan et al, 2018).

In the present paper, the attention will be place on the fuzzy expert system. The rationale behind this approach is that fuzzy expert system are knowledge-based system, and knowledge management field may gain advantages to use their techniques to “support the codification of the knowledge in the knowledge management systems” (Metaxiosis et al, 2003). Moreover, the “fuzzy nature of the medical decision-making process” (Grüsel, 2016) requires a methodology able to include the “vagueness required to describe complex systems” (Vitez et al, 1996).

In this view, the present paper aims at discussing the potential use of fuzzy logic algorithm, to be a supportive tool in the clinical decision-making process, in particular with regard to patients with reduced renal functionality. As iodinated contrast medium used to perform CT, angiographic, and coronary angiography is nephrotoxic, patients with renal impairment are likely to develop acute renal failure, with all the related adverse events and complications, such as the dialysis. Therefore, the paper aims at proposing the results achieved by the implementation of a fuzzy logic algorithm (a sort of many-valued logic, in which, the truth values of variables, may be any real number between 0 and 1 inclusive), to be used for the definition of the proper dose of contrast agent to be administered to such a patients. Accordingly, this research seeks to demonstrate whether the fuzzy logic algorithm may assist clinicians in improving clinical decisions toward patients with renal impairment.

2 Literature review

Studies in the field of cognitive psychology claim that “the reasoning skill of clinicians is imperfect (and) radiologists are prone to cognitive errors” (Jager et al, 2014). Cognitive errors in the radiology practice stand at 20-40% of total radiologic errors (Brady, 2017). By focusing on diagnostic errors in internal medicine, Graber et al (2005) concluded that cognitive errors lead to diagnostic errors in 74% of cases compared with the system-related ones that are less frequent (65%). Therefore, “cognitive error is pervasive in clinical practice” (O’Sullivan & Schofield, 2018), and the importance of those factors needs to be taking into account for understanding the clinical decision-making as a whole.

Lee et al (2013) outlined cognitive errors as a set including faulty perception, failed heuristic and biases. “A significant part of physician’s cognitive effort is properly selecting and utilizing pertinent heuristic approaches” (Patel et al, 2009). Heuristics are often referred to, as mental short cuts (Thompson & Dowding, 2004), relying on “a subconscious integration of somewhat haphazardly gathered patient data, with prior experience rather than on a conscious generation of a rigorous differential diagnosis that is formally evaluated, using specific data from the literature”(McGee, 2018). Likewise, cognitive biases cause a faulty medical reasoning, as they are “the results of psychologic distortions in the human mind, which persistently lead to the same pattern of poor judgment, often triggered by a particular situation” (Lee et al, 2013).

Dilsizian & Siegel (2013) listed five cognitive biases likely to feature in faulty clinical reasoning, and state that “(...) artificial intelligence systems have the potential to be less susceptible to these biases and, despite their limitations, can serve in a complementary role to human decision makers”. For instance, Saifi et al (2013) described the adoption of artificial intelligence to reduce improper use of diagnostic imaging in cardiology field, and the related decrease rate obtained from 10% to 5%. Liao et al (2015) investigated the use of artificial intelligence as supportive information system in enhancing nursing diagnosis, showing consistency with nursing staff’s diagnosis by 87%. Stamey et al (1996), as quoted by other scholars, implemented a

model, based on artificial neural networks to detect prostate cancer, with a diagnostic accuracy of 90%. Artificial neural networks is an artificial intelligence technique, mimicking the function of human brain (Ishak & Siraj, 2004) in processing multiple data and shaping patterns for decision making process (Mintz & Brodie, 2019), used in “image analysis in radiology, data interpretation in intensive care setting and waveform analysis” (Ramesh et al, 2004). In this respect, Esteva et al (2017) implemented a specific subset of artificial neural intelligence, called convolutional neural networks, for classify skin cancers, stating a performance level achieved comparable to the experts tested.

Fuzzy expert systems make use of expert level competence and inference procedures based on fuzzy logic for “complex problems with high degree of uncertainty” (Wahl et al, 2018), whose solutions “can be satisfactorily approximated heuristically relying on human expertise in form of If-Then rules” (Aly & Vrana, 2006).

The work by Djam & Kimbi (2011) focused on the use of such an approach for the management of hypertension risk. Managing hypertension is a complex task due to the multiple variables involved in the diagnostic process. Information obtained from patients are often not exhaustive and imprecise to perform a consistent diagnostic and medical decision. Moreover, conflicting information sometimes arise due to both inaccurate laboratory tests (Vitez et al, 1996) and to unexperienced medical personnel. As a result, the choice about the clinical treatment to be adopted get fuzzy and the increasing level of uncertainty and vagueness lead physicians to make decision based on intuition. To this respect, the study performed a test on a cohort of patients affected with hypertension, showing that the system’s reasoning engine, built upon the experts’ knowledge, alert about the moderate hypertension risk of the sample, assisting clinicians in being aware of monitoring need of patients among possible treatment options.

Bates & Young (2003) described the use of fuzzy logic in determining the amount of intravenous fluid to be administrated to the patient in an intensive care unit. In such a setting, the cognitive load experienced by the physician grow. Physicians have to handle complex trade-offs and making rapid decisions, by relying much more on a subjective assessment. To this respect, the methodological review paper by Patel et al (2008) precised that decision-making in critical care environment, such as intensive care unit or emergency department, bases on the “flow of information between clinical members”. Therefore, detecting the underlying cognitive mechanism that rule the information process is the early stage “for design change that emphasize clarity of communication and the implementation of technology that support specific user tasks”.

Bates & Young (2003) reported a simplified theoretical model, based on two input variables (mean arterial blood pressure and hourly urine output), and compare it to six variables model adopted by Nemoto et al (1999) and Bates et al (2001) for controlling the level of pressure support ventilation in patients in the ICU with chronic obstructive pulmonary disease (Bates & Young, 2003). In the last case, the algorithm displayed recommendations consistent with the clinical choices made actually for the patients, less than narrow variations in the range of 2 cm H₂O in pressure ventilation levels, as reported by Bates & Young (2003).

Based on the literature, a *degree of diagnosis accuracy* comparable to the one of experts is the main expected benefit of any artificial intelligence algorithm in healthcare management. Therefore, the performance of the algorithm, in terms of precision of control achieved, may be assumed as a driver of diagnostic accuracy.

In particular, as discussed above, “fuzzy logic has the ability to capture the experience-based of a particular individual and code it as an algorithm” (Bates & Young, 2003). This suggests that a strong medical expertise, both professional knowledge and clinical experience, affects positively the performance of a fuzzy algorithm. As a result, the following hypothesis is accordingly developed.

H₁: *Medical expertise has a positive impact on the degree of diagnostic accuracy.*

As suggested by Liao et al (2015), by improving the quality of the information available in the decision-making process, the diagnostic choices tend to converge with those indicated by the system of artificial intelligence. Therefore, the following hypothesis is displayed.

H₂: *The quality of information has a positive impact on the degree of diagnostic accuracy*

Moreover, based on Patel et al (2008), critical care environment may mitigate the potential of the algorithm to generate accurate diagnostic predictions based on quality information. This may influence the underlying cognitive mechanism that rule the information process. To this respect, medical setting may be considered as a moderator, in particular with regard to i) the relationship between the medical expertise and the degree of diagnostic accuracy; and ii) the relationship between the information quality and the degree of diagnostic accuracy. The following hypotheses are accordingly developed:

H_{3.1}: *The medical setting has a negative moderator effect on the relationship between quality information and the degree of diagnostic accuracy.*

H_{3.2}: *The medical setting has a negative moderator effect on the relationship between medical expertise and the degree of diagnostic accuracy.*

A synthesis of the research framework developed is proposed in Figure 1.

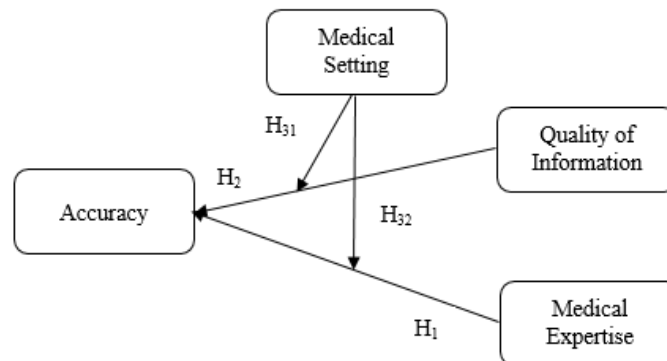


Fig. 1. Model

4 Materials and Methods

Based on the above-mentioned hypotheses derived from literature, variables to be tested were identified.

Firstly, the degree of diagnostic accuracy may be assumed as dependent variable of the framework. Concerning the literature (Liao et al., 2015), the diagnostic accuracy may be explained as a convergence between experts' diagnostic choices and those indicated by artificial intelligence algorithm, thus in the following the variable will be defined as the offset between experts' decisions and algorithm recommendations, namely the doses of contrast medium to be administered to patients.

Secondarily, the medical expertise and the quality of information may be assumed as independent or predictor variables, according to the literature, whilst the medical setting acts as a moderator. In fact, medical setting is described as a variable affecting the strength of the relationship between medical expertise and the output variable, and the potential of the algorithm to generate accurate diagnostic predictions based on information quality.

To complete the model, some control variables were included (i.e. clinician's age, addiction to computer, GFR and weight), to account for the effects of factors which are not a decision-making leverage, but they may affect the algorithm's performance.

Accordingly, to collect data, two questionnaires were developed. The first questionnaire was designed to shed lights on the constructs stemmed from the literature review. In particular, besides personal information (e.g. age, gender, professional role), the questionnaire was composed of mainly quantitative responses, with a 5-items Likert scale ranging from a minimum value of 1 to a maximum value of 5. The domains covered were: i) medical setting, in terms of environmental and personal factors perceived as crucial for the cognitive burden (i.e. uncertainty of clinical profile to be treated, workload and time-dependent decision context) ; ii) medical expertise, depending on seniority; iii) quality of information, in term of knowledge, as basically inferred from literature (Liao et al., 2015).

To assess the decision making model two algorithm were developed. Both algorithms start from two input variables (patient weight and the related Glomerular Filtration Rate – GFR), able to evaluate the dose of contrast agent to administer to the patient with mild or moderate impairment of renal function. Both the algorithms are designed as follow: 1) The input fuzzy variables (patient weight, GFR,) and the output one (contrast medium) are clustered and inserted in specific charts, following the fuzzy logic; 2) the input variables (patient weight and GFR) are transformed from numerical values to non-numeric values used to facilitate the expression of rules and facts. In the present case, the non-numeric values are “low”, “medium” and “high”. After their transformation (fuzzification into fuzzy membership functions), the above variables are inserted in the rulebase to compute fuzzy output function; 3) the decisions defined by the algorithm is de-fuzzified, thus being transformed from non-numeric value to numerical values, leading to the development of output values, thus identifying the level of contrast medium.

In particular, algorithm 1 (ALG 1) was implemented to perform “conservative” decision-making. The reasoning engine was set for working out below risk threshold (i.e. $\text{gIodine/GFR} < 1$) (Andreucci M., 2014). Algorithm 2 (ALG 2) simulates a less cautious decision-making process, by running on the edge of the risk threshold.

To collect the experts’ clinical choices a second questionnaire was employed. Based on the case history of patients observed over time, three tests were included in the questionnaire. i) *Pulmonary embolism*: the test was design to force the radiologists to administer the lowest possible contrast dose for patients with impairment of renal function, seeking to get a sufficient diagnostic iconography. ii) *Hepatic metastasis from colorectal cancer*: unlike the previous test, abdominal triphasic study necessitates a significant dose of contrast medium. Therefore, the test was executed to press radiologists to opt for the highest possible contrast dose consistent with risk of acute renal insufficiency. iii) *Pulmonary nodule*: the test was carried out to observe medical decisions in an intermediate case study.

Each test included 10 case studies. The radiologists accomplished each test and the related case studies as to collect the diagnostic choices without supportive systems to decision-making. The data collected are measured in ml/contrast medium. Only 8 out of 10 radiologists performed the tests. Therefore, a set of 80 results were compared to algorithms’ recommendations.

Subsequently, a correlation analysis was performed to assess both the multicollinearity among variables, and the strength of their relationships. Furthermore, a regression analysis was conducted both for algorithm 1 and algorithm 2, useful to test the above-mentioned hypotheses and define the predictors of the level of diagnostic accuracy. In this view, for each dependent variable (algorithm 1 and algorithm 2), three different models were developed.

- Model 1: Model composed only of control variables.
- Model 2: Model composed of Model 1, with the inclusion of the independent variables.
- Model 3: Model composed of Model 1, Model 2 with the inclusion of the moderator nature of the clinical setting.

5 Results

Both questionnaires were administered to a sample of 10 radiologists, working in an Italian hospital ward, in the month of March 2019. 8 out of 10 radiologists answer to the questionnaire. The final sample was composed predominately of males (60%). In both cases the response rate was of 80%.

The extremes values given back from the algorithms for each run were set as a reference range. This allows to grasp preliminary indications in terms of cognitive burden experienced by the radiologists.

Surprisingly, 15% of radiologists chose doses of contrast medium above the risk threshold in test 1, which refers to case studies with lower scope for taking decisions. Moreover, the risk to induced impairment renal function led radiologists to administer

doses lower than what was proposed by the more cautious algorithm 1 (28,8%). By measuring the standard deviations within the decisions' group belonging to each expert, only 4 out of 8 showed a limited decision making variability. This may make supposing that they did not relied on an initial reference point in making decisions (anchoring bias).

Likewise, radiologists in the test 2 tend to exaggerate the quantities of contrast medium, by exceeding the risk threshold (33,8%), and the intra-expert anchoring in decision making continue to be wide (7 out of 8 experts). It is noteworthy that radiologists tend to overestimate the doses relative to those recommended by the algorithm working out on the edge of critical threshold (45%), in test 3.

Focusing on algorithm 1, Table 2 depicts the correlations among variables. In particular, a significant relationship was found between the degree of diagnostic accuracy and clinician's age ($p < 0.01$); patient's weight ($p < 0.01$); medical expertise ($p < 0.01$). Even a positive correlation was found between clinician's age and medical expertise ($p < 0.01$); information quality ($p < 0.01$). Moreover, medical expertise showed a good positive relationship with clinician's age ($p < 0.05$).

Table 2. Correlation among variables for the algorithm 1

	1	2	3	4	5	6	7	8	9
(1) Accuracy_1	1								
(2) Age	.324**	1							
(3) Addiction to pc	-.061	.508*	1						
(4) GFR	.036	.000	.000	1					
(5) Weight	.346**	.000	.000	.411*	1				
(6) Medical Expertise	.289**	.962*	.535**	.000	.000	1			
(7) Information quality	.117	-.055	.548**	.000	.000	-.052	1		
(8) Information quality x medical setting	.082	.267*	.347**	.000	.000	-.154*	.151*	1	
(9) Medical expertise x Medical setting	.288**	.914*	-.349**	.000	-.000	.971**	-.203**	-.002	1

*Significance levels: * $p < 0.05$; ** $p < 0.01$*

With regard to algorithm 2 (Table 2), the same trend emerged.

Table 2. Correlation among variables for the algorithm 2

	1	2	3	4	5	6	7	8	9
(1) Accuracy_2	1								
(2) Age	.308**	1							
(3) Addiction to pc	-.058	.508*	1						
(4) GFR	.019	.000	.000	1					
(5) Weight	.452**	.000	.000	.411*	1				
(6) Medical Expertise	.275**	.962*	.535**	.000	.000	1			
(7) Information quality	.111	-.055	.548**	.000	.000	-.052	1		
(8) Information quality x medical setting	.078	.267*	.347**	.000	.000	-.154*	.151*	1	
(9) Medical expertise x Medical setting	.274**	.914*	-.349**	.000	-.000	.971**	-.203**	-.002	1

*Significance levels: * $p < 0.05$; ** $p < 0.01$*

Table 3 and Table 4 displayed the regression analyses for algorithm 1 and 2, respectively. Both tests showed that only information quality (algorithm 1: $\beta=0.389$; $p<0.001$); algorithm 2: $\beta=0.370$; $p<0.001$, thus focusing on Model 2) was required to approximate the diagnostic accuracy of a decision-making process supported by artificial intelligence tools (Algorithm 1: Adjusted $R^2 = 0.346$; Algorithm 2: Adjusted $R^2 = 0.407$). The exhaustiveness and the systematization of information was confirmed as necessary to steer an accurate diagnostic choice. A negative relationship emerged between medical expertise and the level of diagnostic accuracy in both the algorithms (algorithm 1: $\beta=-0.032$; $p>0.05$); algorithm 2: $\beta=-0.030$; $p>0.05$), even if no statistical significance emerged. Moreover, noteworthy was the statistical relevance of control variables, which are able to explain 27.8% and 34.6% of dependent variable's variance (Model 1).

Focusing on the medical setting as moderator, no significant effects was reported in both the algorithms. In this view, Model 3 is able to explain the 34.2% and 40.4% of the variance of algorithm 1 and algorithm 2, respectively.

Table 3. Regression analysis for dependent variable accuracy algorithm 1.

	Model 1	Model 2	Model 3
Control variables			
• Age	0.396*	0.600*	0.691*
• Addiction to PC	0.140*	0.440*	0.393*
• GFR	-0.215*	-0.215*	-0.215*
• Weight	0.434*	0.434*	0.434*

Independent variables			
• Medical Expertise		-0.032	-0.062
• Information Quality		0.389*	0.341*
Moderators			
• Information Quality x Medical Setting			0.069
• Medical Expertise x Medical Setting			-0.077
R ²	0.278	0.362	0.364
Adjusted R ²	0.266	0.346	0.342
F value	22.617*	22.076*	16.523*
Δ R ²	0.278	0.084	0.002
F(ΔR ²)	22.617*	15.436*	0.276

Significance levels: *p < 0.05

Table 4. Regression analysis for dependent variable accuracy algorithm 2.

	Model 1	Model 2	Model 3
Control variables			
• Age	0.376*	0.570*	0.657*
• Addiction to PC	0.133*	0.418*	0.374*
• GFR	-0.201*	-0.201*	-0.201*
• Weight	0.535*	0.535*	0.535*
Independent variables			
• Medical Expertise		-0.030	-0.059
• Information Quality		0.370*	0.324*
Moderators			
• Information Quality x Medical Setting			0.065
• Medical Expertise x Medical Setting			-0.073
R ²	0.346	0.422	0.424
Adjusted R ²	0.335	0.407	0.404
F value	31.097*	28.393*	21.231*
Δ R ²	0.346	0.076	0.001
F(ΔR ²)	31.097*	15.375*	0.275

Significance levels: *p < 0.05

6 Conclusions

The model demonstrated that only information quality was required to achieve a comparable diagnostic accuracy to a decision-making process supported by artificial intelligence tools. Despite literature (Bates & Young, 2003) suggested that medical expertise affects positively the performance of a fuzzy algorithm, in this paper, it is not confirmed, as well as the moderator role of medical setting (Patel et al, 2008).

The results may be interpreted as the need to pursue an in-depth analysis on the proxies adopted in literature to better explain the constructs, especially with regard to the specific context, such as the healthcare sector. Further investigations should focus on this important aspect.

Despite the limitations, the present paper provided insights on the potential key role of artificial intelligence in managing clinical decision-making in three different cases of renal impairment. As acknowledged by the model, the wholeness and systematization of knowledge required to implement a clinical decision-making process might enable to ease the cognitive burden sustained by clinicians, by boosting potentially the diagnostic accuracy's convergence. Nevertheless, the cognitive burden experienced by radiologists induced them to desert the tests (2 out of 10) and to rely on heuristic reasoning. In fact, the study revealed a potential anchoring bias, (40% in test 1 and 87% in the last ones), which guided radiologists to assign doses of contrast medium by means of a reference value used to relate intuitively the quantity chosen in each choice. Therefore, future investigations should further stress the analysis, by unbundling the information quality's construct in distinct items.

References

- Aly S., Vrana I. (2006). Toward efficient modeling of fuzzy expert systems: a survey. *AGRIC. ECON. – CZECH*, 52, 2006 (10): 456–460;
- Andreucci M. (2014). La nefropatia da mezzi di contrasto radiografici iodati: Patogenesi, Fattori predisponenti, Prevenzione. *G Ital Nefrol* 2014; 31 (5) – ISSN 1724-5590;
- Bali J. et al. (2018). Artificial intelligence (AI) in healthcare and biomedical research: why a strong computational/AI bioethics framework is required?. *Indian Journal of Ophthalmology*;
- Bates J. H. T., Young M. P. (2003). Applying Fuzzy Logic to Medical Decision Making in the Intensive Care Unit. *American Journal of Respiratory and Critical Care Medicine*, 167(7), pp. 948–952, doi: 10.1164/rccm.200207-777CP;
- Bates J.H.T. et al (2001). Fuzzy logic and mechanical ventilation. *Respir Care Clin N Am* 2001;9:363–377;
- Brady A. J (2017). Error and discrepancy in radiology: inevitable or avoidable?. *Insights Imaging* (2017) 8:171–182 DOI 10.1007/s13244-016-0534-1;
- Chan Y-K et al (2018). Editorial Artificial Intelligence in Medical Applications. *Hindawi Journal of Healthcare Engineering* Volume 2018, Article ID 4827875, 2 pages doi: 10.1155/2018/4827875;

- Dilsizian, S.E. & Siegel, E.L. (2013). Artificial Intelligence in Medicine and Cardiac Imaging: Harnessing Big Data and Advanced Computing to Provide Personalized Medical Diagnosis and Treatment *Curr Cardiol Rep* (2014) 16: 441. doi: 10.1007/s11886-013-0441-8;
- Djam X. Y., Kimbi Y.H. (2011). Fuzzy Expert System for the Management of Hypertension. *The Pacific Journal of Science and Technology*. Volume 12. Number 1;
- Esteva A, Kuprel B, et al (2017). Dermatologist-level classification of skin cancer with deep neural networks. *Nature*. 2017 Feb 2;542(7639):115-118. doi: 10.1038/nature21056;
- Graber M. L. (2005). Diagnostic Error in Internal Medicine. *Arch Intern Med*. 2005;165:1493-1499;
- Gürsel G. (2016). Healthcare, uncertainty, and fuzzy logic. *Digit Med* 2016;2:101-12;
- Ishak W. H. W., Siraj F. (2014). Artificial intelligence in medical application: an exploration. <https://pdfs.semanticscholar.org/0071/b75676057605da2ed632b687caa7ad46350c.pdf>;
- Jager G., Fütterer J. J. et al (2014). Cognitive Errors in Radiology:"Thinking fast and slow"Conference: ECR 2014 Vienna. DOI: 10.1594/ecr2014/C-0899;
- Jiang F. et al. (2017). Artificial intelligence in healthcare: past, present and future. *Stroke Vasc Neurol*. 2017;2(4):230–243. Published 2017 Jun 21. doi:10.1136/svn-2017-000101;
- Kahneman, D., & Tversky, A. (2013). Prospect theory: An analysis of decision under risk. In *Handbook of the fundamentals of financial decision-making: Part I* (pp. 99-127);
- Lee S. C. et al (2013). Cognitive and System Factors Contributing to Diagnostic Errors in Radiology. *American Journal of Roentgenology*. 2013;201: 611-617. 10.2214/AJR.12.10375;
- Liao P.H. et al. (2015). Applying artificial intelligence technology to support decision-making in nursing: A case study in Taiwan. *Health Informatics Journal* 2015, Vol. 21(2) 137 –148. doi: 10.1177/1460458213509806;
- MacGillivray BH. (2017) Characterising bias in regulatory risk and decision analysis: An analysis of heuristics applied in health technology appraisal, chemicals regulation, and climate change governance. *Environment International*, 105, 20-33;
- McGee L. D. (2018). Cognitive Errors in Clinical Decision Making. <https://www.msmanuals.com/professional/special-subjects/clinical-decision-making/cognitive-errors-in-clinical-decision-making>;
- Metaxiotis K. et al (2003),"Decision support through knowledge management: the role of the artificial intelligence", *Information Management & Computer Security*, Vol. 11 Iss 5 pp. 216 – 221. doi:10.1108/09685220310500126;
- Mintz Y., Brodie R. (2019). Introduction to artificial intelligence in medicine. *Minim Invasive Ther Allied Technol*. 2019 Feb 27:1-9. doi: 10.1080/13645706.2019.1575882;
- Nemoto T. et al (1999). Automatic control of pressure support ventilation using fuzzy logic. *Am J Respir Crit Care Med* 1999;160:550–556;
- O'Sullivan E. D., Schofield S.J. (2018). Cognitive bias in clinical medicine. *J R Coll Physicians Edinb* 2018; 48: 225–232, doi: 10.4997/JRCPE.2018.306;
- Pannu A. (2015). Artificial Intelligence and its Application in Different Areas. *International Journal of Engineering and Innovative Technology (IJEIT)* Volume 4, Issue 10, ISSN: 2277-3754;
- Patel, V. L., et al (2008). Translational cognition for decision support in critical care environments: a review. *Journal of biomedical informatics*, 41(3), 413–431. doi:10.1016/j.jbi.2008.01.013;
- Patel V. L., Shortliffe E.H et al (2009). The coming of age of artificial intelligence in medicine. *Artif Intell Med*. 2009 May;46(1):5-17. doi: 10.1016/j.artmed.2008.07.017;
- Ramesh AN et al (2004). Artificial intelligence in medicine. *Ann R Coll Surg Engl*. 2004;86(5):334–338. doi:10.1308/147870804290;
- Saifi S, et al (2013). The use of a learning community and online evaluation of utilization for SPECT myocardial perfusion imaging. *J Am Coll Cardiol Imaging*. 2013;6:823–9;

- Shahmoradi L. et al (2017). Knowledge Management Implementation and the Tools Utilized in Healthcare for Evidence-Based Decision Making: A Systematic Review. *Ethiop J Health Sci.* 2017 Sep;27(5):541-558;
- Simon, H. A. (1955). A behavioral model of rational choice. *The quarterly journal of economics*, 69(1), 99-118;
- Stamey TA et al (1996). Effectiveness of ProstAsure™ in detecting prostate cancer (PCa) and benign prostatic hyperplasia (BPH) in men age 50 and older. *J Urol* 1996; 155: 436A;
- Thompson C., Dowding D. (2004). Awareness and prevention of error in clinical decision-making. *NT* 8 June 2004 Vol 100 No 23;
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *science*, 185(4157), 1124-1131;
- Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *science*, 211(4481), 453-458;
- Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and uncertainty*, 5(4), 297-323;
- Vitez et al (1996). Emerging Technologies. Fuzzy Logic: Theory and Medical Applications. *Journal of Cardiothoracic and Vascular Anesthesia*, Vol 10, N°6, pp. 800-808;
- Von Neumann, J., & Morgenstern, O. (2007). *Theory of games and economic behavior* (commemorative edition). Princeton university press;
- Wahl B, Cossy-Gantner A, Germann S, et al (2018) Artificial intelligence (AI) and global health: how can AI contribute to health in resource-poor settings? *BMJ Global Health* 2018;3:e000798;
- Yu Kun-Hsing, Beam A. L., Kohane I.S. (2018). Artificial intelligence in healthcare. *Nature Biomedical Engineering*, 2, 10, Pp. 719;

Limits and Merits of Transition to Circular Economy in (post-) Transitive Economies of CEE

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Abstract

The transition to a more circular society has been adopted as a guiding principle in several countries' policies. The present paper reviews the international definitional and theoretical approaches to the circular economy originating in the Anglo-Saxon environment with a view to assessing their applicability in the (post-) transitional context of CEE and identifying the elements of their integrative conceptual core. The main finding is that scientific research of circular economy and circular business thinking takes two relatively independent directions (normative/positive), as it is grounded in two different methodological approaches. The paper shows that it is possible to use a starting point for further research on circularity that would not be based on dichotomous approaches but on integrity (holistic approach).

Keywords – Circular Economy, Circular Business Thinking, Transformation Process, CEE

Paper type – Academic Research Paper

1 Introduction

Having gone through a transformation to a market economy, the concept of circularity in the (post-) transitive European countries has tremendous potential. The achievement of this potential, however, depends on the post-communist countries' ability to deal with the socio-economic and political challenges that are no less tremendous. Much of the work that needs to be done toward achieving the potential the circularity offers involves the scientific analysis and reconstruction of basic conceptual foundations. The paper aims to review the international definitional and theoretical approaches to circular economy originating in the Anglo-Saxon environment with a view to assessing their applicability in the (post-) transitional context and identifying the elements of their integrative conceptual core.

The theoretical relevance and practical importance of the development of circular economy (cf. Ellen MacArthur Foundation, 2013; Ghisellini et al., 2016; Lieder and Rashid, 2016) around the world has been experienced, among others, by the post-

communist economies. The trend towards emerging circularity in the transitional economies of Central and Eastern Europe (CEE) has grown in recent years. It can be evidenced also on recent research projects the academics from the Czech Republic are currently working on, e.g. H2020 “Resource-efficient Circular Product-Service Systems”, and TACR “Analysis of Potential of South Moravia regarding the Circular Economy”, as well as their newly published papers, e.g. Škapa and Klapalová (2019), Klapalová (2019), Škapa (2018a, 2018b).

Transition to a circular economy requires a radical change of existing business models and new ways of thinking and doing business (Bocken et al., 2016). The knowledge base of circular economy and circular business models needs a substantial work on expanding, deepening and interconnecting existing pieces of knowledge from multidisciplinary perspectives, which holds true even more for the (post-) transitive context of CEE.

The concept of the transitional economy came into existence at the end of the 1980s when all the countries concerned were gradually abandoning the path towards socialism they had followed under the leadership of the Communist Party. Those were the years when the western countries had already started to cope with the circular economy. While it can be argued that some elements of the market economy also existed in a centrally-commanded economy (just as the state might have intervened in the market), the key feature of the communist regime was the way in which the economy was controlled or planned by the state and not driven by market forces (Shleifer and Treisman, 2014).

The economic transition was not conducted in the vacuum. At the macro level, the transformation of economy has included changes to its structure: in terms of different sectors, industries, branch specializations, and products; in terms of the size of corporations; and in the nature of foreign trade (Vaceková et al., 2019). The accession of several post-communist economies to the EU has involved the complete transformation of the former command economy to one based on the market. And the transformation of the economy was the precondition for a radical change in the political system to create a capitalist social system, a process that was much broader than changes to the economy (ibid). It opened a space for circular business thinking. Has this space been sufficiently used by (post-)transitive economies? If so, how? And if not, why?

Two types of research methods were used to meet the paper goal. Analysis was selected as the general scientific research method; it was used specifically in searching through theoretical resources. The synthesis method and the generalization method were applied in particular in connection with formulating theoretical conclusions. The paper is organized around three major themes. The first one presents the circularity conceptualization in the Anglo-Saxon environment. The next part is an inquiry that provides an analysis of the economic determinants of circular business thinking in the (post-)transitive area. This opens the third one which is devoted to the discussion of limits and merits of transition to circular economy from methodological and conceptual point of view. The paper ends by drawing conclusions, and making suggestions for further research.

2 The transition to a circular economy

In recent years there has been a proliferation of scholars' publications on circular economy (Merli et al., 2017). There are several concepts defining it, nevertheless, no commonly agreed definition yet (Kirchherr et al, 2017). According to Geissdoerfer et al. (2018, p. 712) circular economy „*is based on the idea of putting private business into the service of the transition to a more sustainable system.*“ System view is stressed also by Merli et al (2017, p. 703) arguing that circular economy „*proposes a circular system in which the value of products, materials and resources is maintained in the economy as long as possible.*“ Camacho-Otero et al (2018, p.1) state that a circular economy „*aims at decoupling value creation from waste generation and resource use by radically transforming production and consumption systems.*“

Despite the lack of conceptualisation, circularity has been attracting the attention of scholars, as the shifting to circular economy demands the understanding of how companies can introduce circularity into their business models (Lewandowski, 2016). Until now, most studies use a case study approach. This captures several possibilities and context-based features in specific firms or sectors, but it also limits their generalization (Lewandowski, 2016). Merli et al. (2017) highlight circular economy as an evolving concept that still requires development to consolidate its definition, boundaries, principles and associated practices.

Nevertheless, most of the concepts defining circularity point out the transformation process and the transition to the new phenomenon. This can be seen as a parallel to the transformation process from central-planned to market economies of the post-communist countries. The ‘transitional economies’ constitute a varied mixture of 27 countries, predominantly from the CEE but complemented by the republics of the former Soviet Union situated to the south of the Caucasus and in Central Asia. The concept of the transitional economy came into existence at the end of the 1980s when all these countries were gradually abandoning the path towards socialism they had followed under the leadership of the Communist Party. Instead they were setting out on a phase of transition from a state-controlled economy to one that was driven by the market, a change that was seen as the general goal of economic transformation. While it can be argued that some elements of the market economy also existed in a centrally-commanded economy (just as the state might have intervened in the market), the key feature of the communist regime was the way in which the economy was controlled or planned by the state and not driven by market forces (cf. Vaceková et al., 2019).

In 1989 and 1990, citizen movements were decisive in overturning the political order and, with it, the economic configuration in CEE countries (Strachwitz, 2015). There are big differences in the extent to which individual countries have implemented the development of market economies and the growth of democratic institutions that are seen as complementary to them. Today the transition to the market economy of the post-communist countries is seen to be far from complete but generally typical of states at similar stages of economic development.

When it comes to the issue of business thinking innovation the focus is also on emphasis on the transformation of existing business models. Business model innovation is considered an important source of firm's competitive advantage (Spieth et al. 2014). Recently, it is also pointed as a fundamental aspect in a transition to a more sustainable economy (Klapalová et al., 2018). The transformation is considered as a major driver and obstacle to the implementation of a circular economy (Lewandowski 2016).

At the macro level, the transformation of economy has included changes to its structure: in terms of different sectors, industries, branch specializations, and products; in terms of the size of corporations; and in the nature of foreign trade. The transformation of the economy was the precondition for a radical change in the political system to create a capitalist social system, a process that was much broader than changes to the economy. This holds true even for the circular business thinking.

3 Discussion

While the concept of a transitional economy has always been a kind of simplification or abstraction, all of the economies concerned, even after more than quarter century of transformation, share certain characteristics essentially because the institutions of their democracies and their market economies are not fully developed (Vaceková et al., 2019). This lack of development also holds true for circular economy.

An analysis of the literature shows that scientific research of circular economy and circular business thinking takes two relatively independent directions, as it is grounded in two different methodological approaches. The first approach is descriptive and based on non-normative methodology and the corresponding explanation tools that clarify the role of the circularity and circular business models in the economy. The second approach turns in the normative direction. It is based on normative methodology and on the explication or interpretation of a researched topic. The contrast between these two different methodological approaches to circular economy is a specific example of the current state of scientific discussion in the areas of economics and social sciences. The contrast takes the form of "two cultures" (Snow, 2002) or, in terms of scientific methodology, a form of commensurability or incommensurability between normative and non-normative statements about, or explanations of, a researched topic (Ochrana, 2015).

The general contradictions between economics and social sciences are reflected in the scientific discussion about the circular economy and influence the circular business thinking. The paper is based on a critical evaluation of this discussion and offers a different solution. The solution is an attempt to depart from the existing traditional approaches and reach some synthesis. The paper works on the assumption that it is possible to use a starting point that would not be based on dichotomous approaches but on integrity (cf. Vaceková, 2016; Valentinov 2009; *ibid* 2011; *ibid* 2012; Valentinov & Iliopoulos, 2013; Valentinov et al., 2015)

The methodological basis for this integrity is the holistic approach (Fay, 2002; Ochrana, 2015), enabling a shift in direction toward the integrative approach. The paper seeks answers on how the circular business thinking participates and contributes to this

process which indeed integrates normative and positive aspects: there is a normative imperative to solve problems, and there is positive interest in discovering how circular economy can actually do it.

The need for integrative research of circularity is determined by two groups of factors. The first group is the new economic and social reality within which businesses operate. This new reality includes transformations of the positions, roles, and functions. Therefore, this represents an objective side of the issue: the ontological layer of circular economy. The recent and ongoing changes in the position and functioning of business require a corresponding scientific approach and tools that would enable proper research of these changes. Traditional existing approaches offer dichotomous solutions: either explanations or interpretations (Vaceková, 2016). The integrative theory (see Vaceková, 2016) bridges this dichotomy, offering a comprehensive view of the current issues related to the operations of circular economy. The ambition of the paper was to contribute to the theoretical elaboration of the issue.

4 Concluding remarks

Circularity has received increasing attention in the scientific literature worldwide. This literature is, however, largely Anglo-Saxon and it is not perfectly suited to a context of the transitional economies. The lack of relevant research on circularity in the post-communist countries of CEE shows a considerable gap that strongly indicates the need for deeper insight. The proposed paper contributed to the conversation by rethinking the existing literature in the context of transitional economies, focusing on the merits and limits of transition to circular economy in (post-) transition economies. Furthermore, it aimed to create a space for discussing critical implications and making suggestions for further research.

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References

- Bocken, N. M., de Pauw, I., Bakker, C., & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, 33(5), 308-320.
- Camacho-Otero, J., Boks, C. and Pettersen, I. (2018). Consumption in the Circular Economy: A Literature Review. *Sustainability*, 10(8), 1-26.
- Ellen MacArthur Foundation. (2013). *Towards the Circular Economy. Vol. 1: an economic and business rationale for an accelerated transition.*
- Fay, B. (2002). *Current Philosophy of Social Sciences. Multicultural Approach.* Prague: Sociologické nakladatelství.

- Geissdoerfer, M., Morioka, S. N., de Carvalho, M. M. & Evans, S. (2018). Business models and supply chains for the circular economy. *Journal of Cleaner Production*, 190, 712-721.
- Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner production*, 114, 11-32.
- Kirchherr, J., Reike, D. & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221-232.
- Klapalová, A. (2018). Employee-driven innovation and reverse supply chain management. *International Journal of Entrepreneurship and Innovation Management*, 22(4-5), 489-510.
- Lewandowski, M. (2016). Designing the business models for circular economy—Towards the conceptual framework. *Sustainability*, 8(1), 1-28.
- Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: a comprehensive review in context of manufacturing industry. *Journal of Cleaner production*, 115, 36-51.
- Merli, R., Preziosi, M. & Acampora, A. (2017). How do scholars approach the circular economy? A systematic literature review. *Journal of Cleaner Production*, 178, 703-722.
- Ochrana, F. (2015). *Methodology of social science*. Prague: Charles University in Prague, Karolinum Press.
- Shleifer, A. and Treisman, D. (2014). Normal countries: the east 25 years after communism. *Foreign Aff.*, 93, 92-103.
- Škapa, R. & Klapalová, A. (2019). The Effectiveness of Reverse Logistics: the empirical test of its factors for product returns reduction. *Ekonomický časopis*, 67(1), 86-104.
- Škapa, R. (2018a). An approach to reverse flows: motivation in retrospective. *Proceedings of International Scientific Conference of Business Economics Management and Marketing 2018*. Brno: Masaryk University, 247-254.
- Škapa, R. (2018b). Reverse logistics as a source of the process and product innovation: an empirical study. In Han van der Meer, Guido Einthoven, Giovanni Schiuma. *Proceedings from the 13th International Forum on Knowledge Asset Dynamics*. Delft: Institute of Knowledge Asset Management, 881-889.
- Snow, C. P. (2012). *The two cultures*. Cambridge University Press.
- Spieth, P., Schneckenberg, D. & Ricart, J. (2014). Business model innovation - state of the art and future challenges for the eld. *R&D Management*, 44, 237-247.
- Strachwitz, R. (2015). Introduction. In Ch. Schreier (Eds.) *25 Years After: Mapping civil Society in the Visegrad Countries*. Stuttgart: Lucius et Lucius Verlagsgesellschaft.
- Vaceková, G. (2016). *Nonprofit sector in the economic theory: Beyond mainstream explanations*. Habilitation thesis. Masaryk University, Brno.
- Vaceková, G., Lipovská, H. & Soukopová, J. (2019). From the Third Sector to Social Enterprise: The Transformation of Civil Society in the Czech Republic. In David Billis, Colin Rochester (Eds.) *Handbook on Hybrid Organisations* (forthcoming). London, UK: Edward Elgar Publishing
- Valentinov, V. (2009). Managerial nonpecuniary preferences in the market failure theories of nonprofit organisation. *International Journal of Social Economics*, 36(1/2), 81-92.
- Valentinov, V. (2011). The meaning of nonprofit organization: insights from classical institutionalism. *Journal of Economic Issues*, 45(4), 901-916.
- Valentinov, V. (2012). Toward a holistic nonprofit economics: insights from institutionalism and systems theory. *Journal of bioeconomics*, 14(1), 77-89.
- Valentinov, V., & Iliopoulos, C. (2013). Economic theories of nonprofits and agricultural cooperatives compared new perspectives for nonprofit scholars. *Nonprofit and Voluntary Sector Quarterly*, 42(1), 109-126.
- Valentinov, V., Hielscher, S., & Pies, I. (2015). Nonprofit organizations, institutional economics, and systems thinking. *Economic Systems*, 39(3), 491-501.

Consumer Knowledge and Young Consumer Purchase Behaviour towards Remanufactured products

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Abstract

Remanufacturing plays an important role in the transition towards the circular economy. Since many companies have already begun to implement remanufacturing strategies, consumer's adoption of already used products (e.g., remanufactured products) are highly essential. Hence, the consumer's acceptance of the remanufactured product is now receiving more researcher's attention. The findings of recent studies, however, indicate that consumers have a poor opinion on remanufactured products and thus remain reluctant to buy them. Moreover, these studies focus only on the adult generation and overlook the young generation which will become a new purchase power in the near future. Therefore, the main objective of the presented study is to deeply investigate how product-related knowledge influences the young generation's purchase intention towards remanufactured white goods. The author uses the theory of planned behaviour as a theoretical framework and for data collection questionnaire survey. Furthermore, the proposed model is empirically tested, using Ordinary least squares (OLS) regression, based on the responses from 234 university students. The results indicate that consumer's intention to purchase remanufactured products is positively and significantly influenced by consumer attitude, social norm and perceived behavioural control. Moreover, the presented study also demonstrates that consumer's product-related knowledge is positively associated with both consumer's attitude and consumers' intention to purchase remanufactured products. Thus, based on the presented findings, the study not only brings new insight into the purchase behaviour of the young generation towards remanufactured products but also several theoretical and practical implications.

Keywords: consumer knowledge, remanufactured products, purchase behaviour, theory of planned behaviour

Paper type – Academic Research Paper

1 Introduction

Since the 1990s, fast economic growth has escalated worldwide consumption, which subsequently led to the unprecedented levels of the produced waste and unsustainable exploitation of natural resources (Taufique et al., 2017). Thanks to it we have witnessed the rapid environmental deterioration results in increasing global warming (Satterthwaite, 2008). In response to worldwide concern about environmental especially in the recent decade (Vafadarnikjoo et al., 2018) the environmental issues in the context of business activities have become a major topic of academic research interest (Jiménez-Parra et al., 2014). Companies have been starting to implement end-of-use strategies in remanufacturing, recycling and reuse, to contribute to the transition to more sustainable production and consumption.

In the case of remanufacturing, the implementation of these practices (e.g., reused, repaired, replacing degraded, worn out and obsolete components) has been mainly driven by its environmental friendliness and thanks to it has begun play important role in reducing energy consumption and use of virgin material (Wang et al., 2018). Although many studies have already been conducted on this subject, most authors have focused primarily on the supply side of remanufactured products and dismissed the demand side i.e., the consumers' perception. Despite this little attention, the consumers' acceptance of remanufactured products is regarded as one of the most important requirements for transition to the circular economy. And thus, it becomes inevitable to understand the consumers' behaviour, especially they purchase intention towards the remanufactured product.

This paper contributes to the existing literature by the examination of consumers' purchase intention towards the remanufactured product. Specifically, it focuses on remanufactured white goods (major household electrical appliances such as fridges and washing machines), because there is a new effort from its manufacturers (e.g., in Gorenje). Moreover, since responsible consumption is at least partially depending on consumers' knowledge about the product, the author also empirically investigates how product-related knowledge influences consumers' purchase behaviours. Therefore, the key question is set up as: *"How product-related knowledge influence consumers' purchase intention towards the remanufactured product?"*. To answer this question and better understand the consumers' behaviour the author approaches the topic from two perspectives - first, the author investigates which factors play a significant role in determining the purchase intention; second, the author focus on how product-related knowledge influence the attitude-behaviour relationship. Combining both steps the author contribute the research of remanufacturing from consumer's perspective by assessing the purchase intention of Czech young consumers towards remanufactured products.

2 Theoretical framework

2.1 Remanufactured products

Remanufacturing is a production strategy, where the goal is to bring used products to at least their original quality and performance just like newly manufactured ones (Atasu et al., 2010). Therefore, remanufactured products are defined as "*one which has undertaken the process of disassembling, cleaning, inspecting, repairing, replacing and reassembling the components of a part or product to like-new condition*" (Thorn and Rogerson, 2002:35 "in" Hazen et al., 2012). Thanks to it remanufactured products are considered as the engine of closed-loop supply chain and one of the keystones of circular economy (Hazen et al., 2017). Moreover, these products bring several benefits mainly related to the environment, because its production is more sustainable - i.e., up to 70 % less raw material is required, up to 80 % less emission is produced and up to 60 % less energy is consumed (Wang et al., 2013:871).

The remanufactured products also taught the attention of media and prior business leaders in a variety range of industries. Therefore, remanufactured products can be found in the range from automobile parts to office furniture and electronics - e.g., laptops, mobile phones, cameras, mp3 players (Michaud and Llerena, 2011; Wu, 2012). Moreover, the development of remanufactured products has grown rapidly in recent years. In 2015 the remanufacturing industry even generated €30 billion in turnover and by 2030 it is expected that annual value will reach €70-100 billion (Parker et al., 2015 "in" Vafadarnikjoo et al., 2018).

Remanufactured products also bring several benefits to customers such as lower price, availability or purchase flexibility. According to Giutini and Gaudette (2003) price of remanufactured products is usually 30-40 % lower than the price of new products and their lead time is in many cases shorter than by new products. Moreover, in the context of access-based business model, which shifts the emphasis from selling product ownership to selling product use or its functions (Mont, 2008 "in" Edbring et al., 2016) the remanufacturers may offer customers additional services such as leasing, take-back, upgrading, etc. (Vafadarnikjoo et al., 2018).

2.2 Theory of Planned Behaviour

The theory of planned behaviour is (TPB) proposed by Ajzen (1991) is an extension of the theory of reasoned action and assumes that the behaviour is determined by behaviour intention (Wang et al., 2013). The Theory of Planned Behaviour (TPB) is an important social a cognitive model, which stems from extensive empirical confirmations in variety contexts (e.g., environmental, social and cultural context). While TPB is one of the most influential theories in health psychology, it finds its usefulness also in the context of green purchase behaviour (e.g., organic food, Zagat, 2012; visitation of the green hotel, Chen and Tung, 2014 - Wang). Moreover, its validity was also confirmed in predicting consumers' purchase behaviour towards remanufactured products (Jiménez-Parra et al., 2014; Khor and Hazen, 2017; Wang et al., 2018).

The TPB built on the assumption that the consumers make their decisions based on rational and reasoned choice, which stems from all available information (Wang et al., 2018). Thus, behavioural intention is determined by individuals' attitude, subjective norm, and perceived behavioural controls (Ajzen, 1991).

Attitude refers to an individuals' favourable or unfavourable evaluation of self-performance of behaviour (Ajzen, 1991). The attitudes are represented by an individual's beliefs, which clarify why people hold given attitudes. Additionally, the attitudes influence the intention, and so the more positive the attitude, the stronger the intention to perform the behaviour will be (Smith, A. Paladino, 2010).

Subjective norms can be conceptualized as the social pressure exerted from people that are important in the individuals' life (family, friends, teachers, etc.) to behave in a certain way (Ajzen, 1991; Singhal et al., 2019). In other words, the greater the influence of others is, the more likely is that he/she will perform the behaviour (Jiménez-Parra et al., 2014; Wang et al., 2018).

Perceived behaviour control is described as an individual's perception of the degree of easiness or difficulty performing the behaviour (Ajzen, 1991; Singhal et al., 2019). It deals with situations where people face external factors - i.e., ability, time and money. Therefore, the fuller control over these circumstances the individuals have, the more likely they will act like that (Wang et al., 2018; Smith, A. Paladino, 2010).

Based on the aforementioned constructs of the TPB, the following hypotheses are proposed.

H1: Attitude positively influences the behavioral intention to buy remanufactured white goods.

H2: Subjective norm positively influences the behavioral intention to buy remanufactured white goods.

H3: Perceived behavioral control positively influences behavioral intention to buy remanufactured white goods.

2.3 Remanufactured knowledge

Product knowledge can be defined as consumers' awareness of specific information (i.e., the features, warranty, price, quality, etc.) related to a particular product (Brucks, 1985). Wood et al. (1995: 283) explain that all this information comes to consumers' mind when encountering a particular product and considering its purchase. Moreover, since knowledge is considered an integral part of the consumers' attitude, the product related information also influences the consumers' purchase intention. The same assumption can be applied in the case of remanufactured products. Therefore, the deeper product knowledge related to remanufactured products, the better consumers' attitudes which results in significant influence on consumers' purchasing decision (Lin and Chen, 2006; Fabrigar et al., 2006).

On the other hand, there exist evidence (e.g., Wang et al., 2018; Hazen et al., 2012; Wang and Hazen et al., 2016) that the majority of consumers are not familiar with the remanufactured product and thus prefer new product before the remanufactured ones. According to Xu et al. (2017) consumers feel uncertain about remanufactured products'

characteristics (Wang et al., 2018) and even have incorrect information, because they think that remanufactured products are unusable or second-hand (Wang et al., 2018). This shows that consumers have a lack of understanding of remanufactured products and do not perceive the equivalences with new products (Thorn and Rogerson, 2002 "in" Hazen et al., 2012); although, from the definition, the remanufactured products are brought back to a new-conditions (Jiménez-Parra et al., 2014).

Hence, the level of understanding of the remanufactured product – i.e., the product knowledge – reduce uncertainty and provide a better understanding of all benefits of the remanufactured product (Wahjudi et al., 2018). Since it consequently increases consumers' acceptance and improves their purchasing decision, the author hypothesis that:

H4: Product knowledge about remanufactured white goods positively influence the consumers' attitude towards remanufactured white goods.

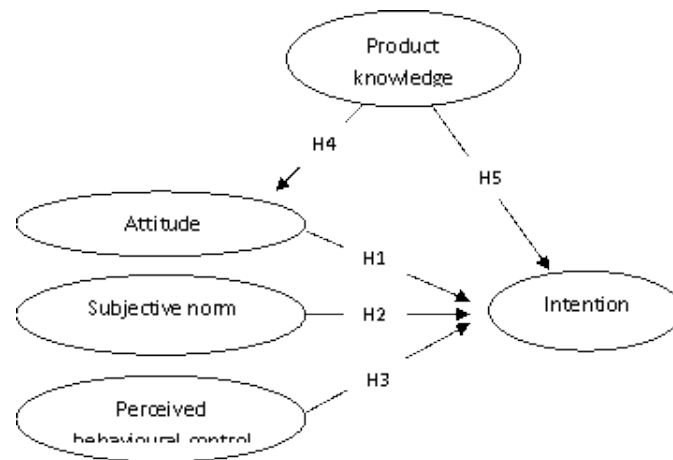
H5: Product knowledge about remanufactured white goods positively influence the consumers' purchase intention towards remanufactured white goods via attitude.

3 Methodology

3.1 The conceptual model

To investigate the reasons why consumer's purchase remanufactured white goods, the study is based on the TPB. The TPB provides more social psychology view by incorporating both social and personal factors thanks to it has very strong explanatory power in behavioural intention (Wang et al., 2013). The validity and reliability of its instruments were already confirmed by studies focusing on remanufactured products (e.g., Wang et al., 2013; Khor & Hazen, 2016; Singhal et al., 2019). Moreover, as stem from a literature review, the consumers have a lack of product knowledge about remanufactured products, and thus their perception is misleading. Therefore, the study also controls for product knowledge and integrate this factor into the conceptual model. On the other hand, since knowledge is an integral part of the consumers' attitude, it is expected that knowledge effect on purchase intention is not direct but mediated via the attitude. This two-step approach will enable us to deeper understand the customers' behavior, and the reluctance of consumer towards the purchase remanufactured white goods.

Based on the aforementioned arguments, the author proposed the following theoretical framework (Figure 1).



Source: Author

Figure 7: Proposed theoretical framework

3.2 Questionnaire development

The data for the proposed survey was collected by using a structured questionnaire, which was developed after an in-depth literature review. Moreover, the wording of single questions was taken over from previous research (see Appendix A). Thereafter, the draft of the questionnaire was sent to experts in the area of academia, psychology and remanufacturing industry to overview the framing and reading of the questions. After incorporating minor correction, the author conducted a pilot survey. As the research focus on the young generation, it was necessary to verify, if the questions are also understandable for this segment. A few questions were slightly corrected, and the final version was drafted.

A final questionnaire comprises of three parts. The first part contains questions prepared in accordance with the TPB. The second part captured the respondents' knowledge about the remanufactured products, especially as regards cost, quality, and environmental impact. The last part describes the respondents' characteristics such as age, gender, education, income, etc. Based on Ajzen's (1985) recommendations, each construct was measured by multiple items on a seven-point Likert scale – ranging from 1 = strongly disagree to 5 = strongly agree.

3.3 Sample and data collection

The study was designed as a cross-sectional survey and thus the data was obtained by surveying undergraduate, graduated and postgraduate students from the second biggest university in the Czech Republic - Masaryk University. The young adults (20-30 years) were chosen primarily because they represent new purchase power and hold new unexamined buying habits. Moreover, they have a higher ability to reflect their attitudes in purchase decision making (Yadav and Pathak, 2016). Data were gathering during February and March 2019, when the questionnaire was spread by snowball methods

through Facebook - most widely used social network by the young generation Eger (2015).

The responsive rate was 46 %, and the survey yielded 234 completed questionnaires. Since some responses were unusable (i.e., contained incomplete responses or was filled by older generation or were outliers), the final sample size was reduced to 197 surveys. Based on Kline's (2011) recommendation (i.e., the number of responses should be at least 10 cases per parameter), the final size is enough to satisfy.

Subsequently, to measure the strength of product-related knowledge, the final sample had to be reduced a second time. This was because some respondents did not know what the refurbished products were (i.e., they had no knowledge of remanufactured products and the definition had to be provided to them). Thus, the second final sample included 109 surveys.

4 Data analysis and results

Testing for the data was carried out with confirmatory and regression approach. First of all, Cronbach's alpha values and consequently confirmatory factor analyses were chosen to measure the reliability and inner consistency was chosen. Although the validity of used questions was confirmed by previous studies, in case of perceived behavioural control, the Cronbach's alpha value did not meet the proposed benchmark - i.e., the value should be greater than 0,70. Therefore one question had to be omitted. Thereafter the ordinary least squares (OLS) regression was run for the model fit and hypothesis testing. Moreover, the author also estimates the effect of control variables – i.e., gender, age, education background, nationality, income, and product-related knowledge¹.

The final regression model has following equation:

$$\text{Purchase Intention} = \beta_0 + \beta_1 \text{Attitude} + \beta_2 \text{Subjective norm} + \beta_3 \text{Perceived behavioural control} + \beta_4 \text{Age} + \beta_5 \text{Education} + \beta_6 \text{Nationality} + \beta_7 \text{Income} + \beta_7 \text{Knowledge}$$

Moreover, as the literature indicates, the effect of product-related knowledge on purchase intention is mediated via attention. Therefore, the author follows Baron and Kenny's (1986) approach and set up the following regression analyses:

$$\text{Purchase Intention} = \beta_0 + \beta_1 \text{Product related knowledge} + \beta_4 \text{Age} + \beta_5 \text{Education} + \beta_6 \text{Nationality} + \beta_7 \text{Income}$$

$$\text{Purchase Attitude} = \beta_0 + \beta_1 \text{Product related knowledge} + \beta_4 \text{Age} + \beta_5 \text{Education} + \beta_6 \text{Nationality} + \beta_7 \text{Income}$$

$$\text{Purchase Intention} = \beta_0 + \beta_1 \text{Attitude} + \beta_4 \text{Age} + \beta_5 \text{Education} + \beta_6 \text{Nationality} + \beta_7 \text{Income}$$

¹ Product-related knowledge means, whether respondents know remanufactured product or not.

$$\text{Purchase Intention} = \beta_0 + \beta_1 \text{Product related knowledge} + \beta_2 \text{Attitude} + \beta_4 \text{Age} + \beta_5 \text{Education} + \beta_6 \text{Nationality} + \beta_7 \text{Income}$$

4.1 Measurement model: confirmatory factor analysis

First, follow Fornell and Larcker's (1981) recommendation, the inner reliability of each construct was measured by Cronbach's alfa score. All constructs excepted perceived behavioural control meet the recommended value of 0,7 (Hair et al., 2010). Therefore, one question from the construct of perceived behavioural control had to be excluded. Afterward, the benchmark for this construct was also met. The value of factor loading for each construct exceeds 60 %. Hence measures have good internal consistency and lay within the recommended boundary, the new factors representing the overall value of constructs were created. Consequently, the author uses confirmatory factor analyses (CFA) to measure the validity of the model.

4.2 Ordinary least squares (OLS) regression

Based on the characteristics of the data the author uses ordinary least squares regression model to test the proposed hypotheses. To deal with heteroscedasticity in the presented sample the author uses robust (HAC) standard errors. Moreover, the values of variance inflation factors (VIFs) are well below 10 (range from 1.050 to 1.894), which signal no problems with multicollinearity.

Firstly, the effect of all three factors determining the purchase intention is tested. The findings show that the proposed model accounts for 56 % of the variance in purchase intention towards the remanufactured product. As Figure 2 shows, attitude ($\beta=0.385$, $p < 0.001$), subjective norm ($\beta=0.379$, $p < 0.001$) and perceived behavioural control ($\beta=0.121$, $p < 0.025$) positively influence the purchase intention. Moreover, since the effect of all TPB constructs is significant, the results support H1, H2, and H3.

Figure 8: Analysis of hypothesis (n= 197)

Determinants			coefficient	p-value	
Attitude	→	Intention	0.385	0.000***	Supported H1
Subjective norm	→	Intention	0.379	0.000***	Supported H2
Perceived behavior control	→	Intention	0.121	0.025**	Supported H3

Note: p-values in parentheses: ** $p < 0.05$; *** $p < 0.01$

Secondly, it was investigated, how product-related knowledge influence purchase intention towards remanufactured products. As the mediation effect is expected, the author follows Baron and Kenny's (1986) approach. In Figure 3, the author reports the results of each regression analysis: Model 1 shows the relationship between product-related knowledge and purchase intention; Model 2 reports the effect of product-related knowledge on attitude; Model 3 shows the association between purchase intention and attitude. Since all models indicate significant relationships, the author proceeds to another

step and run Model 4 including both product-related knowledge as well as attitude. The results confirm partial mediation, i.e., supporting H4 and H5.

Figure 9: Analysis of the mediation hypothesis (n=109)

Independent		Dependent	coefficient	p-value	
Product knowledge	→	Intention	0.347	0.000***	Supported in Model 1
Product knowledge	→	Attitude	0.318	0.001***	Supported in Model 2
Attitude	→	Intention	0.650	0.000***	Supported in Model 3
Product knowledge	→	Intention	0.153	0.059*	Supported in Model 4
Attitude			0.611	0.000***	

Note: p-values in parentheses: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

5 Discussion

This paper uses the well-established social-psychological model (TPB) to examine the purchase intention of the young generation towards remanufactured white goods. Consistent with TPB, the results shown that all key predictor (i.e., attitude, subjective norm and perceived behavioural control) are positively and significantly associated with the young consumer's purchase intention. Moreover, the author highlights the importance of product-related knowledge, which influences consumer's attitude and consequently also determinates the purchase intention.

In this respect, the consumer's attitude has shown as a key element (with the strongest effect) in the process of purchasing remanufactured white goods (also confirm by Jiménez-para et al., 2014; Khor and Hazen, 2017). Moreover, since the attitude is also positively influenced by product-related knowledge (support by e.g., Singhal et al., 2019), the more educated consumers are about the remanufactured products, the more favourable the attitude towards these products they hold. Based on these findings, the author states that if the consumer has a higher level of knowledge related to remanufactured white goods, especially as regards their benefits, his/her purchase intention will also increase.

Additionally, the young consumer's purchase intention is also significantly influenced by subjective norm (i.e., social pressure exerted from people that are important in the individuals' life such as family, friends, teachers, etc.). This finding supports the results of Jiménez-para et al. (2014) and Khor and Hazen (2017). Moreover, the strength of the effect indicates, that this factor also significantly influences young consumer's purchase intention. For this reason, young consumers are intensively influenced by social media, where they stay in contact with close people to them (Seemiller & Grace, 2016). Thus, it is not surprising, that the opinion of these people is important for them.

The findings also reveal that purchase behavioural control has a positive impact on young customer's purchase intention. This result is in contradiction with the findings of Khor and Hazen (2017) and Singhal et al. (2019). This can be partly explained by the fact that young customers use the internet on the daily base, so there is no problem for them to find needed information, such as a place, where to buy remanufactured products.

Moreover, we are living in a world where consumers can buy goods online in seconds, which saving time.

6 Conclusion

In response to new the effort of white goods producers to sell remanufactured version of these products, the main purpose of this study was to investigate how product-related knowledge influences the young generation's purchase intention towards remanufactured white goods. The presented survey is conducted on a sample of 234 students attending the seconds biggest university in the Czech Republic – Masaryk University. Based on the presented results, the study leads to two major findings. First, the author concludes that the purchase intention of the young generation is positively influenced by the consumer's attitude, subjective norm and perceived behavioural control. Secondly, the author states that purchase intention is also influenced by product-related knowledge, however, via the consumer's attitude.

Moreover, this paper contributes to the current research in many areas of the circular economy. First, it provides a deeper understanding of the young generation, which becomes a new purchase power and its habits considerably differ from the habit of the older generation. Secondly, the study brings several practical and theoretical implications. Since the knowledge positively influences the attitude, which is decisive for consumer's acceptance of remanufactured products, the remanufactures and marketing managers should put more attention to promoting information about benefits, specifications and warranty of remanufactured products. Moreover, they may provide educational materials to help consumers to eliminate their negative perception of these products. Thirdly, the study also contributes to the existing literature by confirming the applicability of TPB in the context of remanufactured products.

The presented study also has several limitations. First, the generalizability of the chosen sample is limited. Although the university students are potential consumers of the remanufactured product, in 2017 only 20 % of the Czech population were university graduates (Báčová, 2018). This leads to non-random convenience sampling errors. Therefore, future studies may focus on the young population which finishes its education at high school. Secondly, the study focusses only on the purchase intention towards remanufactured white goods (i.e., fridges, washing machines and household electrical appliances). Since the remanufactured products exist in a wide range, the future research can investigate the consumer's purchase intention towards remanufactured automobile parts, office furniture or electronics (e.g., laptops, mobile phones, cameras, mp3 players). Thirdly, the author uses only the basic TPB model, although Ajzen (1991) recommends incorporating additional variables. Since the remanufactured products bring environmentally benefits the inclusion of new constructs (e.g., environmental concern) in the TPB would be more than desirable.

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References

- Ajzen, I., (1985) "From intentions to actions: A theory of planned behaviour", In Action control, Springer, Berlin, Heidelberg, pp. 11-39.
- Ajzen, I., (1991) "The theory of planned behavior, organizational behavior and human decision processes", vol. 50., pp. 93-114.
- Atasu, A., Guide Jr, V. D. R., & Van Wassenhove, L. N. (2010). "So What If Remanufacturing Cannibalizes My New Product Sales?" California Management Review, Vol. 52, No. 2, pp. 56–76.
- Báčová P., (2018) Podíl vysokoškoláků máme nižší než EU, [online]. Retrieved from: <<https://www.czso.cz/csu/czso/podil-vysokoskolaku-mame-nizsi-nez-eu>> On April 18nd 2019.
- Baron, R. M., & Kenny, D. A., (1986) "The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations", Journal of personality and social psychology, Vol. 51, No. 6, pp. 1173.
- Brucks, M., (1985) „The Effects of Product Class Knowledge on Information Search Behavior", Journal of Consumer Research, Vol. 12, No. 1, pp. 1–16.
- Fabrigar, L. R., Petty, R. E., Smith, S. M., & Crites Jr, S. L. (2006) „Understanding knowledge effects on attitude-behavior consistency: The role of relevance, complexity, and amount of knowledge", Journal of Personality and Social Psychology, Vol. 90, No. 4, pp. 556–577.
- Giutini, R., & Gaudette, K. (2003) „Remanufacturing: The next great opportunity for boosting US productivity", Business Horizons, Vol. 46, No. 6, pp. 41–48.
- Edbring, E. G., Lehner, M., & Mont, O. (2016) „Exploring consumer attitudes to alternative models of consumption: motivations and barriers", Journal of Cleaner Production Vol. 123, pp. 5–15.
- Eger, L., (2015) "Is Facebook a Similar Learning Tool for University Students as LMS?", Procedia - Social and Behavioral Sciences, Vol. 203, pp. 233–238.
- Fornell, C., & Larcker, D. F., (1981) "Evaluating structural equation models with unobservable variables and measurement error", Journal of Marketing Research, Vol. 18, No. 1, pp. 39–50.
- Hair, J. F., Anderson, R. E., Babin, B. J., & Black, W. C., (2010) Multivariate data analysis: A global perspective. A global perspective (7th ed.), Upper Saddle River.
- Hazen, B. T., Mollenkopf, D. A., & Wang, Y., (2017) „Remanufacturing for the Circular Economy: An Examination of Consumer Switching Behavior", Business Strategy and the Environment, Vol. 26, No. 4, pp. 451–464.
- Hazen, B. T., Overstreet, R. E., Jones-Farmer, L. A., & Field, H. S., (2012) „The role of ambiguity tolerance in consumer perception of remanufactured products". International Journal of Production Economics, Vol. 135, No. 2, pp. 781–790.
- Chen, M. F., & Tung, P. J., (2014) „Developing an extended Theory of Planned Behavior model to predict consumers' intention to visit green hotels". International Journal of Hospitality Management, Vol. 36, pp. 221–230.
- Jiménez-Parra, B., Rubio, S., & Vicente-Molina, M. A. (2014) „Key drivers in the behavior of potential consumers of remanufactured products: a study on laptops in Spain", Journal of Cleaner Production, Vol. 85, pp. 488–496.

- Khor, K. S., & Hazen, B. T., (2017) „Remanufactured products purchase intentions and behaviour: Evidence from Malaysia". *International Journal of Production Research*, Vol. 55, No. 8, pp. 2149–2162.
- Kline, Rex B., (2015). *Principles and Practice of Structural Equation Modeling*, Fourth Edition. Guilford Publications.
- Lin, L. Y., & Chen, C. S., (2006) “The influence of the country-of-origin image, product knowledge and product involvement on consumer purchase decisions: an empirical study of insurance and catering services in Taiwan”, *Journal of consumer Marketing*, Vol. 23, No. 5, pp. 248–265.
- Michaud, Céline a Daniel Llerena., (2011) „Green Consumer Behaviour: An Experimental Analysis of Willingness to Pay for Remanufactured Products", *Business Strategy and the Environment* Vol. 20, No. 6, pp. 408–420.
- Satterthwaite, D., (2008) „Cities’ Contribution to Global Warming: Notes on the Allocation of Greenhouse Gas Emissions", *Environment and Urbanization*, Vol. 20, No. 2, pp. 539–49.
- Seemiller, C., & Grace, M., (2016) *Generation Z goes to college*. John Wiley & Sons.
- Singhal, D., Tripathy, S., & Jena, S. K., (2019) „Acceptance of remanufactured products in the circular economy: an empirical study in India", *Management Decision*, Vol. 57, No. 4, pp. 953–970.
- Smith, S., & Paladino, A. (2010) „Eating clean and green? Investigating consumer motivations towards the purchase of organic food", *Australasian Marketing Journal*, Vol. 18, No. 2, pp. 93–104.
- Taufique, K. M. R., Vocino, A., & Polonsky, M. J. (2017) „The influence of eco-label knowledge and trust on pro-environmental consumer behaviour in an emerging market", *Journal of Strategic Marketing*, Vol. 25, No. 7, pp. 511–529.
- Vafadarnikjoo, A., Mishra, N., Govindan, K., & Chalvatzis, K., (2018) „Assessment of consumers’ motivations to purchase a remanufactured product by applying Fuzzy Delphi method and single valued neutrosophic sets", *Journal of Cleaner Production*, Vol. 196, pp. 230–244.
- Wahjudi, D., Gan, S. S., Anggono, J., & Tanoto, Y. Y. (2018). “FACTORS AFFECTING PURCHASE INTENTION OF REMANUFACTURED SHORT LIFE-CYCLE PRODUCTS”, *International Journal of Business & Society*, Vo. 19, No. 2.
- Wang, S., Wang, J., Yang, F., Wang, Y., & Li, J., (2018) „Consumer Familiarity, Ambiguity Tolerance, and Purchase Behavior toward Remanufactured Products: The Implications for Remanufacturers". *Business Strategy and the Environment*, Vol. 27, No. 8, pp. 1741–1750.
- Wang, Y., & Hazen, B. T., (2016) “Consumer product knowledge and intention to purchase remanufactured products”, *International Journal of Production Economics*, Vol. 181, pp. 460–469.
- Wang, Y., Hazen, B. T., & Mollenkopf, D. A., (2018) “Consumer value considerations and adoption of remanufactured products in closed-loop supply chains”, *Industrial Management & Data Systems*, Vol. 118, No. 2, pp. 480–498.
- Wang, Y., Wiegerinck, V., Krikke, H., & Zhang, H., (2013) “Understanding the purchase intention towards remanufactured product in closed-loop supply chains: An empirical study in China”, *International Journal of Physical Distribution & Logistics Management*, Vol. 43, No. 10, pp. 866–888.
- Wood, W., Rhodes, N., & Biek, M., (1995) “Working knowledge and attitude strength: An information-processing analysis”, *Attitude strength: Antecedents and consequences*, Vol. 4, pp. 189–202.
- Wu, C. H., (2012) “Price and service competition between new and remanufactured products in a two-echelon supply chain” *International Journal of Production Economics*, Vol. 140, No. 1, pp. 496–507.

- Xu, X., Zeng, S., & He, Y., (2017) "The influence of e-services on customer online purchasing behavior toward remanufactured products", *International Journal of Production Economics*, Vol. 187, pp. 113-125.
- Yadav, R., & Pathak, G. S., (2016) "Intention to purchase organic food among young consumers: Evidences from a developing nation", *Appetite*, Vol. 96, pp. 122-128.
- Zagata, L., (2012) „Consumers’ beliefs and behavioural intentions towards organic food. Evidence from the Czech Republic", *Appetite*, Vol. 59, No. 1, pp. 81–89.

Appendix

A: Questionnaire items and their source of adoption.

Constructs	Items	Source
<i>Product-related knowledge</i>	<ol style="list-style-type: none"> 1. I am familiar with the environmental impact of remanufactured white goods. 2. I am familiar with the quality of remanufactured white goods. 3. I am familiar with the price level of remanufactured white goods. 	Wang et al. (2013);
<i>Attitude</i>	<ol style="list-style-type: none"> 1. In general, I think that buying remanufactured white goods is a good idea. 2. Buying remanufactured white goods is a wise choice. 3. I have a favorable attitude toward buying remanufactured white goods. 4. I like the idea of buying remanufactured white goods. 	Wang et al. (2013); Wang et al. (2018);
<i>Subjective norms</i>	<ol style="list-style-type: none"> 1. Those who are important to me (such as families and friends) would support me to buy remanufactured white goods. 2. Those who have important influences on me (such as my boss and teachers) think that I should buy remanufactured white goods. 3. People whose opinion I value would agree with my decision to buy remanufactured white goods. 	Wang et al., (2013); Singhal et al. (2019)
<i>Perceived behavioral control</i>	<ol style="list-style-type: none"> 1. If I decide to buy remanufactured white goods, I know where I can go to buy them. 2. I have the resources (i.e., time and money) to buy remanufactured white goods. 3. Whether or not I buy remanufactured white goods is entirely up to me. 	Wang et al. (2018); Singhal et al. (2019)
<i>Purchase intention</i>	<ol style="list-style-type: none"> 1. I am likely to purchase remanufactured products in the near future. 2. I will encourage my relatives and friends in their decision to buy remanufactured products. 3. When I have to choose between new and remanufactured products, I will choose the remanufactured version. 	Wang et al. (2018); Singhal et al. (2019)

Networks and the Transition to Circular Business Models

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Abstract

The shifting to a circular economy (CE) demands the understanding of how companies can introduce circularity into their business models, that is, how companies develop and implement circular business models. In this process networks assume a critical role.

This paper contributes to the theoretical grounding of the role of network forms of organization for Circular Economy, by providing an analysis on how networks have been integrated into the CE literature. For that, it draws on bibliometrics to map and analyze the evolution of the literature on Circular Economy that mentions networks. Moreover, it conducts a systematic literature review (SLR) considering five analytical dimensions: 1) research method used; 2) level of analysis of the study; 3) type of actors in the analysis/network; 4) purpose of the network; 5) network building strategies and challenges.

The results show that the integration of networks in the CE is being accomplished using a diverse set of methodologies, with an underrepresentation of social network analysis and covering several levels of analysis (micro, meso and macro). Studies tend to stress relations inside the value-chain established to manage physical and energy flows. The CE literature also tackles the main challenges in network management, namely coordination, trust and alignment.

Keywords – Network, Circular Economy, Circular Business Model, Bibliometrics, Systematic Literature Review

Paper type – Academic Research Paper

1 Introduction

The main idea behind a Circular Economy (CE) is to develop an economic model in which the production of waste is minimal and resources are used several times to create value (EC, 2014). The shifting to a circular economy demands the understanding of how companies can introduce circularity into their business models, that is, how companies develop and implement Circular Business Models (CBMs)(Lewandowski, 2016).

A CBM can be defined as “a business model in which the conceptual logic for value creation is based on utilizing economic value retained in products after use in the production of new offerings. Thus, a circular business model implies a return flow to the producer from users, though there can be intermediaries between the two parties” (Linder & Williander, 2015: 2).

The literature on CE has already concluded that CBMs have some specific traits since the implementation of CE principles should affect all the BM building blocks, due to the above-mentioned change in the logic behind value creation, delivery, and capture. Some examples found in extant literature are:

- New value propositions, namely based on longer product life cycles, designing for more durable products (Hawken et al. 2000), supporting the end of life strategies and on higher customer service levels (Barquet et al. 2013; Bocken et al. 2016);
- New customer relationships, namely those that promote the shared use of products among users (collaborative consumption) and reward customers that embrace CE behaviors (Bocken et al. 2016);
- New revenue models, namely those based in selling services (instead of selling products), leasing or accessing the products under the pay per use mechanisms (Barquet et al. 2013);
- New key activities, related to closing supply chain loops, like reverse logistics and maintenance (Bocken et al. 2016), enabling components and materials to enter again the production process (Wells & Seitz 2005).

However, scholars have been given less attention to the key partnerships and networks that need to be built in order to implement CBMs. These networks should underlie the relations with all stakeholders and support the new aspects of BM mentioned above, with emphasis on developing new revenue models and closing the supply chain loops.

The paper addresses this gap by contributing to the theoretical grounding of the role of network forms of organization for CE. For that, it draws on bibliometrics to map and analyze the evolution of the literature on Circular Economy that mentions networks. Moreover, it conducts a systematic literature review (SLR) in the two most relevant bibliographic academic databases: SCOPUS and Web of Science.

The paper is structured as follows: section 2 presents the potential of network theory and analysis for the CE literature; section 3 presents the methodology used for the SLR and the results from the bibliometrics analysis; section 4 presents the results from the SLR; and section 5 concludes.

2 Networks as an important form of organization in the Circular Economy

In this section, we resort to some of the main lessons from the literature on network forms of organization from strategy, innovation, and organizational studies. This literature may provide useful insights into the role and configuration of networks for the transition to a CE.

Collaboration with other organizations and actors has long been acknowledged as vital for innovation and value creation (Ahuja, 2000; Lechner & Dowling 2003; Powel et al 1996; Romero & Molina 2011). Through networks companies access a wide variety of resources; perform collaborative R&D, product co-creation, production, and commercial activities; share risks and investments; and get legitimization and counseling.

Network forms of organization are particularly relevant when ambitious, radical and disruptive transformations are at stake, involving risk and experimentation, and where inertia and resistance can hinder the change (Hill & Rothaermel, 2003; Lahti et al, 2018), as is the case of the transition to a CE. It is acknowledged that one single enterprise does not own the entire set of skills and resources required to deliver its value proposition

According to the literature, collaborations can assume diverse formulas. They often materialize in formalized, inter-organizational partnerships/alliances, contractual agreements and joint ventures along the value chain (Ahuja, 2000; Gulati, 1998), or with stakeholders outside the value chain (Geissdoerfer et al, 2018). Collaborations can also be kept in an informal, more personal-based form (Salavisa et al, 2012). These diverse configurations, namely formal and informal relations should also be relevant for the transition to a CE, as suggested by Velenturf & Jensen (2016).

Among the relevant partners, previous research has highlighted the role of other companies, namely competitors, suppliers and clients, universities and research centers and public entities (Baum et al, 2000). It has shown that the diversity of actors in the network impacts on its performance (Nieto & Santamaría, 2007). Partners bring specialized and complementary resources and capabilities (Dyer & Singh, 1998). In the case of the transition to a CE, it is important to cooperate with a broad range of stakeholders (Geissdoerfer et al, 2018), and therefore multi-actor networks should be present. CE scholars suggest that collaborating with actors inside the supply chain is important in order to close material loops (Bocken et al. 2016; Rizos et al. 2016), collaborations with specialized service providers (e.g logistics and after-service) in order to ensure reverse logistics and customer satisfaction (Lahti et al, 2018; Lewandowski 2016), and collaboration with users and clients in order to redesign products for the CE (Bocken et al. 2016; Tukker 2004). These collaborations involve both large companies and SMEs, namely start-ups exploiting new business opportunities and using CBM from the start (Lahti et al, 2018).

Networks also serve as conduits for accessing resources, with emphasis on intangible ones like technological knowledge, know-how, expertise, information and legitimization (Salavisa et al, 2012). Therefore, networks can be built or mobilized to access several tangible and intangible resources for the transition to a CE. As mention in the introduction, when firms are embracing the CE principles they must perform new activities and use a new set of resources and capabilities. The creation of formal partnerships or informal networking enables to access them without huge in-house investments.

Finally, the literature also stresses that building of networks is a complex process, relying on governance mechanisms based on reciprocity, reputation, and trust that demand long-term and recurrent interactions (Gulati, 1995; Powell, 1990). They involve

complex interdependencies among partners and have a reflex on actors' behaviors and strategies (Kim et al, 2006; Powel, 1990). Coordination and alignment between partners are vital to meet benefits, not only at the economic level but also at social and environmental levels that are of utmost importance in CE. The transition to CBMs may demand the reconstruction of the firm's network, since traditional partners may be not aligned with the principles of CE. Therefore, partner selection is also an important topic for the development of CBM.

3 Method

3.1 Systematic Literature Review: Advantages and Procedures

In order to detect the knowledge stemming from network literature and how it is being adapted within circular economy studies a Systematic Literature Review (SLR) was conducted. A SLR is a way to summarize existing evidence, identify gaps and suggest some directions for future research and enables to "comprehensively identify, appraise and synthesize all relevant studies on a given topic" (Petticrew & Roberts 2006: 19). This approach requires scholars to provide explicit and rigorous criteria for searching, including, evaluating and synthesizing the literature. Decisions are noted down, leaving an audit trail, in order to assure its replicability and transparency (Tranfield, et al, 2003).

The search of the literature was made on the two most relevant bibliographic databases: SCOPUS and Web of Science. The steps used for the search and selection of documents are presented in table 1.

Table 1. Systematic literature review procedures

Step	Decision	Comment / Result
Selection of the database	SCOPUS Web of Science	databases containing journals that are generally highly regarded by the academic community; large number of sources, providing broad coverage of the academic literature
Keyword search SCOPUS	Search query: TITLE-ABS-KEY(network* AND "circular economy")	N = 256
Keyword search Web of Science (all databases)	TOPIC: (network* AND "circular economy")	N = 246
Inclusion criteria	Document type = Article OR Article in Press Language = English	SCOPUS: N = 127 Web of Science: N = 132
Database integration	Exclusion of duplicates (documents that are in both databases)	N = 183
First scanning through title, abstract and keyword reading	Exclude 41 papers because did not meet the research criteria, as did not contain the words "network" or "circular economy" within the title, abstract and keywords Exclude 37 papers because they were out of scope (e.g papers dealing with the optimization of materials or energy Flows, namely in	N = 105

	industrial parks, industrial symbiosis or waste collection networks; bibliometric studies using social network analysis)	
Access check	4 articles were excluded because full text was not available	N = 101

Source: Author's own elaboration

Therefore, the database used for the SLR has 101 papers. The SLR was organized in five structural dimensions: 1) research method used; 2) level of analysis of the study; 3) type of actors in the analysis/network; 4) purpose of the network; 5) network building strategies and challenges. For each dimension, several analytical categories were considered. Initially, a deductive approach was used, based on the literature review on networks presented in section 2. After the analysis of the documents, new analytical categories were introduced in an inductive procedure, namely the separation between single and multiple case studies in the research method, and build business models in the network purpose.

Table 2 summarizes the structural dimensions and the analytical categories used in the analysis of each document.

Table 2. Dimensions and categories used in the systematic literature review

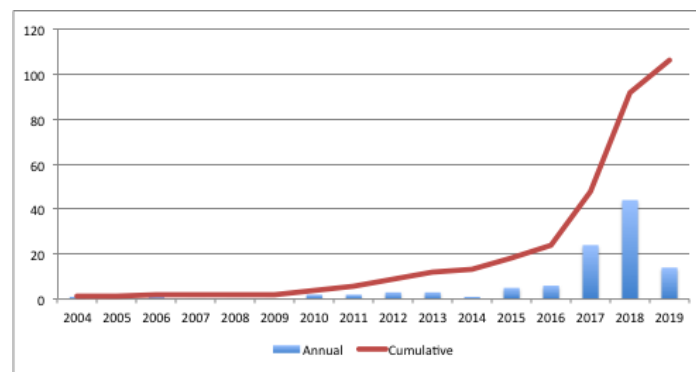
Dimension	Categories
Research method	Theoretical, conceptual and literature review Single case study Multiple case studies Social network analysis (SNA) Models and methods for decision making Other quantitative approaches Other qualitative approaches
Level of analysis	Micro - Firm-level network Industrial symbiosis or industrial parks Supply chain Macro
Actors	Companies in the value chain Other companies Universities and research centres Governments Other stakeholders
Purpose	Close material loops Flow management (e.g. materials, energy) Access to complementary services Product/solution design/development Access to knowledge and information Build business models Access to other resources/capabilities
Network building strategies and challenges	Selection/identification of partners Trust Alignment Coordination Other aspects

Source: Author's own elaboration

3.2 Bibliometrics analysis

The bibliometrics consists in a quantitative analysis of the bibliographic references of a body of literature (Hawkins, 1977), enabling to detect patterns of authorship and publication strategies (Lancaster, 1977), as well as the development of scientific fields (Calero-Medina & Noyons, 2008). In the context of this research, bibliometrics enables the characterization of the database extracted before access check (N=105).

The evolution of the number of papers reveals that networks only recently have become a research topic in the CE literature. Prior to 2010, few studies were published as indicated by the low number of annual publications. Moreover, over three-quarters of the documents were published in the last 2 years (2017 – March 2019).



Source: Author's own elaboration

Figure 1. Evolution of the number of publications (annual and cumulative), until March 2019

Most of these articles were published in journals that have environmental topics (Figure 2), with emphasis to Journal of Cleaner Production (with almost ¼ of the papers) and Resource Conservation and Recycling (with 10% of the papers), which are prominent journals in the area of circular economy (Merli et al, 2018). The 4 most productive journals account for 37.1% of the published articles.



Source: Author's own elaboration

Figure 2. Number of articles per journal (journals with at least 2 articles)

The papers involve a total of 352 authors, most of which (91.8%) have only one paper on this topic. The authors with more than 2 articles are listed in table 3, where one can observe a predominance of Chinese and Japanese authors.

Table 3. Authors with more than 2 articles

Author	Number of papers	Country of affiliation
Bocken, N.	4	Sweden
Dong, L.	4	Japan
Fujii, M.	3	Japan
Geng, Y.	3	China
Liu, Y.	3	China
Wang, Y.	3	China

Source: Author's own elaboration

Table 4 lists the six articles with more than 50 citations. From these, three articles have more than 100 citations in both databases, all originally published between 2010 and 2012, being among the first papers in the topic covered in this analysis.

Table 4. Most cited articles (more than 50 citations)

Paper	Scopus	Web of Science
Shi, H., Chertow, M., & Song, Y. (2010)	177	171
Chertow, M., & Ehrenfeld, J. (2012)	155	145
Boons, F., Spekkink, W., & Mouzakitis, Y. (2011)	127	113
Gregson, N., Crang, M., Fuller, S., & Holmes, H. (2015).	91	75
Dong, L., Zhang, H., Fujita, T., Ohnishi, S., Li, H., Fujii, M., & Dong, H. (2013)	77	67
Winkler, H. (2011)	69	-

Source: Author's own elaboration

4 Results

This section presents the results of the SLR, using the dimensions and categories presented in the Table 2. In this analysis, each document can be simultaneously assigned to more than one analytical category, and therefore, the total count of documents in each dimension may differ.

4.1 Research method

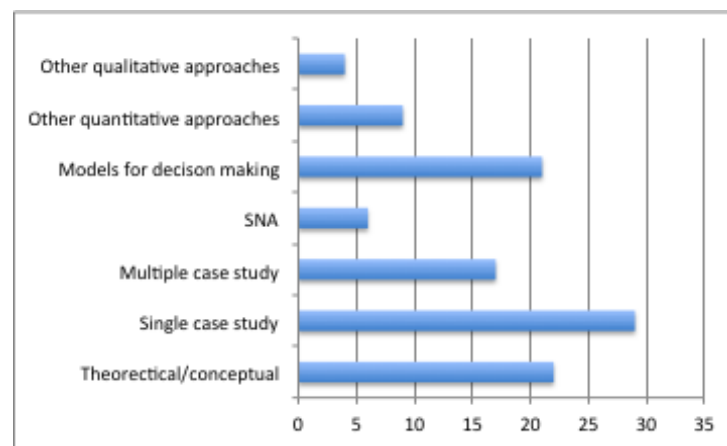
Around 1/5 of the studies have a theoretical, conceptual or review nature. Authors are proposing new frameworks or reviewing the state-of-the-art. This is the case of half of the most cited documents mentioned in the previous section (Boons et al, 2011; Chertow & Ehrenfeld, 2012; Winkler, 2011)

Most empirical studies use a case study methodology, either focusing on a single case or using multiple cases for comparison and generalisation. Some cases studies are combined with models for decision-making (e.g. Accorsi et al, 2015; Dong et al, 2016; Promentilla et al, 2016).

Quantitative methodologies are frequently employed to solve problem of optimization of material flows (waste, energy, by-products) and to help decision-making, either by

firms or network planners, namely in terms network design and location of facilities. Scholars use a diverse set of approaches, including mix integer linear programming (Accorsi et al, 2015; Bangera et al, 2018; Rentizelas et al, 2018), agent-based models (Fraccascia & Yazan, 2018; Lieder et al, 2017), and Life Cycle Assessment (Krystofik et al, 2018; Piezer et al, 2019). Other quantitative approaches, like regressions and cluster analysis, are also used, but less often (e.g. Bag et al, 2019; Barrie et al, 2019; Dubey et al, 2018).

Surprisingly, social network analysis (SNA) is not often employed in this literature. Only six studies use this methodological approach. This is unexpected because SNA is a tool that enables to understand and mapping networks and to analyse the actors/stakeholders in terms of their position in the network, reflecting their power and roles (namely in terms of coordination and brokerage) (Scott, 2000).



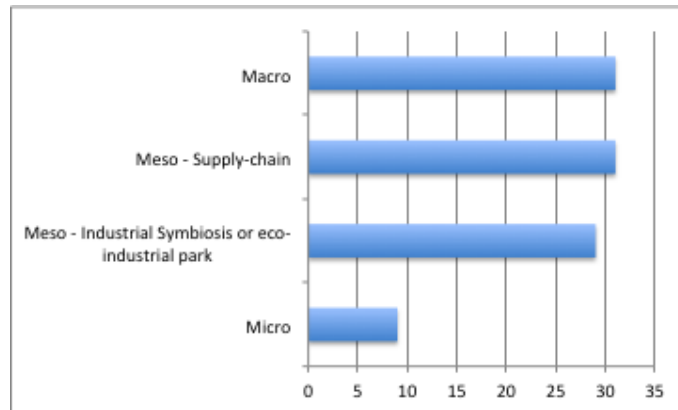
Source: Author's own elaboration

Figure 3. Research method employed in the studies

4.2 Level of analysis

Most studies have a meso perspective, focusing either on networks related to industrial symbiosis and industrial parks (e.g. Boons et al, 2011; Chertow & Ehrenfeld, 2012; Dong et al, 2013; Shi et al, 2010), or on networks related to specific supply-chains (e.g. Accorsi et al, 2015; Lin et al, 2018; Winkler, 2011).

The macro level includes networks developed at a city, region or national level (e.g. Gregson et al, 2015; Nuss et al, 2019; Tong et al, 2018) and networks related to the promotion of the circular economy principles (e.g. Barrie et al, 2019; Ogondo et al, 2013; Pialot et al, 2017; Spring & Araujo, 2017). Finally, in the micro level, authors are focusing on the networks at the firm level (Dubey et al, 2019; Hsieh et al, 2017; Niero et al, 2017).

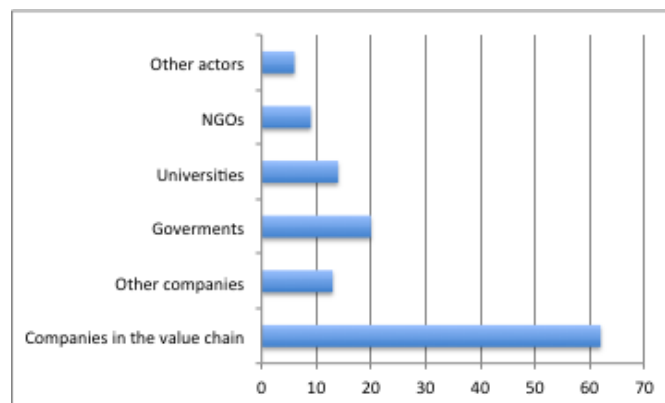


Source: Author's own elaboration

Figure 4. Level of analysis adopted in the studies

4.3 Actors/Stakeholders

Regarding the network actors/stakeholders considered in the analysis, the majority of studies is concerned with the role of companies in the value chain, namely in terms of material flows. Governments (either central or local) are also included in a large number of studies, stressing its role in policy-making (e.g. Gumley, 2014; Lokesh, 2018), partnership creation (Baldassarre et al, 2019) or public procurement (Abreu et al, 2018). Fewer studies include other actors: universities (e.g. Mengal et al, 2018; Perey et al, 2018), companies outside the value chain (e.g. Shi et al, 2010; Winkler, 2011), NGOs (e.g. Herczeg et al, 2018; Kristensen et al, 2016; Mathews et al, 2018) or stakeholders like citizens (Hsieh et al, 2017; Petrescu et al, 2016), consumers (Korhonen et al, 2018; Pialot et al, 2017) and regulatory bodies (Mulrow et al, 2017). Some scholars stress the need to develop networks with a diverse/heterogeneous set of actors (e.g. Bellantuono et al, 2017; Domenech et al, 2019; Giezen, 2018; Wang et al, 2017), or the need to develop tripartite networks including companies, public organisations and the academia (e.g. Barrie et al, 2019; Dong et al, 2016).



Source: Author's own elaboration

Figure 5. Network actors/stakeholders included in the analysis

4.4 Purpose of the network

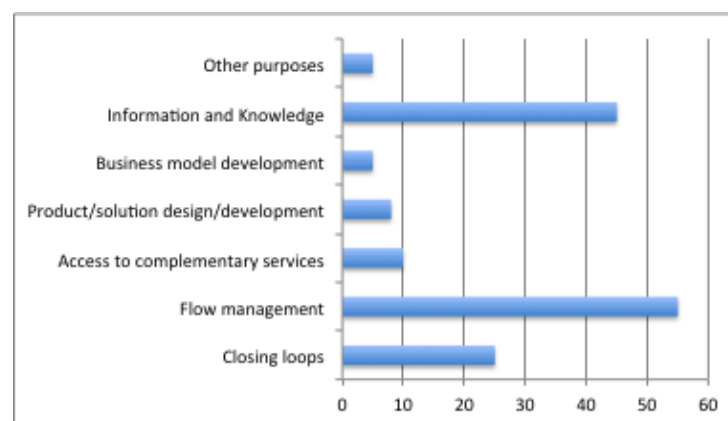
The documents reflect two main reasons for networking behaviour: the management of physical (by-products, materials, waste), energy and monetary flows and the access to knowledge and information.

The management of flows is vital for replacing the linear take-make-disposal/waste model and attaining circularity (Ghisellini et al, 2016), as stressed by the definition of CBE previously presented. Therefore, this is not an unexpected result. The number of studies explicitly addressing the closing of loops is considerably lower, when compared to the number of studies that tackle the issue of flow management.

The relevance of networking to access knowledge and information, strongly acknowledged in innovation studies, is also recognised in these documents. Scholars not only stress the relevance of partnerships to access and sharing knowledge and information, but also to generate new knowledge (e.g. Barrie et al, 2017; Mathews et al, 2018). Some authors distinguish between types of knowledge (for instance explicit vs tacit) (e.g. Aid et al, 2017; Barrie et al, 2019). Several studies (15) stress the role of digital technologies in facilitating information sharing between the network members (e.g. Dino et al, 2017; Dounavis et al, 2019; Fraccascia & Yazan, 2018). This information sharing is related to the path of material flows and to the quality of materials and partners and enables to reduce transaction costs along the value chain.

Access to complementary services through partnerships with third-party service providers for logistics, waste management, IT and remanufacturing is also highlighted in some studies (e.g. Bernon et al, 2018; Perey et al, 2018).

The authors also address the use of networks for co-creation and development of products/solutions (e.g. Brown et al, 2019; Leising et al, 2018; Niero et al, 2017) and business models (e.g. Mengal et al, 2018; Perey et al, 2018). Other purposes include credibility (Gavertsson et al, 2018) and vision (Mengal et al, 2018; Parida & Wincent, 2019) building.



Source: Author's own elaboration

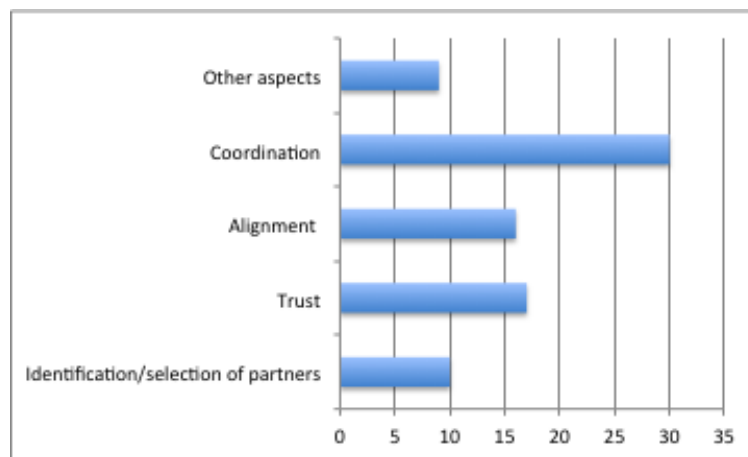
Figure 6. Network purpose

4.5 Network building strategies and challenges

The last dimension of the SLR is related to the network building strategies and challenges in network management. All categories traditionally acknowledge in the network literature are present in this set of studies, chiefly those related to the governance of the network: coordination, trust and alignment.

The coordination challenge is usually raised in the debate between decentralised, bottom-up networks versus planned top-down initiatives (e.g. Giezen, 2018; Guo et al, 2016; Mengal et al, 2018) and to some specific roles that some actors may perform in structuring the network (e.g. Prosman et al, 2017; Zucchella & Previtali, 2019). Some scholars also stress the need to deal with conflict management (Baldassarre et al, 2019; Gupta et al, 2018; Petrescu et al, 2016).

Alignment issues cover a wide range of challenges, namely interest and vision alignment (e.g. Sellitto & Murakami, 2018; Strebel & Posch, 2004), collective goal setting (Aid et al, 2017), expectation management (Baldassare et al, 2019; Barrie et al, 2019) and culture (Walls & Paquin, 2015).



Source: Author's own elaboration

Figure 7. Network building strategies and challenges

5 Conclusions

This paper provides an analysis on how networks have been integrated into the CE literature. For that, it draws on bibliometrics to map the evolution of the literature on Circular Economy that mentions networks, showing that only very recently the CE scholars started to pay attention to the role of networks, since the majority of the studies has 2 years or less.

Moreover, the paper conducts a SLR considering five analytical dimensions: 1) research method 2) level of analysis; 3) type of actors; 4) purpose of the network; 5) network building strategies and challenges.

The results show that the integration of networks in the CE is being accomplished using a diverse set of methodologies, with an underrepresentation of social network analysis and an emphasis on case studies and decision making models (optimization of material flows and facility location). Studies cover all levels of analysis (micro, meso and macro) and tend to stress relations inside the value-chain established to manage physical and energy flows. Despite this fact, there is also the acknowledgement of the role of other stakeholders (e.g. government and universities) and network purposes, like access to information and knowledge. Moreover, the CE literature tackles the main challenges in network management, namely coordination, trust and alignment.

Further research is needed in order to perform a more fine-grain analysis of the contributions of the network theory to the design and implementation of circular business models.

References

- Abreu, M.C.S.D., & Ceglia, D. (2018). On the implementation of a circular economy: The role of institutional capacity-building through industrial symbiosis. *Resources, Conservation and Recycling*, 138, 99–109.
- Accorsi, R., Manzini, R., Pini, C., & Penazzi, S. (2015). On the design of closed-loop networks for product life cycle management: Economic, environmental and geography considerations. *Journal of Transport Geography*, 48, 121–134.
- Aid, G., Eklund, M., Anderberg, S., & Baas, L. (2017). Expanding roles for the Swedish waste management sector in inter-organizational resource management. *Resources, Conservation and Recycling*, 124, 85–97.
- Ahuja, G., (2000). Collaboration networks, structural holes, and innovation: a longitudinal study, *Administrative Science Quarterly*, 45, 425–455.
- Bag, S., Gupta, S., & Foropon, C. (2019). Examining the role of dynamic remanufacturing capability on supply chain resilience in circular economy. *Management Decision*, 57(4), 863–885.
- Baldassarre, B., Schepers, M., Bocken, N., Cuppen, E., Korevaar, G., & Calabretta, G. (2019). Industrial Symbiosis: towards a design process for eco-industrial clusters by integrating Circular Economy and Industrial Ecology perspectives. *Journal of Cleaner Production*, 216, 446–460.
- Banguera, L.A., Sepúlveda, J.M., Ternero, R., Vargas, M., & Vásquez, Ó.C. (2018). Reverse logistics network design under extended producer responsibility: The case of out-of-use tires in the Gran Santiago city of Chile. *International Journal of Production Economics*, 205, 193–200.
- Barquet, A.P.B., de Oliveira, M.G., Amigo, C.R., Cunha, V.P., & Rozenfeld, H. (2013). Employing the business model concept to support the adoption of product–service systems (PSS). *Industrial Marketing Management*, 42(5), 693–704.
- Barrie, J., Zawdie, G., & João, E. (2019). Assessing the role of triple helix system intermediaries in nurturing an industrial biotechnology innovation network. *Journal of Cleaner Production*, 214, 209–223.
- Baum, J.A.C., Calabrese, T. and Silverman, B.S., (2000). Don't go it alone: alliance network composition and start-ups' performance in Canadian biotechnology, *Strategic Management Journal*, 2, 267–294.
- Bellantuono, N., Carbonara, N., & Pontrandolfo, P. (2017). The organization of eco-industrial parks and their sustainable practices. *Journal of Cleaner Production*, 161, 362–375.

- Bernon, M., Tjahjono, B., & Ripanti, E.F. (2018). Aligning retail reverse logistics practice with circular economy values: an exploratory framework. *Production Planning & Control*, 29(6), 483–497.
- Bocken, N.M., de Pauw, I., Bakker, C., and van der Grinten, B., (2016). Product design and business model strategies for a circular economy, *Journal of Industrial and Production Engineering*, 33(5), 308-320.
- Boons, F., Spekkink, W., & Mouzakitis, Y. (2011). The dynamics of industrial symbiosis: a proposal for a conceptual framework based upon a comprehensive literature review. *Journal of Cleaner Production*, 19(9–10), 905–911.
- Brown, P. J., & Bajada, C. (2018). An economic model of circular supply network dynamics: Toward an understanding of performance measurement in the context of multiple stakeholders. *Business Strategy and the Environment*, 27(5), 643–655.
- Calero-Medina, C., & Noyons, E.C. (2008). Combining mapping and citation network analysis for a better understanding of the scientific development: The case of the absorptive capacity field. *Journal of Informetrics*, 2(4), 272–279.
- Chertow, M., & Ehrenfeld, J. (2012). Organizing Self-Organizing Systems: Toward a Theory of Industrial Symbiosis. *Journal of Industrial Ecology*, 16(1), 13–27.
- Dino, G.A., Rossetti, P., Biglia, G., Sapino, M.L., Di Mauro, ... de la Feld, M. (2017). Smart ground project: A new approach to data accessibility and collection for raw materials and secondary raw materials in Europe. *Environmental Engineering and Management Journal*, 16(8), 1673–1684.
- Dong, L., Fujita, T., Dai, M., Geng, Y., Ren, J, ... Ohnishi, S. (2016). Towards preventative eco-industrial development: an industrial and urban symbiosis case in one typical industrial city in China. *Journal of Cleaner Production*, 114, 387–400.
- Domenech, T., Bleischwitz, R., Doranova, A., Panayotopoulos, D., & Roman, L. (2019). Mapping Industrial Symbiosis Development in Europe_ typologies of networks, characteristics, performance and contribution to the Circular Economy. *Resources, Conservation and Recycling*, 141, 76–98
- Dounavis, A.S., Kafasis, P., & Ntavos, N. (2019). Using an online platform for the improvement of industrial symbiosis and circular economy (in Western Macedonia, Greece). *Global Nest Journal*, 21(1), 76–81.
- Dubey, R., Gunasekaran, A., Childe, S.J., Papadopoulos, T., & Helo, P. (2018). Supplier relationship management for circular economy: influence of external pressures and top management commitment. *Management Decision*.
- Dyer, J.H. & Singh, H., (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage, *Academy of management review*, 23(4), 660-679.
- EC (European Commission) (2014). Towards a circular economy: A zero waste programme for Europe. COM(2014) 398 final.
- Fraccascia, L., & Yazan, D.M. (2018). The role of online information-sharing platforms on the performance of industrial symbiosis networks. *Resources, Conservation and Recycling*, 136, 473–485.
- Gåvertsson, I., Milios, L., & Dalhammar, C. (2018). Quality Labelling for Re-used ICT Equipment to Support Consumer Choice in the Circular Economy. *Journal of Consumer Policy*, 1-25.
- Geissdoerfer, M., Morioka, S.N., Carvalho, M.M., & Evans, S. (2018). Business models and supply chains for the circular economy. *Journal of Cleaner Production*, 190, 712-721.
- Ghisellini, P., Cialani, C. and Ulgiati, S., (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems, *Journal of Cleaner Production*, 114, 11–32.

- Giezen, M. (2018). Shifting infrastructure landscapes in a circular economy: An institutional work analysis of the water and energy sector. *Sustainability (Switzerland)*, 10(10).
- Gregson, N., Crang, M., Fuller, S., & Holmes, H. (2015). Interrogating the circular economy: the moral economy of resource recovery in the EU. *Economy and Society*, 44(2), 218–243.
- Gulati, R., (1995). Does familiarity breed trust? The implications of repeated ties for contractual choices in alliances, *Academy of Management Journal*, 38(1), 85–112.
- Gulati, R., (1998). Alliances and networks, *Strategic Management Journal*, 19, 293–317.
- Guo, B., Geng, Y., Sterr, T., Dong, L., & Liu, Y. (2016). Evaluation of promoting industrial symbiosis in a chemical industrial park: A case of Midong. *Journal of Cleaner Production*, 135, 995–1008.
- Gupta, S., Chen, H., Hazen, B.T., Kaur, S., & Gonzalez, E.D.S. (2018). Circular economy and big data analytics: A stakeholder perspective. *Technological Forecasting and Social Change*.
- Gumley, W. (2014). An analysis of regulatory strategies for recycling and re-use of metals in Australia. *Resources*, 3(2), 395–415.
- Hawken, P., Lovins, A. and Lovins, L. (2000). *Natural capitalism: The next industrial revolution*. London: Earthscan.
- Hawkins D.T. (1977). Unconventional uses of on-line Information retrieval Systems: on-line bibliometrics studies. *Journal of the American Society for Information Science*, 28(1), 13–18.
- Herczeg, G., Akkerman, R., & Hauschild, M.Z. (2018). Supply chain collaboration in industrial symbiosis networks. *Journal of Cleaner Production*, 171, 1058–1067.
- Hill, C.W. & Rothaermel, F.T., (2003). The performance of incumbent firms in the face of radical technological innovation, *Academy of Management Review*, 28(2), 257–274.
- Hsieh, Y.-C., Lin, K.-Y., Lu, C., & Rong, K. (2017). Governing a sustainable business ecosystem in Taiwan's circular economy: The story of spring pool glass. *Sustainability (Switzerland)*, 9(6).
- Kim, T.Y., Oh, H. and Swaminathan, A., (2006). Framing interorganizational network change: A network inertia perspective, *Academy of management review*, 31(3), 704–720.
- Korhonen, J., Koskivaara, A., & Toppinen, A. (2018). Riding a Trojan horse? Future pathways of the fiber-based packaging industry in the bioeconomy. *Forest Policy and Economics*.
- Kristensen, D.K., Kjeldsen, C., & Thorsøe, M.H. (2016). Enabling Sustainable Agro-Food Futures: Exploring Fault Lines and Synergies Between the Integrated Territorial Paradigm, Rural Eco-Economy and Circular Economy. *Journal of Agricultural and Environmental Ethics*, 29(5), 749–765.
- Krystofik, M., Luccitti, A., Parnell, K., & Thurston, M. (2018). Adaptive remanufacturing for multiple lifecycles: A case study in office furniture. *Resources, Conservation and Recycling*, 135, 14–23.
- Lancaster F.W. (1977). *The measurement and evaluation of library Services*. Washington D.C.: Information Resources Press.
- Lahti, T., Wincent, J. and Parida, V., (2018), A Definition and Theoretical Review of the Circular Economy, Value Creation, and Sustainable Business Models: Where Are We Now and Where Should Research Move in the Future?, *Sustainability*, 10(8), 2799.
- Lechner, C., & Dowling, M. (2003). Firm networks: external relationships as sources for the growth and competitiveness of entrepreneurial firms, *Entrepreneurship & regional development*, 15(1), 1–26.
- Leising, E., Quist, J., & Bocken, N. (2018). Circular Economy in the building sector: Three cases and a collaboration tool. *Journal of Cleaner Production*, 176, 976–989.
- Lewandowski, M., (2016). Designing the business models for circular economy—Towards the conceptual framework, *Sustainability*, 8(1), 1–28.

- Lieder, M., Asif, F.M.A., & Rashid, A. (2017). Towards Circular Economy implementation: an agent-based simulation approach for business model changes. *Autonomous Agents and Multi-Agent Systems*, 31(6), 1377–1402
- Lin, Y., Jia, H., Yang, Y., Tian, G., Tao, F., & Ling, L. (2018). An improved artificial bee colony for facility location allocation problem of end-of-life vehicles recovery network. *Journal of Cleaner Production*, 205, 134–144
- Linder, M., & Williander, M. (2015). Circular Business Model Innovation: Inherent Uncertainties. *Business Strategy and the Environment*, 26(2), 182–196.
- Lokesh, K., Ladu, L., & Summerton, L. (2018). Bridging the gaps for a «circular» bioeconomy: Selection criteria, bio-based value chain and stakeholder mapping. *Sustainability (Switzerland)*, 10(6).
- Mathews, J.A., Tan, H., & Hu, M.-C. (2018). Moving to a Circular Economy in China: Transforming Industrial Parks into Eco-industrial Parks. *California Management Review*, 60(3), 157–181.
- Mengal, P., Wubbolts, M., Zika, E., Ruiz, A., Brigitta, D., Pieniadz, A., & Black, S. (2018). Bio-based Industries Joint Undertaking: The catalyst for sustainable bio-based economic growth in Europe. *New Biotechnology*, 40, 31–39.
- Merli, R., Preziosi, M., & Acampora, A. (2018). How do scholars approach the circular economy? A systematic literature review. *Journal of Cleaner Production*, 178, 703–722.
- Mulrow, J.S., Derrible, S., Ashton, W.S., & Chopra, S.S. (2017). Industrial Symbiosis at the Facility Scale. *Journal of Industrial Ecology*, 21(3), 559–571
- Nieto, M.J. and Santamaría, L., (2007). The importance of diverse collaborative networks for the novelty of product innovation”, *Technovation*, 27(6-7), 367–377.
- Niero, M., Hauschild, M.Z., Hoffmeyer, S.B., & Olsen, S.I. (2017). Combining Eco-Efficiency and Eco-Effectiveness for Continuous Loop Beverage Packaging Systems: Lessons from the Carlsberg Circular Community. *Journal of Industrial Ecology*, 21(3), 742–753.
- Nuss, P., Ohno, H., Chen, W.-Q., & Graedel, T.E. (2019). Comparative analysis of metals use in the United States economy. *Resources, Conservation and Recycling*, 145, 448–456.
- Ongondo, F.O., Williams, I.D., Dietrich, J., & Carroll, C. (2013). ICT reuse in socio-economic enterprises. *Waste Management*, 33(12), 2600–2606.
- Parida, V., & Wincent, J. (2019). Why and how to compete through sustainability: a review and outline of trends influencing firm and network-level transformation. *International Entrepreneurship and Management Journal*, 15(1).
- Perey, R., Benn, S., Agarwal, R., & Edwards, M. (2018). The place of waste: Changing business value for the circular economy. *Business Strategy and the Environment*, 27(5), 631–642.
- Petticrew, M. & Roberts, H. (2006). *Systematic reviews in the social sciences: a practical guide*. Blackwell Publishing.
- Petrescu, D., Petcou, C., & Baibarac, C. (2016). Co-producing commons-based resilience: lessons from R-Urban. *Building Research and Information*, 44(7), 717–736.
- Pialot, O., Millet, D., & Bisiaux, J. (2017). “Upgradable PSS”: Clarifying a new concept of sustainable consumption/production based on upgradability. *Journal of Cleaner Production*, 141, 538–550
- Piezer, K., Petit-Boix, A., Sanjuan-Delmás, D., Briese, E., Celik, I., ... Apul, D. (2019). Ecological network analysis of growing tomatoes in an urban rooftop greenhouse. *Science of the Total Environment*, 651, 1495–1504.
- Powell, W.W., (1990). Neither Market nor Hierarchy: Networks forms of organization, *Research in Organizational Behavior*, 12, 295–336.
- Powell, W.W., Koput, K.W. and Smith-Doerr, L., (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology”, *Administrative science quarterly*, 41(1), 116–145.

- Promentilla, M.A.B., Bacudio, L.R., Benjamin, M.F.D., Chiu, A.S.F., Yu, K.D.S., Tan, R.R., & Aviso, K.B. (2016). Problematique approach to analyse barriers in implementing industrial ecology in philippine industrial parks. *Chemical Engineering Transactions*, 52, 811–816.
- Prosman, E.J., Waehrens, B.V., & Liotta, G. (2017). Closing Global Material Loops Initial Insights into Firm-Level Challenges. *Journal of Industrial Ecology*, 21(3), 641–650.
- Rentizelas, A., Shpakova, A., & Mašek, O. (2018). Designing an optimised supply network for sustainable conversion of waste agricultural plastics into higher value products. *Journal of Cleaner Production*, 189, 683–700.
- Rizos, V., Behrens, A., Van Der Gaast, W., Hofman, E., Ioannou, A.,... and Topi, C., (2016) Implementation of circular economy business models by small and medium-sized enterprises (SMEs): Barriers and enablers, *Sustainability*, 8(11), 1212.
- Romero, D. & Molina, A., (2011). Collaborative networked organisations and customer communities: value co-creation and co-innovation in the networking era, *Production Planning & Control*, 22(5-6), 447-472.
- Salavisa, I., Sousa, C. & Fontes, M., (2012). Topologies of innovation networks in knowledge-intensive sectors: Sectoral differences in the access to knowledge and complementary assets through formal and informal ties, *Technovation*, 32(6), 380-399.
- Sellitto, M.A., & Murakami, F.K. (2018). Industrial symbiosis: A case study involving a steelmaking, a cement manufacturing, and a zinc smelting plant. *Chemical Engineering Transactions*, 70, 211–216.
- Spring, M., & Araujo, L. (2017). Product biographies in servitization and the circular economy. *Industrial Marketing Management*, 60, 126–137.
- Strebel, H., & Posch, A. (2004). Interorganisational cooperation for sustainable management in industry: on industrial recycling networks and sustainability networks. *Progress in Industrial Ecology*, 1(4), 348–362.
- Tong, X., Wang, T., Chen, Y., & Wang, Y. (2018). Towards an inclusive circular economy: Quantifying the spatial flows of e-waste through the informal sector in China. *Resources, Conservation and Recycling*, 135, 163–171.
- Tranfield, D., Denyer, D. and Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British journal of management*, 14(3), 207-222.
- Tukker, A., (2004). Eight types of product–service system: eight ways to sustainability? Experiences from SusProNet, *Business strategy and the environment*, 13(4), 246-260.
- Velenturf, A.P., & Jensen, P.D. (2016). Promoting industrial symbiosis: Using the concept of proximity to explore social network development. *Journal of Industrial Ecology*, 20(4), 700-709.
- Walls, J.L., & Paquin, R.L. (2015). Organizational Perspectives of Industrial Symbiosis: A Review and Synthesis. *Organization and Environment*, 28(1), 32–53.
- Wang, D., Li, J., Wang, Y., Wan, K., Song, X., & Liu, Y. (2017). Comparing the vulnerability of different coal industrial symbiosis networks under economic fluctuations. *Journal of Cleaner Production*, 149, 636–652.
- Wells, P., & Seitz, M. (2005). Business models and closed-loop supply chains: a typology. *Supply Chain Management: An International Journal*, 10(4), 249-251.
- Winkler, H. (2011). Closed-loop production systems-A sustainable supply chain approach. *CIRP Journal of Manufacturing Science and Technology*, 4(3), 243–246.
- Zucchella, A., & Previtali, P. (2019). Circular business models for sustainable development: A “waste is food” restorative ecosystem. *Business Strategy and the Environment*, 28(2), 274–285.

Knowledge Sharing among Supply Chain Members: the Benefits for Circularity

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Abstract

In the article, the circular economy is elaborated from the reverse flows perspective, as these flows are the essence of the circular economy. The link between these two areas is straightforward as both focus on transition from linear to circular business environment. To make reverse logistics effective, companies need more than (just) the refinement of reuse/repair/recycle activities, but a more thorough redesign of the production system including product design and the whole business model redefinition is often necessary. In particular, the analysis uncovers managerial characteristics typical for companies that include their first-tier supply chain members in their knowledge ecosystem.

The paper utilises the data collected in structured interviews among representatives of companies operating of the Czech market. The interviews covered multiple topics ranging from general management issues to circularity-specific areas such as general business views and motivation, and diverse aspects of management system. For this exploratory research aim, the inferential statistics were employed: besides frequencies, the Mann-Whitney tests and bivariate correlations were calculated for scales and dichotomies variables.

The analysis revealed managerial attitudes and practices, which are related to the intensity of knowledge sharing with the business partners; with the first-tier supply chain members. In other words, based on the perceived level of knowledge diffusion across a company, its customers, and suppliers, we identified typical features of management systems in companies that put effort into boosting their knowledge ecosystem.

First, these companies are more integrated (internally and externally). The multiple indicators suggest that companies boosting the knowledge diffusion in the supply chain also take slightly different actions in tactical and operational level as expressed by planning activities. The ambitions for circularity (as expressed by the motivation for reverse logistics) are not so much solely focussed on marketing motives such as customers loyalty, satisfaction, or image, but their aim is more shifted towards value creation (out of reverse flows) and (environmental) legislation compliance. These companies often believe that reverse flows are useful/necessary to deal with, which is not always the case in companies in general.

Finally, the statistic calculations identified that knowledge sharing has no apparent link to company size, manufacturing/service affiliation, but it is more intensive in companies that are closer to end customers, i.e. in downstream supply chain members.

The findings of exploratory nature provide insight into relationships and mechanisms in companies that share their circular economy related knowledge with their suppliers and

direct customers. Based on perceived company performance, it provides support for the economic rationality of knowledge sharing in the area of reverse flows.

Keywords – circular economy, reverse flows, knowledge sharing in the supply chain, empirical research, secondary data

Paper type – Academic Research Paper

1 Introduction

The transition from linear to circular economy is a complex task requiring a redefinition of business models as well as theoretical concepts and frameworks. The area of logistics belongs to the core of domains that are affected by the transition; however, the theoretical interconnection between the circular economy and (much more elaborated concept of) SCM has not been well developed (Homrich et al., 2017).

The paper put stress on one particular area in circularity - on reverse flows and their logistics and management. As the concept of reverse logistics is older than the circular economy initiative, it is natural that the circular economy is not among factors identified as a driver for reverse logistics in the published research papers. Nevertheless, reverse logistics is accepted as an essential tool, as an environmental initiative, that may close the material loop in supply chains (Govindan and Bouzon, 2018) and in this way it is essential for the circular economy.

In other words, the paper approaches the circular economy by focusing on reverse flows specifically. Obviously, this is a less complex view; still, the coverage of related issues is wide: besides product design issues aiming to maximize value creation over the product's lifecycle and its after use (Genovese et al., 2017), the problem of multiple parties involvement and governance in establishing closed loop supply chain (Tseng et al., 2017), are just examples. The papers aim is to identify such company's attributes that are related to external knowledge sharing to answer the question of what is typical in companies sharing knowledge with suppliers and customers.

2 Data and methods

The paper utilizes the data, which was collected by the department the author is affiliated and which was aimed at the understanding of managerial approaches of Czech companies to improvement initiatives and processes. In this way, the presented analysis belongs to the secondary data research, as it interprets a subset of variables relating to areas specified below.

The original data were collected through personal, structured interviews with the companies' representatives (top and middle management; operations specialists). As the questions asked for the data that companies usually do not measure, collect, and reprocess, the answers are the statements of informants. That was the only source of

information – no financial or any other quantitative data were used. The quick overview of sample structure containing 166 companies is in Tab 1.

Tab 1. Sample structure

Company size:	small	69%
	middle	25%
	large	6%
Industry: services / manufacturing		32 / 67%
ISO 9001/9004 certification		38 %
ISO 14001/ EMAS certification		18%

The questions in the original survey were adopted from papers of de Brito and Dekker, (2003), Jack, Powers, and Skinner (2010), Mollenkopf and Closs (2005), Rogers and Tibben-Lembke (1998).

Methodologically, the paper explores diverse aspects of the company's management system using statistical tools: the most variables are measured on ordinal level (seven-point scales). Therefore the analytical part relays on Spearman rank correlations and Chi-square tests in a lesser extent. The calculations were done in SPSS v24 and MS Excel 2016.

The main variable, which measured the cooperation of companies with its business partners, was then related to variables reflecting the motivation, barriers, and internal processes. Its distribution is apparent from Fig 1. This variable has no relationship to companies size or companies industry affiliation (measure on manufacturing/service level only).

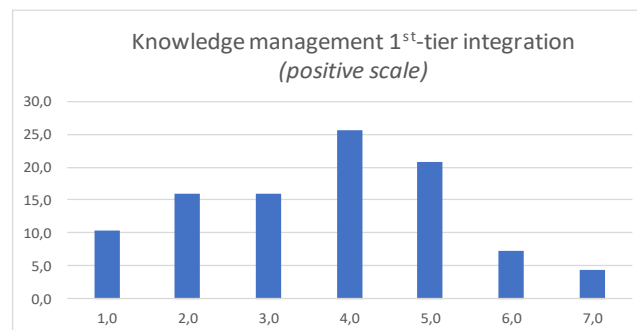


Figure 1: Distribution of Knowledge management 1st-tier integration

3 Findings

The general view on the strategic role of reverse flows is apparent from Tab 2. The mean values (calculated on positively designed scale 1 - 7) give evidence about a slightly above-average role of reverse flows in terms of usefulness, if we accept 3.5 as cut point. The data about innovativeness in the sphere of reverse flows is more impressive: the mean value of 5.03 and 4.4 suggest that companies are intensively trying to optimize/innovate the reverse flow management.

For companies sharing the knowledge with business partners, the above approaches are even more intensive as suggested by significant correlation with the Role of reverse logistics (first line in Tab 2) and Changes in approach to reverse logistics in the last 5 years (the effectiveness of reverse logistics would fit here too if we accept the 1-sided significance).

Tab 2. The general perception of reverse flows

Variables related to knowledge sharing	Spearman rho	mean
Role of reverse logistics (useless vs. very necessary)	0.227**	3.982
The effectiveness of reverse logistics (causing high losses vs important competitive advantage)	0.131	3.920
Management approach to reverse logistics (conservative vs. innovative)	0.106	5.036
Change in approach to reverse logistics in the last five years (no vs substantial change)	0.237**	4.406

Note: ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Building on the previous research, we proposed ten business drivers/motives, which might be relevant for companies then thinking about reverse flows. The list of them in Tab 3 is sorted in decreasing way indicating that in general, the main motivation is related to marketing issues and societal aspects such as fulfilling the legislation requirements and conduction of CSR are weaker factors. Speaking about companies sharing the knowledge with the partners, we see some specific relations: in terms of correlation coefficient (and significance), the knowledge sharing is the most closely related to different drivers; it is value retrieval, legislation, and CSR (with some distance). Value retrieval (and CSR to a certain extent, depending on the interpretation of CSR and its real practice), can be interpreted as more circular thinking.

Tab 3. Overview of motivation for reverse flows

Drivers for reverse flows management	Rho	Mean
Customers' satisfaction	0.245**	5.94
Customers' loyalty	0.244**	5.765
Image	0.211**	5.337
Differentiation from competitors	0.186*	4.789
Cost reduction	0.285**	4.735
Productivity increase	0.193*	4.582
Differentiation from competitors	0.276**	4.277
Value retrieval	0.386**	4.021
Legislation	0.365**	3.909
Corporate social responsibility	0.292**	3.581

Note: ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Further analysis focused on sources of innovation for companies – both product and process innovations. The internal companies' resources (R and D departments, marketing,

quality departments etc.) are the main innovation sources as expressed using several scale questions. One interpretation of the specifics in companies sharing the knowledge is that slightly more attention is also given for fewer importance sources like unaccepted warranty returns, unsold product quantities, unsystematic complaint collection. In this way the approach of these companies is more diversified – they probably try to learn from any available data, not just relying on internal professionals.

Finally, the internal management system was tested for a relationship to external knowledge sharing. In the case of dichotomous variables, the Mann-Whitney test was applied.

Tab 4. Sources of innovation for companies

Innovations sources	Rho	mean
internal corporate resources	0.062	4.64
customers	0.152	4.22
competitors	0.167*	3.52
suppliers	0.181*	2.87
returned warranty product - accepted	0.147	3.40
returned warranty product - unaccepted/refused	0.202**	2.29
customers complaint collected systematically	0.151	3.69
customer complaints collected by employees unsystematically	0.205**	3.51
other unsystematic resources, (e.g.) customer online reviews	0.098	2.76
quantities of unsold products	0.272**	2.96
waste	0.188*	2.32

Note: ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

One block of question on reverse flow planning is summarized in Tab 5 – each line shows the presence of the topic (reverse flows) in a particular planning level (the column “yes”). The most typical level dealing with reverse flows is the operational, followed by strategic plans. The relationship to knowledge sharing was found in tactical and operational plans.

Tab 5. Reverse flows planning

Level of planning	Mann-Whitney U	P-value	“yes” in %
Corporate strategy plan	2923.5	0.265	54.9
Functional/departmental strategy plans	2667	0.102	41.7
Tactical plans	2388	0.003	50.9
Operational plans	1928	0.001	68.3
No plan – presence of ad hoc decisions	2517	0.063	41.9

There is no relationship to ICT support for reverse flow, ISO 9001/14001 certification and the existence of a specialized department for reverse flows (Tab 6).

Tab 6. Diverse management system aspects

Other management system aspects	Mann-Whitney U	P-value	“yes” in %
ICT support for reverse flow	2753	0.075	47.6
ISO 9001 certification	3018	0,574	62.0
ISO 1004 certification	2045	0,945	81.3
Specialized department for reverse flows	2201	0,841	78.7

The cross-functional integration (relating to the process management approach) was divided into five aspects – internal one, the integration for reverse flows processes, integration for customers/suppliers and end-customers, which is relevant if the company is not final product produced, or/and if there are some intermediaries in the distribution.

As it might be expected, all the above integration areas have significant relationships to knowledge sharing, out of which the internal integration is the strongest (both corporate-wide and reverse flows specific). The last line in table 6 suggests that knowledge sharing is more intensive in companies that are closer to its final customers.

Tab 6. Measures of integration

Management system features	Rho	mean
Corporate-wide integration across functions	0.340**	4.2
Cross-functional integration of reverse flows activities	0.291**	3.93
Integration with customers in the area of reverse flows	0.162*	3.91
Integration with suppliers in the area of reverse flows	0.227**	3.54
Direct (directness) relation to end-customers	0.169*	5.51

Note: ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

4 Conclusions

The intensity in knowledge sharing with business partners belongs to those attributes that distinguish the companies in terms of their general strategic orientation (their view on reverse flows in particular) and operational settings. As it was documented by many relationships (identified statistically), the knowledge sharing is linked with circularity – the different view on and the approach to reverse flows is documented by specific motivation and more intense tactical and operational planning. The difference was also found in the innovation sources – compared to whole research sample, the companies with intensive knowledge sharing learn more from diverse sources – in relation to circularity, the reverse flow (refused warranty products) as a source for innovation process is of relevance. The link to integration was confirmed too, even though, this finding was expected. To the contrary, no links were documented in the data in terms of ISO certification.

The study faces several limitations that need to be considered when assessing the validity of the findings. First, the research sample is rather small. There is also a risk of data distortion as a single informant approach was chosen (for a practical reason). As

explained in the beginning, the most questions related to the *non-monitored* facts, so the data were personal perceptions only; the interpersonal view, in this case, would be more relevant here.

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References

- Brito, D. and Dekker, R. (2003) A Framework for Reverse Logistics (SSRN Scholarly Paper No. ID 423654), Rochester, NY: Social Science Research Network, available at: <http://papers.ssrn.com/abstract=423654> (accessed 19 April 2015).
- Genovese, A., Acquaye, A.A., Figueroa, A. and Koh S.C.L. (2017) "Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications", *Omega*, New Research Frontiers in Sustainability, Vol. 66, pp. 344-57.
- Govindan, K. and Bouzon, M. (2018) "From a literature review to a multi-perspective framework for reverse logistics barriers and drivers", *Journal of Cleaner Production*, Vol. 187, pp. 318-37.
- Homrich, A.S., Galvão, G., Abadia, L.G. and Carvalho, M.M. (2017) "The circular economy umbrella: Trends and gaps on integrating pathways", *Journal of Cleaner Production*, Vol. 175, pp. 525-43.
- Jack, E. P., Powers, T.L. and Skinner, L. (2010) "Reverse Logistics Capabilities: Antecedents and Cost Savings", *International Journal of Physical Distribution & Logistics Management*, Vol. 40, No. 3, pp. 228-46.
- Mollenkopf, D. A., and Closs, D.J. (2005) "The Hidden Value in reverse logistics", *Supply Chain Management Review*, Vol. 9, No. 5, pp. 34-36.
- Rogers, D.S. and Tibben-Lembke, R.S., (1999) *Going Backwards: Reverse Logistics Trends and Practices*, Reverse Logistics Executive Council, Reno, Nev.
- Tseng, M.-L., Tan, R. R., Chiu, A.S.F., Chien, C-F., and Kuo, T. C., (2017) "Circular economy meets industry 4.0: Can big data drive industrial symbiosis?", *Resources, Conservation and Recycling*, Vol. 131, pp. 146-47.

How Knowledge Management is Approached in Circular Economy Academic Research?

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Abstract

The main objective of the paper is to gain understanding and overview of how knowledge management practices are understood and approached in the current academic research of circular economy with the focus on business life. A systematic literature review was conducted to identify knowledge management concepts, implemented knowledge management methods, tools or models as well as the areas of knowledge management theory applications and the contexts of applications in the existing academic papers. The aim of the paper behind the main objective is not only to summarize existing evidence but also to draw attention of business practice to the role of knowledge management and complex knowledge ecosystems for meeting the circular economy challenges and overcoming the circular economy barriers.

For this paper peer-reviewed journals articles included in the Web of Science and SCOPUS databases were analysed within the systematic literature review. The main findings show that most of the current body of knowledge management theory is ignored in circular economy and circular business literature and the interest is focused mainly on knowledge sharing, knowledge acquisition and lack of knowledge while other important themes are not elaborated at all or only marginally.

Keywords – Knowledge management, Knowledge ecosystems, Circular economy, Systematic literature review

Paper type – Academic Research Paper

1 Introduction

Circular economy (also CE) is rapidly developing phenomenon which is strongly promoted by many governments worldwide and also in the European Union through different policies, legislation and regulations (Kalmykova et al, 2018) but also by supporting and supportive programmes and actions. CE is an umbrella term encompassing heterogeneous initiatives, multiple schools of thoughts and their principles belonging to the sustainability and sustainable development and sustainable growth movement (Blomsma and Brennan, 2017; Pauliuk, 2018). The “wide-angle view” of the

coverage and complexity of CE concept is reflected also in the understanding of CE given by Murray et al (2017, p. 5) who define it as a “*general term covering all activities...*” that indirectly in the form of policies, strategies and programs or directly in a real life practice aims to “*...reduce, reuse, and recycle materials in production, distribution, and consumption processes*”. The core idea behind CE movement lies in still more urgent problematic global situation when the pursuit of the economic growth leads to serious eco-environmental degradation, to the reduction of the biosphere reproductive capacity (Merli et al, 2018) and to destruction of whole ecosystems (Winn and Pogutz, 2013) which in turn - with some delay - negatively influences also business environment (Dean and McMullen, 2007).

In the business practices the ideas and principles of CE are rather difficult to implement as the transition from the linear way of doing the business into the circular one needs specific innovative capabilities and knowledge of a network of stakeholders within and around the firms (Ritzén and Sandström, 2017; Govindan and Hasanagic, 2018). Closer collaboration with stakeholders (and with more and new stakeholders) especially from the external environment and more intensive utilization of the information technology is inevitable for provision of circular flows of products, packaging, information, finance and knowledge and to make business to become circular (Lahti et al, 2018) as the needed – and sometimes specific – skills, capabilities, knowledge and other resources often “*reside outside of the organizational boundaries*” (Levering and Boss, 2018, p. 44).). Circular value creation and value delivery may also have different impact on the environmental ecosystems (that also can be different) (Zucchella and Previtali, 2018, in press). All these differences are connected also with the changes in knowledge ecosystems and knowledge management (also KM) – of the focal firm and of its stakeholders.

Not only new knowledge will be created with new actors and new processes, but also new patterns and new processes will emerge of how to acquire, capture, analyse, utilize, store and share the knowledge. KM plays the essential role in sustainable and competitive value creation reflected in the organisational performance in general (Schiuma et al, 2012) as well as it plays the crucial role for designing adequate and not only the circular economy promoting knowledge ecosystem (Valkokari, 2015). However, until now there is no study identifying state of the art in the literature and highlighting research gaps and areas of concern for the practice and future research in case of KM in CE.

The main objective of the paper is to gain understanding and overview of how knowledge management practices are understood and approached in the current academic research of circular economy with the focus on business life through the systematic review of literature. As the novelty accompanies circular economy concept, the research questions which guide the review are as following:

How is knowledge management conceived in circular economy theory?

What novel, specific and innovative characteristics and features of knowledge management explored, studied and published are related to circular economy and what specific knowledge, skills, competencies, capabilities are needed in CE?

The first section of the paper presents research approach, in the second results of systematic review are summarized and discussed. Finally, conclusions are drawn, and future research streams are outlined.

2 Methodology

To reach the objective, a systematic literature review was conducted. The main purpose of a systematic review is to identify the key theory-based understanding of the phenomenon of interest (Becheikh et al, 2006), to map “what” and “how” issues in the theory and also to identify gaps in current knowledge and delineate the avenues for future research (Aquilani et al, 2017). Based on Correia et al (2017) the process of the review employed for this paper consists of three broad and general phases: *1) problem formulation and question identification* (see Introduction); *(2) literature search and conducting the review*; and *(3) reporting results*“ (next chapter). For the review of final selected articles, the content analysis was performed.

Only peer-reviewed articles written in English were included in the search. They were obtained by querying the Web of Science and Scopus databases. These databases are commonly used for the purpose of a systematic literature review and are considered as the most comprehensive scientific databases (Aghaei Chadegani et al, 2013). No other exclusion criteria were applied e.g. for publication years and research areas. First, only the basic combination of the general terms “knowledge management” AND “circular economy” was used, but only 3 (Web of Science) and 4 (Scopus) articles were found with one overlap. Therefore, in the second search broader term of “knowledge” (instead of “knowledge management”) was applied. This resulted in 152 articles in Web of Science and 159 articles in Scopus, with 132 overlapping cases.

After the inspection of titles, abstracts and keywords 47 articles entered the step of the whole text screening. The excluded articles did not correspond to the research aims as in the title, abstract or key words they mentioned either one or both keywords in other context than was needed for the review. For the inclusion/exclusion business context of the article must be presented. Full text screening of 47 articles involved evaluation of the relevancy of articles in term of the typical representative concepts and terms of KM that are relevant and connected to KM practices. Similar to the approach to understand the scope of CE also in this case the screening was realized using list of the concepts and terms based on the brief review of 20 most cited articles on “knowledge management” in Web of Science supplemented by the search results of 30 most cited articles within the period 2016 – 2019. Again, in this step – despite promising wording of the titles and abstracts – exclusion of several articles was done if KM was only touched upon, but KM was not the main area or at least one of the areas examined in the articles. The list is not exhaustive and both list and references – due to the limited extent of paper - are available on request from the author.

Thorough reading of the body of the texts lead to the further elimination, so the final list consists of 23 articles relevant to the point of interest. From the 47 articles which entered the steps before the final analysis one was not available.

3 Results

CE needs KM which would help to process, store, visualize, share, exchange amount of data and information from, to and about stakeholders, processes and products and materials involved in circular business in the efficient and effective manner. Online platforms seem to be an appropriate tool for this issue. This is confirmed for instance in the article exploring the role of institutional capacity-building through industrial symbiosis in the development of a circular economy. (de Abreu and Ceglia, 2018). Online platforms help to reduce uncertainties and implement a trustful business, they are an important source of information that firms could use to find business opportunities and they also promote synergies. Collaboration and data sharing tools as very helpful for harnessing knowledge-bases outside traditional knowledge areas needed for the innovative activities are mentioned in the research among waste management sector managers in Sweden (Aid et al, 2017).

Information availability and visibility is crucial for a product lifecycle management (PLM) system and product and material passports are considered to be very helpful to provide right information aiming to increase efficiency in resource management. Research done by Portillo-Barco and Charnley (2015) shows how challenging is to develop the content of a product passport (identification of data requirements and applications of sensing technologies) which would meet all requirements for data and information of the relevant stakeholders and reflect also specific condition of the environment through which product flows in cycles.

For designers and engineers in case of remanufacturing and recycling the knowledge of disassembly time is essential information for designers and engineers to make changes or adaptation into the process (and product design), however this knowledge is gained at the dismantling and de-manufacturing centres. Mandolini et al (2018) suggest and test method which enable to assess the disassembly time, estimated by using an exact disassembly sequence planning approach and a structured repository for the classification of knowledge about elementary disassembly tasks.

Tolio et al ((2017) present a broader and deeper view on different information and knowledge flow for CE in material engineering. They reviewed methods and tools as well as strategies for different CE processes in manufacturing – both theoretical and from practise and gather also information and knowledge processing-related examples.

Jiang et al (2019) proposed and tested a new hybrid method combining rough set (RS) and cased-based reasoning (CBR) for remanufacturing process planning of cores with an interactive interface. This method based on mathematical modelling helps to reuse knowledge generated from existing used parts intended for remanufacturing to facilitate process planning for the new arrival of used parts. The interface allows a user to input important information for decision making related to remanufacturing regarding part as well as failure(s) characteristics. Evaluation of the input information offers user recommendation for remanufacturing.

Network of actors (or stakeholders) represents one of the most important themes in CE. All empirical, all reviews, most of the mixed and some of the conceptual

methodology-based articles deal with issue. Barrie et al (2019) explored the position and role of the triple helix-based system intermediary as an approach to governance for tacit and explicit knowledge transfer, exchange and coordination and facilitation of shared learning in national industrial biotechnology niche network. They also developed concept of “Total knowledge transfer” which “is a multiplex relational attribute formed through the combination of values from tacit and explicit knowledge transfer relational attributes facilitating shared learning” (p. 2013). De Abreu and Ceglia (2018) explored the role of institutional capacity-building through industrial symbiosis. Three dimensions of the institutional capacity must but managed – knowledge and relational resources and capacity for mobilization. Formal structure of industrial symbiosis is beneficial for the development of the CE. Wang et al (2017) confirm the role of a network in industrial symbiosis by promoting relational links across organisations and governance levels. Network, purposely managed helps to increase various types of knowledge.

For a network to work effectively and efficiently collaboration is indispensable. Xiang and Yuan (2018) proposed and tested a “Collaboration-driven mode” based on information sharing which incorporated all relevant information sharing paths and their contents among stakeholders, role and description of role of promoters in the mode and the incentive strategies for information sharing.

Facilitation of networking can be realized via ICT online tools (or the aforementioned platforms). Alvarez and Ruiz-Puente (2017) present “SymbioSyS”, a tool which helps to promote the sustainable use of resources through building of a large database that stores both more or less tacit knowledge of experiences and practices and explicit information about activities.

Leadership, role of champion and enthusiasm and collaborative experimentation within innovative activities, the role of a change agent and an industrial symbiosis promoter for knowledge generation and sharing within CE networks of actors are also stressed as the KM approaches to support transition towards CE (Brown et al, 2019; de Abreu and Ceglia, 2018).

Salvia and Quaranta (2018) present findings from their research studying the attitudes and perceptions of groups of cereal farmers regarding two projects in Basilicata (Italy) region with the aim to return the old traditional knowledge to the nowadays practice of land use and so to reduce production costs and promote soil conservation. They found that full understanding of the advantages/ disadvantages of approaches, transparency of recommendations, more confidence in trusting recommendations for practical applications from other farmers than from researchers and high involvement in the process of learning is critical for the success of transition to this CE practice. Based on the findings from the interviews and survey the authors propose the adaptation of SECI model of KM: 1. receive knowledge (the best source are those who share the same problem), 2. identify knowledge as useful, 3. understand implications of knowledge, 4. choose options to work on knowledge, 5. action the option(s), 6. evaluate results of action(s) and 7. share evaluation with others.

Bueren et al (2018) analysed four existing plant breeding orientations and based on the positive and negative feature suggested the novel approach – „a systems-based

breeding”. Plant breeding is an extremely complex process with long-term impact on whole ecosystem(s). This is why transdisciplinarity of knowledge is needed to create a synergy of social and natural sciences and integration of knowledge at and from various levels – socio-economic, agro-ecological among all. The importance of transdisciplinarity for CE, especially for the transition from linear to circular economy is accentuated also by Marra et al (2018). The authors reviewed 1244 research publications on circular economy and revealed that existing body of knowledge for macro or policy making level, which creates necessary conditions for CE – is extremely deficient and what is missing (also for micro and meso levels) is knowledge coming from social sciences, economics and behavioural sciences and their integration. To this stream of research findings from Antonnen et al (2018) review of key industrial texts, policy reports and abstracts of the academic articles devoted to CE utilizing topic modelling methodology can be added. The aim of the review was to discover how big is “the consensus space” of three institutional spheres of Triple-Helix (industry, government and university) which constitutes an important system to accomplish systemic innovations typical for CE success. Their findings show that the consensus space is rather small, and many crucial aspects of CE functioning are missing not only in this space but also in the individual domains. They point especially to consumer behaviour (in larger social dimension view) and paradoxically also environmental dimension of sustainability (as the current interest is concentrated only on a few areas).

Mutual learning and sharing of the individual knowledge of designers designing CE products and processes is incorporated into the serious game for professionals called „In the Loop: The Critical Raw Materials Game“, developed and tested by Whalen and Peck (2014). Their article is one of the several examples dealing with the changing role and capabilities of designer in CE environment. Mutual learning and increase of understanding as well as overcoming biases for human-machine interfaces is evaluated by Arnold (2018) through the application of a “structural systemic constellations” as an innovative tool which might help to integrate unconscious knowledge in a research context and should be suitable especially in complex systems that are typical in CE. Workshops are another way how to stimulate common understanding and support sharing of knowledge and generation of new knowledge (*De Abreu and Ceglia, 2018*).

With regard to consumers 3 articles pay closer attention to this stakeholder and his role in CE in case of KM. Lofthouse and Prendeville (2018) discuss the role of designers in CE who should integrate knowledge from the social sciences (especially consumption, consumer psychology, cultural studies). Also research on design needs to develop knowledge on how to design products and services for different circular business models “*by considering norms, behaviours, attitudes and the contexts of people’s social live*” (p. 466).

Seminal article written by Tukker (2015) on Product Service Systems (PSS) points to challenges and problems with convincing consumers to shift from the ownership to relatively more circular business models. This may be ranked to the “know-why” and “know-what” issue from KM. In context of PSS Hobson et al (2018) discusses empirical research exploring consumers' reactions to a novel, hypothetical mobile phone. Research

examines consumers' knowledge about current mobile phone life cycles, and responses to the proposed product service system. Action-based research demonstrates also the function of a “systems of practice” framework to discuss the potential for significant changes in phone purchase and use stemming from the increase of understanding and awareness of the complexity of phone production, distribution and recovery options.

*Some articles stress role of designers and innovators for CE and also changes of their role, especially in the broadening of the scope of their work. This is reflected in new knowledge, skills and capabilities requirements. De los Rios and Charnley (2017) focus directly on designers and allege that for designer a variety of new capabilities will be needed, from deeper knowledge of material composition to rich understanding of social behaviour“ (p. 109). Brown et al (2019) point to both **hard capabilities and soft skills** needed for collaborative circular innovation-oriented activities of companies. Specific hard capabilities include specific CE design strategies and product criteria that are linked to different recovery operations across whole product life cycle considering multiple life cycles as well together with the incorporation of knowledge and requirements of stakeholders in circular value network. Knowledge might be rather interdisciplinary and includes also assessment of impacts across multiple product life-cycles and not only at the individual but at the system network level. Skills to build and support collaboration with stakeholders vital for successful circular business models and to translate and communicate CE complexity into a clear future vision to be fully comprehended by stakeholders who operationalize business models belong to the most important soft skills. Barrie et al mention also an urgent need of “transition thinking” for CE.*

Specific manual and technological skills for core CE activities and more complex cognitive skills for the CE enabling activities that should be part of the educational curricula and trainings programs for the future were investigated by Burger et al (2019) in the U.S.A. environment, nevertheless with the general applicability anywhere. They stress particularly skills to collaborate to create joint value, to design for the future, to incorporate digital technology, to be able to prioritise regenerative resources, to use waste as a resource. To rethink the business models, complex problem-solving skills and resource management skills.

Tukker (2015) demonstrates that particularly result-oriented PSS requires different and specific skills (product knowledge and more dedicated and unique customer knowledge and customer and relation management skills) and also the organization. Knowledge is generated not only from relationships but also from remote monitoring and maintenance systems incorporated into the product and tracking the performance. Bottom-up knowledge sharing techniques are supportive to PSS design.

Van Schalkwyk et al (2018) reviewed literature on the metallurgical knowledge, the behaviour of technology elements and existing simulation and modelling techniques in lead metallurgy, which is considered to be a key to the CE. The authors also think about challenges of digitalization for tracking the metallurgical knowledge. The conclusions show that there are big gaps in current knowledge which make barriers for process optimisation and more efficient use of metals in CE.

Aid et al (2017) looked into the Swedish waste management sector and analysed challenges for inter organizational resource network to create circular value offer. Core competencies or in-house technical knowledge of waste management companies are identifying, developing, and implementing solutions (specifically sorting and valuation technology knowledge) for complex wastes and by-products. Advanced market and technology intelligence are perceived to be of increasing importance for companies

Barrie et al (2019) highlight specific transition thinking for the successful move from linear to circular business model.

4 Conclusions

Review manifest enormous inattention to knowledge management in CE theory in comparison to many other fields of study and this conclusion only support idea of Jabbour et al (2017, in press) that CE as a body of knowledge is in its infancy but also the statement that it “*is an exercise in knowledge creation and application....*” (de Abreu and Ceglia, 2018, p. 106).

Paper has several limitations. For instance, conference papers should be included into the review or other databases as well.

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References

- Aquilani, B., Silvestri, C., Ruggieri, A. and Gatti, C. (2017) “A systematic literature review on total quality management critical success factors and the identification of new avenues of research“, *The TQM Journal*, Vol. 29, No.1) pp. 184-213.
- Aghaei Chadegani, A., Salehi, H., Yunus, M., Farhadi, H., Fooladi, M., Farhadi, M. and Ale Ebrahim, N. (2013) “A comparison between two main academic literature collections: Web of Science and Scopus databases“, *Asian Social Science*, Vol. 9, No. 5, pp. 18-26.
- Aid, G., Eklund, M., Anderberg, S. and Baas, L. (2017) “Expanding roles for the Swedish waste management sector in inter-organizational resource management“, *Resources, Conservation and Recycling*, Vol. 124, pp. 85-97.
- Alvarez, R. and Ruiz-Puente, C. (2017) “Development of the tool symbiosis to support the transition towards a circular economy based on industrial symbiosis strategies“, *Waste and biomass valorization*, Vol. 8, No. 5, pp. 1521-1530.
- Anttonen, M., Lammi, M., Mykkänen, J. and Repo, P. (2018) “Circular Economy in the Triple Helix of Innovation Systems“, *Sustainability*, Vol. 10, No. 8, No. 2646.
- Arnold, M. G. (2018) “Combining conscious and unconscious knowledge within human-machine-interfaces to foster sustainability with decision-making concerning production processes“, *Journal of Cleaner Production*, No. 179, pp. 581-592.

- Barrie, J., Zawdie, G. and João, E. (2019) "Assessing the role of triple helix system intermediaries in nurturing an industrial biotechnology innovation network", *Journal of Cleaner Production*, No. 214, pp. 209-223.
- Becheikh, N., Landry, R. and Amara, N. (2006) "Lessons from innovation empirical studies in the manufacturing sector: A systematic review of the literature from 1993–2003", *Technovation*, Vol. 26, No. 5-6, pp. 644-664.
- Blomsma, F. and Brennan, G. (2017) "The emergence of circular economy: A new framing around prolonging resource productivity", *Journal of Industrial Ecology*, Vol. 21, No. 3, pp. 603-614.
- Brown, P., Bocken, N. and Balkenende, R. (2019) "Why Do Companies Pursue Collaborative Circular Oriented Innovation? ", *Sustainability*, Vol. 11, No. 3, No. 635.
- Burger, M., Stavropoulos, S., Ramkumar, S., Dufourmont, J. and van Oort, F. (2019) "The heterogeneous skill-base of circular economy employment", *Research Policy*, Vol. 48, No. 1, pp. 248-261.
- Centobelli, P., Cerchione, R. and Esposito, E. (2017) "Knowledge management in startups: Systematic literature review and future research agenda", *Sustainability*, Vol. 9, No. 3, No. 361.
- Correia, E., Carvalho, H., Azevedo, S. and Govindan, K. (2017) "Maturity models in supply chain sustainability: A systematic literature review", *Sustainability*, Vol. 9, No.), No. 64.
- de Abreu, M. C. S. and Ceglia, D. (2018) "On the implementation of a circular economy: The role of institutional capacity-building through industrial symbiosis", *Resources, Conservation and Recycling*, No.138, pp. 99-109.
- Dean, T. J. and McMullen, J. S. (2007) "Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action", *Journal of Business Venturing*, Vol. 22, No.1, pp. 50-76.
- De los Rios, I. C. and Charnley, F. J. (2017) "Skills and capabilities for a sustainable and circular economy: The changing role of design", *Journal of Cleaner Production*, No.160, pp. 109-122.
- Govindan, K. and Hasanagic, M. (2018) "A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective", *International Journal of Production Research*, Vol. 56, No. 1-2, pp. 278-311.
- Hobson, K., Lynch, N., Lilley, D. and Smalley, G. (2018) "Systems of practice and the Circular Economy: Transforming mobile phone product service systems", *Environmental innovation and societal transitions*, No. 26, pp. 147-157.
- Jabbour, C. J. C., de Sousa Jabbour, A. B. L., Sarkis, J. and Godinho Filho, M., (2017 in press) "Unlocking the circular economy through new business models based on large-scale data: An integrative framework and research agenda", *Technological Forecasting and Social Change*.
- Jiang, Z., Jiang, Y., Wang, Y., Zhang, H., Cao, H. and Tian, G. (2019) "A hybrid approach of rough set and case-based reasoning to remanufacturing process planning", *Journal of Intelligent Manufacturing*, Vol. 30, No. 1, pp. 19-32.
- Kalmykova, Y., Sadagopan, M. and Rosado, L., (2018) "Circular economy–From review of theories and practices to development of implementation tools", *Resources, Conservation and Recycling*, No. 135, pp. 190-201.
- Lahti, T., Wincent, J. and Parida, V., (2018) "A Definition and Theoretical Review of the Circular Economy, Value Creation, and Sustainable Business Models: Where Are We Now and Where Should Research Move in the Future? ", *Sustainability*, Vol. 10, No. 8, 2799, pp. 1-19.
- Levering, R. and Vos, B., (2019) *Organizational Drivers and Barriers to Circular Supply Chain Operations in Operations Management and Sustainability*, ed. L. De Boer and P.H. Andersen, Palgrave Macmillan, Cham.

- Lieder, M., Asif, F. M. and Rashid, A. (2017) "Towards Circular Economy implementation: an agent-based simulation approach for business model changes", *Autonomous Agents and Multi-Agent Systems*, Vol. 31, No. 6, pp. 1377-1402.
- Lofthouse, V. and Prendeville, S. (2018) "Human-centred design of products and services for the circular economy—a review", *The Design Journal*, Vol. 21, No. 4, pp. 451-476.
- Mandolini, M., Favi, C., Germani, M. and Marconi, M. (2018) "Time-based disassembly method: how to assess the best disassembly sequence and time of target components in complex products", *The International Journal of Advanced Manufacturing Technology*, Vol. 95, No. 1-4, pp. 409-430.
- Marra, A., Mazzocchitti, M. and Sarra, A. (2018) "Knowledge sharing and scientific cooperation in the design of research-based policies: The case of the circular economy", *Journal of Cleaner Production*, No. 194, pp. 800-812.
- Merli, R., Preziosi, M. and Acampora, A. (2018) "How do scholars approach the circular economy? A systematic literature review", *Journal of Cleaner Production*, No. 178, pp. 703-722.
- Murray, A., Skene, K. and Haynes, K. (2017) "The circular economy: An interdisciplinary exploration of the concept and application in a global context", *Journal of Business Ethics*, Vol. 140, No. 3, pp. 369-380.
- Pauliuk, S. (2018) "Critical appraisal of the circular economy standard BS 8001: 2017 and a dashboard of quantitative system indicators for its implementation in organizations", *Resources, Conservation and Recycling*, No. 129, pp. 81-92.
- Portillo-Barco, C. and Charnley, F. (2015) "Data requirements and assessment of technologies enabling a product passport within products exposed to harsh environments: a case study of a high pressure nozzle guide vane", *International Journal of Product Lifecycle Management*, Vol. 8, No. 3, pp. 253-282.
- Ritzén, S. and Sandström, G. Ö., (2017) "Barriers to the Circular Economy—integration of perspectives and domains", *Procedia CIRP*, No. 64, pp. 7-12.
- Salvia, R. and Quaranta, G. (2018) "An Iterative Approach for Knowledge Production in the Agricultural Systems and Insights for IS Development", *International Journal of Agricultural and Environmental Information Systems (IJAEIS)*, Vol. 9, No. 4, pp. 45-57.
- Schiuma, G., Carlucci, D. and Lerro, A., (2012) "Managing knowledge processes for value creation", *VINE*, Vol. 42, Iss 1 pp. 4-14.
- Tolio, T., Bernard, A., Colledani, M., Kara, S., Seliger, G., Duflou, J., ... and Takata, S. (2017) "Design, management and control of demanufacturing and remanufacturing systems", *CIRP Annals*, Vol. 66, No. 2, pp. 585-609.
- Tukker, A. (2015) "Product services for a resource-efficient and circular economy—a review", *Journal of Cleaner Production*, No. 97, pp. 76-91.
- Valkokari, K. (2015) "Business, innovation, and knowledge ecosystems: how they differ and how to survive and thrive within them", *Technology Innovation Management Review*, Vol. 5, No. 8, pp. 17-24.
- van Bueren, E. T. L., Struik, P. C., van Eekeren, N. and Nuijten, E. (2018) "Towards resilience through systems-based plant breeding. A review", *Agronomy for Sustainable Development*, Vol. 38, No. 5, pp. 1-21.
- Van Schalkwyk, R. F., Reuter, M. A., Gutzmer, J. and Stelter, M. (2018) "Challenges of digitalizing the circular economy: Assessment of the state-of-the-art of metallurgical carrier metal platform for lead and its associated technology elements", *Journal of Cleaner Production*, No. 186, pp. 585-601.
- Wang, Q., Deutz, P. and Chen, Y. (2017) "Building institutional capacity for industrial symbiosis development: A case study of an industrial symbiosis coordination network in China", *Journal of Cleaner Production*, No. 142, pp. 1571-1582.

- Whalen, K. and Peck, D. (2014) "In the Loop–Sustainable, Circular Product Design and Critical Materials", *International Journal of Automation Technology*, Vol. 8, No. 5, pp. 664-676.
- Winn, M. I. and Pogutz, S. (2013) "Business, ecosystems, and biodiversity: New horizons for management research", *Organization & Environment*, Vol. 26, No. 2, pp. 203-229.
- Xiang, P. and Yuan, T. (2019) "A collaboration-driven mode for improving sustainable cooperation in smart industrial parks", *Resources, Conservation and Recycling*, No. 141, pp. 273-283.
- Zucchella, A. and Previtali, P., (2018, in press) "Circular business models for sustainable development: A "waste is food" restorative ecosystem", *Business Strategy and the Environment*, Vol. 28, No. 2, pp. 274-285.

Implementing Open Innovation: the Role of Boundaries Management

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Abstract

The aim of this paper is to investigate the role of boundaries management when firms should implement open innovation. The paper is based on: the review of relevant literature on strategic management, firm's boundaries and open innovation fields; a survey of a sample of Italian listed firms. Findings show, from a side, that open innovation and many modern paths growth are connected to the firm's boundaries and, on the other side, that boundaries management play a key role for the implementation of open innovation. Indeed, we provide implications for practitioners by shedding light on the advantages and the risks that can jeopardize the successful outcome of opening up the innovation processes without the effective management of boundaries.

Keywords – open innovation, boundaries management, corporate growth strategies

Paper type – Academic Research Paper

1 Introduction

Corporate growth strategies should be properly developed to create innovative paths and competitive advantage (Liu and Liang, 2015; Zhang, 2011). Scholars investigating the innovation paths have recently juxtaposed the “open innovation” to the traditional “closed innovation” perspective (Chesbrough, 2003a; Chesbrough, 2003b; Chesbrough, 2003c; Von Hippel and von Krogh, 2006). Studies on open innovation have at first paid attention to the potential benefits of opening up the innovation processes (Gambardella, Panico, 2014). Following literature highlighted that the implementation of open innovation involves organizational, cultural, managerial and technological challenges (Lombardi et al., 2016; Von Hippel, 1986; Von Hippel, 1988; West and Bogers, 2013) by suggesting issues to face within the firm boundaries and beyond them (Giannopoulou et al., 2010; West et al., 2014). However, despite the relevance of organization boundaries in innovation literature stream (Lakhani et al., 2013), there is a lack of studies analysing the relationships between corporate growth strategies, the implementation of open innovation and firm boundaries (Fiorentino, 2016; Garzella, 2000; Trequattrini et al., 2012). Conversely, studies need to investigate the role of boundaries management – how managers coordinate resources, activities and business processes on the boundaries of the firm - in the implementation of open innovation in order to lead firms in searching the right balance between open and closed approaches. By shedding light on the relationships between corporate growth strategies, open innovation and boundaries management, Scholars should provide implications for seizing open opportunities by effectively managing risks related to the protection of firm internal assets.

Accordingly, approaching the call for what challenges have to face firms embracing open innovation approaches (Chesbrough, 2006; Hossain et al., 2016; Huizingh, 2011; Van de Vrande et al., 2009), the aim of this paper is to investigate the role of boundaries management when firms should implement open innovation.

In order to achieve paper’s purpose, we have developed: a review of relevant literature on strategic management, firm’s boundaries and open innovation fields; an empirical analysis based on a questionnaire survey of a sample of Italian listed firms. An interpretive methodology is used to analyse empirical data. By critically integrating literature review and empirical analysis, a framework is provided with the objective of supporting the open innovation implementation.

The next section provides the theoretical background. Section 3 discusses methodological issues, providing a detailed description of the research methods used to address the research questions. Section 4 presents and discusses the findings. Finally, section 5 presents conclusions, implications and limitations.

2 Theoretical background

Current markets are witnessing a rapid increase of activities, traditionally within companies, realized by outsourcing processes (McIvor, 2009). The search for success pushes frequently towards partnerships and strategic alliances (Boddy et al., 2000). The

traditional “internal” and “external” growth strategies are becoming less useful to analyse corporate growth strategies. Traditional theories, such as “transaction cost economics” and “resource-based views”, generally investigate growth strategies by a “make or buy” lens (Barney, 1991; Coase, 1937; Williamson, 1975). These theories have been recently developed based on the evolutions in competitive and technological landscape pushing towards collaborative decisions in resource, knowledge and business processes management (Foss, 1996; Milgrom and Roberts, 1990; Parmigiani and Mitchell, 2009; Santos and Heisenhardt, 2005; Tortoriello and Krackhardt, 2010).

The rise of new growth strategies characterizes managerial issues and makes the management of firm boundaries a key variable (Foss et al., 2013; Swink et al., 2007). Studies increasingly focus on firm’s boundaries as a third alternative, over integration and market, and the joint use of skills and knowledge has highlighted the role of boundary management (Alexander, 1997). The topic of boundaries was analysed by studies from economics, management and organizational behaviour (Villalonga and McGahan, 2005). These studies have referred to the boundary concept to analyse resources, activities and processes that can be jointly controlled and influenced by many organizations (Yang et al., 2010). Scholars have found that the “control” should be the most useful criterion to define where firm boundaries should be placed: “the organization ends where its discretion ends and another begins” (Pfeffer and Salancik, 1978, p. 32). More in depth, boundaries should be viewed as a continuum area that represents an intermediate form of hybrid governance (Normann and Ramirez, 1993). Since this continuum constitutes a “border area” in which it is not easy to distinguish the firms from the external environment, it is increasingly necessary to use the concept of boundaries and the “boundary zone” (Caputo et al., 2018).

Boundary management should be the way to integrate benefits of internal and external growth strategies (Hargadon, 2002; McEvily and Zaheer, 1999; Park et al. 2004; Lavie, 2006; Steensma and Corley, 2001; Takeishi, 2001) and it is becoming a new paradigm to obtain and sustain competitive advantage (Dyer and Singh, 1998; Garzella, 2000; Wagner, 2003). Scholars suggest advantages from boundaries management (Cao and Zhang, 2011; Cassiman and Veugelers, 2006; Parmigiani and Mitchell, 2009). These findings lead managers to overcome the traditional trade-offs among internal and external growth strategies (Cao and Zhang, 2011; Cassiman and Veugelers, 2006; Fiorentino, 2016; Parmigiani and Mitchell, 2009). These trends suggest to jointly analyse the literature streams on open innovation and boundaries management.

Over the last decades, the relevance of open innovation in management research is showed by an exponential number of studies on the topic (Hossain et al., 2016; Huizingh, 2011). Through the introduction of new paradigm (Chesbrough, 2003a; Chesbrough, 2003b; Chesbrough, 2003c; Von Hippel and von Krogh, 2006), open innovation has been investigated under several perspectives and specific issues referring both to large firms and to small and medium enterprises (SMEs) (Hossain and Kauranen, 2016). In this direction, the pioneering study by Chesbrough (2003a) defines open innovation as “a paradigm that assumes that firms can and should use external ideas as well as internal

ideas, and internal and external paths to market, as the firms look to advance their technology”.

Open innovation is based on outside-in, inside-in and coupled processes or modes (Aloini et al., 2017; Enkel et al., 2009; Gassmann and Enkel, 2004; Trequattrini et al., 2012; West and Bogers, 2013). Thus, open innovation is guided by external versus internal modes of ideas and knowledge (inbond), internal versus external modes of ideas and knowledge (outbond) and a combination of previous modes. Chesbrough et al. (2006) state that open innovation is a “purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation”. Van de Vandre et al. (2009) recognize purposive outflows and inflows of knowledge in the technology exploitation versus technology exploration, including a combination of them: “Purposive outflows of knowledge, or technology exploitation, implies innovation activities to leverage existing technological capabilities outside the boundaries of the organization. Purposive inflows, which we will refer to as technology exploration, relates to innovation activities to capture and benefit from external sources of knowledge to enhance current technological developments.”

Although several open innovation modes exist in terms of openness (Gambardella and Panico, 2014). Abulrub and Lee (2012) study shows as firms use only few types of thirteen identified modes of open innovation among which joint research development, contract R&D, customer involvement, and external networking. Implementing open innovation modes, firms change activities process transforming innovation management model, business model (Lombardi et al., 2016) and sharing knowledge with producers, providers, users, research centers, universities and other network actors (Von Hippel, 1986). The involvement of several external resources becomes a focal issue in recognizing firm boundaries resources and in governing firm through strategic boundaries management (Giannopoulou et al., 2010; West et al., 2014). Although the influence of openness in innovation modes on business performance should be defined (Von Hippel, 1988; West and Bogers, 2013), Toma et al. (2018) underline “OI has been defined as a distributed innovation process based on purposively managed knowledge flows across organizational boundaries (Chesbrough and Bogers, 2014)”. Boundaries management gains a key role (Adamides, 2015; Foss et al., 2013; Garzella 2000; Ritter et al., 2004; Swink et al., 2007; Villalonga and McGahan, 2005). The boundaries management should favour the design and management of innovation in a wider perspective to identify new integration and coordination opportunities among the value chains of the firm and the value chains of external “partners” (Boddy et al., 2000; Pil and Holweg, 2006) by “linking” and “bearing” strategies (Caputo et al., 2018; Scott, 2003). The “linking strategies” seek to internalize the resources and skills of the partners. Firms, pursuing the information sharing and the alignment of internal and external innovation processes, should allow redesigning the entire business model innovatively. At the same time, however, firms need to supervise innovation processes by developing “bearing” strategies that allow protecting from the risk that external actors should acquire key information by the relationship with the firm. Boundary strategies add specific potential to the strengths that characterize open innovation paths.

However, in this scenario, there is a lack of studies analysing the relationships between organizations boundaries, open innovation and corporate growth strategies. Thus, a relevant issue is to discover what challenges have to face firms embracing open innovation models and approaches (Chesbrough, 2006) in the light of boundaries management. In the light of previous considerations, the research questions are the following:

RQ1. What is the link connecting open innovation, new paths of corporate growth and firm boundaries?

RQ2. What are the boundaries resources and activities to foster management and implementation of open innovation?

RQ3. How firms can face the typical risks in implementing open innovation by boundaries management?

3 Methods

An interpretive-qualitative methodology (Yanow et al., 2014; Schwartz-Shea et al., 2012) has been applied to answer the research questions. Particularly, the chosen technique has been the survey questionnaire (Cooper et al., 2006; Hoque, 2018). Although this method is influenced by some bias, such as non-response bias (de Villiers and Dumay, 2014), it is relevant in collecting empirical data and information on the firm through the utilization of one or more questionnaires allowing researchers to propose relevant reflection on results by respondents. The following subsections describe the sample selection, data collection, measures and, data analysis

The sample selection occurred through the utilisation of the data source AIDA provided by Bureau van Dijk. In this way, all Italian listed companies at 31st march 2018 were selected. Thus, the sample of this research is composed of 334 national listed companies belonging to several economic fields. In order to investigate the role of boundaries management when firms adopt and implement open innovation approaches, data were collected using a survey questionnaire created through Google docs and directed to CEO, GM and R&D Responsible of each selected company composing the sample. In this perspective, it is relevant to underling that CEO, GM and CEO-R&D are deputy to assume significant decision-making processes in the organizations, among which decision making on corporate strategy and open innovation implementation. Thus, at the beginning of May 2018, an invitation - via email - to participate to an online questionnaire was sent to Investor Relators of firms sample. To increase the response rate, such invitation included a cover letter. Although the total of questionnaires filled were expected, the data collection process resulted in 18 responses by alternatively CEO, GM and CEO-R&D. Thus, the response rate was about 5%.

Questionnaire used for the online survey reflected what is open innovation and what is implementation of open innovation in the firms. Thus, it was directed to obtain evidence supporting the purpose of this research. Thus, the questionnaire was divided into three main parts in addition to an introduction to this study composed of the general context and aims of research: the first was directed to collect general data about key internal

actors; the second aimed to discover the role of open innovation in the corporate development strategy; the third was directed to obtain information on success factors and risks deriving from open innovation implementation in the firm.

Additionally, the questionnaire included 21 questions of which 2 open-ended questions, 8 open-closed questions (“yes”, “no” and “other”), 11 closed-ended questions. The closed-ended questions were structured in a five-point scale model ranging from “not essential” to “highly essential”. In this perspective, a deep investigation of questionnaire results was conducted according to the responses received at 8th June 2018.

The reliability of proposed questionnaire derives from pre-testing activities conducted by authors. However, the integrity of the proposed investigation is guaranteed by a joint work strategy among the authors as well as by the long-time experience and knowledge of authors in the field. Particularly, the results of the online questionnaire were analysed and discussed among the authors to achieve significant research and practical considerations and implications on the topic analysed. In this direction, findings and discussion are presented in the following section.

4 Findings

Our explorative research aimed to provide a comprehensive view on the role of boundaries management when firms should implement open innovation. We have asked for the links connecting open innovation, new paths of corporate growth and firm boundaries, for boundaries resources and activities to foster management and implementation of open innovation and for the role of boundaries management in facing the typical risks in implementing open innovation. Thus, the experts’ answers provide interesting insights to advance theories in the field of firm boundaries (Cao and Zhang, 2011; Garzella, 2000; Villalonga and McGahan, 2005), open innovation (Chesbrough 2003a; Enkel et al., 2009; Trequattrini et al., 2012) and corporate growth strategies (Fiorentino, 2016; Foss et al., 2013; Garzella, 2000) discovering relevant issues about boundaries management when firms embracing open innovation (Chesbrough, 2006).

Testing in the questionnaire the presence of actions directed to implement open innovation strategy, almost all respondents of our questionnaire declare the existence of several corporate actions directed to develop strategies fostering open innovation contributing to existing theories (Fiorentino, 2016; Foss et al., 2013; Garzella, 2000). Many respondents’ answers consider the activation of collaboration with some partners on innovation projects in next three years more than essential for the firms.

Additionally, we have asked which is the firm willingness to collaborate with some key individuals. In this direction, providers of goods and services and territorial organizations seem the most relevant key individuals in approximately half of expert’s answers. Highly essential key individuals are confirmed in providers of goods, clients, research centres and university and territorial organizations. However, substitute providers and new entrant on the market seem to be the less relevant than other key individuals.

RQ1. The findings suggest that open innovation is equally important for product, process and business model innovation (Fiorentino, 2016; Garzella, 2000; Trequattrini et al, 2012). In the new competitive contexts, the open innovation is an obligatory choice more than a chance. The open innovation represents a real alternative to traditional strategies for achieving positions of competitive advantage.

Most important, respondents suggest that open innovation can be framed mainly as a rethinking of the traditional distinction between internal and external growth strategies. Firms move to open innovation in order to increase creativity, to reduce time to market, and to improve product and process quality more than to reduce risks and costs.

The questionnaires underline that open innovation makes it possible to enhance the knowledge produced outside the company by transferring it within. However, relations with partners emerge as one of the main risks of external growth strategies, and open innovation. Accordingly, in the respondent's opinion boundaries management can play a key role to improve corporate strategies and open innovation first by reducing the timing of innovation processes (so increasing the value of innovation) and avoiding inter-organizational conflicts. Furthermore, boundaries resources and activities can help firms in questioning consolidated thinking models.

RQ2. The findings suggest that the effectiveness of the open innovation process depends mainly on the relational skills of top management (Chesbrough, 2003a; Enkel et al., 2009). In open innovation implementation, relations with customers are, surprisingly, more important than relations with suppliers. The success in implementing open innovation is also related to: the creation of organizational units devoted to boundaries management by new ad-hoc organizational unit for each open innovation process; the creation of culture and organization favourable to open innovation.

Our results underline that in order to foster open innovation, the boundaries managers should be engaged in relevant boundaries activities such as, in order of importance in respondent's perception: the formation of people with boundaries management skills; the selection of subjects to be involved in open innovation implementation; the capability to adequately assess risks and goals of open innovation with other involved subjects; the adoption of linking strategies with partners; the adoption of bearing strategies.

RQ3. The survey confirms that the boundaries management can play a key role (Cao and Zhang, 2011; Cassiman and Veugelers, 2006; Garzella, 2000; Parmigiani and Mitchell, 2009; Wagner, 2003) in: increasing cohesion and collaboration of open innovation working team; reducing the coordination costs; improving the commitment on the project; facing resistances due to corporate culture and leading change management processes; enhance the willingness to share know how in fair mode; protecting internal know-how. Moreover, one generally overlooked factor that was discussed as relevant in our survey is the relations among internal functions, which are more important than relations with external partners. In this regard, the role of boundaries managers is strengthened.

The respondents felt boundaries management to be relevant because it impacts on the management of typical firm risks in implementing open innovation. The boundaries management can improve the selection of partners by effective negotiation processes.

Indeed, the focus on boundaries resources and activities can foster continuous process of manager formation in order to bridge the gap about the lack of skills in the management of collaborative relations. Finally, boundaries management should be useful in the management of internal resistances.

5 Conclusions

Results show that open innovation and many modern firm paths growth are connected to the boundary of which the main significant element is represented by the management.

It is possible both to identify boundary strategies and to understand distinctive resources from which derive their successful implementation. Among these resources, high relational skills, the control of information technology, a strong corporate image within the innovation network, and the managerial skills to dynamically harmonize the power/dependence relations (with partners, customers and suppliers) stand out. Alongside strengths of boundary management and their ability to reading the weak signals from environment, risks of strategic approach and modality for their implementation have also emerged.

This study sheds light on the advantages and the risks that can jeopardize the successful outcome of opening up the innovation processes without the effective management of boundaries studies. Recognizing the boundary as the core of open innovation implementation issues, the boundary management should be based on elements both internal and external and they outline paths difficult to place in the typical and traditional dichotomies and taxonomies of strategic management studies. Consistently, the current theoretical and managerial solutions on open innovation, such those from strategy studies, result insufficient to provide useful contribution to the implementation of paths that are, instead, increasingly based on boundaries resources. Future studies should provide in-depth research on the role of boundaries in open innovation implementation to learn more and to limit the risks of centrifugal thrusts.

Our findings push to overcome the traditional contrast between closed and open innovation models to move the focus on the boundaries of the company. The managerial implications of our research push to shift the focus of open innovation implementation towards the management of the boundaries, where boundaries capabilities and activities play a key role. Thus, we identify and advance insights maximizing potentiality and reducing risks in implementing open innovation.

The implementation of open innovation implies that essential decisions about innovation have been made to shift the attention of corporate leaders neither inside nor outside but in the firm periphery. Our results highlight the importance of overlooked aspects in open innovation implementation such as firm internal relations besides external relations. Accordingly, firms should create ad-hoc organizational units with boundaries management specific skills.

Until today, open innovation scholars have looked, in a two-dimensional perspective, inside or outside the funnel. Our study suggests that it might also be useful to analyze its edges by switching to a three-dimensional perspective.

References

- Abulrub, A.G., and J. Lee. 2012. "Open innovation management: challenges and prospects". *Procedia - Social and Behavioral Sciences*, 41:130-138.
- Adamides, E.D. 2015. "Linking operations strategy to the corporate strategy process: a practice perspective". *Business Process Management Journal*, 21 (2): 267-287.
- Alexander, M. 1997. Getting to grips with the virtual organization. *Long Range Planning*, 30 (1): 122-124.
- Aloini, A., Farina, G., Lazzarotti, V., and L. Pellegrini. 2017. "Implementing open innovation: conceptual design of an integrated ICT platform". *Journal of Knowledge Management*, 21 (6): 1430-1458.
- Barney, J.B. 1991. "Firm resources and sustained competitive advantage". *Journal of Management*, 17(1): 99-120.
- Boddy, D., Macbeth, D., and B. Wagner. 2000. "Implementing Collaboration Between Organizations: An Empirical Study Of Supply Chain Partnering". *Journal of Management Studies*, 37 (7): 1003-1018.
- Cao, M., and Q. Zhang. 2011. "Supply chain collaboration: Impact on collaborative advantage and firm performance". *Journal of Operations Management*, 29 (3): 163-180.
- Caputo A., Fiorentino R., and S. Garzella (2018). "New competitive contexts, business processes and capabilities: from the boundaries of the management to the management of the boundaries", working paper.
- Cassiman, B., and R. Veugelers. 2006. "In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition". *Management science*, 52 (1): 68-82.
- Chesbrough, H.W. 2003a. *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston, MA: Harvard Business Press.
- Chesbrough, H.W. 2003b. "The era of open innovation". *MIT Sloan Management Review*, 44 (3): 35-41.
- Chesbrough, H. 2003c. "The logic of open innovation: managing intellectual property". *California Management Review*, 45 (3): 33-58.
- Chesbrough, H.W. 2006. *Open innovation: The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business Press.
- Chesbrough, H. and M. Bogers, 2014, "Explicating open innovation: clarifying an emerging paradigm for understanding innovation", in Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds), *New Frontiers in Open Innovation*, Oxford: University Press: 3-28.
- Chesbrough, H., Vanhaverbeke, W., and West, J. 2006. *Open innovation. Researching a New Paradigm*. London: Oxford University Press.
- Coase, R.H. 1937. "The nature of the firm". *Economica*, 4 (16): 386-405.
- Cooper, D.R., Schindler, P.S., and J. Sun. 2006. *Business research methods*. New York: McGraw-Hill Irwin.
- de Villiers, C., and J. Dumay. 2014. "Writing an article for a refereed accounting journal". *Pacific Accounting Review*, 26 (3): 324-350.
- Dyer, J.H., and H. Singh. 1998. "The relational view: Cooperative strategy and sources of interorganizational competitive advantage". *Academy of Management Review*, 23(4): 660-679.
- Enkel, E., Gassmann, O., and H. Chesbrough. 2009. "Open R&D and open innovation: exploring the Phenomenon". *R&D Management*, 39(4): 311-316.
- Fiorentino, R. 2016. "Operations strategy: a firm boundary-based perspective". *Business Process Management Journal*, 22(6): 1022-1043.

- Foss, N.J. 1996. "Knowledge-based approaches to the theory of the firm: Some critical comments", *Organization Science*, 7(5): 470-476.
- Foss, N.J., J. Lyngsie, and S. Zahra. 2013. "The role of external knowledge sources and organizational design in the process of opportunity exploitation". *Strategic Management Journal*, 34 (12): 1453-1471.
- Gambardella, A., Panico, C. 2014. "On the management of open innovation". *Research Policy*, 43(5): 903-913.
- Garzella, S. 2000. *I confini dell'azienda. Un approccio strategico*. Milano: Giuffrè.
- Gassmann, O., and E. Enkel. 2004. Towards a Theory of Open Innovation: Three Core Process Archetypes. In: Paper presented at R&D Management Conference, Lisbon.
- Giannopoulou, E., Yström, A., Ollila, S., Fredberg, T., and M. Elmquist. 2010. "Implications of openness: a study into (all) the growing literature on open innovation". *Journal of Technology Management & Innovation*, 5(3): 162-180.
- Hargadon, A.B. 2002. Brokering knowledge: linking learning and innovation. *Research in Organizational Behavior*, 24: 41-85.
- Hoque, Z. 2018. *Methodological issues in accounting research*. UK: Spiramus Press Ltd.
- Hossain, M., Islam, K.M.Z., Sayeed, M.A., and I. Kauranen 2016. "A comprehensive review of open innovation literature". *Journal of Science & Technology Policy Management*, 7 (1): 2-25.
- Hossain, M., and I. Kauranen 2016. "Open innovation in SMEs: a systematic literature review". *Journal of Strategy and Management*, 9 (1): 58-73.
- Huizingh, E.K. 2011. "Open innovation: state of the art and future perspectives". *Technovation*, 31 (1): 2-9.
- Lakhani, K.R., Lifshitz-Assaf, H., and M. Tushman. 2013. "Open innovation and organizational boundaries: task decomposition, knowledge distribution and the locus of innovation". In Grandori A., *Handbook of economic organization: Integrating economic and organizational theory*, Edward Elgar: 355-382.
- Lavie, D. (2006). "The competitive advantage of interconnected firms: An extension of the resource-based view". *Academy of Management Review*, 31 (3): 638-658.
- Liu, Y. and L. Liang. 2015. "Evaluating and developing resource-based operations strategy for competitive advantage: an exploratory study of Finnish high-tech manufacturing industries". *International Journal of Production Research*, 53(4): 1019-1037.
- Lombardi, R., Dumay, J., Lardo, A. and R. Trequattrini. 2016. Modern trends for the strategic use of Intellectual Property Rights: dynamic IP portfolio management, open innovation and collaborative organizations. In *Managing Globalization. New Business Models, Strategies and Innovation of Firms*, Cambridge: Cambridge Scholars Publishing: 114-137.
- McEvily, B., and A. Zaheer. (1999). Bridging ties: A source of firm heterogeneity in competitive capabilities. *Strategic Management Journal*, 20 (12): 1133-1156.
- McIvor, R. 2009. "How the transaction cost and resource based theories of the firm inform outsourcing evaluation". *Journal of Operations Management*, 27 (1): 45-63.
- Milgrom, P. and J. Roberts 1990. "The economics of modern manufacturing: technology, strategy, and organization". *American Economic Review*, 80 (3): 511-528.
- Möller, K.K., and A. Halinen. 1999. "Business relationships and networks: Managerial challenge of network era". *Industrial Marketing Management*, 28 (5): 413-427.
- Normann, R., and R. Ramirez. (1993). "From value chain to value constellation: Designing interactive strategy". *Harvard Business Review*: 71 (4): 65-77.
- Park, N.K., Mezias J.M., and J. Song. 2004. "A resource-based view of strategic alliances and firm value in the electronic marketplace". *Journal of Management*, 30 (1): 7-27.

- Parmigiani, A., and W. Mitchell. 2009. "Complementarity, capabilities, and the boundaries of the firm: the impact of within-firm and interfirm expertise on concurrent sourcing of complementarity components". *Strategic Management Journal*, 30 (10): 1065-1091.
- Pfeffer, J., and G.R. Salancik. 1978. *The external control of organizations: A resource dependence approach*. NY: Harper and Row Publishers.
- Pil, F.K., and M. Holweg. 2006. "Evolving from value chain to value grid". *MIT Sloan Management Review*, 47 (4): 72-80.
- Ritter, T., Wilkinson, I.F., and W.J., Johnston. (2004). "Managing in complex business networks". *Industrial Marketing Management*, 33 (3): 175-183.
- Santos, F.A., and K.A. Eisenhardt. 2005. "Organizational boundaries and theories of organization", *Organization Science*, 16 (5): 491-508.
- Scott, R.W. (2003). *Organizations: Rational, Natural, and Open Systems*. NJ: Prentice-Hall, Englewood Cliffs.
- Schwartz-Shea, P., and D. Yanow. 2012. *Interpretive research design: concepts and processes*. New York: Routledge.
- Steensma, H.K., and K.G. Corley. (2001). Organizational context as a moderator of theories on firm boundaries for technology sourcing. *Academy of Management Journal*, 44 (2): 271-291.
- Swink, M.R., Narasimhan, and C. Wang. (2007). "Managing beyond the factory walls: effects of four types of strategic integration on manufacturing plant performance". *Journal of Operations Management*, 25 (1): 148-164.
- Takeishi, A. (2001). Bridging inter and intra firm boundaries: management of supplier involvement in automobile product development. *Strategic Management Journal*, 22 (5): 403-433.
- Toma, A., Secundo, G., and G. Passiante. 2018. "Open innovation and intellectual property strategies: Empirical evidence from a bio-pharmaceutical case study". *Business Process Management Journal*, 24 (2): 501-516.
- Tortoriello, M., and D. Krackhardt. 2010. "Activating cross-boundary knowledge: the role of simmelian ties in the generation of innovations". *Academy of Management Journal*, 53 (1): 167-181.
- Trequatrin, R., Russo, G., and R. Lombardi. 2012. Open innovation and network models: empirical research. In Trequatrin R., Recinto G., Russo G., *Innovation and Company Network*, Q.R. *Impresa Ambiente Management*, vol. 3, 179-196. Naples: Edizioni Scientifiche Italiane.
- Van de Vrande, V., De Jong, J.P., Vanhaverbeke, W., and M. De Rochemont. 2009. "Open innovation in SMEs: trends, motives and management challenges". *Technovation*, 29(6): 423-437.
- Villalonga, B., and A.M. McGahan. 2005. "The choice among acquisitions, alliances, and divestitures". *Strategic Management Journal*, 26(13): 1183-1208.
- von Hippel E. 1988. *The Sources of Innovation*. New York: Oxford University Press.
- von Hippel, E. 1986. "Lead users: a source of novel product concepts". *Management Science*, 32(2): 791- 805.
- von Hippel, E., and G. von Krogh. 2006. "Free revealing and the private-collective model for innovation incentives". *R&D Management*, 36 (3): 295-306.
- Wagner, B.A. (2003). "Learning and knowledge transfer in partnering: an empirical case study". *Journal of Knowledge Management*, 7 (2): 97-113.
- West, J., and M. Bogers, 2013. "Leveraging external sources of innovation: a review of research on open innovation". *Journal of Product Innovation Management*, 31(4): 814-831.
- West, J., Salter, A., Vanhaverbeke, W., and H. Chesbrough. (2014). "Open innovation: The next decade", *Research Policy*, 43 (5): 805-811.
- Williamson, O.E. 1975. *Markets and hierarchies*, New York, NY: Free Press.

- Yang, H., Z.J., Lin and Y.L. Lin. (2010). A multilevel framework of firm boundaries: firm characteristics, dyadic differences, and network attributes. *Strategic Management Journal*, 31(3): 237-261.
- Yanow, D., and P. Schwartz-Shea 2014. *Interpretation and method: Research methods and interpretive turn*. 2nd ed., Armonk, NY, ME: Sharpe.
- Zhang, D.Z. 2011. "Towards theory building in agile manufacturing strategies - Case studies of an agility taxonomy". *International Journal of Production Economics*, 131(1): 303-312.

“Big Digital Bank” vs “Local Bank”. What Can Be Learnt from the Managers’ Actions to Cope with these Ostensible Controversial Situations?

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Abstract

The Italian banking system has profoundly changed during the last 20 years both due to the privatization of the major State banks and out of the greater use of market financing taken place on the stock exchange. Thanks to the M&A process, nowadays, banks are larger and more complex than in the past but, M&A is a dangerous process if it is not appropriately dealt. The major risks are related to the numerous different items that must be well managed during the transition period such as, e.g., employees and information systems. Concurrently, banks’ managers are being asked to incorporate the new features and changes deriving from the recent years’ digitization. These important changes, unavoidably, lead to the need to close branches reducing the number of employees which has repercussions on the relations that the bank has with the territory and this could compromise the economic local grow.

The present work revolves around the idea of understanding which actions the managers could undertake to ensure that the relationship with the territory is not lost while facing exponential growth in size, caused by the M&A process, and the challenges brought about by digitalisation.

The methodology used in the present paper is an ethnographic exploratory single case study where the information will be collected using semi-structured interviews.

In this first part of a wider project, in addition to a literature review, the process required to elaborate the schemes of the semi-structured interviews is explained.

The value of the work is interesting for scholars as well as for practitioners; in fact, from the analysis of the answers provided by managers it will be possible to learn a lesson regarding the actions that were carried out, but also about the activities that have not led

to the desired results and therefore should be avoided. At the same time, this study could contribute to the academic debate as it allows us to add literature on management while selecting which prior author's position to endorse, regarding the influence of managers' behaviours on obtaining profitability in banking institutions.

Keywords: local banks; M&A; banks dimension; managers' actions; digitalization

Paper type: Academic Research Paper

1 Introduction

In the last years, also due to the merger and acquisition (M&A) processes, banks have had greater gains than in the past and they have become more complex while their organizational structure has evolved (Paoloni, 2018).

The fast step towards M&A in the banking industry was taken many years ago and, with time, many more have been taken (Benston et al, 1995).

According to Altunbas and Ibáñez (2004) between 1992 and 2001 bank mergers in the EU banking industry generally lead to improved accounting profitability. From 1991 to 2005 a process of integration has taken place at the European level, when instead the US banking industry was already integrated. A dismantlement of trade barriers occurred in the European financial services, as shown by the deregulation through the Second Banking Directive (1989), the creation of the single market in financial products and the introduction of the Euro (Molyneux and Wilson, 2007, Beccalli and Frantz, 2009). Moreover, the European bank system has traditionally been different than the US system, because of the prevalence of mutual banks like cooperative and saving banks (Altunbas *et al.* 2001). Precedent studies provide mixed evidence and many fail to show a clear relationship between M&A and performance. Some of the previous literature has examined the impact of M&A operation on different indicators. Although an improvement in performance is found for more recent deals, neither earlier studies nor more recent analysis find evidence of clear positive effects of M&A operations on the performance of US banks (Knapp *et al.* 2006; DeLong and DeYoung 2007). In addition, studies on the M&A activities in the EU banking industry conclude that performance improvements are seldom realized (Altunbas and Ibáñez, 2004).

During the global financial crisis, started in 2007, the landscape of the procedures of M&A changed, because different causes at the basis of this strategy arose, sometimes to gain major access to new geographies (Grave *et al.*, 2012) and sometimes to profit from a greater dimension, necessary to counter increased competition and maintaining (or sometimes regaining) positive levels of profitability. Regarding this there are two different strands, where scholars have different points of view. In fact:

- i) Some researchers believe that an increase in bank size may increase both the standalone and the systemic risk (Laeven *et al.*, 2016; Boyd and De Nicoló, 2005; Altunbas *et al.*, 2016), and

- ii) Others connect the increase in bank size with implicit subsidies related to “too big to fail” (Acharya *et al.*, 2017; Bertay *et al.*, 2013).

The past studies show that M&A failure is not unusual, indeed one operation out of two fails (Demeure, 2000; Habeck *et al.*, 2001) or, within the first two years of merger operations, over half of all mergers fail to meet shareholders’ expectations for value or earnings potential. This is particularly possible in cross border operations caused by contextual and cultural differences among the participants. The success of cross-border M&A depends on the choice of participants and their objectives. Companies’ management must face this challenge (Vander Vennet, 2002; Powell, 2001).

At the beginning of the M&A process it is important to aim to create a large dimensional banking companies because it allows, on the one hand, to better manage the necessary diversification of the businesses and on the other hand, it allows for a reduction of different types of risks and some costs, as well as providing greater access to capital.

But, if in one hand, M&A process became necessary, in the other hand this process is so risky. In fact, is not easy to have an M&A process succeed, as the factors to be managed at the same time are many and different and sometimes controversial. In one M&A transaction there are two primary parties, represented by the buyer and the seller of the company, but other many stakeholders’ interests are involved as advisors, creditors, suppliers, customers, employees, communities, governments, and so on (Bruner, 2002).

To all this, it must be added that a further challenge the banking sector companies are facing is represented by the digitization occurring on the same factors the merger process has already affected.

In the present work, the major problems arising from a M&A process are analysed, regarding both the employees and information system integration, as well as the operations and proceedings integration, without neglect the advent of the technology.

Furthermore, it cannot be forgotten that a larger banking institution and digitalisation could lead to a more distant relationship with the territory, putting the growth of the local economy at risk (Caporale *et al.*, 2016).

If on one hand, it is, also, important to create a large size bank, on the other it is important to maintain the characteristic of territoriality, despite the differences in the *modus operandi* of small and large banks (Berger and Udell, 2002; Felici and Pagnini, 2008). Therefore, analysing the current context in which the banks operate, the research question this work addresses is:

RQ: What are the most effective managerial actions to simultaneously confront the M&A process as well as the advent of digitization, without deteriorating the relationship with the territory?

In an attempt to answer this question, the work is organized as follows. The next section reviews academic literature on the major problems related to the M&A process, as well as the digitalisation and the difficulties in maintaining the “local” dimension. Followed by describing the research method used to elaborate the schemes of the structured-interview that will be done in the next weeks. The last section presents the discussion regarding the findings expected within the interviews and elaborated in consideration of the contents of the literature.

2 Literature review

Following the recommendations provided by the European Central Bank (European Central Bank, 2018) it is important to reduce the number of banks and one of the suggestions is to merge banks in a strategic way and to create sustainable banks. This is the reason why, the M&A processes has undergone a substantial acceleration (Vander Vennet, 1996).

Aware that banking M&As process is composed by two temporal phases (firstly domestic consolidation and secondary international expansion), by analysing the European banking system current situation it is possible to assert that it is in the second phase, namely, international expansion. This phase is characterized primarily by European operations supported by the actions and policies taken by the European Central Bank and the European commission in order to integrate the European financial systems for a better allocation of capital through Europe while supporting banking competition. One of the main catalysts of this process of consolidation is represented by the regulatory harmonization, as, e.g., Basle II, Basel III and IAS/IFRS (Ben Slama *et al.*, 2012), which improves transparency and reduces bank risks.

An acquisition has the effect of bringing together the management groups of two organizations, with styles which might be similar, or alternatively, very different. Significant differences can contribute to, what Buono *et al.*, (1985) call, “cultural ambiguity”, a situation characterized by uncertainties concerning whose style or culture will dominate. The need for post-acquisition integration of operations in an acquisition is primarily bounded by its objectives. An acquisition might form a part of a strategy of related diversification and, therefore, be expected to provide synergistic benefits. Such benefits could be in the form of operating efficiencies and economies of scale requiring high levels of integration as might be feasible in related acquisitions (Porter, 1985; Salter and Weinhold, 1979). The primary objective in post-acquisition integration of operations is to make more effective use of existing capabilities. Merging firms can reduce unit costs in production, inventory holding, marketing, advertising, and distribution integrating similar departments and functions (Howell, 1970; Rappaport, 1987).

Summarizing the problems linked to merger and acquisition processes found in literature, it is possible to assert that the main difficulties regard:

1. Employees integration;
2. Information system and business-processes integration;
3. Banks' over-sized structure.

Regarding the first problem, past literature on M&A consider employees as victims of unintended negative effects of integration, resulting in poor motivation and productivity (e.g. Shrivastava, 1986). Although integration is indispensable for taking advantage of potential synergies, it simultaneously may have negative effects on employees. The organizational and psychological turbulence which often follows can cause stress, anxiety, internal power struggles and politicking (Meyer and Altenborg, 2007). In response, managers are seen as responsible for conducting integration while at the same time considering the well-being of employees and are able to find the best motivation

from the merger. A good integration is difficult if managers, too, suffer during integration, since they are the ones who should be able to lead integration or, at least, limit its negative effects on other employees (Schriber, 2012).

The second critical challenge companies' face during a merger is integrating their information systems. A large number of merging companies run into problems causing delays lost opportunities, and all of these could be the effect to decrease revenues. A primary purpose of integrating diverse information system is to realize ideal synergies among departments. Information system professionals must be an integral part of the M&A team from the early stages of merger planning if the information system merger is to be successful. Otherwise, involving professionals after time could compromise the result of the process (Harrell and Higgins, 2002). According to Harrell and Higgins, (2002) there are different common strategies available when merging IS systems:

- Maintain Status Quo, without integration problems and interruption of business processes but not data sharing between systems;
- Use one company's system or best of breed; or acquire a new system;
- Outsource.

One more challenge for companies and specifically for banks after merger or acquisition is represented by the integration of both the operations and proceedings.

The organization's M&A integration process and capabilities must be in place before the deal gets done (Galpin and Herndon, 2003).

The past studies of Mylonakis (2006) showed that bank employees feel personally threatened by mergers and acquisitions, which are not considered to be justified and necessary entrepreneurial activities conducive to enhanced, quality banking services.

Human resources management within M&A environment is problematic due to changes in the general procedures and in the practices followed by the acquired companies to carry out various tasks, and also due to the growing competition between the employees of the merged parties (Gunu and Olabisi, 2011). Most employees regard Merger and Acquisition as a threat to their jobs, since shareholders often demand limitations in the number of employed staff. Today's facts verify these fears as, during mergers, the number of employees working in the engaged companies is actually less than before (Gunu and Olabisi, 2011).

The restructuring process of European and global banking has brought substantial changes in the nature and quality of employment. This restructuring process is a result of not only the Merger and Acquisition wave observed in the last 15 years, but also of the massive introduction of new technologies into banking. The introduction of new technologies in banking preceded the Merger and Acquisition wave, whereas the latter has accelerated the restructuring process. This is because a bigger M&A wave may exploit new technologies in a more efficient manner and, most of all, it may also undertake to a great extent the cost for the application of these technologies (Koutroukis and Terzidis, 2010), so, at the end, the scenario has become complicated as a result of the change in consumer behaviour and the impetuous digitalization process that requires the identification of new channels and products, as well as to adapt the technological infrastructure, to change the organisation directly, especially if the purpose is to obtain a

strategic positioning in the digital environment (Cuesta *et al.*, 2015). In such cases, the digitalisation is regarded as a driver for ‘disintermediation’ in an established ecosystem (Milkau and Bott, 2015).

Following the idea provided by Cuesta *et al.*, 2015, the major changes resulting from this process impact on the relationship between customer and their experience; on the new idea of branches’ format, revised considering that mobile banking offers benefits such as true freedom from time and place and efficiency for banking transactions (Laukkanen, 2017; Yakhlef, 2001), as well as on the role of employees that, according to some authors, will be revised and certain professional figures will be deleted (Haake, 2017; Gastaldi *et al.*, 2014). At the same time several writers share the view that internet based connections can be used as a means of building relationships with customers and add that they can allow banks to customize and personalize their offerings much more appropriately (Hotchkiss, 1997).

The logics that should be undertaken in this context have to tend to retain the most talented resources and those that are most prone to change within the organization; in fact the employees who remain will be called to make a huge effort to ensure that their training and personal skills adapt to the changes that have occurred and to future ones, as well as to align their skills to the new strategic objectives the bank will define (Lodesani *et al.*, 2018).

Therefore, the need to adopt new technologies to provide additional banking channels for customers has become much more of a strategic necessity for the services industries and, above all, for banks (Ibbotson and Moran, 2003) and involved the existing relationship between the bank and territorial economic organizations, as e.g. SME (small and medium enterprises).

The role played by small regional banks on local economic growth is another important aspect that must be addressed (Modina and Polese, 2008; Hakenes *et al.*, 2009), above all considering that it has emerged that, during the financial crisis, local banks have had a key role. Indeed, some scholars (e.g. Barboni and Rossi, 2013) showed that companies at the local and regional level, during the recession period, have been less affected compared with others.

The idyllic dimension of banks became one of the main topics for discussion in a context in which, on the one hand, there are pressures to create large banks but on the other it is considered important to maintain a relationship with the territory, both to ensure levels of profitability and to avoid endangering local economic growth.

Currently, the banking market is dominated by big-players in some country.

The scenario has changed also in Italy when compared with the past. In this situation it is difficult for the bank to link the “internal” exigencies with customer territorial relationship.

In this paper, the aim is to understand how after a merger among two Italian banks their manager attempted to combine the digitisation process to maintain the customer territorialism.

3 Research methodology

3.1 Background

The aim of the present work is to understand the actions undertaken by banks' management following the dimensional growth due to the M&A process, while taking into account the effects of the digitalization, to maintain the traditional "local" link with the clients.

The present research was developed using a case study methodology that is an empirical method aimed at investigating contemporary phenomena in their context (Runeson and Höst, 2009; Robson and McCartan, 2016). This approach is considered one of the scientific methods that include both quantitative and qualitative data and it is useful to support and explain both the process and outcome of a phenomenon through complete observation, reconstruction and analysis of the cases under investigation (Tellis, 1997).

In detail, following the classification provided by Yin (1984), in which he determines three different categories: exploratory, descriptive and explanatory case studies, the present work is placed in the exploratory case study category, defined as an approach used to explore any phenomenon in the data which serves as a point of interest to the researcher. General questions, such as, "Does a student use any strategies when he reads a text?" and "if so, how often?" are usually for research conducting by exploratory case study. According to Neale and Liebert (1980) that identified two different types of designs when using case studies for explanatory purposes in this work, a single-case design is used.

Considering the goal of the work, for which a community of people must be studied to understand how the members of that community make sense of their social interactions (Robinson *et al.* 2007) the research method could also be defined as an ethnographic study, that is a particular and specialized type of case study focused on cultural practices through field observation (Easterbrook *et al.* 2008).

As different scholars suggest (i.e. Runeson and Höst, 2009), for the present ethnographic exploratory single case study the information was collected using the semi-structured interview, in which the questions are formulated considering the research aim and although planned, they are not necessarily asked in the same order as they are listed. Semi-structured interviews were chosen to permit the interviewees to feel free (Corbetta, 2003) to explain thoughts and to highlight areas of particular interest and expertise that they felt they have (Horton *et al.*, 2004), as well as allow both the interviewers and interviewees to improvise (Runeson and Höst, 2009).

Since our study aims at offering starting points to suggest to other managers how to better deal with the controversial situation they face, it is unnecessary to identify in content theory (Diefenbach, 2009; Rudestam and Newton, 1992).

3.2 The conceptual drawing of the research process

3.2.1 Sample

This study will involve the top management of one of the most important Italian banks who operated an M&A process and that must face the digitalisation issue.

The idea is to interview the managers at the highest levels of the areas that play a key role in the two processes mentioned above, such as administration, communication, organisation, planning and control, human resources, and others. Managers that were already within the entity investigated at the time of the M&A.

3.2.2 Questions

In line with the suggestions to conduct the semi-structured interviews, provided by the main methodology scholars, the questions that will be asked to managers, after requesting some introductory information, are subdivided into consideration of the different domains identified in the literature: i) challenges and opportunities in mergers and acquisitions; ii) digitalization process; iii) oversize structure of banks; iv) territoriality dimension of banks to ensure that all issues of the present study will be covered during the interviews .

The domain “challenges and opportunities in mergers and acquisitions” is investigated considering the main problems that could arise from this process, such as the difficulty to integrate previously employed workers in two different realities, the problems emerging from the integration of the information system, and the challenges in the integration processes of management concerning issues like credit granting. Another problem could sometimes arise from the M&A transaction as well as from the digitalisation process. A problem that the managers are must solve: the oversized entity, in other words the large number of employees and branches. Regarding this specific issue, a new group of questions was created (4th).

The questions were developed based on contributions provide by scholars (Patton, 1990; Salama *et al.*, 2003; Lewis *et al.*, 2004) and revised considering the peculiarities of the present work. The structure of interviews, formulated to stimulate interviewees, is shown in table n.1.

Table n.1: Semi-structure interviews scheme

<u>1st group: Introductory questions</u>	
▪	Describe your work experience prior to the present one.
▪	Describe your last work experience prior to the present one *(Patton, 1982).
▪	How long did you work in the last company?
▪	Describe your current role *(Patton, 1982).
▪	How did you join this company? *(Patton, 1982)
▪	For how many years have you been with this company?
▪	Describe your level of satisfaction with your involvement with this company* (Patton, 1982).
▪	How does your role on this company differ from your previous work experience? * (Patton, 1982)
<u>2nd group: Focus on challenges and opportunities of M&A processes</u>	
<u>Problems in employee integration processes</u>	
▪	What practical steps can be taken to minimize the feelings of uncertainty normally expected

by employees, and also to facilitate the learning process between two groups of people in their cultural and behavioural integration, as an M&A process? *(Salama et al., 2003)

- What perceptions and obstacles did most employees bring forward regarding the M&A process?* (Galpin and Herndon, 2003)
- Were any social activities undertaken to create a better environment during the M&A process? *(Galpin and Herndon, 2003)
- Were Employees benefits defined during the M&A process? *(Galpin and Herndon, 2003)

Problems in information system and business-processes integration

- Were different management systems applied in the merged organizations or were the existing company's systems used? Was a new system chosen or was the IS system outsourced to a third party to process all information requirements?**(Harrell et al., 2002)
- Did one company's strategies predominate over another's? *(Harrell et al., 2002)
- How was the IS department structured? *(Harrell et al., 2002)
- Were Business processes and systems created or was a pre-existing one used during the process? *(Galpin and Herndon, 2003)

3rd group: Focus on the digitalisation process

- What are the primary factors emerging from the digital economy? *(Patton, 1992)
- What are the challenges associated with working within the digital economy? *(Patton, 1992)
- How does working within the digital economy change the communication of teams? *(Lewis et al., 2004)
- In your opinion, which channels are more effective, least effective? Why? *(Lewis et al., 2004)
- What are the communication challenges? *(Lewis et al., 2004)
- What are the communication success? *(Lewis et al., 2004)
- Have you found the lack of adequate skills in the staff, with reference to the IT systems?**(Khalfan and Alshawaf, 2004)

4th group: Focus on the link with clients (territoriality dimension)

- What are the primary channels used to communicate with clients?*(Lewis et al., 2004)
- How does working within the digital economy change the communication with clients?*(Lewis et al., 2004)
- Have sponsorship activities been carried out in the territory in recent years?
- Have any actions been taken to maintain contact with the territory recently?

5th group: Focus on oversize structure of banks

- Have employees been fired after M&A or have other measures been taken to increase the number of employees to actual needs?
- Were the remaining employees trained in consideration of the new skills needed to face a different competitive environment as well as to align their skills with the new strategic objectives defined by the bank?**(Draghi, 2008)
- Have there been ad hoc interviews with employees to understand the abilities and attitudes of each person?
- Have branches been closed in recent years?
- Are there some employees that were assigned to a different role after the M&A process, because the previous task does not exist in the new entity?

*These questions are based on quoted works but are revised considering the specificities of the present study.

** These questions are elaborated considering the literature found in the quoted papers.

4 Discussion and conclusion

The present discussions are elaborated considering both the information and the pieces of evidence raised from the literature analysis.

M&A transaction must be preceded by the definition of a broader medium or longer-term strategy that must in turn, consider different variables that could compromise the success of the process. In the current European banking context, M&A transaction, defined by the ownership and carried out by managers, are direct in respect of the European legislation, issued by European Central Bank (ECB), in a perspective view of patrimonial consolidation and not greatly related to short-term profitability. Furthermore, the additional challenge that managers are called to take on is represented by the impact of digitalization on numbers of employees and branches.

As mentioned in previous paragraphs, the major challenges related to the M&A process refers to employees' management as well as the integration of both information system and business processes.

In fact, an oversized structure usually emerges from the merger, where employees and branches are numerically more than the needed, and consequently increase the operative costs that can in turn, compromise the profitability. A solution for this potential risk could be to manage "digitalization" breaking down structural costs. Both M&A and digitalization bring about a transformation of the traditional bank/customer relationship (Barnes and Howlett, 1998).

The necessary rationalization operations are one of the levers that banks can adopt to increase their profitability. On the other hand, however, it is important to highlight that the processes of rationalization will retain within the organization the most talented resources and those that are most prone to change. In fact, the employees who remain will be called to make a strong effort to ensure that their training and personal skills adapt to the changes that have occurred and to those that will occur, as well as to align their skills to the new strategic objectives defined by the ownership of the bank (Lodesani *et al.*, 2018). It becomes important to identify the key people (Galpin, 2014) and their ability and skills as well as to elaborate a strategy that considers these strengths; furthermore incentives to employees could play a key role in the success of these processes (Gates and Very, 2003)

While regarding the branches, it seems appropriate to underline how the logic related to these has changed over the years, due to the change in the market context. In the past, in fact, it was believed that opening new branches would correspond to growth in funding/lending volumes, while in this context agencies are currently mostly operating costs.

All this, as already stated by some authors, does not mean that employees and branches will disappear but that it will be necessary to change and modify their strategic and operational activities so that they adjust to a new way of relating to customers that, in the latter years, profoundly changed their behaviors. In some cases, the customers do not require face-to-face contact with the employees in a specific branch, which is one of the reason why some scholars assert that it not necessary to maintain the offices throughout the territory. However, on the other hand, most authors showed that the presence of the intermediaries on the territory have a positive effect on local economic growth, as in the case of Italy (Cetorelli and Gambera, 2001; Dalla Pellegrina, 2005; Cosci and Mattesini, 1997).

5 Limitations and value of the paper

The major limitation of the present study is the lack of interviews. In fact, in the work only the literature and the methodology was used to structure the interviews that are taking place currently. A further limit is represented by the use of a single case study, but this limit can be overcome in the future, interviewing managers who are employed by different banks.

The value of the analysis is represented by the implications that will emerge from the interviews and can be used both by insiders as suggestions and by academics to further the debate concerning the management of large banks and their role in the territorial economic context.

References

- Altunbas, Y., Evans, L. and Molyneux, P. (2001). Ownership and efficiency in banking. *J Money Credit Bank*, 33, pp.926–954.
- Altunbas, Y. and Ibáñez, D.M. (2004). Mergers and acquisitions and bank performance in Europe. The role of strategic similarities. *ECB Working paper no. 398*, Frankfurt, Germany.
- Altunbaş, Y., Di Tommaso, C. and Thornton, J. (2016). Do better-capitalized banks lend less? Evidence from European banks. *Finance Research Letters*, 17, pp.246-250.
- Acharya, V.V., Pedersen, L.H., Philippon, T. and Richardson, M., 2017. Measuring systemic risk. *The Review of Financial Studies*, 30(1), pp.2-47.
- Barboni, G. and Rossi, C. (2013). *Does Your Neighbour Know You Better?: Local Banks and Credit Tightening in the Financial Crisis*. European Regional Science Association.
- Barnes, J.G. and Howlett, D.M., (1998). Predictors of equity in relationships between financial services providers and retail customers. *International Journal of Bank Marketing*, 16(1), pp.15-23.
- Beccalli, E. and Frantz, P. (2009). M&A operations and performance in banking. *Journal of Financial Services Research*, 36(2-3), 203.
- Ben Slama, M., Saidane, D. and Fedhila, H. (2012). How to identify targets in the M&A banking operations? Case of cross-border strategies in Europe by line of activity. *Review of Quantitative Finance and Accounting*, 38(2), pp.209-240.
- Benston, G. J., Hunter, W.C. and Wall, L. D. (1995). Motivations for bank mergers and acquisitions: Enhancing the deposit insurance put option versus earnings diversification. *Journal of money, credit and banking*, 27(3), pp.777-788.
- Berger, A. N. and Udell, G. F. (2002). Small business credit availability and relationship lending: The importance of bank organisational structure. *The economic journal*, 112(477), pp.32-53.
- Bertay, A., Demirguc-Kunt, A. and Huizinga, H. (2013). Do we need big banks? Evidence on performance, strategy, and market discipline. *Journal of Financial Intermediation*, 22, pp.532- 558.
- Boyd, J. H. and De Nicoló, G. (2005). The theory of bank risk taking and competition revisited. *Journal of Finance*, 60(3), pp.1329-1343.
- Bruner, R.F. (2002). Does M&A pay? A survey of evidence for the decision-maker. *Journal of applied finance*, 12(1), pp.48-68.
- Buono, A.F., Bowditch J.L. and J. W. Lewis (1985). When cultures collide: the anatomy of a merger, *Human Relations*, 38(5), 1985, pp. 477-500.

- Caporale, G. M., Di Colli, S., Di Salvo, R. and Lopez, J. S. (2016). Local banking and local economic growth in Italy: some panel evidence. *Applied Economics*, 48(28), pp.2665-2674.
- Cetorelli, N. and M. Gambera (2001). Banking Market Structure, Financial Dependence and Growth: International Evidence from Industry Data, *The Journal of Finance*, 56 (2): 617–648. doi:10.1111/jofi.2001.56.issue-2.
- Corbetta, P. (2003). *La ricerca sociale: metodologia e tecniche* (Vol. 3). Bologna: Il Mulino.
- Cosci, S. and F. Mattesini (1997). *Credito e sviluppo nelle province italiane*. In *Credito e sviluppo*, edited by F. Cesarini, G. Ferri, and M. Giardino. Bologna: il Mulino, pp.89–130.
- Cuesta, C., Ruesta, M., Tuesta, D. and Urbiola, P. (2015). The digital transformation of the banking industry. *BBVA Research* (available at https://www.bbvarsearch.com/wp-content/uploads/2015/08/EN_Observatorio_Banca_Digital_vf3.pdf).
- Dalla Pellegrina, L. (2005), *Intermediazione bancaria e crescita nelle province italiane*, 10mo Rapporto sul Sistema Finanziario Italiano, Fondazione Rosselli, Edibank.
- DeLong, G. and DeYoung, R. (2007). Learning by observing: information spillovers in the execution and valuation of commercial bank M&As. *The Journal of Finance*, 62(1), pp.181–216.
- Demeure, B. (2000). Fusion mode d'emploi. *Revue Francaise de Gestion*, 131, pp.119–125.
- Diefenbach, T. (2009). Are case studies more than sophisticated storytelling?: Methodological problems of qualitative empirical research mainly based on semi-structured interviews. *Quality & Quantity*, 43(6), pp.875.
- Draghi, M. (2008). Banche e mercati: lezioni dalla crisi, *Banca d'Italia*, pp.1-23.
- Easterbrook, S., Singer, J., Storey, M. A. and Damian, D. (2008). Selecting empirical methods for software engineering research. In *Guide to advanced empirical software engineering* (pp. 285-311). Springer, London.
- European Central Bank (2018). <https://www.bankingsupervision.europa.eu/about/youthdialogue/html/index.en.html>
- Felici, R. and Pagnini, M. (2008). Distance, bank heterogeneity and entry in local banking markets. *The Journal of Industrial Economics*, 56(3), pp.500-534.
- Galpin, T. J. and Herndon, M. (2003). *The Complete guide to merger and acquisitions process*. Irving, Tex.: University of Dallas.
- Galpin, T. J. (2014). *The complete guide to mergers and acquisitions: Process tools to support M&A integration at every level*. John Wiley & Sons.
- Gastaldi, L. Corso, M., Raguseo, E., Neirotti, P., Paolucci, E. and Martini, A. (2014). Smart working: rethinking work practices to leverage employees' innovation potential. In *Proceedings of the 15th International CINet Conference* (Vol. 100).
- Gates, S. and Very, P. (2003). Measuring performance during M&A integration. *Long Range Planning*, 36(2), pp.167-185.
- Grave, K., Vardiabasis, D. and Yavas, B. (2012). The global financial crisis and M&A. *International Journal of Business and Management*, 7(11), pp.56.
- Gunu, U. and Olabisi, J.O. (2011). Impact of Banks Merger And Acquisition On Their Staff Employment. *The Journal of Commerce*, 3(2), pp.35.
- Haake, G. (2017). Trade unions, digitalisation and the self-employed–inclusion or exclusion?. *Transfer: European Review of Labour and Research*, 23(1), pp.63-66.
- Habeck, M., Kroger, F. and Tram, M. (2001). *Après la fusion: les 7 clés pour réussir l'intégration*. Dunod, Paris.
- Hakenes, H., Schmidt, R.H. and Xie, R. (2009). Regional Banks and Economic Development. *Evidence from German savings banks*. Mimeo (available at: <http://ssrn.com/abstract/41343048>)

- Harrell, H.W. and Higgins, L. (2002). IS integration: Your most critical M&A challenge?. *Journal of Corporate Accounting & Finance*, 13(2), pp.23-31.
- Horton, J., Macve, R. and Struyven, G. (2004). Qualitative research: experiences in using semi-structured interviews. In *The real life guide to accounting research*, pp. 339-357, Elsevier.
- Hotchkiss, D. A. (1997). Brickless banking, *Bank Marketing*, 29(1), pp.36-41.
- Howell, R. A. (1970). Plan to integrate your acquisitions, *Harvard Business Review*, 48(6), 1970, pp.66-76.
- Ibbotson, P. and Moran, L. (2003). E-banking and the SME/bank relationship in Northern Ireland. *International Journal of Bank Marketing*, 21(2), pp.94-103.
- Knapp, M., Gart, A. and Chaudhry, M. (2006). The impact of mean reversion of bank profitability on post-merger performance in the banking industry. *Journal of Banking and Finance*, 30(12), pp.3503-3517.
- Koutroukis, T. and Terzidis, K. (2010). Can European Works Councils be effective? A study of their contributing factors from an HR Management point of view. *International Journal of Decision Sciences, Risk and Management*, 2(3-4), pp.276-290.
- Laeven, L., Ratnovski, L. and Tong, H. (2016). Bank size, capital, and systemic risk: Some international evidence. *Journal of Banking & Finance*, 69, pp.25-S34.
- Laukkanen, T. (2017). "Mobile banking", *International Journal of Bank Marketing*, Vol. 35 Issue: 7, pp.1042-1043, <https://doi.org/10.1108/IJBM-10-2017-0218> Permanent link to this document: <https://doi.org/10.1108/IJBM-10-2017-0218>
- Lewis, J., Wright, P. C. and Geroy, G. D. (2004). Managing human capital: The study of a self-managed group venturing into the digital economy. *Management Decision*, 42(2), pp.205-228.
- Lodesani E.O., Torriero G., Bottino S., Del Conto M. and Marazza M. (2018). Il lavoro in banca nell'era digitale, *Bancaria*, 9, pp.24-46.
- Meyer C. B. and Altenborg, E. (2007). The Disintegrating Effects of Equality: A Study of a Failed International Merger. *British Journal of Management*, 18, pp.257-271.
- Milkau, U. and Bott, J. (2015). Digitalisation in payments: From interoperability to centralised models?. *Journal of Payments Strategy & Systems*, 9(3), pp.321-340.
- Modina, M. and Polese, F. (2008). The Statagic Role of Local Banks' Networks for Quality Standards of Corporate Banking Services for SMEs. In *11th Toulon-Verona Conference*.
- Molyneux, P. and Wilson, J.O.S. (2007). Developments in European banking. *Journal of Banking & Finance*, 31(7), pp.1907-1910.
- Mylonakis, J. (2006). The Impact of Banks' Mergers & Acquisitions on their Staff Employment & Effectiveness. *International Research Journal of Finance and Economics*, (3), pp.121-137.
- Neale J. M. and Liebert, R. M. (1980). *Science and Behavior: An Introduction to Methods of Research*. (2nd Ed.) Englewood Cliffs, NJ: Prentice-Hall.
- Paoloni, N. (2018). Il rapporto banca - Impresa in Italia dopo la crisi 2007/2010. Cedam.
- Patton, M.Q. (1990). *Qualitative evaluation and research methods*. SAGE Publications, inc.
- Porter, M. E. (1985). *Competitive Advantage: Creating and Sulstaining Superior Performance*, Free Press, New York.
- Powell, R.G. (2001). Takeover prediction and portfolio performance: a note. *Journal of Business Finance & Accounting*, 28(7-8), pp.993-1011.
- Rappaport, A. (1987). Converting merger benefits to shareholder value, *Mergers and Acquisitions*, 21(3), pp.49-55.
- Robinson, H., Segal, J. and Sharp, H. (2007). Ethnographically-informed empirical studies of software practice. *Information and Software Technology*, 49(6), pp.540-551.
- Robson, C. and McCartan, K. (2016). *Real world research*. John Wiley & Sons.

- Rudestam, K.E. and Newton, R.R. (1992). *Surviving your Dissertation: A Comprehensive Guide to Content and Process*. London: Sage.
- Runeson, P. and Höst, M. (2009). Guidelines for conducting and reporting case study research in software engineering. *Empirical software engineering*, 14(2), pp.131.
- Salama, A., Holland, W. and Vinten, G. (2003). Challenges and opportunities in mergers and acquisitions: three international case studies—Deutsche Bank-Bankers Trust; British Petroleum-Amoco; Ford-Volvo. *Journal of European industrial training*, 27(6), pp.313-321.
- Salter, M. S. and W. A. Weinhold (1979). *Diversification through Acquisitions: Strategies for Creating Economic Value*, Free Press, New York.
- Schriber, S. (2012). Weakened agents of strategic change: negative effects of M&A processes on integration managers. *International Journal of Business and Management*, 7(12), pp.159.
- Shrivastava, P. (1986). Postmerger Integration. *Journal of Business Strategy*, 17, pp.65-76.
- Tellis, W. M. (1997). Application of a case study methodology. *The qualitative report*, 3(3), pp.1-19.
- Vander Vennet, R. (1996). The effect of mergers and acquisitions on the efficiency and profitability of EC credit institutions. *Journal of Banking & Finance*, 20(9), pp.1531-1558.
- Vander Vennet, R. (2002). Cost and profit efficiency of financial conglomerates and universal banking in Europe. *Journal of Money, Credit and Banking* 34(1), pp.254–282.
- Yakhlef, A., 2001. Does the Internet compete with or complement bricks-and-mortar bank branches?. *International Journal of Retail & Distribution Management*, 29(6), pp.272-281.
- Yin, R.K. (1984). *Case Study Research: Design and Methods*. Beverly Hills, Calif: Sage.
- Zainal, Z. (2007). Case study as a research method. *Journal Kemanusiaan*, 5(1).

Measuring Interconnections in Knowledge-Oriented Ecosystems

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Abstract

If the “early modernity” contemplated the antagonism between high and low complexity, the transition to the new paradigm of so called global and digitized capitalism modifies this relationship in the direction of complementarity. Complexity, far from representing an entity to be compressed and simplified, becomes a source of value for the variety of products and processes and for the management of network interconnections.

The notion of enterprise as a cognitive system, which uses knowledge as a source of sustainable competitive advantage and which continuously creates new knowledge from existing capacities provides researchers with a significant reading key to redirect itself into complexity and to give representation to the new organizations: from the model of the castle to the model of the network, of the widespread enterprise, in whose knots represent subsystems connected in a continuous dynamic of relationships, of knowledge and economic exchanges. In the context outlined, organizations face complex challenges in terms of changing business models and reconfiguring the value chain. In particular, new alternative paradigms emerge with respect to the concept of innovation in the traditional sense, such as that of open innovation. Unlike traditional innovation, based on the vertical integration of the innovative process and on defence, open innovation is based on the idea that the company can create value through a strategic path to open up to the competitive environment.

The level of analysis is twofold. First, an exploratory comparative analysis was conducted with reference to companies that have embraced the “open” approach in their innovation processes, shedding light on the interconnections existing between the various organizational systems, whose complexity determines the spread of the network. A framework that we called SKIN was applied. Second, through the analysis of Enel Open

Power case, attention will be paid to the role of the strategy in the management of the process of transition to a "network" type of business model with a special emphasis to the ecosystem concept where actors, technologies, and institutions co-evolve through their interactions and shared purpose.

Keywords – Measuring, Interconnections, Knowledge-oriented, open business ecosystems, case study.

Paper type – Academic Research

1 Introduction¹

How easily it emerges from the critical literature on the knowledge economy studies, a conceptual and terminological turbulence invests the identification and the very naming of transit between systems which is what commonly goes under the antinomic formulations of *Fordism VS post-Fordism*, of *industrial VS post-industrial*, of *modern VS post-modern* and that signal three different transitions, in competition with each other. In the first terms the characters of the strong paradigm of the rigidity - mechanistic, deterministic, systemic, structuralist - have been attributed; in the second, different characters that over time interact overlapping and that have in common the departure from the codified, Fordist, industrial and modern paradigm: these are from time to time assimilated to the fluidity - organicist, evolutionary, post-structuralist, deconstructionist (Rullani et al., 1999). The dialectic of transition, combined with the impossibility of reducing the multiplicity of complex systems within linear analytical grids, is among the elements that indicate the high degree of complexity, which, as is known, has become a constitutive and qualitative element of the so called "global and digital capitalism". Current research has, in this regard, tried to outline coherent investigation paths aimed at highlighting the persistence - in the transition between paradigms first stated - of complexity, in its various manifestations, while registering differences in the ways in which it is managed (Morin., 1993; Burnes, 2005).

Neither the fluidity of 'postfordism', nor the immateriality of the 'postindustrial' proved to be definitive concepts which can manage the complexity of the transition.

The paradigm that instead is proposed as truly alternative to Fordism, due to its intrinsic strength and its ability to convey all the problems that emerged in the attempts to name the present and to manage complexity, is that of a different perspective on *knowledge* as a reproducible resource, a concept that has represented the source from which - from the industrial revolution onwards - all modernity has drawn, but the novelty lies in the different production and use of knowledge regime, linked to the digital paradigm (Rullani, 2004). This Knowledge is a very creative knowledge that explores, that "imagines" and that cannot try to constrict complexity but it tries to explore it, and it

¹ This paper is the result of a joint reflection of the three authors, however paragraphs 1, 2 3 and 7 are to be attributed to Stella Lippolis, paragraph 4 is to be attributed to Francesco Grimaldi, paragraphs 5 and 6 are to be attributed to Angelo Ruggieri.

is inscribed within a circular, "reflective" process which is nourished by experience but also by other knowledge which exceeds that which can be used immediately. Precisely this auxiliary knowledge, the so-called "cognitive surpluses", represent the space of freedom, creativity and experimentation of the "new knowledge" circuit, within which complexity is inserted (Micelli, 2000).

If the so-called early modernity contemplated the antagonism between high and low complexity and between codified and generative knowledge, the transition to the paradigm of global and digitized capitalism modifies this relationship in the direction of complementarity. Complexity, far from representing an entity to be compressed and simplified, becomes a *source of value* for the variety of products and processes, for the management of network interconnections, for the freedom of choice that characterizes open innovation situations in a digital world (Chesbrough, 2003; Rullani, 2018). Opportunities are identified for the search for new ways of learning and managing knowledge flows within which new value can be generated precisely by the complexity of products, processes and meanings. The cognitive surpluses created by innovation and multiplied by digitalisation are "distributed" among the various actors involved in the supply chain - that can be defined digital and global - according to network logic, and no longer by the single company as in Fordism, or by the typical territorial ecosystem of capitalist district.

In this context it is appropriate to reconsider the business models of companies according to two dimensions: *the one* that allows to realize a sort of "division of labor" in the use of knowledge, participating in the construction of an open innovation system in which each one brings its own knowledge and at the same time uses those of others; *the other*, which allows to initiate flows of communication and cooperation between bearers of needs and possessors of skills, according to the perspective which - thanks to digitization - is transforming all companies into companies that put their skills at the service of potential customers found in global and digital networks (Rullani, 2018).

In these business models organized around the digital network, there is a complex interaction between the participants in the innovation ecosystem (Dat   et al., 2017; Clarysse et al., 2014), whose actions and ideas co-evolve: the creative relationships that the collective intelligence of a community directs towards the realization of a change that has value give shape to the result. The study of open innovation system becomes the study of the forms with which the imagination paths of new ideas are organized, and the enabling contexts are created which make it possible to apply those ideas.

And it is precisely in this perspective that we intend to investigate the quality and the directions of inter-organizational knowledge flows in innovation ecosystems. The level of analysis is twofold. First, an exploratory comparative analysis was conducted with reference to ten companies that have embraced the "open" approach in their innovation processes, shedding light on the interconnections existing between the various organizational systems, whose complexity determines the spread of the network. A framework that we called SKIN was applied by identifying knowledge flows "inbound" and "outbound" (Chesbrough, 2006), shaping the appearance of the ecosystem and highlighting the way of exchanging knowledge.

Second, through the analysis of Enel Open Power case, attention will be paid to the role of the strategy in the management of the process of transition to a "network" type of business model with a special emphasis to the ecosystem concept where actors, technologies, and institutions co-evolve through their interactions and shared purpose (Moore, 2013).

2. Company as a living system (*Impresa vivente*) and the concept of ecosystem: two perspectives to investigate the knowledge-oriented organizations.

The search for the defining coordinates of what is considered a new season for modernity has led researchers to resort to systems and principles learned from other disciplines, based on experimentation and able to propose, from differentiated perspectives, innovative methods to manage complexity. Interdisciplinarity is one of the distinctive features of the recent survey in which, for example the notions of company as a living system (Vicari, 1991) and ecosystem (Ceccherelli, 1923; Moore 1993, 2013, Aarikka, Stenroosa, 2017) draw on heterogeneous approaches and languages.

In fact, the use of organicist, biological and philosophical analogies represent the tool used by economic language to investigate the company and to represent it in respect of the variety, variability and entanglement of connections and relations that the new cognitive dimension of complexity entails.

One of the modes of representation that appears particularly suitable for interpreting the company in internal and external interaction dynamics is the metaphor of the company as a living system. In this system, individuals and institutions are considered knowledge processing and transmission nodes, but the knowledge of the company does not derive from the simple summation of the individual decisions of the single nodes: it results from the constant interaction of them, from the procedures, from the functioning organization, resulting in a complex cognitive process. The communication mechanisms represent the cohesive force that holds the system together allowing the components to interrelate and the individual cognitive patterns to dynamically connect.

Precisely the notion of enterprise as a cognitive system (Rea, 1999), - which uses knowledge as a source of sustainable competitive advantage and which continuously creates new knowledge from existing capacities - provides researchers with a significant reading key to redirect itself into disorder into instability inherited from the deconstruction of 'Fordist firm' and to give representation to the new organizational solutions that arose from the need to overcome the limits highlighted by the Fordist hierarchical organization: from the model of the castle to the model of the network, of the widespread enterprise, in whose knots represent subsystems connected in a continuous dynamic of relationships, of knowledge and economic exchanges (Butera, 1990). If in the Fordist firm the glue, the element of cohesion was represented by the hierarchy, in the reticular organizations the tool of sharing of knowledge is the set of interactions that are established with the aim of achieving a common project and digital technologies represent

the connective tissue that allows nodes to produce and share knowledge in a truly alternative way, the relational infrastructure "that allows the current network to become a virtual network, a 'place' for sharing knowledge (Lippolis, 2010).

The concept of ecosystem has also been borrowed from studies in the biological field, as an analogy to explain the interdependence and co-evolution in economic activity. In this perspective a company belongs to a business ecosystem, that develops itself around an innovation that brings together companies that co-evolve and compete to produce products and meet customer needs and, above all, to develop the next innovation phase. The interaction within the ecosystem allows an evolution of the capacities and roles of the different actors (Moore, 2003; Mancini 2018). This approach allows the investigation "of a new form of organization...that shows promise in achieving shared purposes, sharing value among many contributors, and in bringing the benefits of technology to a range of people, cultures and problems far beyond what earlier systems have achieved" (Moore, 2013). An ecosystem can be also defined as "a co-evolutionary business system of actors, technologies, and institutions" (Aarikka-Stenroos L. et al., 2017, p. 25), in which economic actors are consumers, research centers, competitors.; institutions are legislators, politicians, interest groups.; the technology is understood as the different types of platforms used in the ecosystem for the interaction between the various actors (Aarikka-Stenroos L. et al., 2017).

The concept of ecosystem has been evolved over time, enriching itself with the aspects linked to the use of technology and those connected with other aspects of sharing. Thus, we speak of the digital business ecosystem, when we intend to emphasize the use of information and communication technologies as tools within the ecosystem that allow us to increase collaboration capacity, representing a platform within which the various actors interact and share values and goals (Mancini, 2018). Instead, we speak of collaborative business ecosystem, when the emphasis is on collaboration, which develops between different partners within the ecosystem based on long-term alliances, (Moore, 2013).

Different are the perspectives of analysis of the new form of organizations (company as a living system, ecosystems) that have made instruments and concepts borrowed from time to time by the Industrial Economy, from the Resource-based Theory, from social network analysis. The aspect that, for the purposes of the present discussion, is useful to emphasize, is, as already mentioned, the cognitive and relational dimension associated with the new organizational solutions within which the meeting and the 'contamination' between knowledge and specialized competences are realized, i.e. *learning by interacting*.

This is the concept used by the literature to indicate a way to generate knowledge determined by the nature of the relationships established between the nodes of the network. Dynamic and continuously evolving relationships in which potentially feasible interactions exceed at all times those actually implemented and in which, thanks to the synergies between the competences of the different actors, the tension between specialization needs and contemporary need for flexibility is solved, which characterizes the actions of companies in the complexity of the transition.

"The relational infrastructure" that allows the current network to become a virtual network, a 'place' for sharing knowledge, is represented by the digital technologies that

with their potential for connection and the ability to manage a growing wealth of information, have made it possible to run an increasingly complex environment.

3. The innovation process in Knowledge-oriented organizations.

In the context outlined above, organizations face complex challenges in terms of changing business models and reconfiguring the value chain. In particular, new alternative paradigms emerge with respect to the concept of innovation in the traditional sense, such as that of *open innovation* (Chesbrough, 2003). This concept was formalized by Chesbrough for the first time, but already before companies have practiced forms of open innovation in an unconscious and informal manner within the geographies and supply chains of the districts thus anticipating the phenomenon then synthesized in literature.

Unlike traditional innovation, based on the vertical integration of the innovative process and on defense, open innovation is based on the idea that the company can create value through a strategic path to open up to the competitive environment (Teece, 2006). According to this approach, the innovative process does not have a defined origin in the context of business activities but is fed by flows and processes external to the organization.

This leads companies to reshape their business model in an open way and operate also with regard to the development of innovation with a view to belonging and co-evolution within an ecosystem. The transition from a closed innovation system to an open innovation system came from Chesbrough symbolically represented through the figure of the *funnel* that represented the traditional system of research and innovation. Through a path of "*inbound*" open innovation in the broad part of this funnel to an internal technology base of the company, an external technology base is associated, intercepting the assets needed to innovate. (Chesbrough, 2015; DiMinin, Crupi, 2018). Instead, through an opposite path of "*outbound*" open innovation the funnel itself is designed as a permeable membrane that allows the company to enhance the internal development of technologies by placing assets in different contexts and markets.

The inbound process focuses on finding assets to be acquired from outside to accelerate the innovation process. An example of this is the so-called crowdsourcing, a process that uses digital mediation to acquire knowledge, know-how in the organization. This mode configures the so-called exploration processes. Outbounding, on the other hand, pushes companies to focus on exploitation, that is, by marketing not only the final outputs, but also intermediate inputs and outputs, expanding the strategic options available.

The drivers of the phenomenon of the open innovation are known: an ever-increasing convergence between technological fields, an increasingly widespread diffusion of centers of excellence. There are, indeed, more numerous presence of tools such as venture capital and corporate venture capital, as well as a more careful protection of intellectual property assets.

As widely highlighted in the literature, it is possible to find more often cases of organization in a hybrid position that alternate moments of closed innovation with moments of open innovation (Huizing, 2010; Binci, 2016).

It is in this perspective that our study intends to analyse, first of all, through an exploratory survey, the innovative ecosystems of which companies are part, which, along with classic innovation strategies, have combined open innovation strategies. In particular, attention is focused on the type and direction of knowledge flows, ideas and know-how, which in turn determine the configuration of the ecosystem itself (Chiang, Y et alii., 2010). In the analysis we took into account the literature on the subject of Inter-Organizational Knowledge Transfer and the problems connected to the factors that can affect the effectiveness and the result of the transfer of knowledge (Easterby-Smith M. et alii, 2008).

A second level of investigation concerned, instead, the role of the strategy, in a knowledge-oriented organization where actors, technologies, and institutions co-evolve through their interactions.

4. Methodology and Research Design

This research aims to highlight, using the case study method (e.g, Chiucchi, 2012; Fattore, 2005; Grandori, 1996; Yin, 2003), how individual businesses and closed organization may evolve in open ecosystems focused on knowledge and innovation and how this process requires companies to adopt a business model that allows ideas and technologies flowing from outside the company and, the other way around, from the internal to the external environment.

The choice of the study of a single case is consequent to a well defined motivation: that is, the examined company represents a critical case (Yin, 2003) functional to the verification of what previously formulated. Specifically, it contains numerous conditions that allow the verification of what is shown in the previous paragraphs.

The analysis units selected by the sampling theory, by an empirical investigation referred to a population and through which generalizations are made are denominated cases (Fattore, 2005). Throughout this research, though, the term will be utilized to indicate a complex context whose multiple variables and characterizing size make the object of a monopolistic, deep analysis: hence, we will talk of a “case study” (Chiucchi, 2012).

According to Grandori (1996), a case study is a thorough study of a context not too far in time, which, therefore, can be reconstructed not only through documentary sources, but also through the witnessing of contemporaries (questionnaires, interviews, etc.) and which founds the (inner) validity of knowledge on the system analyzed mainly through the very multiplicity of information sources.

When defining a case study, therefore, some characterizing elements are underlined (relation with the context and contemporaneity of the phenomenon under analysis; multiplicity of data collection and analysis techniques), which are peculiar to that

particular method and make it stand out among other research strategies, influencing both its development process, range and aim. (Chiucchi, 2012).

The object of research is a phenomenon, that is to say a specific empirical context, more or less complex, "close" in time to the investigator, therefore contemporary or related to a recent past. This entails that the researcher has the possibility to observe directly the phenomenon under investigation, or to get into direct contact with those who took part to – or witnessed – it. Another important aspect of the case study-based research is the context: a phenomenon is analyzed within its context of reference. A further characterizing element of this method is the multiplicity of data collection and data analysis techniques, both qualitative and quantitative, available to the researcher. Among the many data sources, the following stand out in importance: the analysis of documents and archives, direct observation and interviews.

All in all, this research employs the case study method according to the perspective indicated by Yin (2003), that is to say, research through study case is meant as an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. The case study enquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical proposition to guide data collection and analysis.

5. Abilities and knowledge as enrichment for ecosystems: the SKIN representation

In this research, in order to achieve a better understanding of the effects eventually explained by the implementation of open innovation systems, the analysis is developed, first of all, by taking as reference the initiatives undertaken in the SKIN representation.

Starting from skills, critical success factors and distinctive traits, companies can implement open innovation strategies, by increasing their value and developing forms of networking and ecosystems with other companies and organizations to build relationships, exchange of ideas and knowledge flows both "inbound" and "outbound" (Chesbrough, 2006) with them. In fact, companies need to assume a position of interchange with their partners and, more generally, with the stakeholders of the ecosystem that comes to be created. The *tab. 1* collects ten cases of companies that have broadened their horizons in a strategic perspective of open innovation, by creating ecosystems that are the result of an exchange between the elements of the first column, *Skills* (overall considered as a set of tools and attributes determining the know-how already present in the company) and those of the second column, *Knowledge*, that is the set of the "hard" and "soft" knowledges (technologies, organizational models, managerial approaches, informative logics ...) that the company draws, as enrichment, from the ecosystem itself. The last column of Networks reports the details relating to the forms and the ways in which the various ecosystems have been conceived and created.

Tab. 1 – Ten cases of ecosystems and networks - SKIN representation. (Source: our elaboration)

	Skills (know-how, tools and attributes)	Knowledge (enrichment)	Network features
AGOS	<ul style="list-style-type: none"> – Brainstorming – Value proposition canvas – Blue ocean strategy – Prototyping – Interdependence e transversality of the community (collective intelligence) 	<ul style="list-style-type: none"> – Lean innovation – Customer centricity – Design thinking – Agile approach – Artificial intelligence 	<ul style="list-style-type: none"> – Innovation lab (AGOS 2020) – AGOS Incubation Program – Collaboration platforms (Skype e Hangouts) – Innovation community – Innovation café – Start-up ecosystems
DOMPÈ AND ENOVIA	<ul style="list-style-type: none"> – Technology transfer (digital e biotech) – Open innovation approach 	<ul style="list-style-type: none"> – Scouting of technologies and patents (assembly) – Internet of things (IoT) and wearable device – E-drug (“inside” technology) 	<ul style="list-style-type: none"> – Department of open innovation (within R&D, with 200 research centers worldwide) – Relations with specialized universities – Venture capital and start-up
FASTWEB AND ONE TRAY	<ul style="list-style-type: none"> – Supply chain – Sponsorship 	<ul style="list-style-type: none"> – New forms of communication (branding of the baskets used in airport security systems) – Blue ocean marketing 	<ul style="list-style-type: none"> – Partnership strategies – Alliances for agreements with airports
ENEL	<ul style="list-style-type: none"> – Divisional structure – Innovation and sustainability as a new business model 	<ul style="list-style-type: none"> – Agile approach – Distance from logics related to purely economic-financial parameters – Zero-waste investment logics – Disruptive production – Crowdsourcing ideas 	<ul style="list-style-type: none"> – Enel innovation hub – Start-up ecosystems – “Open innovability” strategy – Call 4 ideas hub
INTESA SAN PAOLO AND CISCO	<ul style="list-style-type: none"> – Coaching skills 	<ul style="list-style-type: none"> – Digital Factory – IoT – Cybersecurity – Augmented reality – Integrated supply chain – Connected machine – Asset tracking 	<ul style="list-style-type: none"> – Start-up initiative
AUTOGRILL	<ul style="list-style-type: none"> – Valorization of the territory – Craftmanship – New eating styles (sustainable interpretation) 	<ul style="list-style-type: none"> – New restaurant model – “Bistrot” as a flexible concept – Creating shared value (CSV) 	<ul style="list-style-type: none"> – Collaboration with virtuous universities (UNISG)

NESTLÉ	<ul style="list-style-type: none"> – Leadership in the food sector – Strength of the brand 	<ul style="list-style-type: none"> – Meal-delivery knowledge – Production of meal-kit – Packaging sustainability 	<ul style="list-style-type: none"> – Investments in “Freshly”, a meal-delivery start-up
ENGIE	<ul style="list-style-type: none"> – Supply of energy efficiency tools – Distribution network 	<ul style="list-style-type: none"> – Organizational innovation – Elimination of reporting charges – Deconstruction 	<ul style="list-style-type: none"> – Corporate venture capital – Call 4 ideas – Incubators and projects (in agreement with Accenture) – Research centers
LEONARDO	<ul style="list-style-type: none"> – Defense of the territory/aerospace – Safety 	<ul style="list-style-type: none"> – Cybersecurity – Communication – Incremental innovations in air transport 	<ul style="list-style-type: none"> – Corporate entrepreneurship and startup
UNILEVER	<ul style="list-style-type: none"> – Leadership in the mass market and large consumption 	<ul style="list-style-type: none"> – Enhancement of internal skills – Acceptance of external skills 	<ul style="list-style-type: none"> – Crowdsourcing platforms – Talent swap

The cases shown in the *tab. 1* are based on the information identified and collected directly from the institutional websites of the companies considered and from video interviews released online by their main managers. This representation can be defined with the acronym SKIN (Skills and Knowledge improving Networks) and has two implications: first, the interchange between the elements "Skills" (internal factor) and "Knowledge" (external factor) determines the appearance and conformation ecosystem; in the second place the ecosystem, in the forms in which it operates and is conceived, restores indeed new knowledge to all the involved actors, both in terms of "Skills" and "Knowledge".

6 Abilities and knowledge as enrichment for ecosystems: the ENEL case

The analysis is developed through the study of a single case, among the projects implemented in SKIN representation. The choice of the ENEL case derives to the best possible exploitation of the elements characterizing the case study technique, such as a better contextualization of the phenomenon, the contemporaneity of both the phenomenon and the multiplicity of collection and data analysis techniques.

Among these ten cases, it is important to highlight the case of the ecosystem developed by ENEL which, in 2016, met 1550 start-ups and started 80 collaborative projects in many of the 30 countries where the company is present, with a vision originated by the *Open Power* strategy (now *Open Innovability*). Eight projects are part of the open innovation strategy of the first European operator in the energy sector:

1. *Nuvve* is part of a consortium, with Enel and Nissan, which provides Vehicle-To-Grid (V2G) services to customers; these are services that allow vehicle owners to supply the energy stored in the network, thus contributing to its balancing.

2. *Bidgely* is a software developer that remotely identifies the consumption of individual appliances, providing, information for the adoption of efficient behaviours in terms of energy consumption, by using the app, with a view to involving the customer.
3. *Ultrasolar* produces quantum power optimizers that increase the power extracted from photovoltaic modules through new technologies. The partnership between Ultrasolar and Enel concerns the testing of the solution on residential-scale modules first, and then industrial-scale ones.
4. *Archon* realizes hardware and software solutions for simultaneous management of drones, thus made able to independently reach the charging station when the battery is running down and then return to their operations as soon as the recharge is completed.
5. *Nozomi* conceives computer security software for industrial plants, which automatically creates an internal industrial network model even concerning physical processes, by using behavioral analysis and continuous, real-time monitoring.
6. *Demand Energy* has developed a solution that maximizes the economic performance of the behind-the-meter storage systems, alone or in combination with distributed generation which combines the modeling, design and simulation with installation, operational monitoring, control and financial optimization, for implement storage systems quickly and on a large scale.
7. *TeleSense* develops and provides real-time environmental monitoring solutions for industrial applications designed to help managing the risks associated with climate change, by collecting data and processing them with cloud and IoT technologies (Internet of Things) to monitor a series of critical parameters and adopt adequate and real-time measures. This removes human error, improves operational efficiency and reduces risks, costs, damages for liability and regulatory burdens. The collaboration with Enel aims to develop a portable sensor able to collect safety related data.
8. *Sparkcognition* develops really predictive functionalities able to allow important

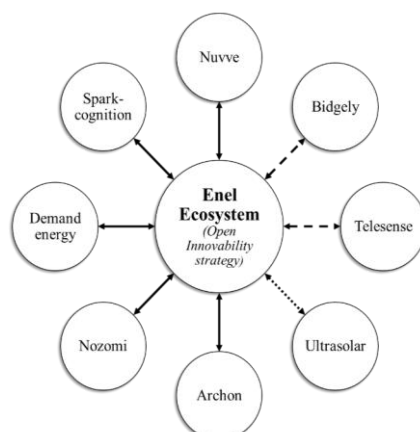


Figure 10. Source: our elaboration

cost savings and to improve the operating efficiency of the operators, by identifying, on the basis of the data collected, by the sensor imminent failures before they occur and warns the operators of any malfunctions before they can cause damage. The collaboration with Enel aims to reduce the instability of combustion in gas turbines, as well as to reduce maintenance costs.

As can be seen in *Figure 1*, the open innovation ecosystem that Enel has built

(thanks to commercial agreements and partnerships) has mainly reported flows of both “hard” and “soft” technological innovations (*continuous flows*). Although to a lesser extent, there is no lack of purely informative flows (*dashed flows*) and only one experimentation flow (*dotted flow*). It is important to highlight that even these last two types are, however, attributable to the development of new technologies: the difference lies in the effective contribution that these flows make to the company, as the technology is, in these cases, only a propaedeutic tool for information and experimentations.

The predominant presence of flows deriving from technology transfer is an evidence that explains what are the motivations that, nowadays, push companies and organizations to move further away from the traditional (and certainly more rigid) “castle” business model and to move towards “network” models (Butera, 1990), with a view to “open organization” and “open innovation” (Whitehurst, 2016; Chesbrough, 2003).

As the most valuable sources of innovative ideas are *start-ups*, Enel has decided to open a series of *Innovation Hub*, a physical space where start-ups can meet each other and exhibit their projects to Enel; at the selected start-ups, Enel provides all the necessary tools for take-off: technological advice of experts (both internal and external to the Group, following the strategic logic of Open Power, combining innovative and sustainable approaches), access to the network of partners (including investors) and the possibility of testing the innovations in its laboratories and plants. Each hub is a nerve center for the start-ups of its geographical and economic area and the network organization is an added value for them: hubs have the opportunity to connect and collaborate with each other and enrich themselves with other experiences. Thanks to this strategic model, Enel manages to be present into the most important innovation ecosystems in the world and collaborates with venture capital funds, accelerators, incubators, universities, large industrial players and government institutions in the constant search for startups and SMEs to open its product experimentation in collaboration with different realities, in order to make traditional businesses more efficient and/or provide industrial growth through new business models. Enel Innovation Hubs network communicates to ecosystems of innovation what are the main problems that the Group is trying to solve and provides an indication of its innovation needs.

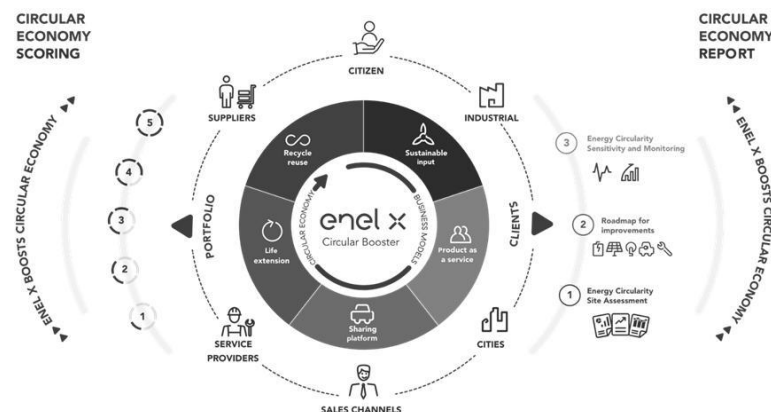


Figure 2. Source www.enelx.com

In 2018, on the wave of its *Open Power strategy*, Enel launched a new brand division, *Enel X*, proposing a new identity that includes four areas of action: *city, industries, home and mobility*. Drawing inspiration from the Circular Economy business models, Enel X positions itself as a *Booster*, or rather an accelerator of circularity, within its ecosystem of suppliers, partners, installers and customers. The aim is to accelerate the level of circularity through the *Circular Economy Boosting Program* (fig. 2), a particularly useful programmatic tool that creates a scoring verified, exported even beyond the internal portfolio of solutions, offering to industrial customers and to Public Administrations the possibility of obtaining an *Energy Circularity Report* that measures energy circularity and identifies a structured roadmap to increase its level through a series of innovative solutions. Enel X cooperates locally with startups and small and medium enterprises in the development of alternative businesses supported by a strong tech support, in a hyperconnected system of horizontal sharing of ideas, needs and solutions.

The case of Enel “Open Power” strategy helps to understand how the knowledge measurement does not always pass through merely numerical or regressive data, but it is necessary to take into consideration also the qualitative analyzes that emerge by observing the great extent of investments in open innovation policies and interconnections where knowledge is a fundamental asset: the growth of companies like Enel is bound, in fact, by the enriching contribution that the ecosystems they create provide in terms of knowledge transfer, know-how flows and skills enhancement.

7 Conclusions

As we have been able to highlight the great attention paid by recent research is due to the transition from what we have defined a 'traditional knowledge', based exclusively on replicative exploitation, to a 'new knowledge' that goes beyond the simple propagation of this which is already known, recombining it and enriching it to produce new knowledge. The transition between these two "epistemic" modes accompanies the difficult transition between systems and is catalyzed by the development of digital technologies and their potential for integration and interaction. The new organizational forms become reticular, in whose nodes represent subsystems connected in a continuous dynamic flows of relationships, knowledge and economic exchanges.

In this redefinition of organizations and inter-organizational flows there are no codified rules, but tendencies (De Biase, 2018). The first is the tendency to consider companies within an ecosystem in which, just like in natural ecosystems, the evolutionary direction is not linear, collaboration is as possible as competition.

The organizations in the ecosystem can be designed so as to favor collaboration and knowledge flows and know-how or, on the contrary, to closure. The same platforms on which open innovation can be developed are therefore not given: they should in turn be imagined, experimented, improved. From this it is possible to point out the role of qualitative investigations that, in this domain, work alongside quantitative surveys.

References

- Aarikka-Stenroosa, L. and Ritalab, P. (2017) Network management in the era of ecosystems: Systematic review and management framework, *Industrial Marketing Management*, 67, pp. 23-36.
- Binci D., (2016), *Innovazione e cambiamento*, FrancoAngeli
- Ceccherelli, A. (1923) *Introduzione allo studio della ragioneria generale. Gli organismi aziendali*, Firenze, Le Monnier.
- Chesbrough H., (2003) *Open innovation: The new imperative for creating and profiting from technology*, Harvard Business Press, Cambridge, MA.
- Chesbrough, H. (2006) *Open Innovation: A New Paradigm for Understanding Industrial Innovation*, in *Open Innovation: Researching a New Paradigm*, eds. H. Chesbrough, W. Vanhaverbeke and J. West, Oxford University Press, Oxford.
- Chesbrough, H. (2015) *From open science to open innovation*, Institute for Innovation and Knowledge Management, ESADE.
- Chiang Y., Hung K. (2010) Exploring open search strategies and perceived innovation performance from the perspective of inter-organizational knowledge flows, *R&D management*, Vol.40, No 3.
- Chiucchi M.S. (2012), *Il metodo dello studio di caso nel management accounting*, Torino, Giappichelli.
- Clarisse, W., Wright, M., Bruneel, J. and Mahajan, A. (2014) Creating value in Ecosystems: Crossing the chasm between knowledge and business ecosystem, *Research Policy*, Vol. 43, No. 2, pp. 1164-1176.
- Datée, B., Alexy, O. and Autio, E. (2017) Maneuvering in Poor Visibility: How Firms Play the Ecosystem Game when Uncertainty is High, *Academy of Management Journal*, Vol. 61, No. 2, pp. 466-498.
- DiMinin A., Crupi A. (2018), *La via italiana all'open innovation*, in ed. Iacobelli G., *Open innovation Made in Italy*, FrancoAngeli, Milano.
- Easterby-Smith M., Lyles M.A., Tsang E.W.K. (2008) Inter-organizational knowledge transfer: current themes and future prospects, *Journal of Management Studies*, Vol.45, No 4.
- Fattore G. (2005), *Metodi di ricerca in economia aziendale*, Milano, Egea.
- Grandori, A. (1996). *Disegni di ricerca in organizzazione*. In Costa, G. e Nacamulli, R. (a cura di), *Manuale di organizzazione aziendale*, V, *Metodi e tecniche di analisi e di intervento*. Torino: Utet, 315-333.
- Huizing E. (2010). *Open innovation : state of the art e future perspectives*, *Technovation*, No. 31, pp.2-9
- Iacobelli, G. (ed.), (2018) *Open innovation made in Italy*, FrancoAngeli, Milano.
- Lippolis, S. (2010) *La funzione amministrativa*, Edizioni Dal Sud, Bari.
- Mancini, D. (2018) *Evoluzione e prospettive dei sistemi di informazione e controllo*, *Management Control*, Suppl. 2, pp. 5-14.
- Micelli, S. (2000) *Imprese, reti e comunità virtuali*, Etas, Milano.
- Moore, J.F. (1999) *Predators and Prey: A New Ecology of Competition*, *Harvard business review*, Vol 71., May-June, pp. 75-86.
- Moore, J.F. (2013) *Shared Purpose: A thousand business ecosystems, a connected community, and the future*, Createspace Independent, Scotts Valley (US).
- Morin, E. (1993) *Introduzione al pensiero complesso*, Sperling & Kupfer, Milano.
- Rea, A. (1999) *Il nuovo significato della comunicazione nel processo di formazione dei sistemi cognitivi "intelligenti"*, in eds. E. Rullani, S. Vicari, (a cura di), *Sistemi ed evoluzione nel management*, Etas, Milano.

- Rullani, E. and Vicari S. (1999) Introduzione: Sistemi ed evoluzione nel management, in eds. Rullani E., Vicari S., Sistemi ed evoluzione nel management, Etas, Milano.
- Rullani E., (2004) Economia della conoscenza – Creatività e valore nel capitalismo delle reti, Carocci, Roma.
- Rullani E.(2018), Il senso della rivoluzione digitale: creare valore dalla complessità, in eds. De Toni A.F., Uomini 4.0, Ritorno al futuro, FrancoAngeli
- Teece D.J. (2006). Reflections on “Profiting from innovation”. Research Policy, No. 35, pp. 1131-1146.
- Vicari S.,(1991) L'impresa vivente, Etas., 1991.
- Yin R. (2003), Case study research: design and methods, Thousand Oaks (CA), Sage.

Open Innovation and Green management: a Framework to Support Environmental Strategies Implementation

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Abstract

This paper proposes a theoretical framework that aims to support firms to adopt the processes of open innovation for implementing successful environmental strategies. The aim of this paper is to investigate the open innovation processes when firms should implement environmental strategies. Through a theoretical analysis, the study highlights the links between environmental strategy and open innovation practices focusing on specific theme of open sustainability innovation model. Drawing on and extending prior studies and practice oriented approaches to environmental strategies, this study identifies some relevant open innovation tools which may provide insights for more effective models of green management. Specifically, the theoretical framework suggests implications for practitioners by shedding light on the sources and methods to translate the transferred/shared knowledge into effective environmental ideas and therefore in goals and actions, to support the strategic decision-making.

Keywords – sustainable innovation; open innovation; environmental strategies; green management.

Nature of the proposed paper: Academic Research Paper

1 Introduction

The increased attention towards social, economic and environmental issues for sustainable development pattern creation requires firms an evolution in their corporate objectives and new management approaches to better meet the needs of its customers, business partner and several stakeholders. Environmental strategies should be properly developed to ensure growth and competitive advantage.

In the past decade, research on green management has expanded rapidly to increase understanding of the ways in which new social and environmental practices enable firms to become more sustainable.

Indeed, the literature shows ample interest in whether and how firms select tools and practices of green management to integrate the environmental dimension in their competitive, financial and organizational strategies (Florida and Davison, 2001;

Dahlmann *et al.*, 2008; Lee, 2009; Garzella and Fiorentino, 2014). At the same time, recent studies argue that open innovation paradigm can be considered a promising approach to develop sustainability ideas, actions and practices. (Hall *et al.*, 2003; Montalvo, 2008; Hansen *et al.*, 2009). In this vein, open innovation practices have started to merge with the sustainability concept, giving rise to open sustainability innovation models (Boons and Lüdeke-Freund, 2013; Peattie and Belz, 2010; Dangelico *et al.*, 2017).

However, despite of the growing attention on these issues in innovation literature stream, the relationship between green management processes and open innovation paths has been the object of limited research. In fact, very little attention has so far been given to open innovation processes to understand their role for shaping, building and controlling the environmental strategies. Indeed, the literature does not provide the needed support to knowledge transfer process and business collaboration from an environmental welfare viewpoint.

In order to bridge this gap, the aim of this paper is to investigate the role and the support of open innovation when firms decide to implement environmental strategies. Specifically, this study sets the following research questions: what is the link between open innovation paths and green management processes? how can open innovation background drive firms to achieve and implement environmental strategies? and how is it possible to identify the benefits of collaboration and to reduce the typical risks of opening up the innovation processes, with regard to green management?

In an attempt to answer these research questions, the paper follows a qualitative approach based on the review of relevant literature on open innovation fields and green management processes. By a literature review and the integration of the compatible elements of previous research on green management, a theoretical comprehensive framework is provided with the objective of supporting the open innovation paths for implementing successful environmental strategies.

This paper is structured as follows. The next section provides the theoretical background. Section 3 analyses the role of the green management as a key capability for the successful environmental strategies. Section 4 advances a theoretical framework based on paths and tools of open innovation for supporting environmental strategies implementation. Finally, Section 5 summarizes the main contribution of the paper and provides implications and ideas for future research.

2 Theoretical background

In order to explain the evolution in the environmental management approaches to support firms to effectively “do well by doing good” (Devinney, 2009; Lee, 2009), the theoretical background is developed with reference to the environmental strategies and open innovation paradigm.

2.1 Environmental strategies

Environmental sustainability is increasingly relevant theme in the current economic context. According to stakeholder and corporate social responsibility approaches, more

and more firms decide to recognize the relevance of the environmental dimension related to the impact and the protection of the biophysical environment in addition to financial and social dimensions (Freeman, 1984). In this seam of research, scholars developed the Environmental Social Responsibility as an autonomous research topic (Hart, 1995; McWilliams and Siegel, 2001). By this way, the environmental strategies have growing importance and relevance of academics and practitioners (Porter and van der Linde, 1995).

In broad terms, “environmental strategies” can be defined as “the organization-wide recognition of the legitimacy and importance of the biophysical environment in the formulation of organization strategy and the integration of environmental issues into the strategic process” (Banerjee, 2001). In this sense, environmental strategies reflect the degree of acceptance and adoption of environmental values and principles in the strategic management (Garzella and Fiorentino, 2014).

However, despite the relevance of environmental issues, the studies on the environmental strategies are characterized by several approaches not always harmonically related (Bowen, 2007).

Some scholars argued that developing environmental actions imply cost higher than benefits and usually the environmental strategies are developed only for moral and social reason or to mitigate reputational and legal risks - for example possible accidents or sanctions for failure to compliance of environmental regulation. (Freedman and Jaggi, 1998; Marcus and Fremeth, 2009).

Differently, other studies agree that correct implementation of environmental strategies can be considered a critical success factor for firms able to trigger new competitive dynamics (Bowen, 2007; Clarkson *et al.*, 2011); in particular, environmental strategies may constitute a support for developing corporate resource and capabilities and for increase competitive advantage. (Porter e Kramer, 2006; Russo e Fouts, 1997).

The link between environmental strategies and competitive advantage should push firms to engage the environmental strategies in response to legitimate demands from stakeholders (Sprengel e Busch, 2011). This voluntary proactive approach to environmental strategies has been proposed as urgent, profitable and sustainable ways for firms to face the variability and the volatility characterizing current competitive context (Darnall, *et al.*, 2010); implementing environmental strategies firms could be pay off in terms of social reputation, corporate image, compliance, sustainability reporting and customer preferences (Lamboglia *at al.*, 2018; Hart and Milstein, 2003).

As a consequence, firms need to understand how to implement proactive environmental strategies. In this vein, the “green management” can be considered a successful factor for competitive and organizational strategies that help a business develop advanced environmental practices while simultaneously lowering costs and creating differentiation benefits (Siegel, 2009).

2.2 Open innovation paradigm

Open innovation is defined as “the intentional use of inflows and outflows of knowledge to accelerate internal innovation, and expand innovative external markets”

(Chesbrough, 2006, p.1). Open innovation approach has been juxtaposed to the traditional paradigm of innovation management, known as the closed innovation model, based on the full control of the R&D process coupled with the full ownership of innovative assets and intellectual property (Chesbrough, 2003a; Chesbrough, 2003b; Berkhout *et al.*, 2006; von Hippel and von Krogh, 2006).

Differently, open innovation approach claims that successful innovation implies that the knowledge sources to feed innovation efforts are widely diffused outside the firms; indeed, the open firms are primarily concerned with leveraging this external knowledge to unlock own potential innovative efforts and improve economic performance.

The increasing diffusion and adoption of open innovation processes has determined an exponential number of studies on the topic (Hossain *et al.*, 2016; Huizingh, 2011). In the literature, open innovation has been investigated under several perspectives and specific issues in terms of number and type of phases in the innovation process, level of integration, organizational and managerial implications related and forms of governance (Emdem *et al.*, 2006; Gassmann and Enkel, 2004).

The studies evolution toward the open innovation approach brought to recognize the increasing permeability of firm's boundaries, stimulating transfer knowledge in-and-outflows between firms and other firms and between firms and creative consumers (Pil and Holweg, 2006; Caputo *et al.*, 2018); this trend provides enabling environments for business collaboration fostering dissemination of knowledge through the network effect. (Chesbrough and Bogers, 2014; Rohrbeck *et al.*, 2009; Traitler *et al.*, 2011).

Many authors have studied the specific advantages firms may gain by opening their innovation process (Reed *et al.*, 2012; Chesbrough and Appleyard, 2007; Enkel *et al.*, 2009).

In particular, embracing the open innovation model, firms can potentially access external sources of ideas, technology and know-how and integrating them with internal resources and skills (outside-in process) or externalize their knowledge and innovative ideas to the outside environment in order to achieve the market faster than they could through internal development (inside-out process). Moreover, firms can combine the outside-in process with the inside-out process to gain external knowledge and, at the same time, to bring ideas to market (coupled process).

Recent studies argue that open innovation can be considered a promising approach to develop sustainability innovations, giving rise to open sustainability innovation models (Varadarajan, 2017; Dangelico and Pujari, 2010; Leach *et al.*, 2012).

Open sustainability innovation model uses the open innovation paradigm in order to development sustainable products, services, processes and initiatives focused on the social needs of people and on the environmental preservation (Peattie and Belz, 2010; Hansen *et al.*, 2009). Thus, this model recognizes the importance of sharing firms' knowledge to elicit direct or indirect ecological improvements and/or to solve particular social-environmental problems (Rauter *et al.*, 2017).

An open sustainability innovation approach could be play a crucial role in the process of developing successful environmental strategies to achieve sustainability goals and increase competitive and financial performances (Arcese *et al.*, 2015; Cappa *et al.*,

2016). Through the correct implementation of environmental strategies based on the open sustainability innovation approach, the firms can benefit from cost savings and environmental benefits.

In particular, the adoption of open sustainability innovation approaches could represent an effective way to gaining competitive advantages and differentiation to environmentally sensitive customers. This approach could lead to reduce production cost and time to market due to development of more environmental efficient technologies reducing at the same time the environmental impact and also increasing firms' process security.

The open sustainability innovation model uses, as stated, the open innovation principles and practices to increase the socio-environmental performance of firms. In truth, the link between environmental strategies and open innovation paths is generally underestimated by firms.

In order to identify the variety of tools and processes of open innovation to support environmental strategies implementation, it is important to analyze, firstly, the strategic process of environmental dimension and the role of green management.

3 Green management process

The adoption of environmental strategies implies multi-lens perspective to green management decision making that concern the overall strategic process in both the formulation and the subsequent implementation steps (Garzella and Fiorentino, 2013).

In attempt to identify the factors that facilitate, or inhibit, the development and implementation of environmental strategies it is important to analyze the strategic process along which these are articulated.

In particular, environmental strategic process may be analyzed with regard to three main steps.

The first step is related to the “formulation of the environmental strategy”, with reference to the integration of environmental, ethical and social issues in firms’ mission and vision (Campbell, 2006; 2007). The second step is related to the “implementation process” with reference to transform environmental decisions into strategic actions aimed to achieving concrete and tangible results (Ilinitich *et al.*, 1998). The last step is based on “analysis of results” generated by implementing environmental strategy. These results must be evaluated with reference to impact of strategic actions on the biophysical environment on one side and environmental performance on firms’ financial dimension and competitive advantage on the other (Clarkson *et al.*, 2011; Epstein, 2008).

The strategic process of environmental dimension is summarized in *Table 1*; for each steps, the table shows different actions, decisions and practices that firms can develop to improve environmental strategies.

The adoption of environmental strategies implies some essential decisions for firms with regard to the environmental aims to selected and their transformation into strategic action in order to improve own environmental performance. The firms' ability to strategically green management has led, firstly, to understand the opportunities of this

development model and then to impose considerations regarding its effective, efficient and correct implementation.

In fact, both the formulation and implementation of environmental strategies do not necessarily guarantee positive outcomes (Wood, 1991). In this vein, the green management play key role to translate strategy into profitable action. Thus, green management adds specific potential to the strengths that characterize the several perspectives of environmental strategies (Capurro *et al.*, 2018). The predisposition and effective application of green management processes facilitates the attainment of strategic aims, driving results along overall strategy process by facilitating internal and external communication goals.

However, firms have erroneously narrow view of environmental strategies; in this way they do not pay adequate attention to environmental growth opportunity and leaves them vulnerable to competitors with broader perspectives (Epstein and Roy, 2001). In new competitive and dynamics contexts where new sharing knowledge tools and new ways of governing relationships are established, the choice of bringing the environmental dimension into the overall strategy promotes the research of business practices that can be the source of great creative stimulus and strong pushes to innovation.

Table 5 - Strategic process of environmental dimension

Strategic steps	Actions
FORMULATION	<ul style="list-style-type: none"> ➤ Integrating “green” in mission/vision and in strategic goals ➤ Eco-R&D investments ➤ Green business entry ➤ Pollutant business exit ➤ Programs to educate employees/consumers on environmental issues ➤ Green innovations ➤ “Green unit” projects
IMPLEMENTATION	<ul style="list-style-type: none"> ➤ Waste reduction actions ➤ Initiatives for pollution abatement ➤ Decreasing emissions and discharges ➤ Consumptions reduction ➤ Environmental certification ➤ Environmental standard adoption ➤ Using renewable energy and replaceable resources and components
ANALYSIS OF RESULTS	
ENVIRONMENTAL RESULTS	<ul style="list-style-type: none"> ➤ Waste reduction ➤ Consumptions and emissions reduction ➤ Scarce resources protection ➤ Decreasing of environmental incidents, crimes and lawsuits ➤ Environmental certification ➤ Green awards
FINANCIAL AND COMPETITIVE RESULTS	<ul style="list-style-type: none"> ➤ Decreasing production costs ➤ Increasing revenues ➤ Product quality ➤ Quality perception ➤ New competences ➤ Improving corporate image and reputation.

4 Theoretical framework

The environmental strategies call for new perspectives in business process management. In current context, sustainability performance of products and services has experienced continuous improvements; fuel efficiency improvements in cars, implementation of hybrid cars, encouragement of car sharing, increased use of recycled materials in packaging, growth in fairly traded products and organic foods and passively heated houses are just some examples of sustainability innovations carried out in cooperation with target consumers group, non-government organizations, policy makers, suppliers, complementary firms and even competitors.

The management of environmental issues needs, from one side, the definition of green management process and, from the other side, a contribution to select the right strategic moves in order to identify new technologies and social practices enable firms to become more sustainable (De Medeiros *et al.*, 2014).

Thus, in an attempt to bridge the gap in literature, to investigate the role and the support of open innovation when firms decide to implement environmental strategies, the study provide a theoretical comprehensive framework that allows to capture the variety of open innovation practices and tools that can be connected in different stages of green management process (*Table 2*).

The theoretical framework covers the formulation and implementation steps of environmental strategies by identifying for each environmental actions open innovation's tools in order to facilitate the achievement of the environmental goals.

Openness in collaboration as joint ventures, in/out/cross-licensing, contract R&D, customer involvement or external networking, can change firms' innovation management model. Indeed, through the correct open innovation process implementation, firms can be gaining access to new areas of knowledge, managing capacity problem with more flexibility, focusing on core competencies, reducing time to market and sharing of risks and costs (Parmigiani and Mitchell, 2009; Tortoriello and Krackhardt, 2010). These advantages can also be exploited to implement environmental strategies.

However, in this context, characterized by high complexity of open business models, a high degree of interdependence among actors and consequently high coordination and control costs, the appropriability issues are crucial aspects that can be checked (Bogers, 2011). Therefore, firms need to develop a careful management of open innovation and environmental process which allows for the maximization of the knowledge creation and use, from a side, and the minimization of the risk of illicit appropriation by external actors, on the other (Van de Vrande *et al.*, 2006).

Table 6 - Open innovation tools in environmental strategies

Strategic steps	Actions	OI tools
FORMULATION	➤ Eco-R&D investments	➤ Crowdfunding
	➤ Green business entry	➤ Strategic alliances
	➤ Pollutant business exit	➤ Joint ventures

IMPLEMENTATION	<ul style="list-style-type: none"> ➤ Programs to educate employees/consumers on environmental issues ➤ “Green unit” projects 	<ul style="list-style-type: none"> ➤ Technological cluster
	<ul style="list-style-type: none"> ➤ “Green innovation” 	<ul style="list-style-type: none"> ➤ Strategic alliances/ Crowdsourcing/ Cross-licensing
	<ul style="list-style-type: none"> ➤ Waste reduction actions ➤ Initiatives for pollution abatement ➤ Decreasing emissions and discharges ➤ Consumptions reduction 	<ul style="list-style-type: none"> ➤ Crowdsourcing/Crowdfunding
	<ul style="list-style-type: none"> ➤ Environmental certification 	<ul style="list-style-type: none"> ➤ Open collaborative networks
	<ul style="list-style-type: none"> ➤ Environmental standard adoption 	<ul style="list-style-type: none"> ➤ Collaboration with Research centers/Universities
	<ul style="list-style-type: none"> ➤ Using renewable energy and replaceable resources and components 	<ul style="list-style-type: none"> ➤ Strategic alliances/Cross-licensing

Indeed, green management and open innovation are complex processes that have the potential to engage a wide range of management decision, mostly if they shall be start together. Firms should choose the environmental actions, strategic paths and open innovation tools that better reflect the corporate objectives, skills and capabilities by identifying the most suitable ways of integration.

In this way, the proposed framework aimed to offering possible applications and methods of open innovation dedicated to better face the environmental challenges in order to maximize the environmental, financial and competitive performance of firms.

5 Conclusions

This study develops a theoretical framework aimed at supporting the process of green management adoption and the success of environmental strategies by application of open innovation paths. Indeed, to link all the relevant success factors of environmental strategies, open innovation may provide insights for more effective models and tools of green management.

The analysis suggests that many modern practices of open innovation – such as crowdsourcing open network, crowdfunding, collaborative networks, strategic alliances and technological clusters – can be connected to the implementation of environmental strategies.

In particular, by a structured literature review on environmental strategies and open innovation paradigm, and the integration of the compatible elements of previous research on green management, a theoretical comprehensive framework is provided with the

objective of supporting the open innovation paths for the firms that want to develop successful environmental strategies.

The proposed framework provides suggests sources and methods to translate the transferred/shared knowledge into effective environmental ideas and therefore in goals and actions, to support the strategic decision-making.

The list of items is not intended to be a comprehensive one but rather that address the main areas of environmental practices.

Based on early theoretical results of this study and the absence of an empirical test, future research could test the effectiveness of this framework and to analyse and to measure the relation between environmental strategies, supported by open innovation, and firm's environmental, financial and competitive performance.

Although, the proposed framework, highlighting the multiple dimensions of green management and its link with the open innovation processes, confirms the need for an operational approach that is able to develop and to integrate monitoring tools for the strategic assessment of performance and results achieved in order to provide a concrete response to corporate issues in terms of sustainability and environmental responsibility.

References

- Arcese, G., Flammini, S., Lucchetti, M. and Martucci, O., (2015) "Evidence and experience of open sustainability innovation practices in the food sector", *Sustainability*, Vol. 7, No. 7, pp. 8067-8090.
- Banerjee, S.B. (2001), "Corporate environmental strategies and actions", *Management Decision*, Vol. 39, No. 1, pp. 36-44.
- Berkhout, A.J., Hartmann, D., Van Der Duin, P., and Ortt, R., (2006) "Innovating the innovation process" *International Journal of Technology Management*, Vol. 34, No. 3-4, pp. 390-404.
- Bogers, M., (2011) "The open innovation paradox: knowledge sharing and protection in R&D collaborations", *European Journal of Innovation Management*, Vol. 14, No. 1, pp. 93-117.
- Boons, F. and Lüdeke-Freund, F., (2013) "Business models for sustainable innovation: state-of-the-art and steps towards a research agenda", *Journal of Cleaner production*, Vol. 45, pp. 9-19.
- Bowen, F. (2007) "Corporate social strategy: competing views from two theories of the firm" *Journal of Business Ethics*, Vol. 75, No. 1, pp. 97-113
- Campbell, J.L. (2007), "Why would corporations behave in socially responsible ways? An institutional theory of corporate social responsibility", *Academy of management Review*, Vol. 32, No. 3, pp. 946-967.
- Campbell, J.L. (2006), "Institutional analysis and the paradox of corporate social responsibility", *American Behavioral Scientist*, Vol. 49, No. 7, pp. 925-938.
- Cappa, F., Del Sette, F., Hayes, D. and Rosso, F., (2016) "How to deliver open sustainable innovation: An integrated approach for a sustainable marketable product" *Sustainability*, Vol. 8, No. 12, p. 1341.
- Capurro R., Fiorentino R. and Garzella S. (2018), *La corporate social responsibility e il green management: dalla "dimensione sociale" verso la complessiva formula strategica in L'azienda e la corporate social responsibility. Approfondimenti dottrinali e riflessioni gestionali*, Milano, Franco Angeli.
- Caputo, A., Fiorentino, R. and Garzella, S. (2018) "From the boundaries of management to the management of boundaries: business processes, capabilities and negotiations" *Business Process Management Journal*.

- Chesbrough, H.W., (2003a) "The era of open innovation" MIT Sloan Management Review, Vol. 44, No. 3, pp. 35-41.
- Chesbrough, H., (2003b) "The logic of open innovation: managing intellectual property". California Management Review, Vol. 45, No. 3, pp. 33-58.
- Chesbrough, H.W., (2006) Open innovation: The new imperative for creating and profiting from technology. Boston, MA: Harvard Business Press, Boston.
- Chesbrough, H. W. and Appleyard, M. M., (2007) "Open innovation and strategy", California management review, Vol. 50, No. 1, pp. 57-76.
- Chesbrough, H. and Bogers, M. (2014) Explicating open innovation: Clarifying an emerging paradigm for understanding innovation" New Frontiers in Open Innovation, Oxford University Press, Forthcoming, pp. 3-28.
- Clarkson, P.M., Li, Y., Richardson, G.D. and Vasvari, F.P., (2011) "Does it really pay to be green? Determinants and consequences of proactive environmental strategies", Journal of Accounting & Public Policy, Vol. 30, No. 2, pp. 122-144.
- Dahlmann, F., Brammer, S. and Millington, A., (2008), Environmental management in the United Kingdom: new survey evidence, Management Decision, Vol. 47, No. 2, pp. 264-283.
- Dangelico, R. M. and Pujari, D. (2010) "Mainstreaming green product innovation: Why and how companies integrate environmental sustainability", Journal of business ethics, Vol. 95, No. 3, pp. 471-486.
- Dangelico, R.M., Pujari, D. and Pontrandolfo, P. (2017) "Green product innovation in manufacturing firms: A sustainability-oriented dynamic capability perspective" Business Strategy and the Environment, Vol. 26, No. 4, pp. 490-506
- Darnall, N., Henriques, I. and Sadorsky, P. (2010) "Adopting proactive environmental strategy: The influence of stakeholders and firm size" Journal of management studies, Vol. 47, No. 6, pp. 1072-1094
- De Medeiros, J. F., Ribeiro, J. L. D. and Cortimiglia, M. N. (2014) "Success factors for environmentally sustainable product innovation: a systematic literature review", Journal of Cleaner Production, Vol. 65, pp. 76-86.
- Devinney, T. M., (2009), "Is the socially responsible corporation a myth? The good, bad and ugly of corporate social responsibility", Academy of Management Perspectives, Vol. 23, No. 2, pp. 44-56.
- Emden, Z., Calantone, R. J. and Droge, C., (2006) "Collaborating for new product development: selecting the partner with maximum potential to create value" Journal of product innovation management, Vol. 23, No. 4, pp. 330-341.
- Enkel, E., Gassmann, O. and Chesbrough, H. (2009) "Open R&D and open innovation: exploring the phenomenon", R&d Management, Vol. 39, No. 4, pp. 311-316.
- Epstein, M.J. (2008), Making Sustainability Work: Best Practices in Managing and Measuring Corporate Social, Environmental and Economic Impact, San Francisco, CA: Berrett-Koehler Publishers.
- Epstein, M. J. and Roy, M. (2001), "Sustainability in action: identifying and measuring the key performance drivers", Long Range Planning, Vol. 34, No. 5, pp. 585-604.
- Florida, R. and Davison, D., (2001) "Gaining from green management: environmental management systems inside and outside the factory" California management review, Vol. 43, No. 3, pp. 64-84.
- Freedman, M. and Jaggi, B. (1988) "An analysis of the association between pollution disclosures and economic performance, Accounting, Auditing & Accountability Journal, Vol. 1, No. 2, pp. 43-58.
- Garzella, S. and Fiorentino, R. (2014), "An integrated framework to support the process of green management adoption". Business process management journal, Vol. 20, No. 1, pp. 68-89.

- Garzella, S. and Fiorentino, R. (2013), "How to control environmental strategy?", *Management Control*.
- Gassmann, O. and Enkel, E., (2004) Towards a theory of open innovation: three core process archetypes.
- Hansen, E. G., Grosse-Dunker, F. and Reichwald, R., (2009) "Sustainability innovation cube—a framework to evaluate sustainability-oriented innovations", *International Journal of Innovation Management*, Vol. 13, No. 4, pp. 683-713.
- Hart, S.L. (1995), "A natural-resource-based view of the firm", *Academy of Management Review*, Vol. 20, No. 4, pp. 986-1014.
- Hart, S.L. and Milstein, M.B., (2003) "Creating sustainable value" *Academy of Management Perspectives*, Vol. 17, No. 2, pp. 56-67.
- Hossain, M., Islam, K.M.Z., Sayeed, M.A., and Kauranen, I., (2016) "A comprehensive review of open innovation literature" *Journal of Science & Technology Policy Management*, Vol. 7, No. 1, pp. 2-25.
- Huizingh, E.K., (2011) "Open innovation: state of the art and future perspectives" *Technovation*, Vol. 31, No. 1, pp. 2-9.
- Ilinitich, A.Y., Soderstrom, N.S. and Thomas, T.E. (1998), "Measuring corporate environmental performance", *Journal of Accounting & Public Policy*, Vol. 17, No. 4/5, pp. 383-408.
- Lamboglia, R., Fiorentino, R., Mancini, D. and Garzella, S. (2018) "From a garbage crisis to sustainability strategies: The case study of Naples' waste collection firm" *Journal of Cleaner Production*, Vol. 186, pp. 726-735.
- Leach, M., Rockström, J., Raskin, P., Scoones, I. C., Stirling, A. C., Smith, A. and Folke, C., (2012) "Transforming innovation for sustainability", *Ecology and Society*, Vol. 17, No. 2, p. 11.
- Lee, K. (2009), "Why and how to adopt green management into business organizations?", *Management Decision*, Vol. 47, No. 7, pp. 1001-1021.
- Marcus, A.A. and Fremeth, A.R. (2009) "Green management matters regardless", *Academy of Management Perspectives*, Vol. 23, No. 3, pp. 17-26.
- McWilliams, A. and Siegel, D. (2001) "Corporate social responsibility: a theory of the firm perspective" *Academy of Management Review*, Vol. 26, No. 1, pp. 117-127.
- Montalvo, C. (2008) "General wisdom concerning the factors affecting the adoption of cleaner technologies: a survey 1990–2007", *Journal of Cleaner Production*, Vol. 16, No. 1, pp. 7–13.
- Parmigiani, A. and Mitchell, W., (2009) "Complementarity, capabilities, and the boundaries of the firm: the impact of within-firm and interfirm expertise on concurrent sourcing of complementary components", *Strategic Management Journal*, Vol. 30, No. 10, pp. 1065-1091.
- Peattie, K. and Belz, F. M. (2010) "Sustainability marketing—An innovative conception of marketing", *Marketing Review St. Gallen*, Vol. 27, No. 5, pp. 8-15.
- Pil, F. K. and Holweg, M. (2006) "Evolving from value chain to value grid" *MIT Sloan management review*, Vol. 47, No. 4, p. 72.
- Porter, M.E. and Kramer, M.R. (2006) "The link between competitive advantage and corporate social responsibility" *Harvard business review*, Vol. 84, No. 12, pp. 7892.
- Porter, M.E. and Van der Linde, C. (1995), "Green and competitive", *Harvard Business Review*, Vol. 73 No. 5, pp. 120-134.
- Rauter, R., Perl-Vorbach, E. and Baumgartner, R. J. (2017), "Is open innovation supporting sustainable innovation? Findings based on a systematic, explorative analysis of existing literature", *International Journal of Innovation and Sustainable Development*, Vol. 11, No. 2-3, pp. 249-270.
- Reed, R., Storrud-Barnes, S. and Jessup, L. (2012) "How open innovation affects the drivers of competitive advantage: Trading the benefits of IP creation and ownership for free invention", *Management Decision*, Vol. 50, No. 1, pp. 58-73.

- Rohrbeck, R., Hölzle, K., and Gemünden, H. G. (2009) "Opening up for competitive advantage—How Deutsche Telekom creates an open innovation ecosystem" *R&d Management*, Vol. 39, No. 4, pp. 420-430.
- Russo, M.V. and Fouts, P.A. (1997) "A resource-based perspective on corporate environmental performance and profitability" *The Academy of Management Journal*, Vol. 40, No. 3, pp. 534-559.
- Siegel, D.S. (2009) "Green management matters only if it yields more green: an economic/strategic perspective" *Academy of Management Perspectives*, Vol. 23, No. 3, pp. 5-16.
- Sprengel, D.C. and Busch, T. (2011), "Stakeholder engagement and environmental strategy – the case of climate change", *Business Strategy and the Environment*, Vol. 20, No. 6, pp. 351-364.
- Traitler, H., Watzke, H. J. and Saguy, I. S. (2011) "Reinventing R&D in an open innovation ecosystem" *Journal of food science*, Vol. 76, No. 2, pp. 62-68.
- Tortoriello, M. and Krackhardt, D., (2010) "Activating cross-boundary knowledge: The role of Simmelian ties in the generation of innovations", *Academy of Management Journal*, Vol. 53, No. 1, pp. 167-181.
- Van de Vrande, V., Lemmens, C. and Vanhaverbeke, W., (2006) "Choosing governance modes for external technology sourcing" *R&d Management*, Vol. 36, No. 3, pp. 347-363.
- Varadarajan, R., (2017) "Innovating for sustainability: a framework for sustainable innovations and a model of sustainable innovations orientation", *Journal of the Academy of Marketing Science*, Vol. 45, No. 1, pp. 14-36.
- von Hippel, E., and von Krogh, G., (2006) "Free revealing and the private-collective model for innovation incentives" *R&D Management*, Vol. 36, No. 3, pp. 295-306.
- Wood, D.J. (1991) "Corporate social performance revisited" *Academy of Management Review*, Vol. 16, No. 4, pp. 691-718.

Analysing the Concept of Ecosystem: a Systematic Literature Review

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Abstract

This paper aims to provide an explanatory representation of the concept of ecosystem by mean of a systemic review of a selected sample of research papers hinged on the study of ecosystems in the field of management and business.

Reviewed papers were selected according to a multistep process and the following criteria: 1) coverage of a comprehensive range of business and management-related peer-reviewed journals chosen from Scopus database; 2) timeframe of the investigated topic restricted to the period 1993-2019; 3) papers mainly focused on providing a general framework on ecosystems drawn from research.

This paper represents an attempt to give a systemic representation of the existing research on the definition of ecosystem.

This study has implications not only for researchers, but also for business practitioners. By means of this literature review it is possible to properly interpret, according to the criteria selected, the concept of ecosystem as depicted in the field of management and business.

Keywords – ecosystem, literature review, business, innovation.

Paper type – Academic Research Paper

1 Introduction

Managerial and business literature have long studied the firm within its environment trying to examine the nature of its relationship with external actors and the system (societal, technological and institutional). However, over the last three decades technological transformation and liberalization of trade policies have strongly contributed to blur and eventually dissolve the traditional multiple boundaries between and within firms and industries and spurred increasing collaboration across different knowledge and technological domains.

At the dawn of the Internet era, an emerging academic literature has started observing business and industries as complex, evolving and adaptive ecosystems and questioning how firms survive in a fast-changing and competitive environment continuously disrupted by technological innovation. The business lexicon has then been enriched with the term “ecosystem” which encompasses a wide range of meaning and categories. Since the seminal paper of Moore (1993) the analogy with biological and natural ecosystems has been employed by numerous scholars to depict business communities consisting of firms and other actors that coexist, co-evolve and collaborate in order to innovate and survive in an “open” environment highly competitive. According to Moore (1997), who pioneered and for long mastered the topic, business managers should think of themselves as part of organisms participating in an ecosystem instead of focusing on the focal organization and its external counterparts, either competitors, partners or consumers which all together form a linear and peer-to peer representation of the business environment (otherwise defined as the “extended enterprise”).

Managerial literature on ecosystems is not recent but has scattered over time and so far, has not yet accomplished a definite and comprehensive systematization of the topic. Any attempt to explain the concept of ecosystem is still considered a challenging task and as in any emerging research field there is still substantial uncertainty about the definition of ecosystem and its boundaries within a business context.

The literature on ecosystems is highly fragmented and other authors have noted that a relevant number of studies come from practitioners rather than academics (Erkko and Llewellyn, 2014) and the word itself is sometimes a convenient catchphrase used by management consultants to impress without substance. Yet it is also a fact that the word ecosystem has widely been used in academic journals in the field of management in the attempt of finding a coherent theoretical framework and a holistic view of the concept of ecosystems are still lacking in literature. As noted by Tsujimoto et al. (2018) the concept of ecosystem in the field of management of technology and information was used in an increasingly number of papers published on scientific journals from 1995 to 2014.

Scholars has long attempted to define the concept of ecosystem. The mainstream literature has identified different types of ecosystems arising from the analysis of their inherent characteristics (Scaringella and Radziwon, 2018): business ecosystems (Moore, 1993; Iansiti and Levien, 2004); innovation ecosystems (Adner, 2006); entrepreneurial ecosystems (Prahalad, 2005; Roundy et al., 2017); knowledge ecosystems (Jarvi et al., 2018).

The goal of this paper is to present a literature review of the concept of ecosystem within the research field of management and business. We argue that a thorough review of existing literature on ecosystems may eventually: 1) give a proper valuation on the extent of studies already undertaken on this specific topic; 2) give support to a better understanding of the concept of ecosystem in the field of management and business in the view of developing a coherent theoretical framework which would highlight specific issues, methodologies and theories in prior investigations.

In order to reach the previously mentioned goals we address the following research questions. RQ1: what have been investigated in prior ecosystem research? RQ2: what kind of analysis have been used in prior ecosystem research? RQ3: what is the existing gap in current ecosystem research that future studies may further investigate?

In the attempt to give an answer to the aforesaid research questions this paper employed a multistep process of reviewing existing literature selectivity chosen from the Scopus database. The selected papers were then classified according to the criteria suggested by Jarvi and Kortelainen (2017) who identified three units of analysis in ecosystem research: individual actors, the relationship between the actors, and the ecosystem as a whole.

2 Research method

In order to properly collect existing studies on ecosystems in the business and management literature, starting from January to March 2019 we conducted a multistep focused search on the Scopus database. Research papers dealing with the concept of ecosystem in a business setting were gathered based on the following criteria.

First, the search was limited to papers published between 1993 and 2019 containing the term 'ecosystem' in the title, abstract or keywords; books and book chapters were excluded from the search. Second, the search was then limited to articles published in journals belonging to the subject category "business and management". Third, we decided to focus on peer-reviewed journals and consequently conference proceedings were dismissed coherently with Tranfield et al. (2003). As a result of this multistep selection process, a subset of articles were identified and chosen for subsequent analysis.

The initial search based on the term ecosystem returned results with a lot of 'noise', meaning that not all the articles dealt with ecosystems in the business context. For example, some of the articles considered as 'noise' focused on the natural and biological ecosystems. Consequently, those articles deemed out of scope were eliminated. The final sample consisted of 43 articles.

We have then examined existing literature review such as the one proposed by Pilinkienė and Maciulis (2014) who identified five different types of ecosystems: business ecosystems, entrepreneurship ecosystems, innovation ecosystems, digital ecosystems and industrial ecosystems. We also built our analysis on literature reviews proposed by Gawer (2014), Gawer and Cusumano (2013), Jardi and Kortelainen (2017) and Scaringella and Radziwon (2017). Finally, the systematization of the selected papers was conducted according to the methodological approach employed by Jardi and Kortelainen (2017) who

identified three units of analysis in ecosystems research: the individual actors; the relationship between the actors and the ecosystem as a whole.

3 Analysis of the findings

Ecosystems have been analysed from different theoretical perspectives and at different level of analysis. Ecosystems have been analysed through the lens of institutional theory (Di Maggio and Powell, 1983) or resource-dependency theory (Pfeffer and Salancik, 1988). Scholars have also associated the concept of ecosystem with open innovation (Chesbrough, 2003) and dynamic capabilities (Teece, 2018). Furthermore, scholars in the field of business and management have been approached the study of ecosystems using different units of analysis. As already mentioned, we have drawn from Jarvi and Kortelainen (2017) the methodological approach of systematizing the reviewed papers according to whether they focus on individual actors in the ecosystem, on the relationship between actors or the ecosystem as a whole.

Early researchers in the field such as Moore (1993) and Iansiti and Levien (2004) have focused on individual actors. The individual actors involved in ecosystems can play different roles (e.g. customers, seller of complementary products and services, supplier, policy maker) and occupy distinct positions performing for instance the role of hub or focal firms (Iansiti and Levien, 2004; Moore, 1993). Autio and Thomas (2013) define hubs as connecting production and use-side participants, giving rise to the first type of observed relationship between different actors in the ecosystems. This relation has been addressed in a study by Henierth et al. (2014) and in studies examining how users adopt technological platforms in ecosystems (e.g. Makinen et al., 2014). Other studies of technology or platform owners (Iyer and Davenport, 2008; Isckia, 2009; Li, 2009; Tee and Gawe, 2009; West and Wood, 2013; Gawer and Cusumano, 2014; Wareham et al., 2014) have also placed particular emphasis on focal firms in ecosystems (Cohen, 2006; Nambisan and Baron, 2013; Li and Garnsey, 2014). Much research attention has also been devoted to strategic interactions with independent complementors (Pierce, 2009; Adner and Kapoor, 2010; Ethiraj and Posen, 2013; Kapoor, 2013; Kapoor and Lee, 2013; Kapoor and Furr, 2014).

Ecosystems have been discussed under different labels, including business ecosystems, digital ecosystems, innovation ecosystems technology ecosystems and platform ecosystems.

Referring to the above units of analysis (the individual actor, the relationship and the ecosystems), we analysed in more detail the different theoretical perspectives applied to these different units of analysis, based on our sample selected articles.

Table 7 Existing studies on ecosystems by unit of analysis

<i>Unit of Analysis</i>	<i>References</i>
The individual actor	Moore (1993), Iansiti and Levien (2004) Autio and Thomas (2013), Xu et al. (2010), Kang and Downing (2015) and Mäkinen et al. (2014) Gawer and Cusumano (2013), Teece (2018), Helfat and Raubitschek (2018), Cohen (2006), Hagel et al. (2008), Arker and Van Alstyne (2017)
The relationship	Moore (1996), Adner (2006), Pereira et al. (2017), Pierce (2009), Adner and Kapoor (2010), Gyrd-Jones and Kornum (2013), Wareham et al. (2014), Ethiraj and Posen (2013), Kapoor and Lee (2013) and Kapoor and Furr (2015), Acs et al. (2018), Immomen et al. (2016), Hein et al. (2019), Aulkemeirer et al. (2019)
The Ecosystem	Adner (2017), Anzari et al. (2017), Clarysse et al. (2014), Dattée et al. (2017), Gawer and Cusumano (2013), Battistella et al. (2013), Ritala et al. (2013), Adner (2006), Tencati and Zsolnai (2009), van der Borg et. (2012), Calcei and M'achiurgi (2012), Cennamo and Santalo (2013), Jackson (2011), Gomez et al. (2016), Russel and Smorodinskaja (2017), Xu et al. (2017), Luo (2017), Oh et al. (2016)

Research that takes the individual actor as the unit of analysis focused on firms and consumers. In particular, research on firms in ecosystems examined both focal and peripheral firms, on different positions within the ecosystems (Cohen, 2006; Hagel et al., 2008). The individual actors were examined in the context of platform ecosystems and some authors suggested two types of platforms: internal or company-specific platforms, and external or industry-wide platforms, (Gawer and Cusumano, 2013). They defined internal platforms as a set of assets organized in a common structure from which a company can efficiently develop and produce a stream of derivative products; while they defined external platforms as products, services, or technologies that act as a foundation upon which external innovators organized as an innovative business ecosystem, can develop their own complementary products, technologies or services.

Expanding the literature on adoption and diffusion, consumer-related decisions to adopt have been examined in the context of platform ecosystems (Xu et al., 2010; Kang and Dowling, 2015; Makinen et al., 2014).

Other studies addressed the issue of the optimal levels of openness and of intellectual property duration in a platform ecosystem (Parker and Van Alstyne, 2017).

Another part of the literature examined the distinctive capabilities of firms in ecosystems. Teece (2018) placed firms at the center of platform-based ecosystems and argued that dynamic capabilities can enable firms to create and capture value by building ecosystems and designing appropriate business models. Similarly, Helfat and Raubitschek (2018) proposed three types of dynamic capabilities which are critical for platform leaders: innovation capabilities, environmental scanning and sensing capabilities and integrative capabilities.

Studies focusing on the relationship between the individual actors of the ecosystems, moved from the notion that ecosystems changed the view from traditional inter-firm

competition to a joint approach of coopetition – simultaneous competition and cooperation – between actors (Moore, 1996; Adner, 2006; Pereira et al., 2017). In fact, many recent studies have gone beyond value creation in individual companies, because firms have integrated customers, partners, and stakeholders in a mutual value co-creation process.

A group of such studies examined the relationship between the focal firms and the complementor (Pierce, 2009; Adner and Kapoor, 2010; Gyrd-Jones and Kornum, 2013; Ethiraj and Posen, 2013; Kapoor and Lee, 2013; Kapoor and Furr, 2015). Other recent studies described the role of entrepreneurial ecosystems in economic growth (Acs et al., 2018). Research has, above all, highlighted how ecosystems' members can strengthen their forces by co-operating, though remaining independently, that happening especially in the digital service ecosystem (Immomen et al., 2016) and in the context of emerging Internet of things (IoT) platforms (Hein et al., 2019). With regard to inter-organizational collaboration in digital ecosystems, Aulkemeier et al. (2019) underlined that current systems tend to rely on static collaboration patterns between individual partners and are engineered without interoperability in mind, limiting the opportunities for firms to engage in dynamic collaboration relationships. They argue that a platform with a federated architecture can improve the agility of the collaboration between members of a business network and propose a corresponding platform architecture and a prototype for the online retail sector.

The third unit of analysis – the ecosystem as a whole – has also been examined from different perspectives.

The ecosystem approach has recently gained a great deal of interest in disciplines such as strategic management (Adner 2017; Ansari et al., 2017; Dattée et al., 2017) and innovation and technology management (Clarysse et al., 2014; Ritala et al., 2013).

Based on ecosystem level outcomes, interest has focused on collective and collaborative value creation within the ecosystem (Adner, 2006; Tencati and Zsolnai, 2009; Adner and Kapoor, 2010; Van der Borg et al., 2012) and competition between different ecosystems (Calcei and M'Chiurgi, 2012; Cennamo and Santalo, 2013; Kang and Downing, 2015).

In this context, previous research remarked a turning point in the literature, that is the transition from business ecosystems to innovative ecosystems (Jackson, 2011). Business ecosystem relates mainly to value capture, while innovation ecosystem relates mainly to value creation (Gomes et al., 2016).

In this direction, some scholars attempted to develop a specific framework about innovation ecosystems (Russell and Smorodinskaya, 2017), considering the integrated value chain and the interactive network (e.g. Xu et al., 2017). Other studies focused on the architecture of innovation ecosystem (Luo, 2017), on its risks and critical aspects (Oh et al., 2016).

4 Conclusions

Studies on ecosystems have shown there is a methodological issue related to different concepts and definitions of ecosystems that have been originated by diverging streams of research dealing with ecosystems. It is worth noting that scholars have been placing some efforts in order to identify a common ground across different research streams (Scaringella and Radziwon, 2017) and to strengthen the theoretical foundations of this research field. Specifically, we suggest to associate the recently published ecosystem literature with the well-established literature strands adopting the territorial approach such as for instance the literature on industrial districts, Marshallian districts and regional innovation clusters.

In this study we systematized the reviewed papers using three unit of analysis suggested by other researchers in the field (Jarvi and Kortelainen, 2017). From the analysis of the existing literature it emerged that academic research has been focusing on the analysis of specific case-studies particularly in the context of innovation ecosystems. Furthermore, it emerged that empirical studies that take the whole ecosystem as their unit of analysis are relatively limited and only recently have begun to emerge. Indeed, the ecosystem as unit of analysis is very challenging for empirical researchers mainly due to the difficulty to draw precise boundaries for the concept of ecosystem. Likewise, the interconnectedness between actors in ecosystems and their evolution (and co-evolution) can hardly be captured by conventional research methodologies such as qualitative case studies or network analysis. From this viewpoint, Jarvi and Kortelainen (2017) urged for the use of alternative research methodologies such as simulation and agent-based modelling which are especially well-suited for theory development.

References

- Aarikka-Stenroos, L. and Ritala P., (2017) "Network Management in the Era of Ecosystems: Systematic Review and management Framework", *Industrial Marketing management*, Vol. 67, pp. 23-36.
- Acs, Z.J. and Estrin, S.; Mickiewicz, T. and Szerb L., (2018) "Entrepreneurship, Institutional Economics, and Economic Growth: An Ecosystem Perspective", *Small Business Economics*, Vol. 51, No.2, pp. 501-514.
- Adner, R., (2006) "Match Your Innovation Strategy to Your Innovation Ecosystem", *Harvard Business Review*, Vol.84, No. 4, pp. 98-107.
- Adner, R. and Kapoor, R., (2010) "Value Creation in Innovation Ecosystems: How the Structure of Technological Interdependence Affects Firm Performance in New Technology Generations", *Strategic Management Journal*, Vol. 31, No. 3, pp. 306-333.
- Adner, R., (2017) "Ecosystem as Structure: An Actionable Construct for Strategy", *Journal of Management*, Vol. 43, No. 1 pp. 39-58.
- Ansari, S.S.; Garud, R. and Kumaraswamy, A., (2016) "The Disruptor's Dilemma: TiVo and the US Television Ecosystem", *Strategic Management Journal*, Vol. 37, pp. 1829-1853.
- Aulkemeier, F. and Iacob, M.E. and Van Hillegersberg, J., (2019) "Platform-Based Collaboration in Digital Ecosystems", *Electronic Markets*, <https://doi.org/10.1007/s12525-019-00341-2>.

- Autio, E. and Thomas, L.D.W., (2013) "Emergent Equifinality: An Empirical Analysis of Ecosystem Creation Processes", 35th DRUID Celebration Conference 2013, Barcelona, Spain.
- Autio, E. and Thomas, L.D.W., (2014) "Innovation Ecosystems", *The Oxford handbook of innovation management*, pp. 204-288.
- Calcei, D. and M'Chirgui, Z., (2012) "Coalition Building Dynamics in Video Format Wars" *Innovation Organization & Management*, Vol.14, No. 3, pp. 324-336.
- Cennamo, C. and Santalò J., (2013) "Platform Competition: Strategic Trade-Offs in Platform Markets", *Strategic Management Journal*, Vol. 34, No. 11, pp. 1331-1350.
- Clarysse, B.; Wright, M.; Bruneel, J. and Mahajan, A., (2014) "Creating Value in Ecosystems: Crossing the Chasm Between Knowledge and Business Ecosystems", *Research Policy*, Vol. 43, No. 7, pp. 1164-1176.
- Cohen, B., (2006) "Sustainable Valley Entrepreneurial Ecosystems", *Business Strategy and Environment*, Vol.15, No. 1, pp.1-14.
- Datteè, B.; Alexy, O. and Autio, E., (2017) "Maneuvering in Poor Visibility: How Firms Play the Ecosystem Game when Uncertainty is High", *Academy of Management Journal*, Vol.61, No.2.
- Di Maggio and Powel (1983) "The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields", Vol. 48, No. 2, pp. 147-160.
- Ethiraj, S.K. and Posen, H. E., (2014) "Do Product Architectures Affect Innovation Productivity in Complex Product Ecosystems?", *Advances in Strategic Management*, Vol .30, pp.127-166.
- Erkko, A. and Llewellyn, D.W.T. (2014) "Innovation ecosystems. Implications for innovation management? In Dodgson, M., Gann, D., Phillips, N. (ed.) "The Oxford Handbook of innovation management" Oxford: Oxford University Press, pp. 204-228.
- Galateanu, E. and Avasilcai, S., (2014) "Business Ecosystem Reliability", *Procedia- Social and Behavioral Sciences*, Vol. 124, pp. 312-321.
- Gawer, A., (2014) "Bridging Differing Perspectives on Technological Platforms: Toward an Integrative Framework", *Research Policy*, Vol. 43, No. 7, pp. 1239-1249.
- Gawer, A. and Cusumano M.A., (2014) "Industry Platforms and Ecosystem Innovation", *The Journal of Product Innovation Management*, Vol. 31, No. 3, pp. 417-433.
- Gyrd-Jones, R.I. and Kornum, N., (2013) "Managing the Co-Created brand: Value and Cultural Complementarity in Online and Offline Multi-stakeholder ecosystems", *Journal of Business Research*, Vol.66, No. 9, pp. 1484-1493.
- Gomes De Vasconcelos, L.A., Figueiredo Facin, A.L., Salerno, M.S. and Ikenami R.K., (2018) "Unpacking the Innovation Ecosystem Construct: Evolution, Gaps and Trends", *Technological Forecasting & Social Change*, Vol. 136, pp. 30-48.
- Hagel, J., Brown, J.S. and Davison, L., (2008) "Shaping Strategy in a World of Constant Disruption", *Harvard Business Review*, Vol. 86, No. 10, pp. 80-89.
- Hein, A., Weking, J., Schreieck, M., Wiesche M., Böhm, M. and Krcmar H., (2019) "Value Co-Creation Practices in Business-to-Business Platform Ecosystems", *Electronic Markets*, pp. 1-16.
- Helfat, C.E. and Raubitschek, R.S., (2018) "Dynamic and Integrative Capabilities for Profiting from Innovation in Digital Platform-Based Ecosystem", *Research Policy*, Vol. 47, No. 8, pp. 1391- 1399.
- Iansiti, M. and Levien, R., (2004) "The keystone advantage: what the new dynamics of business ecosystems mean for strategy, innovation and sustainability", Harvard Business School Press, Boston.
- Iansiti, M. and Levien R., (2004) "Strategy as Ecology", *Harvard Business Review*, Vol. 82, No. 3, pp. 68-81.

- Isckia, T., (2009) "Amazon's Evolving Ecosystem: A Cyber-Bookstore and Application Service Provider", *Canadian Journal of Administrative Sciences*, Vol. 26, No. 4, pp. 332-343.
- Iyer, B. and Davenport, T.H., (2008) "Reverse Engineering Google's Innovation Machine", *Harvard Business Review*, Vol. 86, pp. 58-68.
- Immonen, A., Ovaska, E., Kalaoja, J. and Pakkala, D., (2016) "A Service Requirements Engineering Method for a Digital Service Ecosystem", *Service Oriented Computing and Applications*, Vol. 10, No. 2, pp. 151-172.
- Jarvi, K., Almpantopoulou, A., Ritala, P. (2018). "Organization of knowledge ecosystems: prefigurative and partial forms", *Research Policy*, Vol. 47 (2018), pp. 1523-1527.
- Jarvi, K. and Kortelainen, S., (2017) "Taking Stock of Empirical Research on Business Ecosystems: A Literature Review", *Journal Business and System Research*, Vol. 11, No. 3, pp. 215-224.
- Jucevicius, G. and Grumadaite, K., (2014) "Smart Development of Innovation Ecosystem", *Procedia- Social and Behavioral Sciences*, Vol. 156, pp. 125-129.
- Kang, J-S. and Dowing, S., (2015) "Keystone Effect on Entry into Two-Sided Markets: An Analysis of the market Entry of WiMAX", *Technological Forecasting and Social Change*, Vol. 94, pp. 170-186.
- Kapoor, R., (2014) "Collaborating with Complementors: What Do Firms Do?", *Advances in Strategic Management*, Vol. 30, pp. 3-25.
- Kapoor, R. and Furr, N.R., (2015), "Complementarities and Competition: Unpacking the Drivers of Entrants' Technology Choices in the Solar Photovoltaic Industry", *Strategic Management Journal*, Vol. 36, No. 3, pp. 416-436.
- Kapoor, R. and Lee, J.M., (2013) "Coordinating and competing in ecosystems: How organizational Forms Shape New Technology Investments", *Strategic Management Journal* Vol. 34, No. 3, pp. 274-296.
- Li, Y.R., (2009) "The Technological Roadmap of Cisco's Business Ecosystem", *Technovation*, Vol. 29, No. 5, pp. 379-386.
- Li, J.F. and Garnsey, E., (2014) "Building Joint Value: Ecosystem Support for Global Health Innovations", *Advances in Strategic Management*, Vol. 30, pp. 69-96.
- Luo, J., (2017) "System-of-Systems Innovation: Proactive Methods for Conception and Strategies for Implementation", *Journal of Enterprise Transformation*, Vol. 7 pp. 1-25, <https://doi.org/10.1080/19488289.2017.1409296>
- Luo, J., (2018) "Architecture and Evolvability of Innovation Ecosystems", *Technological Forecasting & Social Change*, Vol. 136, pp.132-144.
- Makinen, S.J.; Kanninen, J. and Peltola I., (2014) "Investigating Adoption of Free Beta Applications in a Platform-Based Business Ecosystem", *The Journal of Product Innovation Management*, Vol. 31, No. 3, pp. 451- 465.
- Moore, J.F., (1993) "Predators and Prey: A new Ecology of Competition", *Harvard Business Review*, Vol. 71, No. 3, pp.75-86.
- Moore J.F., (1996) "The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems", Harper Business, New York.
- Nambisan, S. and Baron, R.A., (2013) "Entrepreneurship in Innovation Ecosystems: Entrepreneurs' Self-Regulatory Processes and Their Implications for New Venture Success", *Entrepreneurship Theory and Practice*, Vol. 37, No. 5, pp. 1071-1097.
- Oh, D.S.; Phillips, F.; Park, S. and Lee, E., (2016) "Innovation Ecosystems: A Critical Examination", *Technovation*, Vol. 54, pp. 1-6.
- Parker, G. and Van Alstyne, M., (2017) "Innovation, Openness, and Platform Control", *Management Science*, Vol. 64, No. 7, pp. 2973-3468.
- Pfeffer, J. and Salancik, G., (1978) *The External Control of Organizations: A Resource Dependence Perspective*. Harper & Row, New York.

- Pilinkienė, V. and Mačiulis, P., (2014) "Comparison of Different Ecosystem Analogies: The Main Economic Determinants and Levels of Impact", *Procedia-Social Behavioral Sciences*, Vol. 156, pp. 365-370.
- Pierce, L., (2009) "Big Losses in Ecosystem niches: How Core Firm Decisions Drive Complementary Product shakeouts", *Strategic Management Journal*, Vol. 30, No. 3, pp 323-347.
- Pereira, D.; Leitão, J. and Devezas, T., (2017) "Coopetition and Co-innovation: Do Manufacturing and Service Providers Behave Differently?", *Industry 4.0 Entrepreneurship and Structural Change in the New Digital Landscape*, pp. 397–431.
- Prahalad, C.L. (2005) "The fortune at the bottom of the pyramid", Pearson Education India, New Delhi.
- Ritala, P.; Agouridas, V.; Assimakopoulos, D. and Gies, O., (2013) "Value Creation and Capture Mechanisms in Innovation Ecosystems: A Comparative Case Study", *International Journal Technology Management*, Vol. 63, No. 3/4, pp.244- 267.
- Russell, M.G. and Smorodinskaya N.V., (2018) "Leveraging Complexity for Ecosystem Innovation", *Technological forecasting & Social Change*, Vol. 136, pp. 114-131.
- Scaringella, L. and Radziwon, A. (2018) "Innovation, entrepreneurial, knowledge, and business ecosystems: old wine in the new bottles?", *Technological Forecasting & Social Change*, Vol. 136 (2018), 59-87.
- Smorodinskaya, N.; Russell, M.; Katukov, D.; Still, K., (2017) "Innovation Ecosystems vs. Innovation Systems in Terms of Collaboration and Co-creation of Value", *Proceedings of the 50th Hawaii International Conference on System Sciences*.
- Tee, R. and Gawer, A., (2009) "Industry Architecture as a Determinant of Successful Platform Strategies: A Case Study of the I-Mode Mobile Internet Service", *European Management Review*, Vol.6, No. 4 pp. 217-232.
- Teece, D.J., (2018) "Business Models and Dynamic Capabilities", *Long Range Planning*, Vol.51, No. 1, pp. 40-49.
- Tencati, A. and Zsolnai, L., (2009) "The Collaborative Enterprise", *Journal of Business Ethics*, Vol. 85, No.3, pp. 366-376.
- Tsujimoto, M., Kajikawa, Y., Tomita, J., Matsumoto, Y., (2018) "A review of the ecosystem concept – Towards coherent ecosystem design", *Technological Forecasting & Social Change*, Vol. 136 (2018), 49-58.
- Van De Borgh, M.; Cloudt, M. and Romme, A.G.L., (2012) "Value Creation by Knowledge-Based Ecosystems: Evidence from a Field Study", *R & D Management*, Vol. 42, No. 2, pp. 150-169.
- Wareham, J. and Fox, P. B. and Cano Giner, J. L., (2014). "Technology Ecosystem Governance", *Organization Science*, Vol. 25, No. 4, pp. 1195–1215.
- West, J. and Wood, D., (2014) "Evolving An Open Ecosystem: The Rise and Fall of the Symbian Platform", *Advances in Strategic Management*, Vol.30, pp. 27-67.
- Xu, X.; Venkatesh, V.; Tam, K.Y and Hong, S. J. (2010) "Model of Migration and Use of Platforms: Role of Hierarchy, Current Generation, and Complementarities in Consumer Settings", *Management Science*, Vol. 56, No. 8, pp. 1304-1323
- Xu, G. and Wu Y. and Minshall T. and Zhou Y., (2018) "Exploring Innovation Ecosystems across Science, Technology, and Business: A Case of 3D Printing in China", *Technological Forecasting & Social Change*, Vol. 136, pp. 208-221.

Organizing Knowledge Co-Creation for Radical Innovation within Knowledge Ecosystem

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Abstract

The present study explores organizing knowledge co-creation for radical innovation within knowledge ecosystem. Building on research on knowledge creation, innovation, and organizing, the study at hand understands knowledge co-creation as central basis for organizing and source of interdependence. Study sheds light on temporary and emergent organizing of knowledge co-creation within knowledge ecosystem. The findings of the study reveal that process of knowledge co-creation is cyclic in which each cycle builds on previous one. In addition, knowledge co-creation considers multidimensional orientation between technology, business and regulation throughout the process. Hence, beyond formal project organization, organizing knowledge co-creation is temporary, dynamic, informal, and follows cyclic and generative process. Specifically, organizing comprises activities of shared problem identification, shared goal setting, making experiments (testing), open demonstrations, and seeking internal and feedback and knowledge synthesis. Such an organizing enables contextual, situational, and flexible involvement of critical knowledge for the development of innovation, building novel business, and changing regulation. The paper discusses the findings and implications more detailed.

Keywords – knowledge co-creation, organizing, temporary, radical innovation, knowledge ecosystem

Paper type – Academic Research Paper

1 Introduction

New knowledge and knowledge creation are important for all innovations, not to mention radical, new-to-the-world innovations. In particular, complex radical innovations result of integration of knowledge and efforts of diverse actors and parties (e.g. Belderbos et al., 2004; Shawney, 2006, Harvey, 2014), and are therefore conducted in collaborative networks (Romero and Molina, 2011; O'Connor and DeMartino, 2006), open innovation systems (Chesbrough, 2006), innovation systems (Lancker et al., 2016) or ecosystems (Valkokari, 2015). Ecosystems are knowledge domains involving various independent parties committed to work interdependently for particular function or goal: innovation in innovation ecosystem (Valkokari, 2015), new knowledge in knowledge ecosystem (Van der Borgh et al., 2012; Valkokari, 2015) or both. As to produce radical innovations is to advance existing knowledge remarkably (e.g. Abernathy and Clard, 1985), it is appropriate to take lenses of knowledge ecosystem to study organizing knowledge creation for RI.

While ecosystems provide a rich (breadth and depth) knowledge base for radical innovations, an ability of the system to employ and use its knowledge (Dhanaraj and Parkhe, 2009; Dougherty and Dunne, 2011) is critical for the success of its function as well as for the shared goals. On the one hand, distributed knowledge among diverse independent domains is a challenge (e.g. Dougherty and Dunne, 2011). On the other hand, an ecosystem as a temporary organization and emergent form of organizing is an opportunity to build sufficient practices and processes to support joint function and goals, like innovation or new knowledge. Much of research has studied joint innovation partnerships (Tether, 2002), organizational innovation systems (Lancer et al., 2016), and ecosystems as systemic phenomena (Valkokari, 2015). However, there exist less research on convergent innovation (Phillips 2015), that is, interdependently produced innovation. Particularly, we know very little about organizing knowledge co-creation for joint innovation within knowledge ecosystems. This is surprising, as knowledge co-creation is central activity, function, and outcome in knowledge ecosystems (Valkokari, 2015), central basis of organizing (Järvi et al., 2018), and a source of interdependence. Consequently, organizing knowledge co-creation within knowledge ecosystems deserves attention, because 1) knowledge is created in social and dynamic interactions between people, when they openly explore contradictions and integrate perspectives in dialectical process (Nonaka and Toyama, 2003; Harvey, 2014) by simultaneously shaping shared goal. 2) knowledge co-creation is grounded by multiple complexities (Garud et al., 2011; Phillips 2017; Phillips et al, 2017) resulting of situational, relational and intersubjective processes (Tsoukas, 2008; Weick, 1979) that can be addressed through temporal orientations and organizing (Bakker et al., 2016; Tsoukas, 2003). To shed light on organizing knowledge creation is particularly important, because various kinds of knowledge-creation are required to achieve complex and challenging joint innovation (Nisula, Kianto and Andreeva, 2019), and because each knowledge creation process is unique (Elsbach & Kramer, 2003; Erden, von Krogh & Nonaka, 2008; Harvey, 2014; Unsworth, 2001) with varied composition of participants and varied goals.

Given the dynamics of knowledge co-creation in relation to the complex, fuzzy, and shared radical innovation outcome, it is clear that organizing knowledge co-creation becomes into highlight. Past research suggest that flexible and adaptive organizing (e.g. Kellogg, Orlikowski and Yates, 2006) better serves such conditions of complexity and volatility. This is likely to occur under limited hierarchy, horizontal relations, and interdependence (e.g. Girard and Stark, 2002; Kellogg et al., 2006). However, there exist very little research and empirical evidence on *how can knowledge co-creation for radical innovation be organized within a knowledge ecosystem?*

Building on literature on knowledge creation, innovation and organizing the present study explores organizing knowledge co-creation within one knowledge ecosystem. While doing so, we conducted a qualitative one case study, which assembled empirical evidence from one specific knowledge ecosystem constructed to bring together number of complementary parties for producing particular radical innovation.

The findings reveal that the process of knowledge co-creation is cyclic in which each cycle builds on previous one. The cyclic organizing comprises shared problem identification, shared goal setting, making experiments (testing), open demonstrations, searching internal and external feedback, and knowledge synthesis grounded by constant multidimensional orientation. Such an organizing enables integration of critical knowledge in a situational and contextual manner for the problem at hand.

2 Theoretical background

2.1. Radical innovation and knowledge co-creation

Radical innovations, as outstanding outcomes and game changers (Cooper and Kleinschmidt, 1993; Christensen et al., 2004; Schmidt and Calantone, 1998; Frederiksen and Knudsen, 2017) result of complex and multifaceted process (Van de Ven et al., 1999; Garud et al., 2011) involving diverse actors and parties. Such a non-linear and cyclic process is grounded by flexibility, emergence and learning (Arnold and Barth, 2012; Kroon et al., 2018, Lancker et al 2016). In addition to fuzzy goal of innovation, the process should address multidimensionality of innovation (Lancker et al., 2016). The cyclic processes are known among practitioners, like in start-up firms (Ries, 2011) as a pivoting or in software as agile development (Beck et al., 2001), as well as in learning as a problem based learning (Savery, 1995). However, these models lack theoretical basis and end short in addressing multidimensionality of joint innovation in knowledge ecosystem.

Knowledge creation and innovation are inherently intertwined in producing radical innovation. When innovation is conducted within knowledge ecosystem outside formal organizations, among parties who interdependently work for shared goals, knowledge creation and innovation are joint achievements. Further, as innovation comprises multiple discoveries (O'Connor and Rice, 2001; O'Connor and McDermott, 2004) throughout the process, it is clear, that various kinds of knowledge-creation in various compositions of

actors is required in addressing emerging complexities in generation of joint outcomes (Nisula, Kianto and Andreeva, 2019).

Based on literature on knowledge creation (Nonaka, 1990; Nonaka and Takeuchi, 1995; Nonaka and Toyama, 2003), collective creativity (Drazin, Glynn, Kazanjian, 1999; Harvey, 2013, 2014; Hargadon and Bechky, 2006; John-Steiner, 2000), and collaborative emergence (Sawyer and deZutter, 2009; Gray, 1989; Prince, 2009; Dougherty and Dunne, 2011) knowledge creation is inherently collaborative and collective process. We use term *knowledge co-creation*, which is a joint process to create new knowledge and understanding by integrating knowledge, expertise, and perspectives of diverse actors in situational, contextual and novel way for shared goals.

2.2. Organizing knowledge co-creation for radical innovation

Organizing knowledge co-creation for innovation within knowledge ecosystem is temporary, as it is conducted within predetermined timeframe and/or purpose (innovation), and it terminates once the goal is achieved (e.g. Bakker et al., 2016; Goodman & Goodman, 1976). It therefore differentiates from formal organization and organizing, which in general concerns division of labor and coordination of effort (e.g. Puranam et al., 2014). However, these aspects exist and are addressed differently in various types of organizing.

It is also clear that organizing multifaceted radical innovation cannot be fully planned, rather it is unfolding, characterized by emergence, uncertainty, and constant movement between complexities (temporal and relational) and synthesis (e.g. Garud et al., 2013). Therefore, an organizing, which enables flexibility, autonomy, and speed to make fast assignments, temporary agreements, shifts in accountability, roles, grouping (Kellogg et al., 2006; Girard and Stark, 2002), and in work modes (Garud et al., 2011) better address the requirements of organizing. This is likely to occur under limited hierarchy, horizontal relations and interdependence (e.g. Girard and Stark, 2002; Kellogg et al., 2006). Consequently, scholars suggest that in circumstances of complexities an unfolding organizing constitutes of set of practices (Kellogg et al., 2005; Garud et al., 2011), that is, activities and processes (Bakker et al., 2016) through which organizing is conducted and enacted (Orlikowski, 2000; Fortwengel et al., 2018). Hence, in addition to organization, we target our research to the activities and processes of organizing knowledge co-creation for radical innovation within knowledge ecosystem.

3 Methods

3.1 Research design

The present study employed a qualitative research strategy, and particularly, a single case study research approach to explore organizing knowledge co-creation for RI. As we were interested on micro-level activities of collective innovation, the case study research is well suited to investigate it. In a one case study the case itself is interesting and unique, and it can be used to analyze one or a few complex processes or phenomena when enough

cases, observations or similar types of cases do not exist at all (Yin, 1994; Gummesson, 2000; Eriksson and Kovalainen, 2016). The case was chosen as to our knowledge it is among the rare ones to consciously adopt cyclic approach in development of RI within ecosystem. Our study concerns radical innovation project during two years period in 2015-2016.

Case description

“We neither know what is the problem nor we know how to solve that problem – in this sense it is somewhat chaotic state” (respondent).

The radical innovation, “intelligent control solutions for networks and radios and related novel business models”, aimed to produce disruptive systemic technology innovation by simultaneously developing technology, changing regulation and standardization, and building novel business models (commercialization). It was conducted under the national (Finnish) research funding (TEKES) program, TRIAL, which aimed to accelerate commercialization of collaborative innovations. The ecosystem for the radical innovation was built to bring together all the critical partners (Universities, Research institutes, Applied Universities, Mobile operators, Regulatory authority, Defence forces, Technology company, and Start-up companies) required for the development of novel cognitive radio technology, to change regulation, and standardization as well as to develop novel business models. The composition of parties was unique involving academia, practitioners, and public authorities. In addition to diversity in expertise and perspectives, the actors were geographically located in different sites in Finland. Further, innovation was interdependent, because it could not have been possible by any of the partners on their own - instead it demanded an engagement and input of all actors.

As a result, the project validated the feasibility of spectrum sharing between mobile broadband networks and other types of incumbent spectrum users utilizing Finnish cognitive radio field trial environment (CORE). The project was the first to develop and validate e2e system concepts for the most prominent spectrum-sharing concepts the CBRS (FCC 2015) from the US and Europe initiated LSA (ECC 2014) in end to end field trials (Matinmikko et al. 2013, Yrjola et al. 2016, Aho et al. 2016). Validation of the sharing concepts was implemented using commercial technologies-based experimental design set-ups, wherever possible to provide practical knowledge for the selection of technology components for the next generation 5G needs while carefully considering the scalability and the total cost of ownership. Improvements in the efficiency of the spectrum usage stem from exploitation of fluctuation in the spectrum resource availability that may happen in frequency, time, space and power. The results of the project have been utilized by regulation and standardization forums not only for studying the sharing concepts themselves, but the future of spectrum management, and the evolution towards future mobile broadband systems enhanced with innovative spectrum sharing enabled business models to cope with the growing demand for capacity and new services by humans and machines.

3.2 Data collection and analysis

Altogether sixteen in-depth interviews were conducted for the present study. The informants were from variety of representatives and functional perspectives. Each interview took between 30 to 97 minutes and was recorded and transcribed. In addition, informal conversations and discussions were used as a complementary data. The use of multiple data types and data sources enables triangulation and improves reliability of findings.

For data analysis, we employed qualitative content analysis (Eriksson and Kovalainen, 2016). First, based on interview data we constructed the knowledge co-creation/innovation process. Thereafter, we fed it back to some key actors and reconstructed it based on the feedback. Second, we generated the coding scheme first inductively from data, and there after revised it with circulating between data and theory, to emphasize the contextual nature of data. As often in abductive analysis (Dubois and Gadde, (2002) the process of analysis is dynamic, proceeding iteratively between data and theory (Eriksson and Kovalainen, 2016). We used qualitative analysis software (NVIVO 2.0) to organize data. The analysis was informed by our focus on organizing knowledge co-creation, but we were also alert to emerging notions.

4 Results

4.1 Organization and underlying aspects of organizing

Radical innovation was conducted as a multiparty project around the project plan for the funding agency. The project organization involved responsible director and steering group that comprised representatives of all parties (including funding agency). The steering group was responsible for the administration of the project and it monitored the advance of the project regularly. Each party had their own research plan, which they conducted independently while simultaneously being involved into shared project plan. We target our research on the interdependent knowledge co-creation and exclude parties' independent goals. Despite the formal project organization and plan, a more sensitive and flexible organizing was consciously searched to support the sticky development of interdependent RI and to consider the multidimensionality of the RI, that is, technology, business and regulation.

For that purpose, three specialized working groups (WG) were built (technology, business, and regulation). The members and the leaders for the working groups were negotiated and collectively allocated. Two criteria guided the membership: expertise and representativeness (working groups were built to involve members of diverse parties). In addition, cross membership was also emphasized (some members were involved in two or more working group).

The working groups were non-hierarchical, meaning that there were no supervisor-employee relationship between working group members, that is, there were no defined roles within the working groups. The only exception is the leader of the working group, who was responsible about coordination within WG and between WGs.

4.2. Knowledge co-creation process

Knowledge co-creation and innovation are inherently intertwined and co-evolving, which generative dance was fostered via specific practice comprising chains of cycles (labelled as “trials”). The chain of cycles constitute a circular process, in which each cycle builds on discoveries (created knowledge), feedback, knowledge synthesis of the previous one, and thereby direct the forthcoming and future cycles and advance interdependent development of technology, regulation and business simultaneously. The circular process constituted of cycles, each of which involved five major phases (Figure 1):

1. **Problem identification and goal setting:** Problem is collectively searched and identified in relation to overall innovation by moving between problem identification and goal of the trial (public demonstration), while simultaneously amplifying between technology, business and regulation. This fuzzy orientation and ‘planning’ phase looks back (findings and results from previous trial), present and forward, while anchoring the current state and setting next steps and goal for next trial.
2. **Knowledge co-creation:** generation of new knowledge, seeking solutions and solving problem, making field test, interpreting what is found and integrating knowledge discovered.
3. **Internal knowledge sharing:** sharing results and findings within ecosystem parties and their members (who are not involved into project), by discussing about the meaning of the results.
4. **External knowledge sharing and feedback search:** Sharing findings and demonstrating (demo) for external audience in conference or other kind of forums (= goal of the trial)
5. **Knowledge synthesis:** Synthetizing knowledge gained: knowledge discovered, internal ideas, external feedback, in relation to innovation advance.

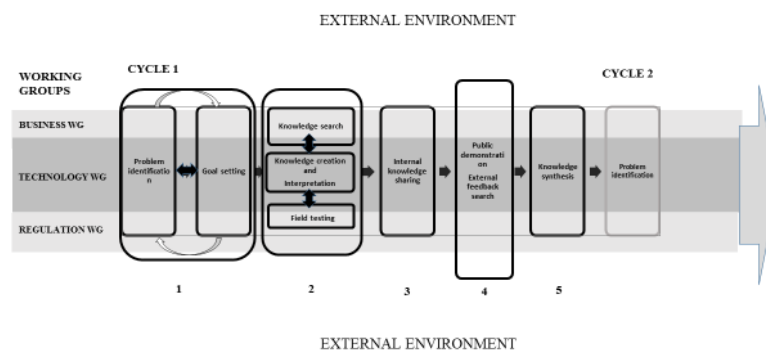


Figure 1: Knowledge co-creation/innovation process

4.2.1 Participation in knowledge co-creation

Participation in knowledge co-creation is dynamic, meaning that there were several shifts in participation within each cycle. Participation varied and was organized in changing compositions of participants along the cycle according to problem, expertise, purpose and interest.

At the beginning of each cycle (problem identification and goal setting), the participation was broad involving members from all working groups and an executive board group as well. Once the problem was identified and the goal set, the participation based on expertise and the problem at hand. In this phase, autonomous, self-organising groups around the problem took responsibility of seeking solutions. Internal knowledge sharing phase gathered a broad participation, involving members of the project parties as well as their members (who were not involved into the project, but were interested about it). Participation in the external demonstration based on expertise, experience and 'involvement' on discoveries to be demonstrated. Participation in knowledge synthesis was also broad involving members of all working groups including volunteers.

4.2.1 Coordination knowledge co-creation

Coordination knowledge co-creation was informal as there were no formal rules or decision-making processes. It also followed the cyclic process, that is, each phase in cycle is a kind of orientation (probing) and anchoring point to coordinate knowledge and activities related to innovation.

Decision-making was distributed and dynamic, ranging between decisions made by particular experts to distributed team decision making. However, decision-making based on collectively produced knowledge and understanding, that is, integration of knowledge and perspectives of diverse actors to explore and identify problems as well as to build collective sense-making. For example, regular whole day seminars were organized to gather all participants around some specific theme, like to explore *"how the business scenarios, mobile operators and their business models or ecosystems will change in future?"* (respondent).

Thus, coordination occurred through regular meetings, probing through intense dialogue and collaboration. *"Active working groups meet regularly and repeatedly, fortnightly or when needed"* (respondent). Coordination involved following types of orientations: 1) past-present-future; 2) technology-regulation-business; 3) innovation – external environment, and in knowledge co-creation 4) knowledge search - field tests - knowledge interpretation. Such a multidimensional orientation is critical, because interpretation of discoveries in relation to alternative possibilities and future direction demands thorough interpretation and integration of knowledge and expertise of diverse actors to build a shared understanding. In addition, spontaneous meetings and communication emerged according to need. *"We have a spontaneous collaboration. Once a question arises, we immediately contact (send e-mail or call) the person in charge"* Likewise, coordination practices emerged and were developed in interaction between participants according to the demands.

To support coordination several tools were employed: *E-mail*, and differentiated e-mail lists were used to leverage information either to all or to specific groups of participants and to interconnect people around a specific theme or problem. *Canvas or map* was used as a boundary object in orientation, in identifying the problem, and in visualizing the current state, advance and potential future directions of the innovation. *Databases*, to which all members had an access, were used to share documents, results, and the real time ‘roadmap’ of trials regarding the content and environment. However, documentation was not the key issue and it was kept as low as possible.

5 Discussion and conclusions

The present study examined organizing knowledge co-creation for radical innovation within knowledge ecosystem, and particularly, in one radical innovation ecosystem project.

We found that within (and despite) formal project organization organizing knowledge co-creation can, indeed, be dynamic and informal, and it seems to act as a fundamental basis of organizing knowledge ecosystem. This finding aligns with research findings by Järvi et al., (2018). Whereas the formal organization is responsible of the administrative aspects of knowledge ecosystem, it simultaneously emphasized dynamic organizing in knowledge co-creation for radical innovation. This finding is important for all types of organizations aiming to foster knowledge co-creation and innovation, as it shows that successful knowledge creation can occur under dynamic and specific kind of organizing, which can sustain also within formal organization.

Further, our findings reveal that knowledge co-creation and development of innovation are intertwined. Particularly, process of knowledge co-creation and innovation is cyclic in which each cycle builds on previous one. This refers to previous studies, which present innovation as cyclic process (Lancker et al. 2011), as well as pivoting in start-up firms (Ries, 2011) and problem based learning process (Savery, 1995). Although there exist a plan for development of innovation, it rarely is the final plan, because the process on radical innovation is grounded by emergence, setbacks, discoveries, as well as conscious decisions.

What is more, we found that when development of innovation is organized based on knowledge co-creation, it enables to capture multidimensionality of innovation (in this case orientation between technology, business, and regulation) throughout the process as well as situational and contextual complexities of innovation, while simultaneously building new knowledge. Hence, temporary, dynamic, and informal organizing enables cyclic process enacted.

Our results contribute to the research on knowledge creation (e.g. Nonaka and Toyama, 2003; Harvey, 2014) by providing a cyclic process model for dynamic knowledge co-creation within temporal and emerging collective, that is, knowledge ecosystem. Such a cyclic process enables to capture various kinds of knowledge co-creation with varied compositions of participants, which finding aligns with the recent research on knowledge creation by Nisula et al. (2019). Likewise, our findings add on

research on organizing joint innovation within temporary knowledge ecosystems, by providing empirical evidence on dynamic organizing process anchored according to the knowledge co-creation. Further, our results contribute to the literature on radical innovation, by shedding light on organizing cyclic process of innovation anchored around knowledge co-creation, which considers multidimensionality of radical innovation (e.g. Lancker et al., 2011). Further, our research contribute to the research on knowledge ecosystem function, by suggesting that knowledge co-creation process is central function in knowledge ecosystem, and a source of interdependency throughout innovation. In a broader sense, our findings contribute to the research on ecosystem capabilities (Phillips et al., 2017), by suggesting that organizing knowledge co-creation is a central function and capability in ecosystems in general, as it builds interdependence among actors as well as contributes to interdependent outcome (Tjosvold, 1989).

References

- Abernathy, W. J., & Clark, K. B. (1985). Innovation: Mapping the winds of creative destruction. *Research policy*, 14(1), 3-22.
- Aho et al. 2016
- Ahrne, G., & Brunsson, N. (2011). Organization outside organizations: The significance of partial organization. *Organization*, 18(1), 83-104.
- Arnold, M., & Barth, V. (2012). Open innovation in urban energy systems. *Energy efficiency*, 5(3), 351-364.
- Bakker, R. M., DeFillippi, R. J., Schwab, A., & Sydow, J. (2016). Temporary organizing: Promises, processes, problems. *Organization Studies*, 37(12), 1703-1719.
- Belderbos, R., Carree, M., & Lokshin, B. (2004). Cooperative R&D and firm performance. *Research policy*, 33(10), 1477-1492.
- Chesbrough, H. (2006). Open innovation: a new paradigm for understanding industrial innovation. *Open innovation: Researching a new paradigm*, 400, 0-19.
- Christensen, C.M., Anthony, S.D., and Roth, E.A. (2004) Seeing What's Next – Using the Theories of Innovation to Predict Industry Change. Boston, MA: Harvard Business School Press.
- Cooper, R. G., & Kleinschmidt, E. J. (1993). Major new products: what distinguishes the winners in the chemical industry?. *Journal of product innovation management*, 10(2), 90-111.
- Dougherty, D., & Dunne, D. D. (2011). Organizing ecologies of complex innovation. *Organization Science*, 22(5), 1214-1223.
- Drazin, R., Glynn, M. A., & Kazanjian, R. K. (1999). Multilevel theorizing about creativity in organizations: A sensemaking perspective. *Academy of management review*, 24(2), 286-307.
- Elsbach, K. D., & Kramer, R. M. (2003). Assessing creativity in Hollywood pitch meetings: Evidence for a dual-process model of creativity judgments. *Academy of Management journal*, 46(3), 283-301
- Eriksson, P., & Kovalainen, A. (2015). *Qualitative methods in business research: A practical guide to social research*. Sage. TSEKKAA 2016 painos
- Erden, Z., Von Krogh, G., & Nonaka, I. (2008). The quality of group tacit knowledge. *The Journal of Strategic Information Systems*, 17(1), 4-18.
- Fortwengel, J., Schüßler, E., & Sydow, J. (2017). Studying organizational creativity as process: Fluidity or duality?. *Creativity and Innovation Management*, 26(1), 5-16.
- Frederiksen, M. H., & Knudsen, M. P. (2017). From creative ideas to innovation performance: The role of assessment criteria. *Creativity and Innovation Management*, 26(1), 60-74.

- Garud, R., Gehman, J., & Giuliani, A. P. (2014). Contextualizing entrepreneurial innovation: A narrative perspective. *Research Policy*, 43(7), 1177-1188.
- Garud, R., Tuertscher, P., & Van de Ven, A. H. (2013). Perspectives on innovation processes. *Academy of Management Annals*, 7(1), 775-819.
- Gehman, J., Treviño, L. K., & Garud, R. (2013). Values work: A process study of the emergence and performance of organizational values practices. *Academy of Management Journal*, 56(1), 84-112.
- Girard, M., & Stark, D. (2002). Distributing intelligence and organizing diversity in new-media projects. *Environment and Planning A*, 34(11), 1927-1949.
- Goodman, R. A., & Goodman, L. P. (1976). Some management issues in temporary systems: A study of professional development and manpower-the theater case. *Administrative science quarterly*, 494-501.
- Gray, B. (1989). Collaborating: Finding common ground for multiparty problems.
- Gummesson, E. (2000). *Qualitative methods in management research*. Sage.
- Hargadon, A. B., & Bechky, B. A. (2006). When collections of creatives become creative collectives: A field study of problem solving at work. *Organization Science*, 17(4), 484-500.
- Harvey, S. (2013). A different perspective: The multiple effects of deep level diversity on group creativity. *Journal of Experimental Social Psychology*, 49(5), 822-832.
- Harvey, S. (2014). Creative synthesis: Exploring the process of extraordinary group creativity. *Academy of Management Review*, 39(3), 324-343.
- John-Steiner, V. (2000). *Creative collaboration*. Oxford University Press.
- Järvi, K., Almpantopoulou, A., & Ritala, P. (2018). Organization of knowledge ecosystems: Prefigurative and partial forms. *Research Policy*, 47(8), 1523-1537.
- Kellogg, K. C., Orlikowski, W. J., & Yates, J. (2006). Life in the trading zone: Structuring coordination across boundaries in postbureaucratic organizations. *Organization science*, 17(1), 22-44.
- Kroon et al., 2018,
- Van Lancker, J., Mondelaers, K., Wauters, E., & Van Huylbroeck, G. (2016). The Organizational Innovation System: A systemic framework for radical innovation at the organizational level. *Technovation*, 52, 40-50.
- Matinmikko et al., 2013
- Nisula, A. M., Kianto, A., & Andreeva, T. (2019). What Can Knowledge-Creating Organisations Learn from Theatrical Improvisation?. In *Knowledge Management, Arts, and Humanities* (pp. 55-75). Springer, Cham.
- Nonaka, L., Takeuchi, H., & Umemoto, K. (1996). A theory of organizational knowledge creation. *International Journal of Technology Management*, 11(7-8), 833-845.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford university press.
- Nonaka and Toyama, 2003
- O'Connor, G. C., & DeMartino, R. (2006). Organizing for radical innovation: An exploratory study of the structural aspects of RI management systems in large established firms. *Journal of product innovation management*, 23(6), 475-497.
- O'Connor, G. C., & McDermott, C. M. (2004). The human side of radical innovation. *Journal of engineering and technology management*, 21(1-2), 11-30.
- O'Connor, G. C., & Rice, M. P. (2013). New market creation for breakthrough innovations: Enabling and constraining mechanisms. *Journal of Product Innovation Management*, 30(2), 209-227.
- Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization science*, 11(4), 404-428.

- Phillips, M. (2015). An integrated approach to innovation in convergent industrial ecosystem: exploratory studies. Paper presented at the XXIV ISPIM Conference – Shaping the Frontiers of Innovation Management, Budapest, Hungary, 14-17, June 2015.
- Puranam, P., Alexy, O., & Reitzig, M. (2014). What's "new" about new forms of organizing?. *Academy of Management Review*, 39(2), 162-180.
- Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. Crown Books.
- Romero, D., & Molina, A. (2011). Collaborative networked organisations and customer communities: value co-creation and co-innovation in the networking era. *Production Planning & Control*, 22(5-6), 447-472.
- Savery, J. R., & Duffy, T. M. (1995). Problem based learning: An instructional model and its constructivist framework. *Educational technology*, 35(5), 31-38.
- Sawyer, R. K., & DeZutter, S. (2009). Distributed creativity: How collective creations emerge from collaboration. *Psychology of aesthetics, creativity, and the arts*, 3(2), 81.
- Schmidt, J. B., & Calantone, R. J. (1998). Are really new product development projects harder to shut down?. *Journal of product innovation management*, 15(2), 111-123.
- Sawhney, M., Wolcott, R. C., & Arroniz, I. (2006). The 12 different ways for companies to innovate. *MIT Sloan management review*, 47(3), 75.
- Tether, B. S. (2002). Who co-operates for innovation, and why: an empirical analysis. *Research policy*, 31(6), 947-967.
- Tjosvold, D. (1989). Interdependence and power between managers and employees: A study of the leader relationship. *Journal of management*, 15(1), 49-62.
- Tsoukas, H. (2003). Forms of knowledge and forms of life in organized contexts. In *In the realm of organisation* (pp. 52-76). Routledge.
- Tsouka 2008
- Unsworth, K. (2001). Unpacking creativity. *Academy of management review*, 26(2), 289-297.
- Valkokari, K. (2015). Business, innovation, and knowledge ecosystems: How they differ and how to survive and thrive within them. *Technology Innovation Management Review*, 5(8).
- Weick, K. E. (1995). *Sensemaking in organizations* (Vol. 3). Sage.
- Yin, R. K. (1999). Enhancing the quality of case studies in health services research. *Health services research*, 34(5 Pt 2), 1209.

Importance of Knowledge Management Practices: a Case Study of the Maturity of Swiss Companies

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Abstract

Knowledge Management (KM) is vital factor to successfully undertake projects. The temporary nature of projects necessitates employing useful KM practices for tackling issues such as knowledge leakiness and rework.

The existing Project Management Maturity Models (PMMMs) have focused on discussing Project Management practices, however, the management of project knowledge is yet to be addressed, at various levels of maturity.

This research project was undertaken to investigate the mentioned gap for addressing KM practices at the existing PMMMs investigating how the knowledge being captured, managed, redistributed, shared and stored in the interviewed companies and the identification of the tools used to ensure that this occurs correctly and properly timed, to pursue continuous improvement and the success of the projects with the aim of sharing and promoting the development of the Project Management culture and Knowledge Management starting from the academic sphere, encouraging company's growth and effectiveness thanks to:

- *Improved business decisions thanks to facilitated access to expertise and to leading practices*
- *Increased efficiency, productivity and work smarter by reducing cases of "reinventing the wheel"*
- *Improved Innovation through wider and borderless collaboration.*
- *Reduced loss of know-how by capturing explicit and tacit knowledge*
- *Speeded-up productivity with on-board trainings and timely access to knowledge*
- *Increased client satisfaction by delivering value insights*
- *Enhanced quality and ability to collaborate by standardizing ways of working and enabling discussions with leading experts*

Due to the exploratory and inductive nature of this research, statistical methods were chosen as the research methodology. The web and free tool has been chosen to distribute the survey across the selected list of participants.

Keywords – Knowledge Management (KM), Project Management Office (PMO) Project-based Organization, Project Manager (PM), Project Management.

Paper Type - Academic Research Paper.

1 Introduction

A multilingual and modelled electronic questionnaire has been developed to investigate the Swiss economic context and more in particular, the maturity within Swiss Enterprises of the KM practices.

Due to multicultural environment of the Swiss enterprises reality, the electronic questionnaire has been developed in English, translated in Italian, German and French, among the Swiss national languages, and structured in four main parts:

1. Enterprise's location, size and Industrial Sector of belonging
2. Overall assessment of KM Practices
3. KM Practices
4. KM Effectiveness

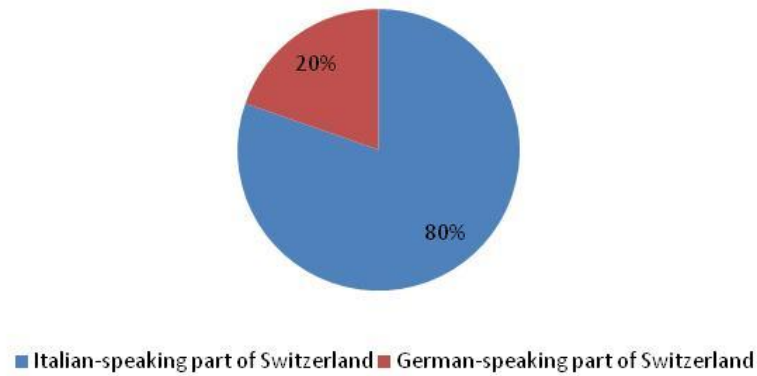
To be reported the minimum threshold represented by the questions up to third, thought to determine if proceed further in the investigation of KM practices.

The survey was composed of 23 questions and focused on investigating the importance of KM practices, nowadays. The survey made it possible to get info and making consideration over 80 Swiss companies.

2 Enterprise's location, size and Industrial Sector of belonging

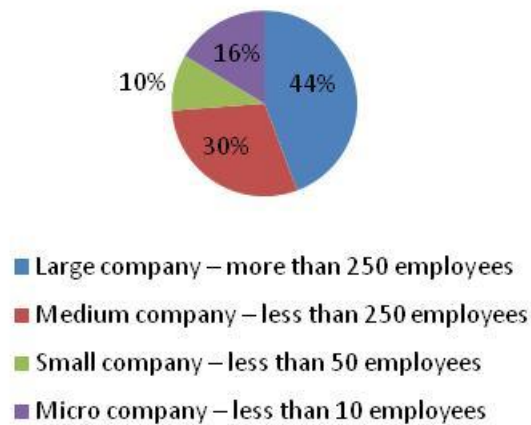
The survey has shown a pre-dominant participation of Italian-speaking users (80%) but also a significant participation of German-speaking users (20%). French-speaking users have been omitted, since their participation has not been considered relevant for statistical purposes.

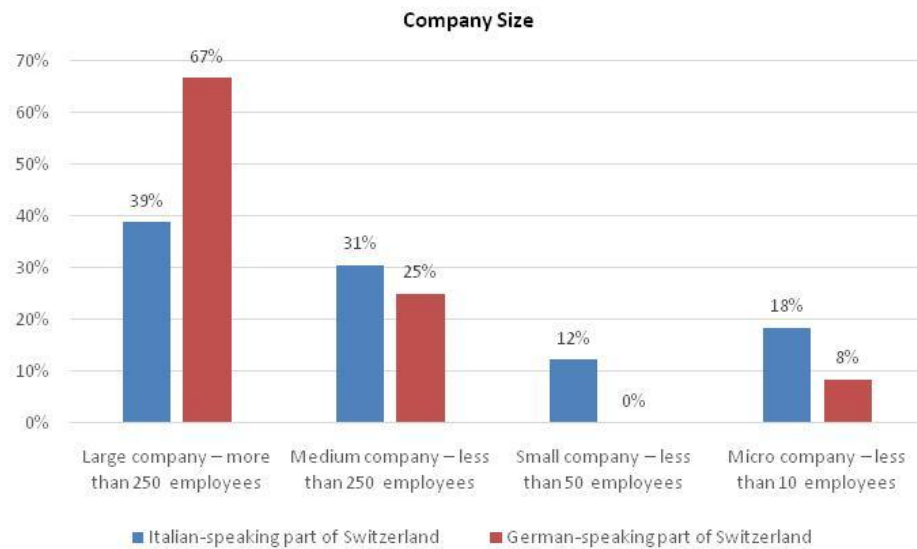
Linguistic Region where the company is based



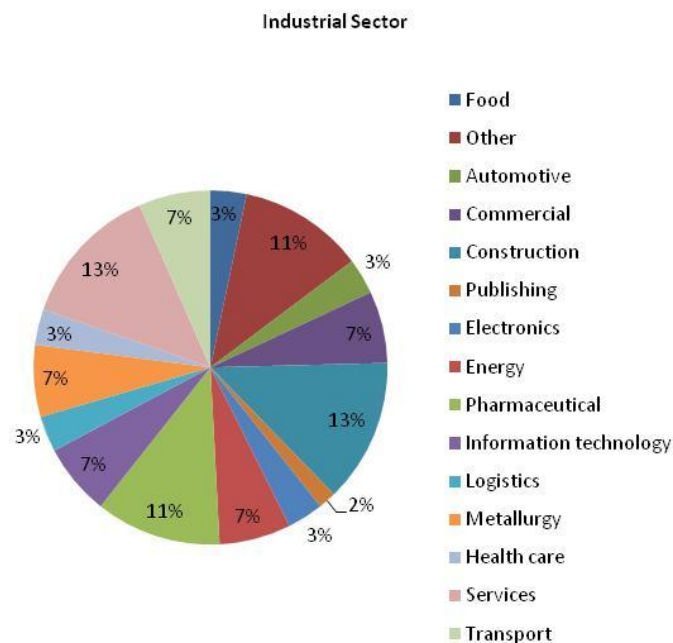
Considering the subject of the survey, namely the maturity of Swiss companies, "declined" in the management of knowledge, it is not surprising that as many as 74% of the people who took part in the survey are part of a big (44%) or medium (30%) company.

Company Size





In the Helvetic confederation, German-speaking Switzerland is characterized by the highest presence in the territory of large companies. Italian Switzerland emerges as a reality mainly composed of medium and micro-enterprises.

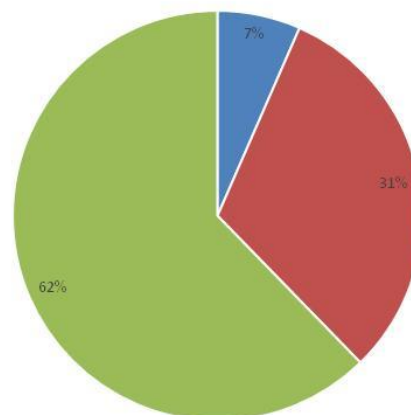


Analyzing the segmentation of the surveyed users according to the sector of belonging of their own company, we find a peculiarity of the Swiss productive fabric. Pharmaceuticals, Construction and Services are confirmed to be among the leading sectors.

3 Overall assessment of KM Practices

It is interesting to note that although knowledge management practices are recognized as value-added activities (only 7% of respondents declare the total lack of a global / local knowledge management program), their implementation according to structured practices and through appropriate tools it is far from being implemented in 31% of cases. While the large enterprise is predictable to be the most equipped with well-structured and well-defined practices for knowledge management, in the medium-sized enterprise, although acknowledged the importance of the KM topic, programs and practices for the management of it are under implementation and still not structured adequately.

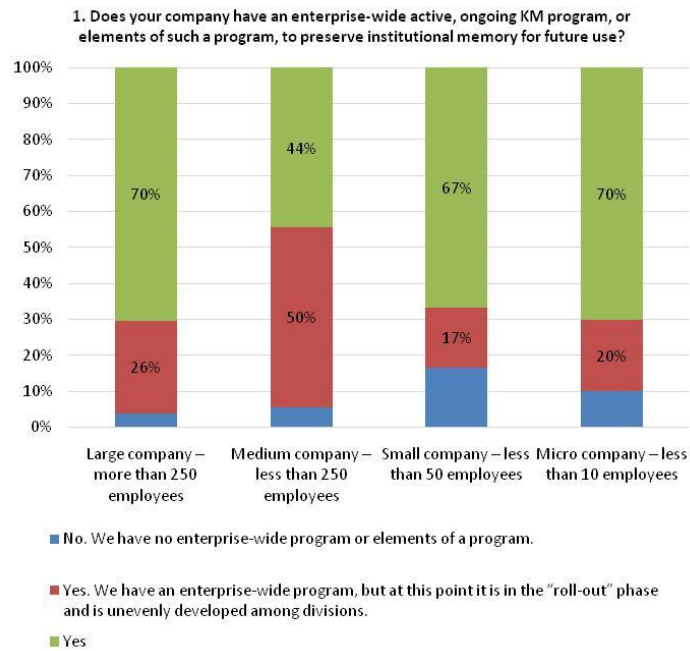
1. Does your company have an enterprise-wide active, ongoing KM program, or elements of such a program, to preserve institutional memory for future use?



■ No. We have no enterprise-wide program or elements of a program.

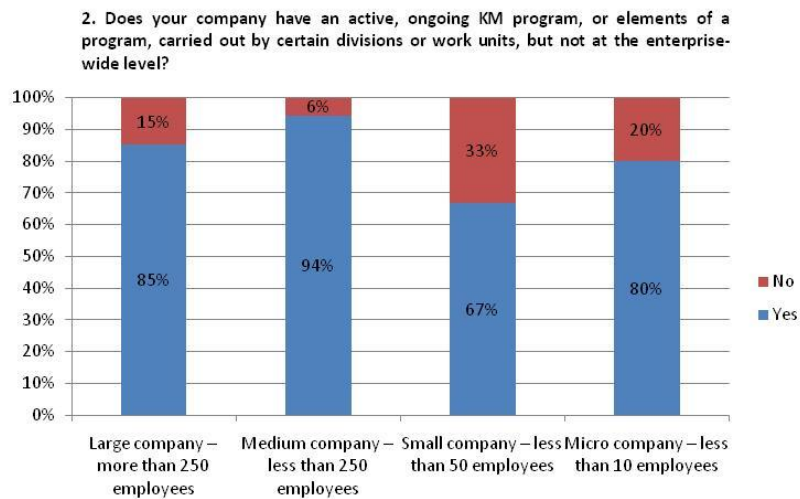
■ Yes. We have an enterprise-wide program, but at this point it is in the "roll-out" phase and is unevenly developed among divisions.

■ Yes



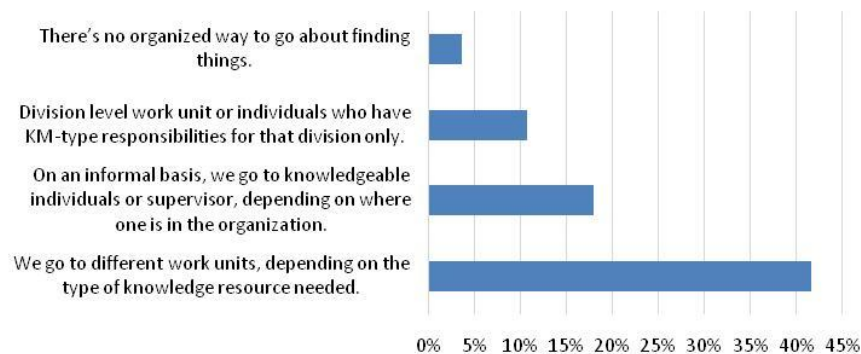
As many as 62% of respondents, to a punctual question about the presence of a centralized and structured archive for knowledge management, answered affirmatively.

Percentage however destined to reach a significant 93% if within the knowledge management practices is considered a local management of it.



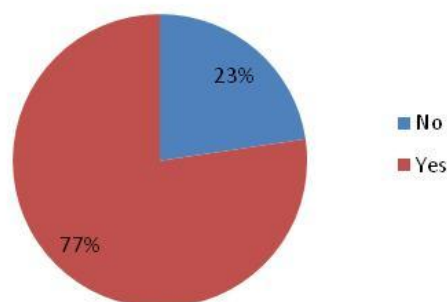
Finally, not considering the percentage of centralized and structured knowledge management, therefore focusing the analysis on a local knowledge management, the point of contact to access the knowledge resulted to be the teams - work units (42%) - and the individuals (18%).

3. Who or where is your institutional memory point of contact; that is, to whom do people go, or to whom are they referred, if there is a need for historical materials or documents about prior programs or projects?



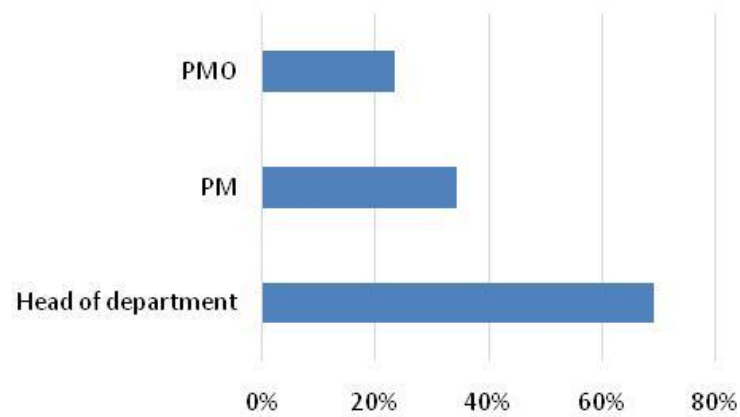
As previously pointed out, 77% of respondents recognize the importance attributed in their company to the management and archiving of knowledge, answering affirmatively to question 4 related to the expectations of the company management regarding the consultation by the employee of the archived knowledge.

4. Before beginning new projects or programs, does management expect employees to consult prior organizational experience as evidenced in documents, databases, knowledgeable people, and other resources?

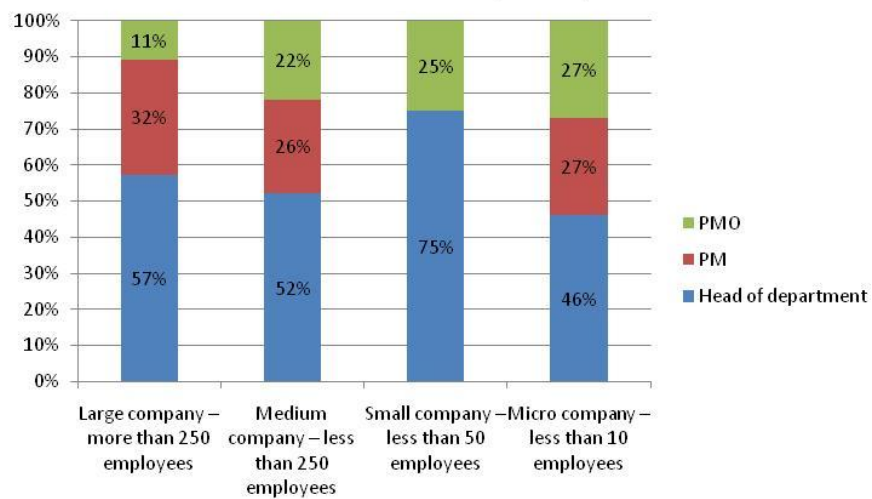


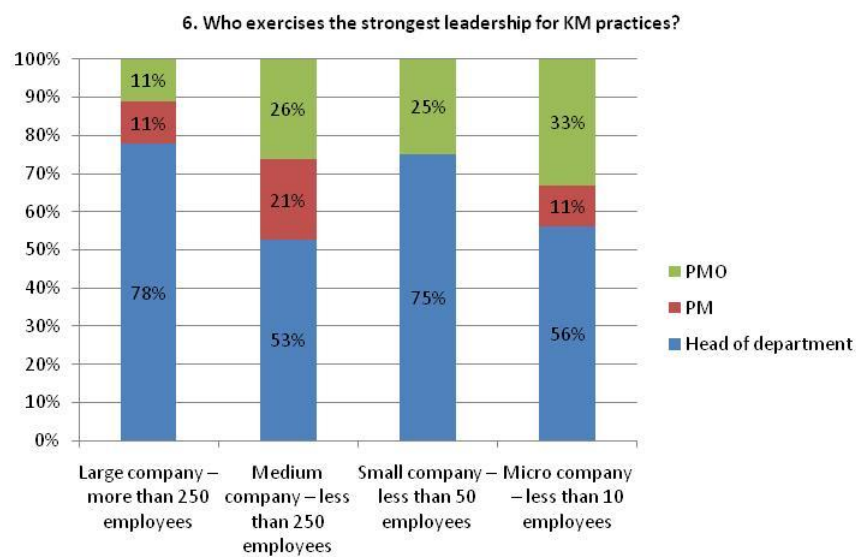
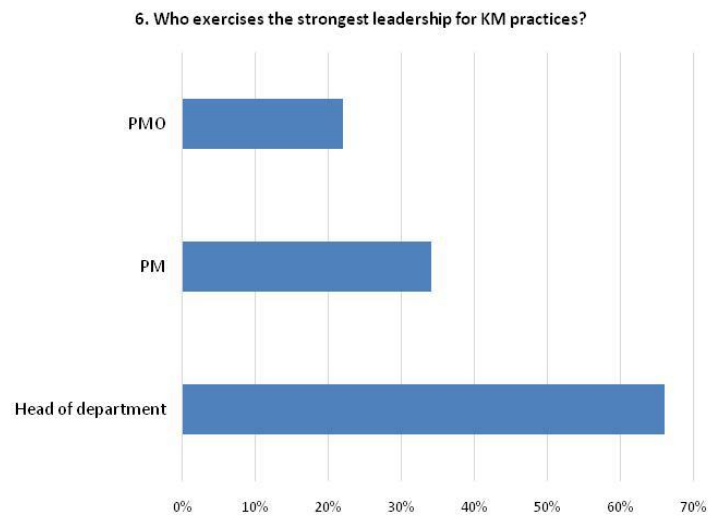
Transversely to the size of the company, even in the presence of a centralized and structured knowledge management, the head of department / division is identified as the element exercising authority and leadership in the KM.

5. Who exercises overall authority over KM practices?

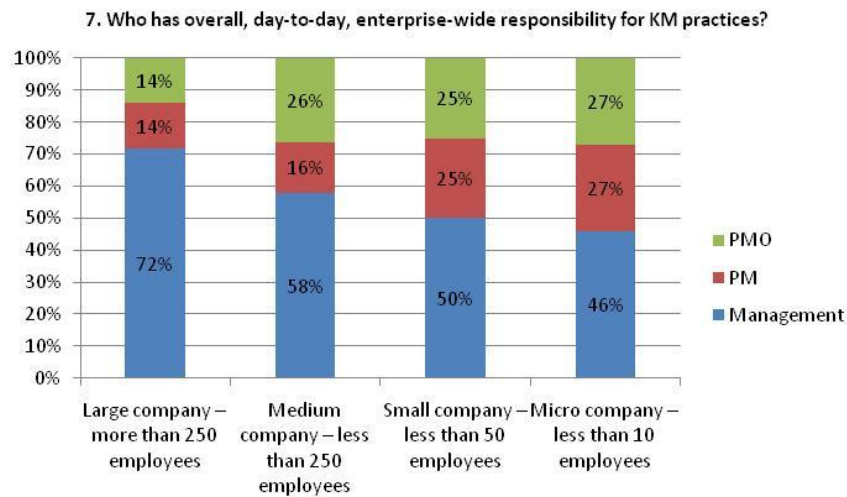
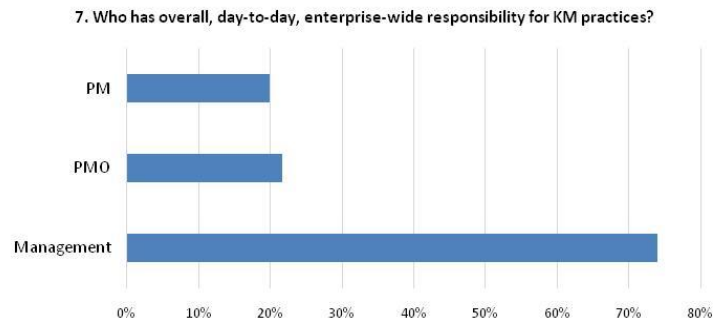


5. Who exercises overall authority over KM practices?



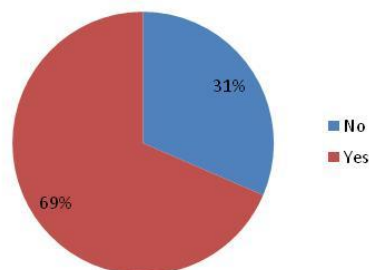


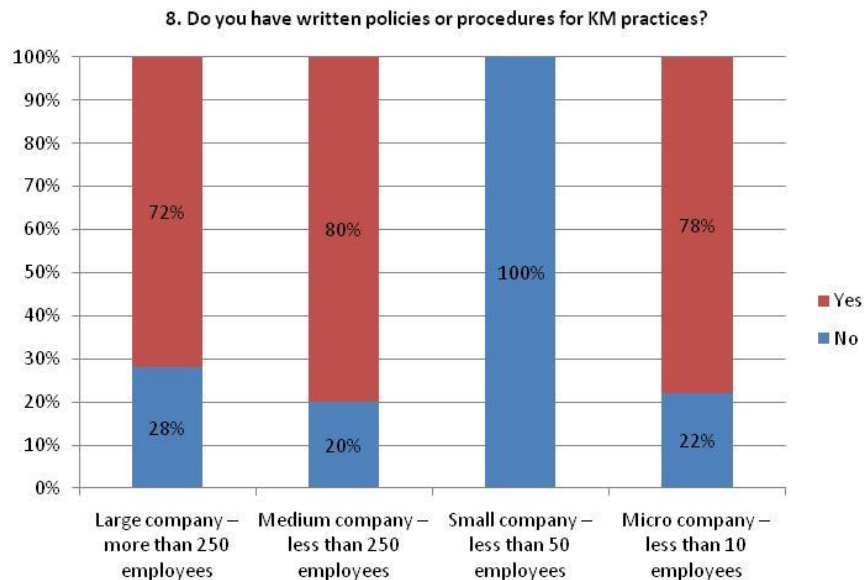
Over 70% of respondents identify the management as the responsible for knowledge management. The data would seem to imply, even in the more structured company realities, the non-definition of the PMO or a questionable assignment of responsibilities related to it.



The presence of company procedures / regulations surveyed in question 8 (69%), denotes a congruity with what was surveyed in question 1 - where 62% of the interviewees confirmed the existence of a program for a centralized and structured or local knowledge management.

8. Do you have written policies or procedures for KM practices?

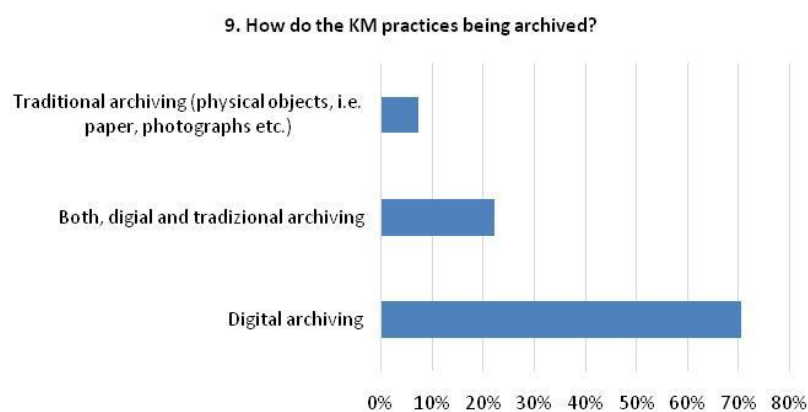




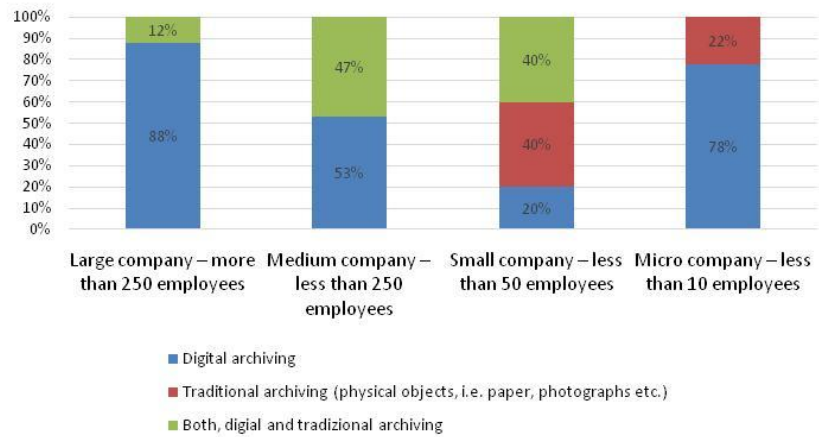
Where knowledge management and archiving being performed, in 7 companies out of 10 it takes place digitally. In less than 10% of cases, it only takes place on traditional media (paper, photographic, etc.).

In line with expectations, question 9 reports about digital archiving performed mainly in large and medium-sized companies and a transition phase which involves both, digital and traditional archiving, in the small enterprises.

On the contrary, a mutually exclusive choice characterizes the micro companies.

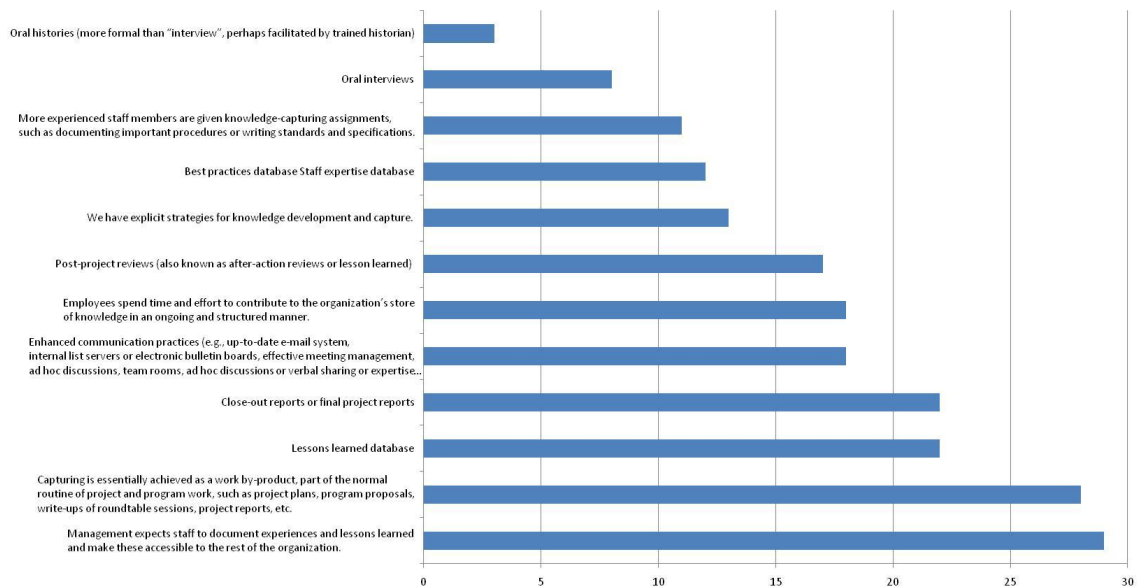


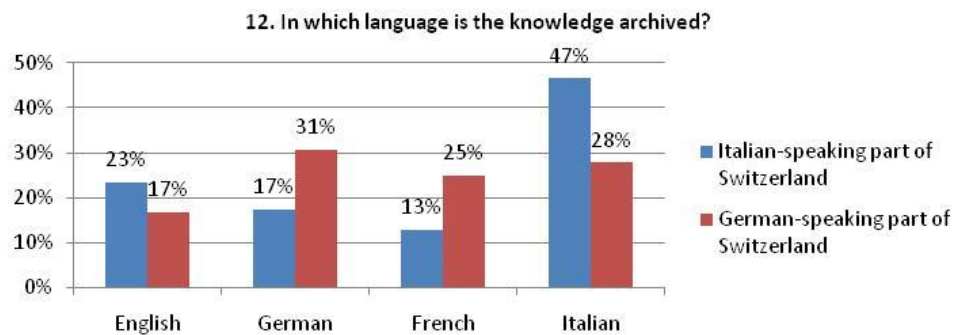
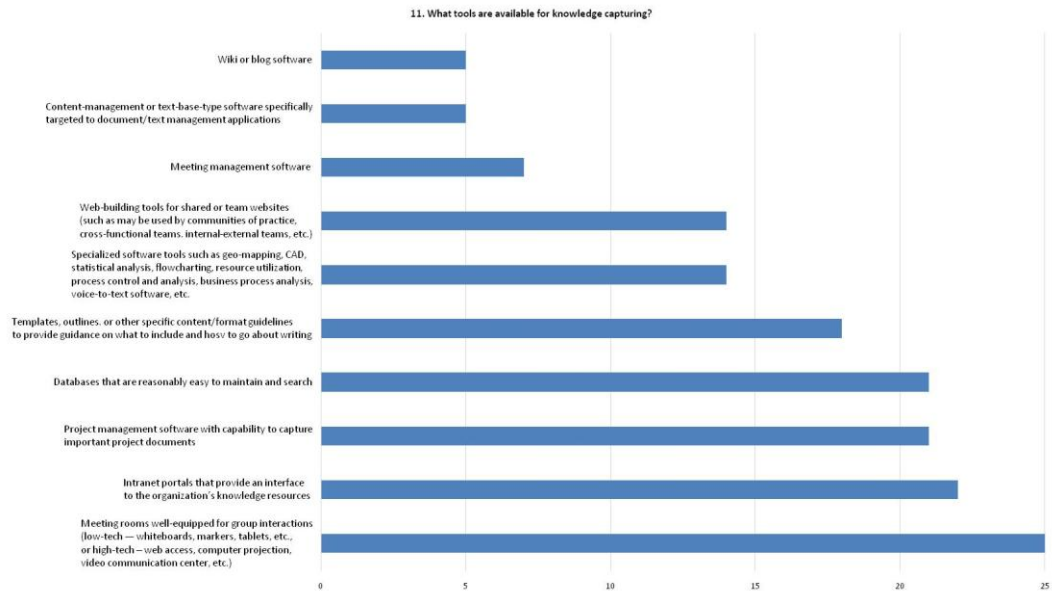
9. How do the KM practices being archived?



4 KM Practices

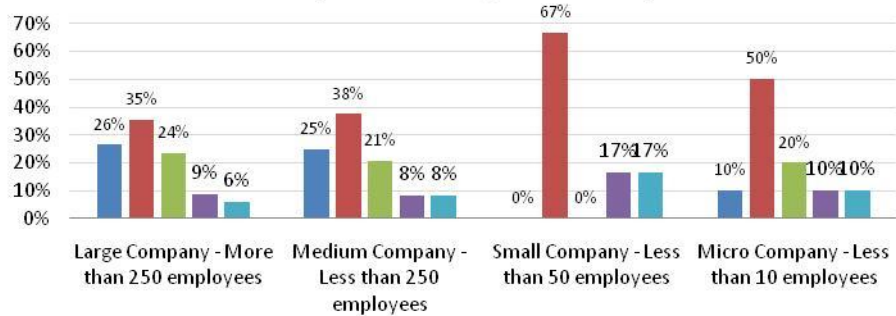
10. What methods are used to capture knowledge?
(Note: for this synthesis, "capturing" refers to the process of transferring knowledge from employees' minds into tangible resources, such as text documents, maps, photos, databases, websites, etc.)





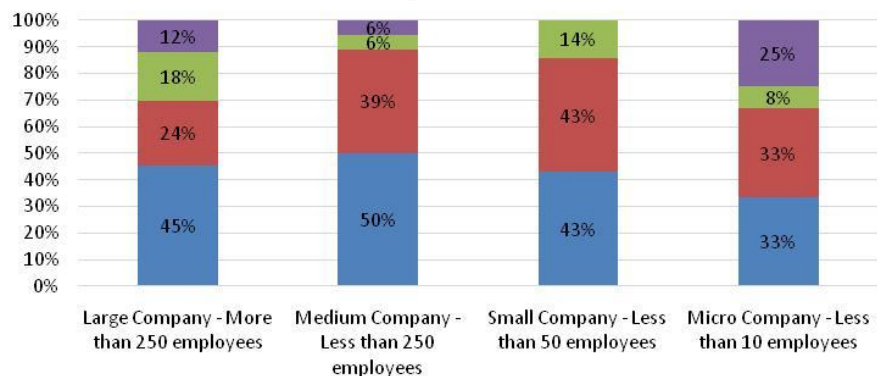
In one company out of two, employees declare that they generally know what needs to be archived and how to do it and that the processes for doing so are in most of the cases well-defined. In particular, for small and micro enterprises, the processes are known more than the strategies, which are rarely present (micro company) or even absent (small companies).

13. Are practices for storing KM resources in place?



- We have a clear strategy for storing our knowledge assets.
- Employees generally understand what needs to be stored, and how to get resources from their possession into storage. The process is well-defined for most resource types.
- Storage practices are well-defined for some critical resources, such as legal or financial documents, but not necessarily for all.
- Storage practices are well-defined for physical resources but not for electronic resources
- No practices in place

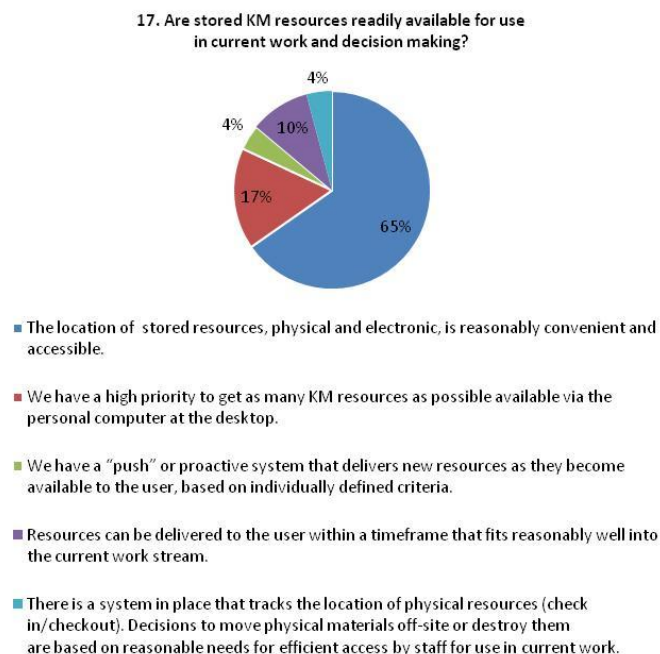
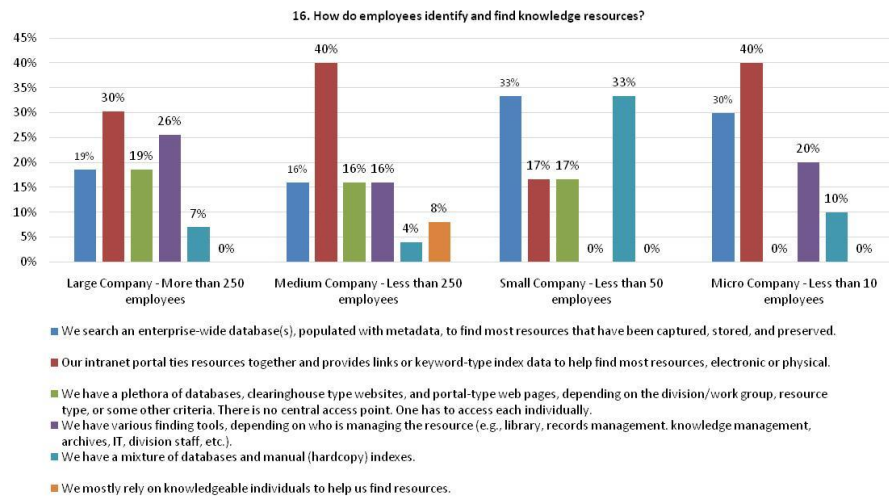
14. Where are captured resources stored?



- Physical resources are stored in company-owned enterprise-level archives.
- Electronic resources are stored in an enterprise-level repository.
- We capture a lot, short-term, on personal computers or group-level servers, but we don't really have an organized way or central repository to store electronic resources long-term.
- We store our resources at another organization (i.e. state archives, museums, etc.).

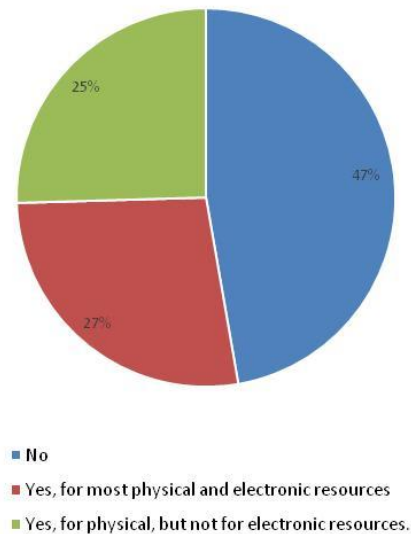
What emerges in question 14, is in line with what was surveyed by question 1; one company out of two carries out a structured and centralized archiving and over the 30% of the companies performs at least a local digital archiving.

On the other hand, small enterprises outsource in 25% of cases.



Transversely to the size of the company, in over 65% of cases, the access to the knowledge is reasonably convenient and easy while in 17% of cases, the knowledge is managed locally.

18. Is there an established practice for destruction of obsolete KM resources?



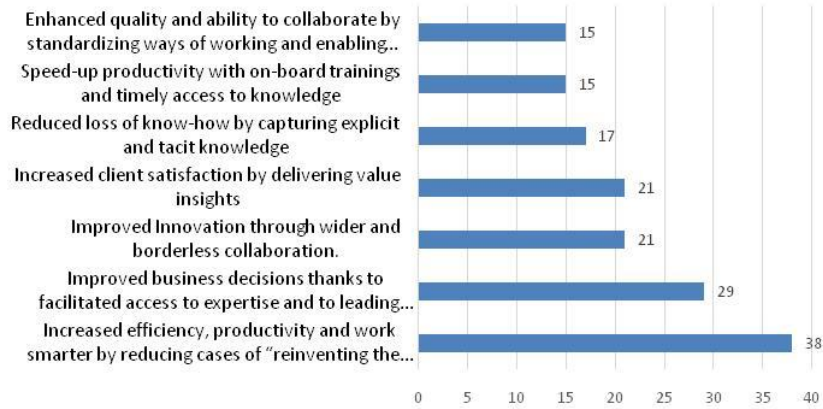
In one company out of two, there is no practice for the disposal of obsolete knowledge.

On the other hand, where it is present, it is more linked to the disposal of resources stored on physical rather than electronic media.

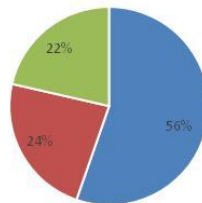
5 KM Effectiveness

For over 7 out of 10 respondents, proper knowledge management translates into greater efficiency, productivity and better work organization. One in two interviewees considers it an element that improves business decisions.

19. What are the benefits of an effective knowledge management strategy?

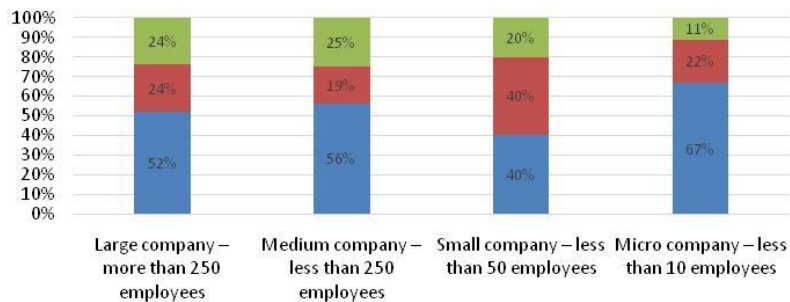


20. Do KM practices enjoy continuity and persistence over time?



- The program is robust and continues through staff and administration changes.
- The program exists but is not evenly supported or well-communicated by management.
- The program may or may not survive, depending on factors such as budget cycles, administrative changes, etc.

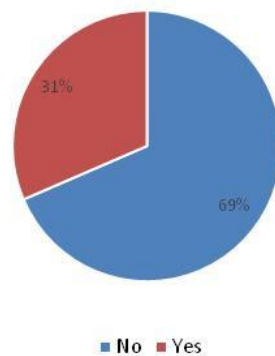
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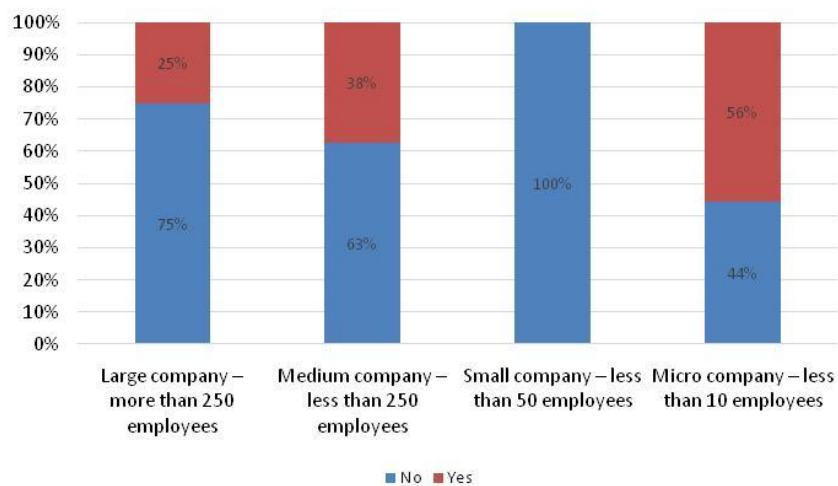
- The program is robust and continues through staff and administration changes.
- The program exists but is not evenly supported or well-communicated by management.
- The program may or may not survive, depending on factors such as budget cycles, administrative changes, etc.

The maturity of Swiss companies shows a gap when KM is probed in terms of continuity and persistence over time. In only 50% of cases, the knowledge management program is robust, well-structured and continuous over time. In the other 50% of cases it exists but is not appropriately supported by the MGMT in terms of sponsorship and continuity of the program.

21. Does your company use metrics to gauge the value-added and/or effectiveness of the KM program, or to justify costs?



21. Does your company use metrics to gauge the value-added and/or effectiveness of the KM program, or to justify costs?



Consequently, what highlighted with question 20, is further reflected in question 21, where is given evidence of a lack of metrics for the evaluation of the benefits related to knowledge management. In seven out of ten companies, there are no metrics that allow its evaluation.

6 Conclusions

Nowadays, speak about KM in a company implies a level of maturity that leads to recognize the company itself as a place of creation and accumulation of knowledge, its immaterial resources (knowledge accumulated in the organizational memory or incorporated in human resources) are the key element in the analysis of the determinants of the creation and sustainability of the competitive advantage over time.

The competitive advantage no longer consists only in providing excellent products and services in the most attractive markets but also consists in building, making operational and defending those deep competences that differentiate a company from its competitors.

To succeed in all this, organizations must realize the importance of acquiring those skills that allow them to transform business knowledge into a value, or to make of everything that the company knows, but also what it does not know to know, a competitive advantage.

Knowledge therefore represents the basis on which the specific skills of each company are built, but above all, it is the basis for taking the best decisions at every level and for reducing errors.

Competitively, what makes the difference is having an innovative knowledge management system adapted to the characteristics of the company itself.

Generating, capturing, not dispersing and operating knowledge to offer value to the customer is an essential requirement for building and sustaining competitive advantage. However, the only introduction of a management system to nothing would be worth it if it were not accompanied by a cultural change that involves every aspect of the organization. These changes must be simultaneous and interconnected.

It is therefore essential for a cultural maturation of employees towards the exchange and dissemination of knowledge, with the aim of creating a shared vision. Employee motivation for change is the key to the success of a KM process. Internal communication, rewarding systems, human resources management and working practices are the best tools to create a learning organization and to motivate employees, encouraging them to take documents to be updated and periodically checked from the company intranet.

Management have to try to eliminate the obstacles to the change - posed by those who consider it risky because of uncertainty - through the explanation of the benefits obtainable by the entire organization and by those who make it up; it has also to promote an innovative knowledge sharing culture through direct actions, staff incentives, project financing and investments in technologies aimed making people work together.

With these guidelines and with the awareness of the fundamental role played by the knowledge in the creation and maintenance of competitive advantage, we have explored the reality of Switzerland, assessing the maturity of companies respect to the implementation of practices for knowledge management.

The picture that emerged has shown a transversal awareness of employees and MGMT, regarding the importance of generating, capturing and managing knowledge, aimed to provide value added to customer.

Indeed, KM has turned out to be a current topic in all the surveyed realities, large, medium, small and micro enterprise.

In large and medium-sized enterprise, one of the two pre-conditions linked to a successful implementation of knowledge management, namely that of possessing an innovative knowledge management system adapted to the characteristics of the company, was fulfilled or, as in medium-sized companies, closed to a complete fulfillment. Large and medium-sized companies have indeed turned out to be appropriately equipped from a technological point of view. As expected, small and micro companies, suffer due to conservative company policies, showing therefore a certain delay, especially in technological terms.

Small companies, even more than micro-companies, have shown a bigger delay on the issue of the existence of an appropriate knowledge management system in the company.

However, in all the surveyed companies, a full awareness about the cultural shift needed within the organization to make effective tools and policies for knowledge management, has emerged.

Swiss productive fabric seems to have understood, even at level of small and micro enterprises, the centrality of the topic related to the knowledge management.

The cultural shift in these realities is indeed ahead respect the technological one.

In large and medium-sized enterprises, the level of acquired corporate maturity is such that it determines the shift of the focus in terms of knowledge management, from the implementation of a KM policy, to the identification of metrics that allow an appropriate assessment of the benefits related to it.

Knowledge Management to make better decisions, reduce errors and increase efficiency.

References

- Girard, John P.; Girard, JoAnn L. (2015). *"Defining knowledge management: Toward an applied compendium"* (PDF). Online Journal of Applied Knowledge Management. **3** (1): 14.
- "Introduction to Knowledge Management"*. www.unc.edu. University of North Carolina at Chapel Hill. Archived from the original on March 19, 2007. Retrieved 11 September 2014.
- Nonaka, Ikujiro (1991). "The knowledge creating company". Harvard Business Review. **69** (6): 96–104.
- Abell, A., & Oxbrow, N. (2006). Competing with knowledge: the information professional in the knowledge management age. London: Facet.
- April, K., & Izadi, F. A. (2004). Knowledge management praxis. Lansdowne, Cape Town: Juta.
- Allee, V. (2003). The future of knowledge: increasing prosperity through value networks. Amsterdam; Boston: Butterworth-Heinemann.
- Awad, E. M., & Ghaziri, H. M. (2007). Knowledge management. Delhi: Dorling Kindersley, licensees of Pearson Education in South Asia.
- The PMBOK, Fifth Edition, Project Management Institute (PMI), 2013*
- CMMI, Capability Maturity Model Integrated, CMMI Project, v 1.3, 2010*

Special Economic Zones' Governance and Organizational Structures: Comparative Study by Focusing on a Policy Network Approach in Iran, UAE and Kazakhstan

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Abstract

In such a competitive world government's effort is providing an effective procedure to develop the international market and economic. Special economic zone (SEZ) is regularly used as a tool for developing economic growth, to attract more foreign direct investment, enhance international interaction and boost the national trade, especially in developing countries. On the other hand, it seems clear that governments seek more effective procedure by involving other sectors in projects of SEZs. In Policy network approach the governments involve more private sectors for solving the general problems. To perform the analysis, we study the main characteristic of special Economic zones such as geographical locations, projects, type of zones, and organizational classifications as well as indicators that reflect the institutional framework: zone's ownership, main authority, and management. The article presents a comparative analysis of SEZs institutional framework by considering the network policy approach in selected zones in Iran, UAE, and Kazakhstan. The results of this comparison between cases illustrate the main

institutional framework, governing procedure, and effect of network approach in special economic zones.

Keywords: Special Economic Zone, Policy network, comparative studies, organizational structures

Paper type: Practical Paper

1 Introduction

There are several definitions for the special economic zone, in general term, Special economic zones represent designated geographical areas within a country, where business activity is subject to different rules from those prevailing in the rest of the economy. (Farole, 2011; Zeng, 2015) Generally, the main establishers of SEZs base on their main objectives and economic targets; they design different type of zones in the countries. Overall, there are a variety of establishment classifications for special economic zone structure. World Bank (2008) categorized these zones under six main modern zones such as Export processing zones, Free trade zones, Enterprise zones, Free ports, single factory zone, and specialized zones.

By considering the important role of SEZs to attract the investors, literature reviews highlighted the studies which are a focus on the relationship between SEZs performance to attract FDI (Chakraborty, et.al, 2017; Chandrachud &Gajalakshmi, 2013). Another interesting feature of SEZ is analyzing SEZs' aspects especially on the economic situation of developing countries (Yeung, et.al.2009; Kuzmenko, et, al.2018). In respect to the main capacity of SEZ in economic growth, comparative studies on special economic zone cases are notable between these ranges of researches which are considered more the successful zones in India and China or African countries. (Roux & Schoeman, 2016; Zeng, 2015; Farole, 2011; Olga &Mayburov, 2017)

Boerzel (1997) defined the policy networks as a network of actors who have benefited by determining the policy and they provide resources (material and non-material) for adjusting, deciding and implementing of these politics. Recently, Policy network approach got also favorite concepts for researchers in policy-making process especially for analyzing its theoretical aspect (Renate & Bernd,1991; Dowding,1995; Klijn,1996; Boerzel, 1997; Moberg,2014), determining the structure of network governance(Provan &Kenis,2007), some studies take a look on the relationship between Public Management and Policy Networks (Koppenjan& Klijn,2000) other investigations explore the relationship between privatization and corporate governance (Martinez, et al, 2013) or innovative methods in management (Martinez, et, al, 2012; Grantham, 2001) .

Reviewing the background of studies on special economic zones demonstrate that most of researches design to analyze the economic aspect of these zones, therefore, few types of research have addressed the governing structure, management policy, and policy network as alternative approach to enhance the efficacy of these special zones. Many researchers compared the SEZs for understanding though there are similar works, in the

present work we have a comprehensive study on SEZs framework in selected countries (Iran, UAE, and Kazakhstan) which has never been done before. On the other hand, applying the network policy approach has never considered in previous studies for analyzing the organizational structures of SEZ in these countries. So the result will provide a range of innovative process for policymakers in special economic zones to improve the success and improve the effective operations of public and private sectors in these zones.

2 Main purpose of this study

The purpose of this study is to compare and demonstrate the similarities and differences of SEZs program, main authority and regulations, management strategies in selected countries, and to discuss the challenges of governing these zones regarding their primary organization plan and managing strategies by considering a political situation of each county.

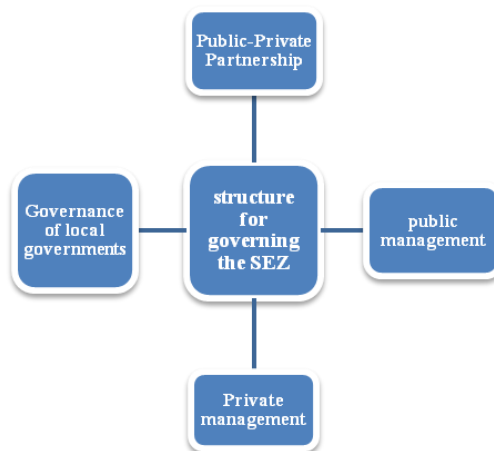
The research will respond to main questions such as:

- How institutional characteristics of SEZs' framework in different national situation conduct patterns of networking policies?
- What is the influence of the policy network process on the interactions in SEZs?

3 The institutional framework of governance in special economic zones

There is different sort of institutional adjustment to determine the authorities that include government companies, ministry, a zone-specific management board, or an investment promotion agency. (ADB, 2018)

SEZ implications are properly depend on country's specific situations and establishing these special zones are not necessarily a suitable instrument for any country(Zeng,2015) and Private sector development or public-private partnerships participations in SEZs governing cannot increase the efficiency of these zone individually, but they can help the procedure for reducing the risk of government's activities in these areas. (Farole & kweka, 2011) Base on World Bank (2017) operational review on institutional framework for governing the SEZs and FIAS's (2008) findings, in this study the special economic zones' classified in four different management structures as bellow:



(Source: Rafiee, 2009; World Bank, 2017, FIAS, 2008)

4 Theoretical framework: the policy network approach

Based on a network policy approach, an organization is considered as part of a complex arrangement that has multiple interacts with other organizations and sectors. As Rhodes(2006) definition: “Policy networks are sets of formal institutional and informal linkages between governmental and other actors structured around shared if endlessly negotiated beliefs and interests in public policymaking and implementation.(Galay&Youngs,2014)

The policy network approach designed to provide the scheme for determining the complex processes to develop management process, strategies planning and it illustrates the framework for strategic interaction processes and institutional relations in organizations. (Koppenjan& Klijn, 2000)

Background of study in policy network illustrates that the main focus in this filed was on theoretical part of governance network and political economy (Rhodes,1990; Marin & Mayntz,1992; Boerzel,1997; Klijn,1996; Grantham,2001; Provan&Kenis,2008; Galey& Youngs,2011) , inter-organizational relationships(Iacono et.al 2012; Iacono , Berni ,and Martinez,2012) and therefore there is a little attention on integration of this concept on the function of SEZ and general trade zones.

For our purpose, we consider the network as a formal and informal interaction in selected projects and different partners. Moreover, we focus on the network relation differences which are associated with the different management strategies in our case studies. The principle reason to pick up the network policy as the theoretical framework of this research is affiliated intricacy of special economic zones complex which includes a range of interaction between governments’ agencies, private sectors and also local and foreign investors at the same time.

5 Methodology

The methodology of this research comes from a combination of more qualitative and quantitative approaches. We use qualitative multiple case study design to determine a clear vision and provides a strong basis for comparing ‘how’ the SEZs authorities performance respond to the institutional framework through networking policies and what is the connived organization process for managing the SEZ in our case studies.

5.1. Data collection

We collected data through semi-structured interviews with decision makers in special economic zones; with choosing them among the domestic top and key employees of SEZ, government authorities, representatives from governmental supporting agencies and the manager in charge of the firm’s internationalization process. In addition, emails and phone calls will use to ensure that the selected cases matched the sampling. For archival data, we used resources such as websites of SEZs in selected countries, business publications, annual reports, project biographies and databases, and reports of support agencies.

6 The main feature of special economic zones in selected case studies

Reviews of the literature of studies on Special Economic Zones around the world indicate that most of them focus on cases in China, India and South Africa. In the present study, we design our case studies between some selected SEZs in developing countries such as UAE, Iran, and Kazakhstan. Regarding COMCEC report in the year 2017, UAE, Iran, Kazakhstan has a comprehensive plan to increase their zones' competitiveness between other Islamic worlds.

We choose three different economic zones relevant to their specific organizational, political characteristic, geographical position and strategic location SEZ and innovative process for developing their economic zones. We organized our research to compare the cases in selected countries base on a number of SEZs, country’s legislation and regulatory mechanisms to establish and development of SEZs, type of management, governance and institutional framework in the free trade zone, ownership structure. In this part, we take a look at selected case studies and the main comparative advantage of these areas that make each of them as a unique case.

A case study of Special economic zones in the United Arab Emirates

Base on a dataset of World Bank (2018), UAE’s GDP grew from US\$ 289.78 billion in 2010 to US\$ 382.5 billion in 2017. There are more than thirty free trade zones in UAE and they are defined as a territory which is offering special tax, customs and imports regime and they are governed by their own framework of regulations (UAE criminal law). Dubai is one successful example of FTZ in the Middle East by holding more than twenty Free zones and it is the fourth most open economy in the world and the most exposed economy in the Gulf to foreign trade and capital investment flows.

The governments of the UAE have been actively involved in the development of different economic projects in association with both local and foreign businesses, especially in free zones. Like many other global experiences, governments known as the main establisher of SEZs in UAE. Regarding the main objects of establishing the SEZ in UAE, an independent free trade zone authority governs each zone and this unit is the main responsible for issuing the licenses and operating the projects in a free zone.

Table 1 Classification of selected free zones in UAE

	Jebel Ali Free Zone	Masdar City	Dubai Airport Free Zone (DAFZ)	Dubai Multi-Commodities Centre (DMCC)	Dubai International Financial Centre (DIFC)
Year of establishment	1985	2009	1996	2002	2004
Area	Over 57 km ²	6 km ²	696,000 m ²	200-ha	110 ha
Types of ownership	-Free Zone Company (FZCO), multiple shareholding -Free Zone Establishment (FZE) -Branch of a foreign or UAE company	- Free Zone Limited Liability Company (FZ-LLC) -Branch of a foreign or UAE company	-Free Zone Company (FZCO) -Branch of a foreign or UAE company	-Free Zone Limited Liability Company (FZ-LLC) -Branch of a foreign or UAE company	-Company Limited by Shares -Branch of a foreign or UAE company
Main authority	Jebel Ali Free Zone	Abu Dhabi Future Energy Company	Authorizes by Dubai Airport Free Zone (DAFZ)	Established by government and Ahmed Bin Sulayem is the Executive Chairman of DMCC. Authorizes by Dubai Multi-Commodities Centre (DMCC)	Independent authority by Dubai International Financial Centre) DIFC has its own independent, internationally regulated regulator and judicial system

Source: (McCarthy & Rimmington, 2014, authors)

A case study of Special economic zones in Iran

With reference to Iran's geographic situation, this country has seven free-trade zones (FTZ) and 23 completed special economic zones (in form of a free port, industrial zone, Industrial Parks) and around 20 ongoing SEZs. The Main objective FTZs is attracting Foreign Direct Investment (FDI) and to increase international industrial transits by promoting Iran's non-oil exports. The history of the special economic zone in Iran back to the 1970s by developing Kish Island as a first free trade area in Iran. The FTZs are

strategically positioned for their potential international links and the SEZs for improving the country's main industry distribution system and supply network. (Hakimian, 2011)

Main structure of governing and Management of SEZ in Iran

Governing FTZs and SEZs in Iran has followed the different regulation. In order to accelerate of economic development progress and increase the investment process, create more job opportunity the government set range of regulation as the “The Law on the Administration of Free Trade-Industrial Zones ” in special economic that emphasis each zone is managed by an Authority organized as a company, with an independent legal condition that the funds belong to the government.

The Law on the Administration of Free Trade-Industrial Zones “includes 28 Articles and 8 Notes, this law gives comprehensive information about all procedures of management and governance in the zones.

Base on this law, each zone shall be administered by an authority organized as a company, with autonomous legal status, whose capital shall belong to the government. Such companies and their affiliates and subsidiaries shall be exempt from the laws and regulations governing state-owned companies and from other general regulations decreed by the government.

Management controls each zone through a Board of Directors, which consists of three to five persons who are selected by the Board of Ministers. In Iran, public-private partnership operation has been briefly mentioned in the Fifth Five Year Development Act and more details of PPPs were provided in the yearly budget. (Ministry of Industries and Mines, 2008)Special economic zone in Iran follow the different regulation that is known as “The Law on the Establishment and Administration of Economic Zones in the Islamic Republic of Iran”. This law comprises 25 Articles and 12 Notes and covers all aspects of the operation, management and governance in the zones.

Table 2 Summary on free trade zones in Iran

free trade zone in Iran:	Establishment year	Area	location	Authority	projects
Anzali port	2003	9400 ha	caspian sea /north of Iran	Ports and Shipping Organization	•Tourism industry •Agriculture and Fishery
Chabahar Free Trade-Industrial Zone (CFZ)	1992	140 ha	south east	Chabahar Free Zone Organization	•Energy hub •Food and tourism industry •Products rooted in the sea-based economy •ITC services
Kish	1989	91.5 km2	persian gulf	Kish Free Zone Organization	•Tourism industry •Banking and financial services •Electronic industries •Marine drilling technology

Arvand	2004	37,400 ha	north west of Persian Gulf	Arvand Free Zone Organization	<ul style="list-style-type: none"> •Heavy and Marine installation •oil and petrochemical industries
Qeshm Free Trade Industrial Zone	1990	480 km2	Persian Gulf and the Sea of Oman.	Qeshm Free Zone Organization	<ul style="list-style-type: none"> •Fishery industries and industrial fishing •Energy park •Oil logistic services •Transit and transportation industry
Aras	2005	9,700 ha	Northwest of Iran	Jolfa Development Company	<ul style="list-style-type: none"> •Transportation and transit industries • Expansion of agricultural, animal husbandry and transformational industries.
Makou	2010	5000 ha	northwest of Iran	Maku free zone is governed by an independent legal entity and its capital completely belongs to the government	<ul style="list-style-type: none"> •Large agricultural and industrial units. •Transportation and transit of goods

Source : (official website of each special economic zone in Iran)

Special economic zone in Republic of Kazakhstan

Kazakhstan has been experimenting with SEZs since the early 1990s. The first free economic zone law was introduced in 1990, which was replaced by another law in 1996. In 2001, it introduced an ‘SEZ law Astana’ with a focus on constructing a capital city. In 2007, the government approved a law on SEZs again, which also met with little success. (Asian Development Bank, 2018)

The Law on special economic zones of the Republic of Kazakhstan dated July 21, 2011, defines Special economic zone (SEZ) as a territory of the Republic of Kazakhstan having precise marked borders, on which a special legal regime shall be applied to carry out priority activities. The purpose of the creation of the SEZ have accelerated construction of a new administrative and business center of the capital; the opening of new industries

About the administration of the special economic zone this law indicates that if the establishment of the special economic zone was initiated by a central executive body, administration of the special economic zone shall be carried out by the central executive body appointed by the government of Kazakhstan. Indeed, the administration of the special economic zone shall be carried out by the local authority of the administrative-territorial unit, where the SEZ is located. (chapter2, article7)

Table 3 The free trade zone characteristic in Kazakhstan

free trade zone in Kazakhstan	Establishment year	Area	location	Type of projects	Main authority
Astana	2002	7634.71 ha	Astana.	The development of Astana city, including the creation of modern infrastructure by focusing on construction field.	“Department of investment and development of Astana city” serves as the management company of SEZ Astana – New City.
SEZ Seaport Aktau	2003	2,000 ha	Aktau	It is to accelerate the development of the region by enhancing Kazakhstan’s access to the global market	Local government (akimats) is the shareholder of Management Company of SEZ Aktau Seaport
SEZ Saryarka	2011	534,9 ha	Karaganda region	It is design to develop metallurgical and metal-processing industries	Local government (akimats) Management Company of SEZ Saryarka
SEZ Ontustik (Shymkent)	2005	200 ha	Ontustik	enterprises that process cotton for the textile and garment industries;	Local government is the shareholder of management company of SEZ Ontustik
SEZ Burabay	2007	370 ha	borovoe	tourist services	Investment Committee of Ministry for Investments and Development (MID),
SEZ National Industrial Petrochemical Technoparc (Atyrau)	2007	3,476 ha	Republic of Kazakhstan Atyrau oblast	Projects in petrochemical industry for hydrocarbon processing;	The 97.5% owned by the Ministry of Energy, and 2.5% belongs to the United Chemical Company, which is fully owned by Samruk-Kazyna, a state-owned company. Ministry of Energy
SEZ Pavlodar	2011	3,300 ha	Pavlodar	chemical and petrochemical sectors, with a focus on the production of export-oriented products	Local goveremnt of Pavlodar is a shareholder of JSC «The management company of SEZ Pavlodar»
SEZ Parc of Innovative Technologies (Almaty)	2003	343 ha	Almaty	information technology (IT), R&D	Private management company; Autonomous Cluster Fund which is funded by government.

SEZ Khorgos - Eastern Gates	2011	4,591 ha	Almaty region	transport, logistics, and industrial hub	Joint shareholder companies own by state government
SEZ Chemical Parc Taraz	2012	505 ha	Zhambyl Region	Produce chemical goods	The management company of EZ Chemical Park Taraz 100% owned by United Chemical Company

Source : (sezunion.kz Asian Development Bank, 2018, and website of each SEZ, 2018)

7 Main results of comparative analysis

In this section, we are discussing similarities and differences between selected SEZs in three countries. Comparative analysis indicates that the most common typology recorded within our selected case is Free Trade Zones (FTZs), Special Economic Zones (SEZs) and industrial high tech parks. Analysis of main characteristics shows that like many global trends, SEZs within these three countries were typically located close to both port and airport infrastructure. In all three countries, the governments are the main establisher of SEZs but the distributions of their power are a difference.

As can be seen from the table (above), the main difference is related to ownership of zones in the cases. Kazakhstan applies more public ownership which the government takes on the role of developer, operator, and regulator of the zones. However, a public-private partnership is actively developing recently but there is still a lack of knowledge, experience to apply PPP. The free zones in Iran are state-owned, and the administration mechanism is also state-owned, but in the special areas, the private sector is also active. For these same reasons, special economic zones are more successful than free zones.

Iran and UAE exert more privately owned zones which the companies develop, manage and operate the zones under the government's regulatory and public-private partnerships, whereby the government takes part in the zone development and operation in order to encourage private sector participation in this project. In fact, UEA follows the more liberal procedure for governing the zones to compare Iran and Kazakhstan.

8 Comparison of the key aspects of Special Economic Zones

	UAE	Kazakhstan	IRAN
Number of SEZ and FTZ	More than 40 free trade zone	10 special economic zone	six free-trade zones (FTZ) 23 special economic zones (SEZ)
Type of SEZ	Seaport free zones, airport free zones, mainland free zones. Free-trade zone	Industrial SEZ Service SEZ Technical SEZ SEZ with a combined priority activities (industrial and service	Free trade zone Seaport free zones Free Trade Industrial Zone

forms of ownership	Private and ppp	Most public ownership for SEZs	Public ownership and ppp for FTZ
Management and administration	- administered by an authority organized as a company	-Government Authorities -Ministries	- Board of Directors - administered by an authority organized as a company --Ministries
Regulator	governments	governments	governments
Developer of zone	Private sectors	governments	governments
Operator	Private sectors	Governments and private sectors	Governments and private sectors

The other notable difference is associated with main authority regulations; Iran and Kazakhstan are pursuing a more comprehensive framework that covers all zones but in the case of UAE each zone possesses different regulation.

The strategic plan of government for economic development in UAE is more related to private rather to public development of zones and they involved more foreign and private sectors in main projects by focusing on ICT and technology sectors.

Involving more the private sectors bring the necessity to design and have a more precise mechanism for simplifying the communication between government and investors and develop networking. The term of policy network and corporate governance has an important role to increase the efficacy of managing the SEZ and improve the private and public sectors.

In the case of UAE, this country takes advantage of new technologies to provide a framework for the relationship between government, state agencies and private sectors. The long term program in SEZs in UAE is improving the network approach by providing the latest technology and connectivity in legal services in zones such as world's first free zone to offer electronic signature (DMCC), Business Apps Manager for guarantee firms to compliance their activities with UAE regulations.

Regarding the governments' strong role in SEZs structure in Iran and Kazakhstan, these two countries could not improve their networking process like UAE. Kazakhstan has improved its SEZs situation by making a platform to progress academic relationship especially in R&D sectors and establish data center that helps investors to have a better connection inside SEZs. (Innovation Technology Park SEZ)

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especially in R&D sectors and establish data center that helps investors to have a better connection inside SEZs.(Innovation Technology Park SEZ)

In spite of comprehensive regulation of SEZ and FTZ in Iran, the lack of coordination and network policies between the state agencies and the lack of attention to integrated management in these areas have led various agencies and organizations in free zones to implement their own laws and programs in a discrete manner and regardless of integrated zone management.

By considering the principle role of SEZs to attract FDI, foreign firms have a more effective role in special zones to transferring knowledge and advanced technology to host counties. Consequently, having an inclusive network approach can provide a flexible and effective procedure for the integration of private and not state sectors in SEZs goals.

As well as an innovative process for governing the modern SEZs it seems that corporate governance through a board of directors and local management in each zone which can balance the power in special areas. UAE successful experience represents that there is a positive relationship between independence and the level of autonomy of SEZ and the performance of firms.

References

- Kuzmenko, O.A., Pelkova,S.V, Lukianenko O.V., Fomichev I.Y.,(2018) Comparative Analysis of Taxation for Special Economic Zones in Russia and APEC Economies. *European Research Studies Journal*, Volume XXI, Special Issue 1.
- Asian Development Bank., (2018) A Diagnostic Study of Kazakhstan's Special Economic Zones and Industrial Zones. ISBN 978-92-9261-154-5.
- Sinenko,O.and Mayburov,I.,(2017) Comparative Analysis of the Effectiveness of Special Economic Zones and Their Influence on the Development of Territories, *International Journal of Economics and Financial Issues*, 7(1), 115-122.
- Dubai Multi Commodities Centre Authority (DMCC),(2018), Uaefreezone.org.
- Mullan,C.,(2017) fDi Global Free Zones of the Year 2017 ,www.fdiintelligence.com.
- Chakraborty,T.Gundimeda,H. and Kathuria,V.,(2017) Have the Special Economic Zones Succeeded in Attracting FDI? Analysis for India, *Theoretical Economics Letters*, 7, 623-642.
- Report of Committee for Economic and Commercial Cooperation of the Organization of the Islamic Cooperation (COMCEC),(2017) Special Economic Zones in the OIC Region:Learning from Experience. Ankara/ turkey, 978-605-9041-96-6.
- le Roux,N.andSchoeman,A(2016) A comparative analysis of design of special economic zones: South Africa, Malaysia, Indonesia. *Journal of Economic and Financial Sciences* (3), pp. 749-768.
- Douglas,Z Z.,(2015) Global experiences with special economic zones: focus on China and Africa (English). Policy Research working paper; no. WPS 7240. Washington, D.C. World Bank Group.
- Farole,T. and Moberg,L.,(2014) It worked in China, so why not in Africa? The political economy challenge of special economic zones, WIDER Working Paper, No. 152, The United Nations University World Institute for Development Economics Research,Helsinki.
- The Law of the Republic of Kazakhstan, (2014) On the innovation cluster "Park of innovation technologies" No. 207-V, ministry of justice of republic Kazakhstan republic center of legal information.

- Moberg,L.,(2014) The Political Economy of Special Economic Zones. Forthcoming in the Journal of Institutional Economics, SSRN.2297871.
- Gale,S,. and Youngs ,P.,(2014) Moving Towards an Integrated Theory of Policy Networks: A Multi-Theoretical Approach for Examining State-Level Policy Change in U.S. Subsystems,working paper 45,education policy center .university of Michigan.
- McCarthy,J and Rimmington,A.,(2014) Overview of selected UAE free zones, Clifford Chance ,<http://www.cliffordchance.com>.
- Chandrachud,S.,and Gajalakshmi,P.,(2013) A study on role of FDI in SEZ - special reference to MEPZ. International Journal of Business and Management Invention, Volume 2, Issue3.
- Martinez,M., Jamison M, Tillmar M., (2013) Public utilities corporate governance. The journal of management and governance, vol. 17.
- Canonica P, Mercurio R, Mangia G, Martinez M, De Nito E.,(2012) Meta-Logistic operators as focal organizations in Italian Logistic Platforms. The ICAFI Journal of supply chain management.
- Berni,A, Iacono,M,P., Martinez,M., (2012) Organizational Change and Dynamics of Control: An Analysis of Italian Call Center Workplace.Chinese Business Review 11.4.
- Iacono,M,P,Martinez,M., Mangia,G, Galdiero,C.,(2012) Knowledge creation and inter-organizational relationships: the development of innovation in the railway industry, Journal of Knowledge Management, Vol. 16 Issue: 4, pp.604-616.
- Farole,T, and Kweka,,J.,(2011) Institutional Best Practices for Special Economic Zones: An Application to Tanzania - Africa Trade Policy Note siteresources.worldbank.org.
- Farole, T., (2011) Special Economic Zones: What Have We Learned? Poverty reduction and economic management (PREM) network, No 64.
- Hakimian, H., (2011) Iran's Free Trade Zones: Back Doors to the International Economy? Iranian Studies, 44:6, 851-874.
- Yeung,Y.,Joanna,L.,and, Gordon,K.,(2009) China's Special Economic Zones at 30.Eurasian Geography and Economics, 50, No. 2, pp. 222–240.
- Rafiee, M., (2009) Comparative policy review Notification of Article 44 and Free zones Commercial, Special Economic Zones journal, No 57,Vol 7.
- FIAS.,(2008) Special Economic Zones: Performance, Lessons Learned, and Implications for Zone Development. The World Bank, Washington DC, E3.
- Provan,K and Kenis,P.,(2008) Modes of Network Governance: Structure, Management, and Effectiveness ,Journal of Public Administration Research and Theory, Volume 18, Issue 2, 1 , Pages 229–252.
- Grantham,A.,(2001) How network explain unintended policy implementation outcome: the case UK rail privatization. Public administration, Vol 79, No 4.
- Klijn E.H.and Koppenjan,J.F.M.(2000) Public Management and Policy Networks:Foundations of a network approach to governance, Public Management 2(2):135-158.
- Klijn ,E.,(1996) Analyzing and Managing Policy Processes in Complex Networks: A Theoretical Examination of the Concept Policy Network and Its Problems. Administration & Society 28(1):90-119.
- Boerzel, T.A. (1997) Organizing Babylon: on the different conceptions of policy networks. Public Administration.
- Law of the Republic of Kazakhstan (1996) on special economic zones in the Republic of Kazakhstan.
- Bernd,M and Mayntz, R.,(1992) Policy Networks: Empirical Evidence and Theoretical Considerations. Westview press publisher.

Rhodes,R., (1990) Policy Networks: A British Perspective, Journal of Theoretical Politics 2 (3): 293-317.

Ministry of Industries and Mines, Law on the Administration of Free Trade-Industrial Zones of the Islamic Republic of Iran. <http://en.mimt.gov.ir>.

Dowding,K.,(1995) Model or Metaphor? A Critical Review of the Policy Network Approach, political science journal. Volume: 43 issue: 1.

Dealing with Complex Environments: the Case of Special Economic Zones in Italy

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Abstract

The forms of collaboration and the relationships among public and private actors are crucial to create value for regional development and to enable economic growth. Policy makers promote projects to stimulate innovation and to facilitate knowledge creation and diffusion. The paper aims to investigate the emergence of a network set up to develop a complex project. In particular, our work tries to investigate inter organizational relationships and collaboration among academic institutions, industrial organizations, researchers, policy makers and institutional actors participating to a common project to boost regional development. Firstly, our contribution focuses on the evolution of this network. Moreover, it analyses the role of different actors and the governance of the forming network studying the effects of collaborative processes on knowledge creation and diffusion.

The project was set up to introduce and create a SEZ (Special Economic Zone) in the South of Italy (Campania Region) in order to foster regional development and to boost employment as well as local and national growth. The present preliminary study is part of an ongoing program including Universities, institutional actors and organizations from different industrial sectors.

The research is based on a qualitative investigation using the case study approach. The findings could be a useful tool for institutional actors, policy makers, organizations and management to develop strategies to enhance local development. At the same time, it is essential to understand and assess the economic impact of the introduction of the SEZ, as proposed by the Regional Council (DGR No. 175 of 28/03/2018) on the entire regional economy. The observation of collaboration interactions while the network is forming is useful to understand the actors' behavior and governance mechanisms. The development of clusters is a complex process linked to actors' collaboration and to inter-organizational relationships. Integration task as well as roles in knowledge creation and collaboration among actors are key elements crucial for the development of the local areas.

Keywords – network, governance mechanisms, projects, SEZ.

Paper type – Academic Research Paper

1 Introduction

The forms of collaboration and the relationships among public and private actors are crucial to create value for regional development and to enable economic growth. Policy makers promote projects to stimulate innovation and to facilitate knowledge creation and diffusion. Recently researchers have increased their attention on the development of special economic zones (SEZ) as a tool to increase investments, to boost employment and economic growth through fiscal incentives and economic benefits (FIAS, 2008, OECD, 2009; World Investment report 2018). International experience suggests that the relationship among institutional actors such as national and local government, agencies, public and private organizations and other stakeholders are crucial to create innovation, to increase development and to improve competitiveness (Hall, Taylor 1996; Sun, Cao 2018). On one hand, most studies focus on the economic impact of SEZ; on the other hand, fewer investigate the effect of other features (i.e. management, governance, the role of actors, institutional framework etc.) on the success of these special areas. For this reason, it is interesting to study the role of actors and the governance mechanism within the network since its emergence.

The paper aims to investigate the emergence of a network set up to develop a complex project. In particular, our work tries to investigate inter organizational relationships and collaboration among academic institutions, industrial organizations, researchers, policy makers and institutional actors participating to a common project to boost regional development. Firstly, our contribution focuses on the evolution of this network. Moreover, it analyses the role of different actors and the governance of the forming network studying the effects of collaborative processes on knowledge creation and diffusion.

2 Theoretical framework

The paper contributes to the understanding of inter organizational relationship and flexible/temporary form of organizing (Bakker, 2010; Bakker et al. 2016; Sydow et al., 2004; Kenis et al., 2009 March, 1995 Ahuja 2000; Gulati, Gargiulo, 1999). The context of study regards the creation of a group of individual and collective actors who were challenged with Government Issue to set a new complex project.

2.1 The definition of Special Economic Zones

The number of special economic zones (SEZ) is rapidly growing, although the first type of free zone were set up since 1700, in the past 20 years the number of modern special economic zones has increased worldwide. Generally, SEZs are defined as specific geographical areas characterized by a particular set of incentives or economic benefits for actors who decide to locate their business in the area (World Bank 2008; Farole 2011)

The SEZ basic concept is broad¹ and includes several specific characteristics: a) a geographically delimited area usually physically secured, b) a single management or administration c) it offers benefits for investors physically within the zone d) it has a separate customs area (duty-free benefits) and streamlined procedures (FIAS 2008; World Bank 2008; Farole 2011). In addition to this, these zones have other common “special” features such as special regulation, public services, infrastructures, fiscal incentives etc. (Zeng 2016). Some studies (Zeng, 2010, 2016) confirm that successful SEZs can contribute to generate two main benefits: “direct” economic benefits, such as employment generation, export growth, government revenues, foreign currency gains; “indirect” economic benefits, such as upgrading skills, technology transfer and innovation, economic diversification and better performance of local firms.

SEZ can take a number of different forms, the most common are: Export processing zones, Free trade zones, Enterprise zones, free ports, single factory zone, specialized zones, comprehensive SEZ, bonded area and Eco industrial zones (World Bank 2008, Zeng 2016)

- Free trade zones (FTZ) are duty-free areas offering facilities for storage and distribution for trade, trans-shipment and re-export.
- Export processing zones (EPZ) are industrial zones with special incentives to attract foreign investors, in which imported materials undergo some degree of processing before being exported again (ILO) There are in general two types of EPZs: one is a comprehensive type, open to all industries; another is a specialized type, only open for certain specialized sectors/products.
- Free ports are special zones on the land area of the port cities. They host different types of activities as well as incentives and benefits to help export markets

Generally, the public opinion debates on whether SEZ have to be considered as part of economic policy reforms acting as tools for economic development or whether they are rather instruments for political purposes acting as an escape for unemployment.

Usually studies and researches classified SEZ according to different types of governance structure (World Bank 2017). The management of these special areas could be either public or private. In other cases, the management can be both public and private through partnership or a different structure such as consortium.

Another way of considering SEZ can be a broader definition: ” SEZ *are administratively defined territories, influencing interactions and competitive/co-operative behaviour of economic agents, through dynamic and interrelated cognitive, normative, regulative and organizational structures, routines, incentives and process*”(Hazakis 2014) a different concept of SEZ based on critical dimensions which are relevant to institutionalist approach. This approach highlights the complexity of the environment

¹ The core definition of a free zone, as well as proposed guidelines and standards for them, are contained in the Revised Kyoto Convention of the World Customs Organization (WCO). Annex D of the International Convention on the Harmonization and Simplification of Customs (revised in 1999) defines a free zone as “part of the territory of a Contracting Party where any goods introduced are generally regarded, insofar as import duties and taxes are concerned, as being outside the Customs territoryand not subject to the usual Customs control.”

made up of social actors, as consequences SEZ are the outcome of a socially embedded process (Hazakis 2014).

3 Methodology

The project was set up to introduce and create a SEZ¹ (Special Economic Zone) in the South of Italy (Campania Region) in order to foster regional development and to boost employment as well as local and national growth. This preliminary study is part of an ongoing program including Universities, institutional actors and organizations from different industrial sectors.

The research is based on a qualitative investigation using the case study approach, which is suitable to investigate emergent and dynamic empirical settings. The collection of empirical data is carried out using a heterogeneous plurality of instruments. The methods include document analysis, semi-structured interviews and participant observations.

The analysis focuses on collaboration by different actors involved in the process of SEZ emergence.

4 Context of study

4.1 SEZ in Italy

Currently there are four “free tax” areas (Free Port of Trieste, Venice Free Zone (VFZ Free Zone of Port of Gioia Tauro, Free Zone of Port of Taranto) in Italy. Recently, Italian Government (following European Council Law) has set up a set of measures aimed at enhancing economic growth in the South of Italy in order to create SEZ. 2The new SEZs should have the same structure and requirements (methods, time and governance, financial and economical features). This will require a high level of agreement between local, regional and national institutions as well as economic stakeholders.

Generally, according to the regulation and to the previous zones already set in Europe, the main purpose is to foster industrial growth and to increase innovation through increasing firm competitiveness and export rates, attracting foreign investment as well as boosting employment.

4.2 Case study: SEZ in Campania

According to the public actor who promote the creation of the special area in Campania the main purpose was to promote the local development helping firms already

¹ The introduction of SEZ in Campania has been proposed by the Regional Council (DGR No. 175 of 28/03/2018)

²² D.L. 20 June 2017, n. 91 art 4 c.2. definition of SEZ. The decree of the President of the Council of Ministers 25 January 2018 n. 12 defines the modalities for the establishment of SEZ, including interregional SEs; their duration; the criteria for identifying and delimiting the SEZ area; the criteria governing company access; general coordination of development objectives.

settled in the region trying to attract new actors through economic and fiscal incentives. Essentially, the first proposal includes three ports area and their surroundings.

In the first phase order to draw up the strategic development plan the regional government has been strongly engaged with stakeholders and with all actors involved in the creation of the Special Economic Zone in Campania: majors, trade unions, port Authority, Universities, trade associations, environmental associations, industrial development consortii, transport operators and associations.

At this stage, the regional government has designed the zones (table 1) according to

Table 1- List of Areas of SEZ in Campania

Areas	City/town
Port of Napoli	Napoli
Port of Castellammare di Stabia	Castellammare di Stabia
Port of Salerno	Salerno
Industrial area Napoli Est	Napoli
Area Bagnoli/Coroglio	Napoli
Airport	Napoli, Casoria
Intermodal logistic centre Campano	Nola
Industrial development consortium	Nola, Marigliano
Industrial development consortium	Pomigliano D'Arco
Industrial development consortium	Acerra
Industrial development consortium	Caivano
Industrial development consortium	Arzano, Casoria, Frattamaggiore
Intermodal logistic centre Sud Europa	Marcianise, Maddaloni
Industrial development consortium	Marcianise, San Marco Evangelista
Industrial development consortium	Teverola, Carinaro, Gricignano di Aversa
Industrial area di Castellammare "Foce Sarno"	Castellammare di Stabia, Torre Annunziata
Airport	Pontecagnano, Bellizzi
Industrial development consortium	Salerno
Industrial development consortium	Battipaglia
Industrial area Nocera	Nocera Inferiore
Industrial area Sarno	Sarno
Industrial development consortium	Fisciano, Mercato San Severino
Logistic centre di Contrada Olivola	Benevento
Industrial development consortium	Benevento
Industrial development consortium	Flumeri, Frigento
Industrial development consortium	Avellino, Grottolella, Manocalzati Montefredane, Prata di Principato Ultra, Pratola Serra, Atripalda
Industrial development consortium	Lacedonia

The management of the SEZ is public: 1) the steering committee, coordinated by the Central Tyrrhenian Port Authority, who promotes the government development strategy 2) governing body who is in charge of the coordination between local and national government.

In addition to this, a regional One-Stop Shop for Production Activities (SURAP) has been established, in order to improve the reliability of investment through fixed administrative procedures.

5 Preliminary evidences

The findings could be a useful tool for institutional actors, policy makers, organizations and management to develop strategies to enhance local development.

At the same time, it is essential to understand and assess the economic impact of the introduction of the SEZ, as proposed by the Regional Council (DGR No. 175 of 28/03/2018) on the entire regional economy. SEZ can be catalyst of development and innovation if a real integrated network exists. The challenge is to develop an interdependent co-operative group formed by SEZ actors and institutions (away from the government intervention). The observation of collaboration interactions while the network is forming is useful to understand the actors' behavior and governance mechanisms. The development of clusters is a complex process linked to actors' collaboration and to inter-organizational relationships. Integration task as well as roles in knowledge creation and collaboration among actors are key elements crucial for the development of the local areas.

References

- Ahuja G. (2000), Collaboration networks and innovation: a longitudinal study, *Administrative Science Quarterly*, 45: 425-455.
- Bakker, R. M. (2010). Taking stock of temporary organizational forms: A systematic review and research agenda. *International Journal of Management Reviews*, 12(4), 466-486.
- Bakker, R., DeFillippi, R. J., Schwab, A. & Sydow, J. (2016). Temporary Organizing: Promises, Processes, Problems. *Organization Studies*. Editorial for Special Issue on "Temporary Organizing", 37(12), 1703-1719.
- Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A. (2014). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, 43(7), 1164-1176.
- Farole T., (2011) Special Economic Zones: What Have We Learned?, World Bank Report
- FIAS (2008) "Special Economic Zones: Performance, Lessons Learned, and Implications for Zone Development." World Bank, Washington, DC (<http://www.ifc.org/ifcext/fias.nsf/AttachmentsByTitle/SEZpaperdiscussion>)
- Hazakis J.K., (2014) The rationale of special economic zones (SEZs): An Institutional approach, *Regional Science Policy & Practice*, Volume 6 Number 1
- Järvi, K., Almpantopoulou, A., Ritala, P. (2018). Organization of knowledge ecosystems: Prefigurative and partial forms. *Research Policy*.
- Kenis, P., Janowicz-Panjaitan, M., Cambré, B. (2009) (Eds.) *Temporary organizations Prevalence, logic and effectiveness*, Cheltenham, UK: Elgar.
- Lundin, R. A., & Söderholm, A. 1995. A theory of the temporary organization. *Scandinavian Journal of Management*, 11(4): 437-455.
- March, J. G. (1995). The future, disposable organizations and the rigidities of imagination, *Organization*, 2 (3-4), 427-440
- Sun Y, Cao C., (2018) The evolving relations between government agencies of innovation Policy making in emerging economies: A policy network approach and its application to the Chinese case, *Research Policy* 47
- Zeng D.Z. (2010) *Building engines for growth and competitiveness in China: Experience with special economic zones and clusters*. World Bank, Washington

Zeng DZ (2011) How do special zones and industrial clusters drive china's rapid development?
Working paper 5583, World Bank, Washington, DC

Knowledge Integration Mechanisms in an Inter-Organizational Research Project: a Case Study from a Backward Region

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Abstract

In recent years an abundant literature has been focusing on the way U-I collaborations work and on the main factors and variables that affect the process. Some studies have related to the role of proximity in explaining inter-organizational collaborations and facilitating interactions between firms and academia. Others reflected on the different mechanisms adopted in order to manage the project in a successful way. In this paper we investigate which kind of coordination mechanisms are adopted and how they influence the U-I collaboration.

Keywords – Automotive; University-Industry Partnership; Coordination mechanisms

Paper type – Academic Research Paper

1 Introduction

In recent years, universities have more and more been running research projects involving firms, also thanks to public expenditure policies that indirectly encouraged university–industry (U–I) collaborations (Giuliani and Arza, 2009). Industry–University (I–U) cooperation is not new the academic debate, and nowadays it represents an interesting stream in the managerial debate, due to the role of public research centres (and in particular of universities) in contributing to the economic development of countries or regions. Literature on knowledge and business ecosystem underline the role of these key actors in fostering knowledge creation inside a specific area. As mentioned by Järvi et al (2018; 1524): “Knowledge ecosystems have been characterized as geographically co-located hotspots, in which local universities and public research organizations are typically the central actors (Clarysse et al., 2014), and where the key activity of knowledge exploration is accomplished through collaborative research work (Valkokari, 2015)”. Industry–university interactions foster knowledge creation and innovation and are positively related to economic growth (Santoro and Chakrabarti 2002).

Recently part of the literature has investigated two different issues in I–U cooperation: one concerns the management of the project (Morandi, 2013; Rajalo and Vadi, 2017) and another deals with the process of commercialization. The latter tries to understand how it is possible to help universities in making their business ideas ready for the market (Würmseher, 2017). Particularly prolific is the topic of university spin-off, defined as new ventures initiated in an academic setting and based on university developed technology (Würmseher, 2017). Universities are heterogeneous and need differentiated technology transfer policies depending on their research intensity and other factors (Huyghe and Knockaert, 2015); similarly, at the more micro-level, the differences in scientists' attitudes to entrepreneurialism call for different policy approaches (Würmseher, 2017; p.13).

Regarding the management of the U–I collaboration, one of the main dimension concerns the knowledge transfer and in particular the firms' need of acquiring new knowledge, due to the fact that sometimes this kind of collaboration are unsuccessful. A lot of attention has been paid (Perkmann and Walsh, 2007) to the interactions taking place on the university–industry border in terms of appropriate mechanisms able to facilitate knowledge exchanges. A growing number of management studies have emphasized the relevance of linkages between universities and industry in automotive sector (e.g. Meng et al., 2019; Rasiah and Govindaraju, 2009). As argued by Steinmo and Rasmussen (2016; p. 1250): “The challenge of such knowledge transfer often relates to the development of trust and the establishment of a common understanding in communications and interactions between firms and academics”. This is why many scholars are trying to understand the way U–I collaborations work and which are the main factors and variables that affect the process. Some studies relate to the role of proximity in explaining inter-organizational collaborations and facilitating interactions between firms and academia (Steinmo and Rasmussen, 2016). Others reflect on the different mechanisms adopted in order to manage the project in a successful way (Morandi, 2013; Rajalo and Vadi, 2017). We want to go deeper in this direction and to investigate which

kind of coordination mechanisms are adopted and how they influence the U-I collaboration.

The paper sets out as follows: the next two sections review the literature on University-Industry research projects. We then analyse coordination and control mechanisms and how they relate to research projects and describe the methodology used for the empirical analysis. Finally, we present and discuss data from the empirical research before summarising the main findings and conclusions.

2 University-Industry collaborations

2.1 University-Industry collaborations: overview of organizational issues

University-Industry collaborations have been studied from a variety of perspectives and standpoints, including institutional dimensions of the collaboration, organizational culture, interorganizational relations, intermediaries and brokerage able to facilitate such collaborations. Several aspects have been incorporated in theoretical models depicting the collaborations both at meso (the dyadic relationships) and macro (the network) levels. It has also been recognised that the process of working together is not well understood at the micro level (Rigby and Edler, 2005:786).

There is little understanding of the different issues that are able to influence the collaboration process, for instance the coordination processes that may influence the U-I collaboration (Morandi, 2013). U-I collaboration has been put forward as a higher-level process that require intense teamwork and coordination. U-I collaboration has been characterised by “cultural divide” between partners in terms of goals, perspectives, motives and routines; therefore, such collaboration is highly multifaceted. The decision-making processes in collaboration are challenging (Bäck and Kohtamäki, 2015), and individual factors are bound to affect it. Amabile et al. (2001) have attributed three important features to the collaboration between academic researchers and business practitioners: 1) it involves people who are members of different professions (academia and business); 2) it is a collaboration between individuals or teams, not between organisations; and 3) the collaborators are not all members of the same organisation.

Interdependence among partners becomes key issue, related to inter-organizational streams of activities to and the extent to which partners are dependent upon one another to perform tasks. As the degree of interdependence increases, different mechanisms are needed to coordinate partners’ tasks. Coordination through standards, plans and by mutual adjustment are suitable to meet different categories of interdependence.

2.2 University-Industry collaborations: coordination issues

The need of coordination and control in a U-I collaboration represent a critical issue that could affect the final result and the way the research is conducted. In the managerial literature four different knowledge integration mechanisms are commonly identified inspired by Grant’s (1996) seminal work. They are rules and directives, sequencing, organizational routines and group problem-solving and decision-making.

Rules and directives involve “plans, schedules, forecasts, rules, policies and procedures, and standardized information and communication systems” (Van de Ven et al., 1976, p. [0].323) and may be viewed as standards which regulate the interactions between individuals. Sequencing is the organization of activities in a time-patterned sequence, so that each specialist’s input may be designed independently, receiving a separate time slot for contribution. Routines are “relatively complex patterns of behaviour [...] triggered by a relatively small number of initiating signals or choices and functioning as recognizable units in a relatively automatic fashion” (Winter, 1986, p. 165). Routines are generated by specialists in the form of sequential patterns of interaction, allowing integration of their specialized knowledge without causing knowledge transfer. Group problem-solving and decision-making require time-consuming face-to-face interaction, typically meetings. The choice of integration mechanisms depends on the characteristics of the tasks to be carried out. Less expensive mechanisms, such as rules and directives, sequencing and organizational routines, are suggested for situations with low interdependences among activities and low overall complexity. Some tasks may require more personal and communication-intensive forms of integration. Galbraith (1973) pointed to the need for “impersonal” coordination through rules and plans to be supplemented by “personal” and “group” coordination modes such as meetings.

In the literature on university–industry relationships, coordination and control issues have been considered in a few studies (Morandi, 2013; Rajalo and Vadi, 2017). Actually, the control issue is not really relevant in many U-I collaborations, because firms do not perceive the risk of a University’s opportunistic behaviour, due to the fact that University is not generally considered as a potential competitor or as a player that could acquire and transfer internal intellectual capital (Morandi, 2013). Morandi (2013) adopts a contingent approach in order to give useful insights on the adoption of different coordination mechanisms. In particular, according to her, planning is often adopted in U-I collaboration, but it has a significant role only in the initial phase of the project in order to align partners in terms of output, while mutual adjustments mechanisms are the main mechanism during the project life. As argued by Morandi (p. 84): However, despite the great effort devoted to planning activities, the initial plans do not always provide exhaustive explanations of the activities needed to reach the planned goals or a detailed description of project opportunities and challenges. The adoption of written reports is justified to control the intermediate research outputs and to transfer intermediate findings if the interdependence among partners is sequential.

Temporary group meetings of partners’ R&D staff (task forces) are also adopted. At a more general level, according to Morandi, what really matters in a U-I research project is the role of people who act as broker, liaison positions held by people with formal authority and a hub role within their organizations. In a contingent view the increase in task uncertainty in cooperative research leads to a greater decentralization of coordination and control practices (Morandi, 2013; p. 87).

Rajalo and Vadi (2017) studied the different practices adopted during the two main steps of a U-I research (initiation and implementation) in order to facilitate the

management of the project. They adopted the Rau et al. (2012) approach to define practices adopted to fill the gap between the partners in order to facilitate knowledge exchange. They refer to the boundary-crossing mechanisms and pragmatic boundary-crossing mechanisms as different practises in order to facilitate the communication and to build trust among the partners. If the general issue is to understand how it is possible to manage U-I collaborations, more light should be shed on the nature and implications of coordination mechanisms in U-I research settings. Our research question may therefore be formulated as: RQ1. What kind of coordination mechanisms are adopted in a U-I research project and how they affect the initialization and implementation phase of the research project. In particular, our aim is to investigate how the adoption of different integration mechanisms in the various steps of a typical university-industry research project overlaps with the need of establishing common ground.

3 Research Design

The empirical analysis was based on a qualitative investigation. We analysed empirical material collected within a research project originated by a partnership involving Fiat-Chrysler Automotive (FCA), a multi-brand auto manufacturer whose product range covers different market segments, and two universities: the University of Sannio (Department of Management, Italy) and the University of Portsmouth (Department of Operations & System Management, UK). The project is funded by the National Operative Programme FSE-FESR Research and Innovation, Action 1 - *“Dottorati Innovativi con caratterizzazione industriale”*. Driven by the objective of our research, in the selection phase we met the following main criteria. First, the automotive industry represents an interesting case for analysing innovation processes. In the last two decades, this industry has undergone a radical transformation. There have been three basic but intertwined structural changes. The first is that car companies have shifted their focus from national to global markets. This means changes in market scope, new competition regimes and new forms of production organization at international level. Secondly, along with this new international framework, most automotive firms have tried different organizational models for production, trying to move from the Fordist approach to newer models such as lean production. Finally, inter-company relationships have changed, because of modularization and outsourcing (Cabigiosu et al., 2012; Frigant and Layan, 2009). Second, as it is common in literature, we selected a case study in which the phenomena of interest about the use of coordination mechanisms in a University/Industry collaboration setting are transparently observable. This study used empirical material collected at FCA's Pratola Serra plant, in Avellino, Italy. Pratola Serra Plant was founded in 1991 and during these years received many certifications and awards, but it experienced also some criticalities and important organisational changes. From a performance perspective, it passed from a production of 570.000 engines in 2007 to 170.000 in 2014, to come back to 300.000 in 2015. Recent trends and forecasts are encouraging enough to think of a new increase. In 2016, FCA occupied about 1.800 people, and produced mostly diesel engines for different vehicles of different brands

(Fiat, Jeep, Alfa Romeo, Suzuki). It's a complex network made of 165 suppliers located mainly in Italy and in Europe, to supply more than 1.500 part numbers.

We carried out the analysis iteratively with a semi-grounded approach, and our data informed the selection of theory presented upfront (Van Maanen et al., 2007). The in-depth case study approach is advised when the boundaries between phenomenon and context are not entirely obvious, for example, the coordination mechanisms used within a University-Industry partnership (Dubois and Gadde, 2002). This is in line with Dyer and Wilkins (1991, p. 614), who advocated case studies, recommending that researchers should be aware of the benefits stemming from "the careful study of a single case that leads [them] to see new theoretical relationships and question old ones".

We used three data collection techniques: internal document analysis, observation/site visits and semi-structured interviews. Documentary analysis enabled understanding of the project structure and identified coordination implications. Observation was used to explore coordination mechanisms issues among partners. We carried out five semi-structured interviews with the top management of FCA and two management researchers. Each interview was conducted by at least two authors of this paper to reduce interviewer bias (such as first-impression error, non-verbal influences or negative emphasis). They used a semi-structured questionnaire designed to stimulate a narrative approach in the dialogue with the interviewees. All interviews were recorded and transcribed. They aimed at obtaining information on the adoption of different coordination mechanisms. The collection of data was carried out between October 2018 and early April 2019.

In the case study, we will focus our analysis on the relationships between FCA and the two Universities. This choice is coherent with our aim of analysing coordination mechanisms deployed on the university-industry border.

4 Case Analysis

4.1 Project description

The research project considered in the case study aims, in general, to: *a)* contribute to the development of a network of subjects involved in experimenting innovative management control systems; *b)* define new professional skills valued by the labour market; *c)* support the development of *Lean Organization* models.

At the time of drafting of the case study, the project, formally presented in December 2017, was in the initial phase (October 2018 - April 2019), which took place after the decision of the Italian Ministry of the University to finance its activities for a three-year period. This research aims at the testing of mathematical models of multi-criteria analysis in support of organizational control functions *in the automotive* sector. Within the organizational control management systems context, the research proposes the use of methods allowing a more conscious weighing of the factors that determine organizational performance, favoring organizational development, innovation and the enhancement of human capital.

The research program is divided into the following activities:

1. *Review* of the literature on control systems in the *automotive* sector;
2. Definition of knowledge gaps and the research focus;
3. Development of an experimental model for organizational performance monitoring, applicable to typical company production processes;
4. Model *testing*;
5. Experimental use of the model at the company premises, data collection and analysis.

One of the most important elements of the project is the actual use of results of the empirical research. In particular, the funding body has evaluated very positively the possibility of creating a Start-Up dedicated to the provision of management consultancy services that adopt the decision support model experienced during the project with FCA.

4.2 The stages

The universities and the company carried out different types of activities in the execution of the research project on organizational control topics. These activities can be grouped into three distinct phases: *a)* preliminary study activities; *b)* drafting the project; *c)* the launch of the project.

A) Preliminary activities

For approximately two years, the Italian university, located in the same region of the FCA plant that hosts the project, carried out together with the company study activities on the organizational control topics, which were the foundation for second phase of the project, namely the drafting. In particular, the collaboration involved the creation of three graduations theses, company visits to all production departments, the drafting of two scientific articles discussed at international conferences, holding three discussion meetings at the university and at the company. For the preparation of the theses, the company, in collaboration with the university tutor, defined the objectives of the study, provided data on the evolution of its organizational control models and facilitated five meetings between students, professors and company managers at factories in Italy - Turin, Cassino, Pomigliano d'Arco (NA), Melfi (PZ) and Pratola Serra (AV).

The role played by the World Class Project Coordinator at the global level for the FCA Group was of particular importance during this stage, who contributed, during the first study whose scope was the discussion of a graduation thesis, to defining the framework of the events that have determined the evolution of organizational control systems in the company. In fact, in 2005, following an experience in Japan and in the USA, the manager was appointed with the task of conveying and implementing the WCM method first in Fiat and subsequently in CNHInd. and Chrysler.

"To understand our need today to develop our organizational control system, we need to frame the stages of development of WCM in our company! For this reason I will be the one to provide you with the books and reports that I consider the most significant among those drafted and published over the last 10 years. Furthermore, it is necessary that you observe with your students the different levels of maturity of the organizational system at the different Italian establishments. I will accompany you!" - the manager said during the first meeting with the professors of the Italian university.

During the preliminary phase, the same group consisting of professors and managers who had already facilitated studies and company visits, organized a meeting at the Melfi Plant Academy, the modern internal training centre created in Italy and subsequently developed in a number of EMEA factories, becoming an example of excellence at a global level. During the one-day visit, accompanied by managers and specialized workers, the scholars were able to observe how in the company education and training are continuously linked to the organizational control results. The anomalies and inefficiencies detected by the organizational control system requirements automatically convey the programming of training courses, as well as with the aid of work process virtual simulation systems and the involvement of organizational design experts.

The Director of the Centre stated during the meeting: *"In the four main laboratories that make up the Plant Academy our task is to ensure the best simulation of theoretical concepts in order to increase the effectiveness of learning, research and testing innovative solutions to expand to the Plant."*

B) Drafting of the project

The most common coordination solution in the project development phase was the set of practices devised by the partners and focused on communication and on the direct comparison between them. Through recurring meetings, theoretical and operational perspectives of the study were discussed and defined; expected goals and outputs have been negotiated; and the investigation methodology was developed. The choices made in the definition of the project represented the synthesis of the needs expressed by the scholars responsible for the definition of the theoretical frame of reference and those expressed by the company management interested in the rate of application of the models and the results of the analysis to the processes of change of the company.

The company quality manager, during one of the first call conferences dedicated to the drafting of the project, was confronted with the teacher of the foreign university on the choice of the duration and the contents of the different activities: "I understand that after the collection of the set of data, you need to carry out your model testing and development activities, but the data we are considering could lose significance in such a long time and negatively reflect on the quality of the analysis!". Furthermore, the collaboration between university and business in the case under study took place through two other types of coordination mechanisms. On the one hand, the comparison between the partners has been "channeled" into a formal drafting path of the project in which an important role has been played by the tools made available to the Ministry to access the evaluation and funding. The use of a form, the access by professors and company managers to the FAQs related to the call for proposals, the criteria and the standards of access and evaluation have created a common idea among the partners within which to define the contents freely chosen for the research.

On the other hand, the collaboration on the occasion of the research project described here has benefited from the level of knowledge and trust already matured among the partners previously. The study experiences conducted to support the training of young university students or to test the organizational models devised by the company in the

context of international scientific forums have become the occasion to develop this level of trust. In particular, the company, as stated by the head of the RU during an interview: "... has been able to verify that the university did not only look for fertile land to exploit, devising complex models of interpretation of reality that cannot be used at an operational level! We were struck by the humility and patience shown by scholars in listening carefully to the starting points of the models we wanted to experiment and in having always clear that the point of arrival for all of us had to be organizational change!".

C) Launch of the project

After the positive results of the evaluation procedure by the Ministry and the consequent three-year financing of the proposed activities, the group composed of 4 university researchers and 4 company managers carried out a series of meetings aimed at defining the details of the first activities and at the start of the search. In particular, two work sessions were carried out at the Italian university in which the mathematicians for decision-making and organizational control illustrated for their areas of expertise models, expected results and necessary activity programs. Two other meetings were held at the Plant to present the project to the employees involved in the work processes being studied and to discuss the selection and data collection criteria with which to carry out the start-up phase of the theoretical decisions model.

The partners adopted a more informal approach to managing the interdependencies that emerged in the detailed design flow of the activities to be carried out.

In this sense the physical proximity of the Plant with respect to one of the two universities has facilitated the realization of a large number of meetings and contacts aimed at understanding the phenomena and the data selected to co-construct the mathematical model of decision support.

The Plant Director states in an interview: "From the beginning, I proposed to choose, as a focus of the research study, the problem related to the evaluation of improvement actions that could be designed periodically, after the detection of anomalies during engine assembly. But only after a long chat with the two professors, I realized that I should have asked a specific effort from the management to assign a weight relative to the different alternatives of choice. I also realized that the weight given to the alternatives had to be "built" by us, considering economic aspects but also elements connected to the quality of the work. Only in this way could the mathematical model give us a complete view of the most convincing possible solutions. I already knew the mathematical model adopted by the project, but talking about it calmly with my university friends, while we were running our company data, made me go much better in research! ".

5 Discussion

The collaboration university-industry relies on a variety of different coordination mechanisms. The first is identified when using formal and informal standardization mechanisms. In the Sub-Phase 2, for instance, rules and directions represent the predominant integrating mechanisms. The integration of opinions and specialist

contributions during the planning stage was facilitated by interpreting and redefining the “rules” to be followed during the project.

The template for the project (which must be adhered to obtain public funding) that had taken part in similar tenders previously, constituted the predominant frame in the implementation of this stage. Compliance regulated interactions between the management and researchers. The standardized forms for planning purposes constituted a way to specify and control the content that was to be shared among project members, also giving structure to discussions in project meetings. These factors influenced the way the group cooperated and, above all, provided constraints to the project both technically and economically. This means that partners relied on less communication and interaction-intensive mechanisms for knowledge integration and tried to structure the discussion in collective arenas, using standardized forms for reporting.

In sub-phase 1 and 3 of the WP3 common routines and sequencing were used in the management of day-to-day activities. Project members interacted extensively with members from their own departments to integrate knowledge. Physical and relational proximity increased not only the frequency of interactions but also the effectiveness of knowledge exchange through these interactions. It facilitated face-to-face contact and contributed to the emergence of cooperation.

At the same time, researchers from the same organization reactivated common previous experiences (Valentine and Edmondson, 2015), had shared experience and a common background and spoke the same language, or adopted role-based coordination.

The arrangements for managing the research project were “tried and tested”, even if the results, interactions and implications changed. The need to integrate remained significant, and every specialist had to exchange ideas with other members of the project team, both within the same fields and in different ones.

First phase was characterized by more personal and communication intensive forms of integrations. Knowledge integration in these complex phases is enabled by group problem solving and decision-making, in a collective setting. These sub-phases rely on more personal and less standardized knowledge integration mechanisms to allow project members to more freely communicate and interact to solve problems and deal with interfaces. The quest for combining scientific upgrading with process and project innovation is indicative of the final phase (dissemination) and is conducted through a dialectic process between individuals with heterogeneous core skills, mentalities and even interests.

In summary, we showed that the project was more a meta-coordination mechanism than a situated learning environment because of the need to compare and discuss the results during each sub-phase. A crucial aspect was the level of mutual understanding of specialist knowledge. When project members were derived from different sides of the university-industry border, there was a major need for recurring to more structured coordination mechanisms, even if the scientific background of participants was homogeneous. This in turn recalls the idea that soft issues such as technical jargon and similar ways of framing technical issue are not sufficient to enforce integration and more expensive coordination mechanisms (such as group problem solving and decision-

making) are to be enforced. In a nutshell, the origin of project members in terms of one side or the other of the university-industry border is more powerful than homogeneity of specialization and existence of common ground to determine the appropriate coordination mechanisms.

6 Conclusions

As shown by our case study, there are various options in terms of coordination mechanisms during the life of a university-industry research project. Our analysis shows that the choice of such mechanisms can differ across the various sub-phases of a project in relation to the organizational affiliation of project participants and the heterogeneity of their common knowledge. The study was able to expand understanding of coordination mechanisms in university-industry research settings in two respects. First, only a few studies have previously investigated such coordination mechanisms at the level of granularity we have selected. Second, the study was exploratory, which may be useful for generating research hypotheses in future work, connecting the features of interdisciplinary projects with the development of coordination mechanisms. Our results could be useful for other firms operating in the same sector, and also for policy makers wishing to stimulate this industry. The automotive industry has been involved in an extensive process of innovation within which the processes of (inter and intra) organizational coordination mechanisms have taken on a much more significant role. This study presents also limitations that have to be taken into account when evaluating its results. First, the qualitative approach here adopted is consistent with the objectives pursued and the nature of the research question, and allows us to draw insights that can be important for advances in theory. However, explanatory factors and forms of cooperation which can foster positive outcomes of interdisciplinary teams should be further analyzed. Second, as discussed before, the setting of our case study is represented by a specific context that conditions our concluding remarks; accordingly, future studies should address how integration can be achieved in practice within similar interdisciplinary research groups in this or other contexts. Finally, we should go more deeply in analyzing how the coordination mechanisms adopted in each phases of the research project actually influence final results.

References

- Amabile, T.M., Nasco, C.P., Mueller, J., Wojcik, T., Odomirok, P.W., Marsh, M., Kramer, S.J., (2001). Academic-practitioner collaboration in management research: a case of cross-profession collaboration. *Acad. Manag. J.* 44 (2), 418–431.
- Bäck, I., Kohtamäki, M., (2015). Boundaries of R & D collaboration. *Technovation* 45–46, 15–28.
- Cabigiosu A., Zirpoli F., Camuffo A. (2013) Modularity, interfaces definition and the integration of external sources of innovation in the automotive industry. *Research Policy*, 42 (3): 662–675.
- Clarysse, B., Wright, M., Bruneel, J., Mahajan, A., (2014). Creating value in ecosystems: crossing the chasm between knowledge and business ecosystems. *Res. Policy* 43, 1164–1176.

- Dubois, A. and Gadde, L.E. (2002), "Systematic combining: an abductive approach to case research", *Journal of Business Research*, Vol. 55 No. 7, pp. 553-560.
- Frigant V., Layan JB. (2009) Modular production and the new division of labour within Europe : the perspective of French automotive parts suppliers, *European Urban and Regional Studies*, Vol.16, n°1, 11-25
- Galbraith, J.R. (1973), *Designing Complex Organizations*, Addison Wesley Publishing.
- Giuliani, E., Arza, V. (2009). "What drives the formation of 'valuable' university-industry linkages?: Insights from the wine industry," *Research Policy*, Elsevier, vol. 38(6), 906-921, July.
- Grant, R.M. (1996a), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17, pp. 109-122.
- Grant, R.M. (1996b), "Prospering in dynamically-competitive environments: organizational capability as knowledge integration", *Organization Science*, Vol. 7 No. 4, pp. 375-387.
- Huyghe, A., M Knockaert (2015) The influence of organizational culture and climate on entrepreneurial intentions among research scientists, *Journal of Technology Transfer*, 40 (1)138-160
- Järvi, K., Almpantopoulou, A., P Ritala (2018) Organization of knowledge ecosystems: Prefigurative and partial forms, *Research Policy*, vol.47, n.8.
- Matysiewicz, J. and Smyczek, S. (2013), "Knowledge creation in international scientific networks on example of NetAware intensive programme", *Equilibrium: Quarterly Journal of Economics and Economic Policy*, Vol. 8 No. 4, pp. 107-122.
- Meng, D., Li, X., Rong, K. (2019), "Industry-to-university knowledge transfer in ecosystem-based academic entrepreneurship: Case study of automotive dynamics & control group in Tsinghua University", *Technological Forecasting and Social Change*, Volume 141, Pages 249-262.
- Morandi, V. (2013), "The management of industry-university joint research projects: how do partners coordinate and control R&D activities?", *Journal of Technology Transfer*, 38:69-92.
- Perkmann, M. and Walsh, K. (2007), "University-industry relationships and open innovation: Towards a research agenda", *International Journal of Management Reviews*, Vol. 9, pp.259-280.
- Pezzillo Iacono, M., Esposito, V. and Berni, A. (2013), "Temporary project network and innovation: a research on Italian regional wine industry", *International Journal of Managing Projects in Business*, Vol. 6 No. 2, pp. 274-292.
- Rajalo, S., Vadi, M. 2017. University-Industry Innovation Collaboration: Reconceptualization. *Technovation*, 62–63(April): 42–54
- Rasiah, R., Govindaraju, C. (2009), 'Industry-university linkages in the automotive, biotechnology and electronics sectors in Malaysia', in *Promoting Effective Modes of University-Industry Interaction and their Evolution for Economic Catch-up in Asia*, eds. Lee et al., Seoul: East Asia Institute, pp. 71–97.
- Rigby, J.,J. Edler (2005) Peering inside research networks: some observations on the effect of the intensity of collaboration on the variability of research quality, *Res. Pol.*, 34 (6), 784-794
- Santoro, M.D., Chakrabarti, Alok K. (2002) Firm size and technology centrality in industry-university interactions, *Research Policy*, vol.31 n.7
- Santoro, M. D., Bierly III, P. E. (2006). Facilitators of knowledge transfer in University- Industry Collaborations: A Knowledge-based perspective, *IEEE Transactions on Engineering Management*, 53 (4), 495 – 507.
- Schartinger, D., Rammera, C., Fischer, M.M. and Fröhlich, J. (2002), "Knowledge interactions between universities and industry in Austria: sectoral patterns and determinants", *Research Policy*, Vol. 31, pp. 303-328.

- Steinmo, M. T., Rasmussen, E. (2015). How firms collaborate with public research organizations: the evolution of proximity dimensions in successful innovation projects. *Journal of Business Research*, 69(3), 1250-1259.
- Valkokari, K. (2015) Business, innovation, and knowledge ecosystems: how they differ and how to survive and thrive within them, *Technol. Innov. Manage. Rev.*, 5 (8) (2015), 7-24.
- Van de Ven, A. H., Delbecq, A. L., & Koenig, R. (1976). Determinants of Coordination Modes within Organizations. *American Sociological Review*, 41(2), 322-338.
- Van Maanen, J., Sorensen, J.B. and Mitchell, T.R. (2007), "The interplay between theory and method", *Academy of Management Review*, Vol. 32 No. 4, pp. 1145-1154.
- Winter, S.G. (1986), "The research program of the behavioral theory of the firm: orthodox critique and evolutionary perspective" in Gilad, B. and Kaish, S. (Eds), *Handbook of Behavioral Economics*, JAI Press, Greenwich, CT, pp. 151-188.
- Würmseher, M. 2017. To each his own: Matching different entrepreneurial models to the academic scientist's individual needs. *Technovation*, 59 (January): 1-17
- Yin, R.K. (2003), *Case Study Research: Design and Methods*, 3rd ed., Sage Publications, Beverly Hills, CA.

Organizational Hybridity and Fluidity: Possibilities and Challenges for Knowledge Management

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Abstract

Hybridity and organizational fluidity are theoretical approaches that are increasingly challenging our thinking about management. These phenomena blur the previously clear institutional boundaries separating professions and organizational entities and will inevitably have implications for intellectual capital (IC) management as well as knowledge management (KM) more broadly. However, there has been little discussion about these implications, despite the practice of KM, and management more generally, have evolved and changed rapidly during the last decades. This paper embarks on a journey to weave connections to the theoretical discussions on hybridity and fluidity as a purpose of analysing their possible implications on management and especially managing knowledge. The research question this paper provides perspectives to is whether and how knowledge management approaches need to be adjusted to maintain their managerial relevance also when organizational environment gets hybrid and fluid. The main contribution of the paper lies in the recognition of avenues for future research in the areas of intellectual capital management and knowledge management.

Keywords – hybridity; hybrid governance; fluid organizations; knowledge; data

Paper type – Academic Research Paper

1 Introduction

Organization theorists and management scholars have been increasingly interested in hybrid organizations, hybrid governance and hybridity more generally (cf. Hansmann, 1996; Thynne, 2011; Kreps and Monin, 2011; Reay and Hinings, 2009; Pache and Santos, 2013; Ebrahim et al., 2014). Along with hybridity, organizational fluidity challenges

traditional ways of thinking about organizations (Schreyögg and Sydow, 2010). In this paper, we consider hybridity as an external, system-level characteristic and fluidity as an internal organizational feature. The underlying assumption of the paper is that these two theoretical viewpoints bring along new perspectives also to the discussions of knowledge management. Indeed, the paper aims to elaborate some of those forces that in authors' view require new kind of thinking from the knowledge management scholars in the specific context of hybridity and organizational fluidity.

In this paper, knowledge management (KM) refers to identifying and leveraging the collective knowledge in an organization to help the organization compete (von Krogh, 1998). KM involves processes such as creating, storing, transferring, and applying knowledge (Alavi and Leidner, 2001). Most importantly, knowledge management is aimed at improving an organization's overall performance (Wiig, 1997; Kalling, 2003). Knowledge management has a two-fold role in supporting performance improvement (Laihonen et al., 2015). First, knowledge assets and their management lay the foundation for competitive advantage (Grant, 1996; Sveiby, 1997; Seetharaman et al., 2002). Second, information management cycle enables efficient decision-making (Choo, 1996). This paper argues that hybridity and organizational fluidity change both the ways how valuable knowledge resources are defined and managed and what information is considered important. The results of the paper show that when the strict control relationships between the actors are missing, a need for knowledge governance arises (e.g. Peltokorpi, and Tsuyuki, 2007; Foss, 2007) to support what we have traditionally called knowledge management as an organizational function.

The paper is organized into four main sections. After the introduction, the key concepts of hybridity and organizational fluidity are defined in section two. Then, section three discusses these concepts in relation to knowledge management and recognizes some of the KM areas that on authors' view need special attention in the context of hybridity and organizational fluidity. In this phase, we are not taking a position whether they are pros or cons but that this question will provide many interesting discussion areas for future research. Finally, section four summarizes the discussion and presents some concluding remarks.

2 Hybridity and organizational fluidity

2.1. Hybridity

Hybridity has been approached from the viewpoints of institutional economics, which approaches them from the perspective of governance structures, and sees hybrids between hierarchies and markets (e.g. Powell, 1990; Williamson, 1975; Stark, 2009). For public administration theory hybridity refers to "ambiguous types of social organizing and manifests itself in institutional settings where public and private organizations operate according to public interest" (Johanson and Vakkuri, 2017). Battilana and Dorado (2010) define hybrid organizations as "organizations that combine institutional logics in unprecedented ways". According to Johanson and Vakkuri (2017) hybridity covers

situations of: 1) mixed ownership, 2) goal incongruence and competing institutional logics, 3) multiplicity of funding arrangements, and 4) public and private forms of financial and social control. Thus, in hybrids actors from diverse policy sectors with different governance modes come together to attain common goals and outcomes.

The overlapping and coexisting governance modes and especially their implications on managing knowledge make hybridity interesting from the knowledge management perspective, (cf. Lowndes and Skelcher, 1998). The central challenge both in theory and in practice lies in the unit of analysis. Whereas knowledge management literature focuses primarily to an individual organization and its objectives and business strategy (e.g., Zack, 1999; Laihonen and Mäntylä, 2018), the hybrid governance literature acknowledges the presence of goal incongruence, competing institutional logics and different forms of management control. In the latter case, the unit of analysis needs to be on the hybrid arrangement not only on an individual organization and its objectives and knowledge needs.

What becomes evident from the hybrid governance literature is that ambiguity of objectives seems to be intrinsic for a hybrid organization. In addition, hybrid governance like network governance more generally seems to rely and build on trust, mutuality and shared identity (cf. Parker, 2007). The network literature has also shown that seamless knowledge flow and shared measurement information are important determinants creating trust and commitment (Laihonen, 2012; D'Aunno et al., 2018). Therefore, it can be derived that shared knowledge base and efficient knowledge management are important performance drivers for hybrid organizations and thereby lay in the core of hybrid governance.

2.2. Organizational fluidity

Organizational fluidity refers to the increasing flexibility and dynamism and the decreasing importance of organizational boundaries, structure, and processes (Järvi, Almpantopoulou, & Ritala, 2018; Kellogg, Orlikowski, & Yates, 2006; Schreyögg & Sydow, 2010). Research suggests that the organizations are becoming more fluid to survive and thrive in the current increasingly dynamic and complex environment. Schreyögg and Sydow (2010) describe the characteristics of fluid organizations: “from hierarchies to networks, from formal programs and coordination rules to spontaneous interaction, from specialized departments and staff units to improvised processes and temporary project teams, and from vertical lines of command to lateral organization-wide communication.” Further, fluid organizations focus rather on diversity than similarity and seek speed and adaptability.

Knowledge management is at the core of what makes an organization fluid. Organizations that operate in a knowledge-based domain have two major functions. They must learn about the environment surrounding them and use this knowledge to provide value to their customers and stakeholders. These two functions, exploration and exploitation, constitute *organizational learning* (March, 1991). In a turbulent environment, the loop between exploration and exploitation must be short both in terms of organizational distance and time.

In fluid organizations, exploration and exploitation can be organized in two different ways (Schreyögg and Sydow, 2010). The first option is to dedicate organizational units to either explore or exploit. Alternatively, each individual member in an organization is expected to both explore and exploit. This dual capability is referred to as *ambidexterity* (Gupta, Smith and Shalley, 2006). While Schreyögg and Sydow (2010) conclude that ambidexterity at individual level is the optimal way to operate, Eisenhardt and Furr (2010) among others suggest a more fine-grained view to organizations that balance between efficiency and flexibility.

In knowledge-intensive organizations, information technology provides a medium for knowledge management practices and also everyday communication and interactions. Literature perceives IT as a mechanism that gives rise to organizational fluidity (Chatterjee, Sarker and Siponen, 2017). Moreover, research even suggests that information technology enables the operation of improvisational capability as the “third hand” for organizations and individuals (Pavlou and El Sawy, 2010). Radical adoption of mobile technology enables full-fledged distributed work and moves the knowledge worker to a continuous liminal state “between and betwixt” space, time, tasks, and technology (Stein, Jensen, Hekkala, 2015).

3 Hybridity, fluidity and knowledge management

In hybrid context, actors are dependent on each other’s resources in a similar manner like in networks (cf. Powell, 1990). This pooling of resources, and especially knowledge assets and decision-making information, lies in the essence of hybrid governance. However, the majority of knowledge management literature focuses on organizations and has ignored the linkages between knowledge and governance (Peltokorpi, and Tsuyuki, 2007; Eisenhardt and Santos, 2002). In this paper, we take this argument on weak linkages as an indication of the extensive focus on entities where the characteristics of hybridity or fluidity have not induced a need to focus on wider governance issues. Governance here refers to “a set of organizational mechanisms and informal practices fostering the knowledge contributions of firm members” (Peltokorpi, and Tsuyuki, 2007).

Following the above, it is argued here that the main emphasis of KM is on organization-specific knowledge, which is being acquired and gathered for the purposes of organization’s business objectives and performance management. Further, many KM models and related managerial heuristics oversimplify the world and do not recognize or consider situations where different institutional logics and forms of financial and social control come together. Similar problems relate to understanding and harnessing organizational fluidity. Inability of KM to recognize these phenomena may well be due to the weak linkage between knowledge and governance. From the hybrid governance perspective, this may mean that regarding KM, organizations within a hybrid may apply very different approaches, which makes it difficult for them to understand each other’s and define shared objectives as well as measure and report performance in a coherent way. Within a hybrid, organization-specific information can only provide a partial picture of the phenomena and may lead to sub-optimal solutions. Therefore, we call for a careful

analysis not only on hybridity as such but also the ways that hybrids understand, conceptualize and define their performance and information they base their decision-making on.

From the theoretical viewpoint, majority of knowledge management studies follow the theoretical foundations of resource-based view (Barney, 1991) and knowledge-based view (Grant, 1996; Spender, 1996). These put their emphasis on the organizational entity (firm), which is not a sufficient approach in hybrid context where actors operate in inter-organizational arrangements with different institutional logics, and where perceptions of value and performance may differ significantly. Value creation in hybrids may even call for a reconsideration of organizational boundaries. Kunttu (2017) and Santos and Eisenhardt (2005) present four distinct conceptions of organizational boundaries that each lead to different theoretical explanations of the boundary setting. Thus, each of them also leads to very different questions and expectations for knowledge management. Table 1 brings together the discussion on organizational boundaries and knowledge management.

Table 8. Organizational boundaries and knowledge management (original discussion on organizational boundaries presented by Kunttu (2017) and Santos and Eisenhardt (2005)).

	Theoretical roots	Examples of knowledge management questions in hybrids
Efficiency	Efficiency and transaction cost economy: "The boundaries should be set at the point that minimizes the cost of governing activities."	What are the costs of the new approach compared to the traditional one? Do we even know what are the costs of KM in the traditional model? How are these costs allocated in hybrids?
Power	Resource dependence and industrial organization: "Organizational boundaries should be set at the point that maximizes strategic control over crucial external forces and critical external dependencies."	Who has power over others in hybrids? Who is a legitimate actor? Who has the authority to define objectives and roles? Who is accountable for these decisions? Who defines critical knowledge? Who evaluates the risks and solves issues of data security?
Competence	Contingency theory and resource-based view: "Organizational boundaries should be set at the point that maximizes the value of the firm's resource portfolio."	What kind of competences are needed in the new world? What competences are specific to hybrids and how they differ from the traditional model? What is the value of partner's competences?
Identity	Managerial cognition and organizational identity: "Boundaries are set to achieve coherence between the identity of the organization and its activities."	How is organizational identity composed if organization boundaries get blurred and are continuously redrawn? How to solve principal-agent problems? Where are the boundaries of knowledge governance? Whose knowledge? How managers shape their actions and interpretations of the world? How values and norms are constituted?

A fluid organization that operates on digital technology and information systems both disrupts management practices and introduces new management capabilities. The disruptive aspects circle around the increasing autonomy of individual actors. The management practices that scholars (e.g., Schreyögg and Sydow, 2010) propose for fluid organizations are based on monitoring and variations of enacted sensemaking (cf., Bendoly, 2016; Weick, Sutcliffe and Obstfeld, 2005). That is, the individuals are permitted to operate autonomously and the management intervenes when they identify a behavioral pattern that insists on doing so. From a critical viewpoint ubiquitous monitoring can be perceived as panopticon-like control mechanism, inviting further research on balanced management activities (Leclercq-Vandelannoitte, Isaac and Kalika, 2014; Leclercq-Vandelannoitte, 2017). From knowledge management viewpoint, we observe fluid organizations as social structures (Borgatti and Foster, 2003; Lee and Hassard, 1999) of interconnected, ambidextrous, and autonomous individuals. Moreover, we subscribe to Ashcraft, Kuhn and Cooren (2009) in that organizations are fundamentally constituted through communication (cf. Putnam, Nicotera and McPhee, 2009).

The increased autonomy of individuals combined with the diminishing importance of the organizational envelope implies that the mechanisms that drive the formation of social networks in general come into play. The two such core mechanism are homophily and triadic closure. The homophily bias implies that forming a new connection between two individuals is more likely the more similar the individuals are—“birds of a feather flock together” (McPherson, Smith-Lovin and Cook, 2001). Triadic closure means that new connections are more likely to form among between actors that share a *strong tie*, i.e., among friends of friends (Granovetter, 1973).

When these two mechanisms unfold in unison over a period of time, the organizational social structure takes the shape of a mycelium of homogenic social groups (Kossinets and Watts, 2009), often referred to as echo chambers or silos, that connect to each other through *weak ties* (cf. Granovetter, 1973). A significant body of literature explores the importance of weak ties as potential sources of novel information (Aral, 2016). However, both strong and weak ties have their role in facilitating the flow of information within and between organizations (Aral and Van Alstyne, 2011). Professional social matching is a new academic endeavor that seeks to take advantage of the accumulating digital data and the growing importance of information technology in steering the evolution of the organizational social structure toward a beneficial direction (Olsson, Huhtamäki and Kärkkäinen, 2019). We look forward to future social matching research and development that seeks to balance diversity (weak ties) and bandwidth (strong ties) (cf. Aral and Van Alstyne, 2011).

Another interesting stream of literature from the viewpoint of this paper deals with knowledge governance (e.g. Choi, Cheng, Hilton and Russell, 2005; Foss, 2007; Zyngier and Venkitachalam, 2011; Schroeder et al., 2012; Zyngier and Burstein, 2012). This is despite the fact that its focus is in many cases narrower and focuses on governing knowledge management initiatives within an organization. However, this literature considers also the linkage between knowledge and governance as discussed in this paper.

Knowledge governance refers to choosing structures and mechanisms that can influence the processes of sharing and creating knowledge (Foss, 2007). This literature considers governance as “the distribution of decision making rights and responsibilities and the procedures and mechanisms for making and monitoring strategic decisions” (Schroeder et al., 2012; Peterson, 2004).

Considering the characteristics of hybridity and organizational fluidity, it seems inevitable that different knowledge systems will collide and new tools and methods are needed in finding a satisfying mix of governance modes, ways of organizing and knowledge management approaches. What this paper aims to postulate is that in many cases these are not primarily knowledge management discussions. Knowledge governance and integration of knowledge systems is required but before that, there are many questions to be solved that are in the hands of knowledge managers. Indeed, we believe that it is of critical importance to strengthen the link between knowledge and governance as stated by Peltokorpi, and Tsuyuki (2007). At the same time, we still believe that knowledge management can help in building a common ground for performance dialogue also in hybrid and fluid contexts (cf. Laihonon and Mäntylä, 2017; Rajala et al., 2018) if actors are willing to participate and trust each other’s enough to share their experiences and interpretations.

In addition to theoretical considerations, we believe that hybridity and organizational fluidity will also require new methods for collecting, storing, integrating and analysing data. Recently there has been significant advances in this area and many approaches are available to model hybrid systems, their structures and dynamics. Some examples of these methods are computational network analysis (Huhtamäki et al., 2015), system dynamics modelling, agent-based modelling and various machine learning approaches. To support quantitative data analytics, information visualization and visual analytics allow sense-making and storytelling, that is, gaining insights on the data and in sharing the findings (Bendoly, 2016; Bendoly and Clark, 2017; Russell et al., 2015).

4 Conclusions

The paper discussed the future of knowledge management in the specific contexts of hybridity and organizational fluidity. The aim was to recognize areas where knowledge management theory and practice needs to be re-thought. The underlying argument is that in order to develop knowledge management to better support organizational activities in these contexts we need to first understand how these phenomena change our perceptions of organizational life and then develop common ground for such knowledge management strategies and practices that would benefit all actors. We believe that this necessitates a dialogic approach and can only succeed when a mutual understanding of the shared benefits and value can be found and when a shared knowledge can be constructed to enable and support this dialogue. The presented discussion can be summarized into three arguments that provide a starting point advancing our understanding on KM and novel organization forms:

- ✓ Knowledge management for hybrid governance and fluid organizational structures require a wider theoretical standpoint than the dominant knowledge-based view.
- ✓ The essence of knowledge management in the given contexts lies in the dialogic interaction between actors as well as on recognition of mutual benefits.
- ✓ New methods and data are needed to understand and model value creation in hybrid and fluid arrangement.

The paper contributes to the knowledge management literature by opening a discussion about two timely phenomena that on authors view challenge both knowledge management theory and practice. We see a significant role for knowledge management in building organizational success in the future but also believe that hybridity and organizational fluidity will increase and require changes in how knowledge management is perceived. In our the role of knowledge management is no only technological but far more profound, which calls for a careful analysis of the organizational context where KM is to applied.

References

- Aral, S. (2016) "The future of weak ties", *American Journal of Sociology*, Vol. 121 No. 6, pp. 1931-1939.
- Aral, S. & Van Alstyne, M. (2011) "The diversity-bandwidth trade-off", *American Journal of Sociology*, Vol. 117 No. 1, pp. 90-171.
- Alavi, M. and Leidner, D. (2001) "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues", *MIS Quarterly*, Vol. 25, No. 1, pp 107-136.
- Bendoly, E. (2016). Fit, Bias and Enacted Sensemaking in Data visualization: Frameworks for Continuous Development in Operations and Supply Chain Management Analytics. *Journal of Business Logistics*, 37(1), 6–17.
- Bendoly, E., & Clark, S. (Eds.). (2017). *Visual Analytics for Management: Translational Science and Applications in Practice*. New York, New York, USA: Taylor & Francis / Routledge.
- Chatterjee, S., Sarker, S., & Siponen, M. (2017). How Do Mobile ICTs Enable Organizational Fluidity : Toward a Theoretical Framework. *Information and Management*, 54 (1), 1-13. doi:10.1016/j.im.2016.03.007
- Choi, C.J., Cheng, P., Hilton, B and Russell, E. (2005) "Knowledge governance", *Journal of Knowledge Management*, Vol. 9, No. 6, pp 67-75.
- Choo, C. (1996). "The Knowing Organization: How Organizations Use Information to Construct Meaning, Create Knowledge and Make Decisions." *International Journal of Information Management* 16(5): 329–340.
- Ebrahim, A., Battilana, J. and Mair, J. (2014) "The governance of social enterprises: Mission drift and accountability challenges in hybrid organizations", *Research in Organizational Behavior*, Vol. 34, pp 81–100.-
- Eisenhardt, K M. (1989) "Agency theory: An assessment and review", *Academy of Management Review*, Vol. 14, pp 57-74.
- Foss, N.J. (2007) "The emerging knowledge governance approach: challenges and characteristics", *Organization*, Vol. 14, No. 1, pp 29-52.

- Gupta, A. K., Smith, K. G., & Shalley, C. E. (2006). The Interplay between Exploration and Exploitation. *The Academy of Management Journal*, 49(4), 693–706. <http://doi.org/10.2307/20159793>
- Granovetter, M. (1973) “The strength of weak ties”, *American Journal of Sociology*, Vol. 78 No. 6, pp. 1360–1380.
- Grant, R. M. (1996). “Toward a Knowledge-Based Theory of the Firm”. *Strategic Management Journal*, 17, 109-122.
- Hansmann, H. (1996) *The Ownership of Enterprise*. Cambridge, Mass: The Belknap Press of Harvard University Press.
- Johanson, J-E and Vakkuri, J. (2017) *Governing hybrid organisations. Exploring diversity of institutional life*. New York/London: Routledge.
- Järvi, K., Almpapoulou, A. and Ritala, P. (2018). “Organization of knowledge ecosystems: Prefigurative and partial forms”, *Research Policy*, Vol. 47, No. 8, pp. 1523–1537.
- Kalling, T. (2003) “Organization-Internal Transfer of Knowledge and the Role of Motivation: A Qualitative Case Study”, *Knowledge and Process Management*, Vol. 10, No. 2, pp 115-126.
- Kellogg, K. C., Orlowski, W. J. and Yates, J. (2006) “Life in the Trading Zone: Structuring Coordination across Boundaries in Postbureaucratic Organizations”, *Organization Science*, Vol. 17, No. 1, pp. 22–44. doi: 10.2307/25146011.
- Kossinets, G. and Watts, D.J. (2009) “Origins of homophily in an evolving social network”, *American Journal of Sociology*, Vol. 11 No. 2, pp. 405-450.
- Kreps, T.A. & Benoît, M. (2011) “Doing Well by Doing Good”? Ambivalent Moral Framing in Organizations, *Research in Organizational Behavior*, Vol. 31, pp 99-123.
- Laihonon, H., Lönnqvist, A. and Metsälä, J. (2015), “Two knowledge perspectives to growth management”, *VINE: Special Issue on Knowledge Strategies*, Vol. 45 No. 4, pp. 473-494.
- Leclercq-Vandelannoitte, A., Isaac, H., & Kalika, M. (2014). Mobile information systems and organisational control: beyond the panopticon metaphor? *European Journal of Information Systems*, 23(5), 543–557. <http://doi.org/10.1057/ejis.2014.11>
- Leclercq-Vandelannoitte, A. (2017). An Ethical Perspective on Emerging Forms of Ubiquitous IT-Based Control. *Journal of Business Ethics*, 142(1), 139–154. <http://doi.org/10.1007/s10551-015-2708-z>
- March, J. G. (1991). Exploration and Exploitation in Organizational Learning. *Organization Science*, 2(1), 71–87. <http://doi.org/10.1287/orsc.2.1.71>
- McPherson, M., Smith-Lovin, L. and Cook, J.M: (2001) “Birds of a feather: Homophily in social networks”. *Annual Review of Sociology*, Vol. 27. No. 1, pp. 415-444.
- Olsson, T., Huhtamäki, J., & Kärkkäinen, H. (2019). Directions for Professional Social Matching Systems. *Communications of the ACM*. In Press.
- Pache, A-C & Santos, F. (2013) “Inside the Hybrid Organization: Selective Coupling as a Response to Competing Institutional Logics”, *Academy of Management Review*, Vol. 56, No. 4, pp 972–1001.
- Pavlou, P. A., and El Sawy, O. A. 2010. “The ‘Third Hand’: IT-Enabled Competitive Advantage in Turbulence through Improvisational Capabilities,” *Information Systems Research* (21:3), pp. 443-471
- Peltokorpi, V. and Tsuyuki, E. (2007) "Organizational governance in internal hybrids: a case study of Maekawa Manufacturing Ltd", *Corporate Governance: The international journal of business in society*, Vol. 7 Issue: 2, pp.123-135, <https://doi.org/10.1108/14720700710739778>
- Peterson, R.R. (2004) “Crafting information technology governance”, *Information Systems Management*, Vol. 21, No. 4, pp 7-21.
- Powell, W.W. (1990) “Neither market nor hierarchy: network forms of organization”, *Research in Organizational Behavior*, Vol. 12, pp 295-336.

- Reay, T. & Hinings, C.R. (2009) "Managing the Rivalry of Competing Institutional Logics", *Organization Studies*, Vol. 30, No. 6, pp 629-652.
- Russell, M. G., Huhtamäki, J., Still, K., Rubens, N., & Basole, R. C. (2015). Relational Capital for Shared Vision in Innovation Ecosystems. *Triple Helix: A Journal of University-Industry-Government Innovation and Entrepreneurship*, 2(1), 36. <http://doi.org/10.1186/s40604-015-0017-2>
- Schreyögg, V. and Sydow, J. (2010) "Organizing for Fluidity? Dilemmas of New Organizational Forms", *Organization Science*, Vol. 21, No. 6, pp. 1251–62. doi:10.1287/orsc.1100.0561.
- Schroeder, A., Pauleen, D., Huff, S. (2012) "KM governance: the mechanisms for guiding and controlling KM programs", *Journal of Knowledge Management*, Vol. 16, No. 1, pp 3-21.
- Seetharaman, A., Sooria, H. and Saravanan, A.S., (2002) "Intellectual Capital Accounting and Reporting in The Knowledge Economy", *Journal of Intellectual Capital*, Vol. 3, no. 2, pp.128–148.
- Stark, D. (2009) *The sense of dissonance: accounts of worth in economic life*. Princeton: Princeton University Press.
- Stein, M.-K., Jensen, T., & Hekkala, R. (2015). Comfortably 'Betwixt and Between'? Delimiting and Blending Space, Time, Tasks and Technology at Work. *Proceedings of International Conference on Information Systems 2015*, 19. Retrieved from <https://aisel.aisnet.org/icis2015/proceedings/GeneralIS/2>
- Sveiby, K-E. (1997) *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*, San Francisco: Berrett-Koehler.
- Thynne, I. (2011) "Ownership as an Instrument of Policy and Understanding in the Public Sphere: Trends and Research Agenda", *Policy Studies*, Vol. 32, No. 3, pp 183-197.
- Von Krogh, G. (1998). "Care in Knowledge Creation", *California Management Review*, Vol. 40, No. 3, pp 133-153.
- Wiig, K.M. (1997) "Knowledge Management: An Introduction and Perspective", *Journal of Knowledge Management*, Vol. 1, No. 1, pp 6-14.
- Williamson, O.E. (1975) *The economic institutions of capitalism*. New York: Free Press.
- Zyngier, S. and Burstein, F. (2012) "Knowledge management governance: the road to continuous benefits realizations", *Journal of Information Technology*, Vol. 27, pp 140-155.
- Zyngier, S. and Venkitachalam, K. (2011) "Knowledge management governance – a strategic driver", *Knowledge management research & practice*, Vol. 9, pp 136-150.

The Influence of Endogenous and Exogenous Factors on Innovative Performances: Implication for Start-Ups

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Abstract

Despite the extensive literature on the start-up, an understanding of the main factors influencing innovative performances is still lacking. Our research adds to these previous works by conducting a literature review of the main factors that intervene, at multiple levels, to improve or reduce start-up performances. The study is based on a comparison of 133 articles in the innovation management field and follow the Tranfield methodology. Results highlights a multilevel nature of the various factors that affect start-up performances. The first level explores the main factors affecting performances within the organizational boundaries (Firm Level). The other three levels (Network, Competitive, Macro environment) show that the external environment can positively or negatively affects start-ups performances. The review reveals differences among the solutions adopted in each level summarizing the current state of affairs.

Keywords – start-up; innovative performance; influencing factors; endogenous variable, exogenous variable.

Paper type – Academic Research Paper

1 Introduction

Literature on innovativeness demonstrates contrasting scenarios. Several studies suggest a positive link between innovativeness and firm survival. Innovativeness can enhance firms' market power (Schumpeter, 1934), can improve the ability to escape competition (Porter, 1990), can reduce production costs (Cohen and Klepper, 1996a, 1996b), can support dynamic capabilities (Teece et al., 1997), and can lead to enhanced absorptive capacity (Zahra and George, 2002). In other cases, less linear start-up processes, (Samuelsson and Davidsson, 2009) or more skewed returns (Scherer and Harhoff, 2000) can generate a negative link. This shows us the key role of innovation in supporting not only firms survival but mainly their performances improvement (Damanpour 1991; Smith et al. 2005). The academic literature has a long history of struggling with regards to the measurement of the performance, and in particular with regards to the innovative performance of companies (Freeman and Soete, 1997; Griliches 1998; Ernst, 2001;), even if the results of this studies have not yet led to a common view of the typologies of indicators nor a to common way to use them. While much importance has been given to the study of performances measurement, still unexplored fields remains, especially those concerning the key factors influencing firms innovative performances. Most of the literature studies have focused on the analysis of indicators: some have analyzed single indicator (R&D, patents, patent citations, or new product announcements) arguing that the specific indicator that is applied has fewer shortcomings than the other indicators; other studies used two or more indicators to generate a more complex construct. Instead, the research on factors influencing performance in new and small companies is extensive: some for example found that strategies affect industry conditions, the competitive environment, and the entrepreneur's background. Although these works provide a solid basis for understanding the dynamics of firm performance, an extensive analysis of all internal and external influencing factors is missing. Our research adds to these previous works by conducting a systematic review of contribution on the various factors that affect start-up innovative performances. Results reveals the multi-level nature of innovation, and the necessity to fully understand the determinants and dynamics of firms' innovative performance. In the next sections, we present the theoretical background and the methodological approach followed. Then, we provide an overview of key evidences regarding the main factors influencing start-up innovative performances.

2 Theoretical Background

Analysing the academic literature on innovation, it is possible to observe that start-ups play a key role in the generation of radical innovations. This depends of the small size and the absence of established market positions. (Utterback 1994; Henderson 1993; Chandy and Tellis 2000) and from the necessity to create something new starting from what already exists (Hargadon 2002; Lo Storto 2006; Weiss and Gangadharan 2010). Nonetheless, it is agreed that start-ups tend to lack, the skills and routines to assemble, organize, and monitor their resources (Katila and Shane 2005), the main assets to

generates profits (Teece 1986) and consequently the sufficient capital to finance innovation. For this reason is crucial for start-ups to pursue radical innovation and scholars have started examining under which circumstances the innovation performances are enhanced (De Man and Duysters 2005). A prevailing view in literature suggests a positive link between start-up performances and innovativeness. According to Rosenbusch et al. (2011), innovation is positively associated with start-up performance and this is explained through a detailed meta-analysis of the innovation–performance relationship among small and medium-sized enterprises (SMEs). Also, Song et al. (2008) report that a positive innovativeness–performance link is found in over two-thirds of the empirical studies they review. Both of these meta-analyses also find that the results may be context-dependent and heterogeneous; Strategy can also be considered as an influencing factor that affect performance outcomes (profitability, growth, or return on asset) contingent on industry conditions (McDougall and Robinson 1988; McDougall et al. 1994; Carter et al. 1994), environmental characteristics (Covin and Slevin 1989, 1990), the entrepreneur’s background (Stuart and Abetti 1988; Sandberg 1986; Feeser and Willard 1990). Results show that particular types of strategies impact a variety of performance outcomes—profitability (McDougall and Robinson 1990), survival (Cooper, Dunkelberg, and Woo 1988), growth (McDougall and Robinson 1988), and nonfinancial measures (Stuart and Abetti 1988). Other research studies, considered innovation as an effective strategy to boost organizational performance (Butler, 1988; Drucker, 1985), and an important mechanism for a business to keep itself informed of the outer competitive environment. Moreover, Subrahmanya (2005) defined innovation as a company applying new knowledge or key techniques to development, manufacturing, or service. Besides, according to the literature review on organizational innovation and organizational performance, there is a positive and significant correlation between the two (e.g., Chen and Chen, 2006; Damanpour et al., 2009; Eddleston et al., 2008; Liao and Rice, 2010; Naranjo-Gil, 2009; Subrahmanya, 2005; Yam et al., 2004). Another important aspect regards the role of venture capitals. Some studies examined the effects of venture capital financing and strategic alliances networks on startups’ performance, highlighting that, the lack of financial resources was the most limiting factor for the growth of startups. (Boeker, 1989; Churchill and Lewis, 1983). Also, inter-firm alliances, represents a key factor for the innovative performances growth and consequently the concept of geographical proximity; a factor that tend to facilitate knowledge exchange, particularly when knowledge is complex and has a strong tacit component (Lorenzen, 2007; Zucker et al., 2002). Several studies argued that the relevance of geographical proximity lies mainly in the fact that co-location favours the development of other types of proximity – social, cognitive, organisational – which may generate significant impact on firm performance (Breschi and Lissoni, 2001; Boschma, 2005; Torre and Rallet, 2005). Specific studies also focused on the importance of Intermediary Actors and the relative impact of firm performance. They argued that for medium to low innovative firms, there is a positive correlation between firms having access to tangible and intangible resources at the STFC and their performance, while with regards to highly innovative firms, having a business partnership with incubators or universities appears to be a positively correlation with firm

performance. Other studies, in this field, instead realized that, the creation of an incubator, or the presence of a University, per se, was not sufficient for improving performance (Patton et al. 2009) and that new firms needed specialized support, especially in soft skill areas (Hindle and Yencken 2004; Colombo and Grilli 2005). The above discussion indicates that performances measurement represents a key element for firm growth and improvement. Literature mainly focused on the firm performances analysis and description (Freeman and Soete, 1997; Griliches 1998; Ernst, 2001;) and on understanding specific dynamics that lead to possible improvements. Nevertheless, an understanding of the main exogenous or endogenous factors influencing start-up performances is still lacking. Our research adds to these previous works by conducting a systematic review of the literature, analyzing the various factors that intervene, at multiple levels, to improve or reduce start-up performances, identifying the key research element.

3 Methodology

In this section we describe the methodological approach used, considering that our goal is to collect all the contributions in the literature with specific reference to factors affecting Start-up innovative performances, with the final aims to identify areas of convergence and suggest opportunities for future research on the main influencing factors.

Procedure proposed by Tranfield et al. (2003) makes it possible to identify publications of interest to researchers and then to describe the choice of relevant publications and the preparation of the research report. This procedure is systematic, transparent and replicable, in fact it consists of a series of steps that help authors define the research objective and plan the way articles are retrieved and reported):

1. The term [start-up] was used as base of the research, then a list of keywords¹ based on our prior experience was discussed with a review panel of three experienced academics in the field of innovation management.
2. We conducted Boolean searches on several combinations of the keywords identified in step 1 and discussed them with the review panel. These searches included: [start-up* OR startup* AND innovat*], [start-up* OR startup* AND performance*], [start-up* OR startup* AND endogenous variable*], [start-up* OR startup* AND exogenous variable*],
3. The review was limited to non-invited peer-reviewed journal articles published up to October 2018 (inclusive), excluding working papers, editorials, research notes and commentaries, interviews, dissertation abstracts, books, book chapters and conference proceedings (Keupp et

¹ “Innovation”, “innovative”, “performance”, “endogenous variable”, “exogenous variable”.

al. 2012); we included journals listed in the “Management” and “Business” subject category of the ISI Web of Knowledge.

4. Then we take in consideration only journal with a five-year impact factor (or the current impact for journals established later than 2014) greater than the "aggregate impact factor" value¹, ensuring the inclusion of article significantly influential in the academic debate. This choice reduced the number of journal to 15 for a total of 211 articles.

The titles, abstracts and keywords of the 211 initial articles were reviewed following a path based on the relevance of the articles to the object of our analysis and therefore we have defined specific *exclusion criteria* (Meier 2011; Pittaway *et al.* 2004; Rashman *et al.* 2009; Wang and Chugh 2014). The selection process relied on the use of more formal decision criteria to cut the broad pool of the initial list as well as on authors’ reading and understanding of the literature through textual analysis (Bakker 2010). These criteria (see Tables 1) were discussed with the review panel and subsequently used to select the relevant publications.

Table 1: Exclusion Criteria

N.	Reason of exclusion
1	Articles concerning “technology transfer” through the use of models and theories.
2	Articles concerning conceptualisation of entrepreneurial ecosystem
3	Articles focusing only on performance firms
4	Articles concerning Venture Capital
5	Articles concerning organizational management
6	Articles concerning team entrepreneurial characteristics

Of the 211 papers reviewed, 78 papers were excluded because they did not match with the aim of our research, leaving

As reported in Figure 1, the articles resulting from this methodology were published between 1990 and 2018, with more than half (65%) published since 2012, highlighting the emergent nature of the topic.

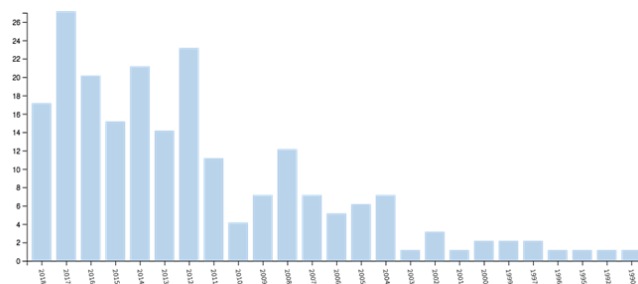


Figure 1 : Number of articles per year

¹ The aggregate impact factor is calculated by the ISI Web of Knowledge for each scientific category and takes into account the number of citations for and the number of articles of all the journals in the category. The value of the aggregate impact factor for the Business category was 2,557 and for Management was 2,393 in 2016.

Interestingly, examining the journals in which the sample articles were published reveals how widespread this topic is in the innovation management literature. Indeed, these articles appear in 15 different journals, mostly top-quality outlets such as Small Business Economics, Research Policy, Strategic Management Journal, Journal of technology transfer and Technovation (as reported in Figure 2).

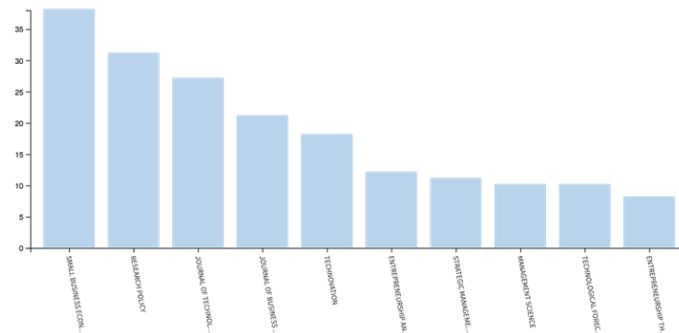
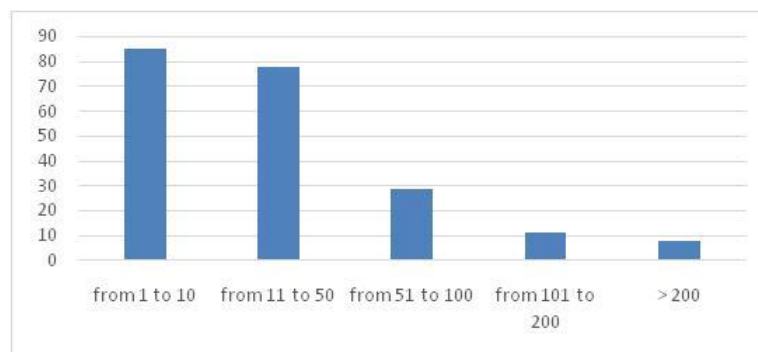


Figure 2 : Number of articles per journal

In addition, in order to highlight the impact of the topic, (Figure 3) depicts that the 51% of the sample articles received between the 50 and 100 citations.



4 Analysis of the main results

The systematic review highlights a multilevel nature of the various factors that affect start-up performances. Several authors, in their works emphasized and put in light, influences coming from firm boundaries. Some of them, considered the development of innovative entrepreneurship a significant factor for the success of a start-up (Li et al., 2018), and that innovation orientation and perceived personal control, positively affects managers' tendency to rely on interpersonal ties to gather knowledge (Schierjott et al., 2018).

Different forms of capital play a significant role in the innovation and performance of start-ups (Neubert et al., 2017). Also, companies launched by a team of founders are more

likely to succeed than companies launched by individuals, in terms of, organizational innovation and organizational performance (Huang et al., 2012),

Knowledge is recognized as a key factor for economic growth, especially if it is transformed into products and services (Mueller, 2007). Firms that seek to exploit opportunities based on existing market knowledge, are more likely to attain substantial growth (Saemundsson and Dahlstrand, 2005). The role of initial worker and job characteristics (e.g., qualification, age, number of employees, marginal employment) of start-ups can determine a variation of start-up performances (Koch et al., 2013; Held et al., 2018).

Among the challenges of a team, such as creating a new venture or solving a start-up problem, hires great importance the entrepreneurship education (Dutta and Folta, 2016; Backes-Gellner and Werner, 2007). In particular, ventures cannot ignore founding team composition and expect to later professionalize their top management teams to align with their strategy and environment (Eesley et al., 2014).

Other authors put in light influences coming from external environment with a focus on network, competitive land macro environment level. Business Incubator, for example, is considered a key asset to support the commercialization of laboratory research results of innovative new science and technology-based firms (M'Chirgui et al. 2018); The technical-financial support of an incubator has a positive influence on all levels of innovation activity in all regions (Xiao et al., 2018), but effects of incubation services on the initial growth of new technology-based businesses vary according to the local context (Xiao et al., 2017). Moreover, the collaboration between incubates and incubator management also has increased incubates financial knowledge and their likelihood of raising capital (Rubin et al., 2015). Some Authors considered strategic the alliance of spin-offs with other firms (Hagedoorn et al. 2018) in order to improve resource, knowledge and competence (Parida et al., 2017).

Also, the hybrid alliances, that combine exploration and exploitation activities, can lead synergies thus to improve alliance innovation performance (Colombo et al., 2015). Therefore, the high technology start-up's innovative capability and inter-firm network (Zheng et al., 2010) bring about competitive advantage, innovations, (Littunen et al., 2003) employment growth during the early life course of firms (Stam et al., 2009) and consequently, a growing complementary effect of innovative capability and network heterogeneity on firm valuation. (Zheng et al., 2010).

Others authors considered the role of universities, as generators and disseminators of valuable knowledge (Fischer et al., 2018) and the university-industry collaboration (Chang et al., 2017) as a key asset to enhance the capabilities/efficiencies of innovation systems and to the access to financial capital (Soetanto et al., 2015; Partanen et al., 2014).

Marketing skills, through design and product innovations (Dan, 2018; Chen, 2017), the combination of different knowledge and the use of entrepreneurial strategies (Miller and Le Breton-Miller, 2017), as well as the presence of corporate structural elements (Protogerou, 2017) are considered influencing factors for start-up performances. The use and implementation of information and communication technologies (ICT) in business

management have become increasingly crucial for the growth of competitive advantage in the market (Steinfeld et al;2010).

Venture capitals are considered important factors for the financing of the knowledge-intensive enterprises (Rossi et al. 2017), creating value for the investing firms in terms of growth (Bertoni et al.,2011; Chang, ,2004).

Investors have realized that the economy of culture exists and is a field of innovation, which allows start-ups to develop a certain ability to innovate their business and management processes, making them attractive to investors (Wolf, 2012).

An important step for a start-up that operates in the innovation ecosystem is to be listed on the stock exchanges (Parhankangas, 2012). In the field of external funding, some authors point out that governmental venture capital investors (GVCs) stimulate invention and innovation and that the GVC are an ineffective substitute, but an effective complement, of IVCs (Bertoni et al.;2013). Moreover, the social capital of venture capitalists (VCs) had positive effect on the funding of start-ups, allowing superior access to information about investment objects and opportunities to leverage them in the future (Alexy et al.;2012).

Others initiatives that may contribute to the growth of a start-up in terms of profit, survival and reputation are the so-called M&A transactions (Yim, Hyung Rok;2008); but the key to economic development are the new technology ventures, which could rejuvenate industries with disruptive technologies (Song et al.;2008). Therefore, investing in an equity fund involves implicit risks and for these reasons some authors consider investment, in an arbitrage strategy on M & A transactions, as a strategic alternative (Anokhin et al;2014).

Patents and trademark have the function of facilitating relations with external partners in order to acquire financing, ensuring an increase in attractiveness for investors (Maresch et al.,2016; Block et al.,2014). To support the development of innovative products in addition to venture capital there are other forms of alternative finance for start-ups, in particular, the reward-based crowdfunding, which ignites professional investors' interest, helping secure subsequent funding (Roma et al.;2017).

The new industrial policies of governments encourage companies to invest resources in production inventions, through subsidies (Dai et al.,2015), which include access to non-financial resources (networks, business knowledge) and the reduction of administrative burdens(Patzelt et al.; 2009), improving the competitiveness of the country system.

Among the public initiatives to support of the competitiveness and successful of start-ups, some authors considered programs for technological innovation to provide indirect support, improving investment efficiency on R&D (Jun et al.,2017; Soderblom et al.,2015), as well as the international research joint ventures and their positive impact on technological assets of participants (Barajas et al.,2016). In the field of academic research, the spin-offs (RSOs)-enterprises originating from a university or research institute-appear to have higher innovative potential and capabilities than other start-ups, pursuing several business models (Lejpra,2014; Clausen and Rasmussen,2013).

5 Conclusions

The results of the analysis points out that the majority of the studies have focused on the analysis of indicators: some have analyzed single indicator, other studies used two or more indicators to generate a more complex construct.

Analyzing them in detail, however, it emerges that these indicators are strongly influenced by dynamics that operates in different way: improving the innovative performances of a start-up is the result of a set of determinants operating at different levels of analysis (Figure 4).

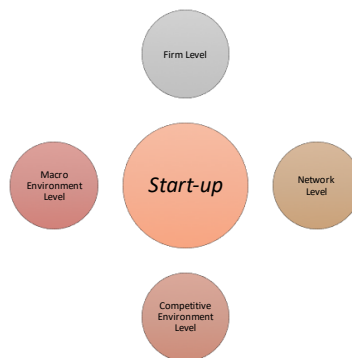


Figure 4: Different Levels of influence

A specific group of authors, in their works emphasized and put in light, influences coming from firm boundaries that we can call “Firm Level”.

Another set of authors put in light influences coming from external environment. This environment refers to a set of values, rules, norms, connection, relations (Edquist and Johnson, 1997) and to differences in institutional endowments (Hart, 2009) that separately or in combination can affect the growth of a company. In particular, it is possible to identify a level of influence related to factors such incubators, alliances, collaborations that we can call “Network Level”; other level that includes influencing factors as barriers, competitors, economy of scale/scope (Competitive Environment Level), and a last level that explores the influencing factors as Political, economic, social, technological, environmental, legal (Macro Environment Level).

References

- Adams, R., Bessant, J. and Phelps, R. (2006). Innovation management measurement: a review. *International Journal of Management Reviews*, **8**, pp. 21–47.
- Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S. and Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: a scheme of analysis, *Research Policy*, **37** (3), pp.407–429.
- Boeker, W., (1989). Strategic change: the effects of founding and history. *The Academy of Management Journal*, **32**, pp. 489–515.

- Butler, J.E., (1988). Theories of technological innovation as useful tools for corporate strategy. *Strategic Management Journal* **9** (1), pp. 15–29.
- Carter, N., Stearns, T.M., Reynolds, P.D., and Miller, B.A. (1994). New venture strategies: Theory development with an empirical base. *Strategic Management Journal* **15**(1), pp. 21–42.
- Chandy, R. K., & Tellis, G. J. (2000). The incumbent's Curse? Incumbency, size, and radical product innovation. *Journal of Marketing*, **64**(3), pp. 1–17.
- Chen, M.Y., Chen, A.P., (2006). Knowledge management performance evaluation: a decade review from 1995 to 2004. *Journal of Information Science* **32** (1), pp. 17–38.
- Chesbrough, H. (2003) Open Innovation: The New Imperative for Creating and Profiting from Technology, *Harvard Business Press*, Cambridge, MA.
- Churchill, N., Lewis, V., (1983). The five stages of small business growth. *Harvard Business Review*, **61** (3), pp. 30–50.
- Cohen, W.M., Klepper, S., (1996a). Firm size and the nature of innovation within industries: the case of process and product R&D. *Review of Economics and Statistics*, **78**, pp. 232–243.
- Cohen, W.M., Klepper, S., (1996b). A reprise of size and R&D. *The Economic Journal*, 106, pp. 925–951.
- Colombo, M. G., Grilli, L., & Piva, E. (2006). In search of complementary assets: The determinants of alliance formation of high-tech start-ups. *Research Policy*, **35**(8), pp. 1166–1199.
- Cooke, P. (2004). The role of research in regional innovation systems: new models meeting knowledge economy demands, *International Journal of Technology Management*, **28** (3-6), pp. 507–533.
- Cooper, A.C., Dunkleberg, W.C., and Woo, C.Y., (1988). Survival and failure: A longitudinal study. In B. Kirchoff, W. Long, E. McMullan, K. Vesper, and W. Wetzel, eds., *Frontiers of Entrepreneurship Research*. Wellesley, MA: Babson College, pp. 225–237.
- Covin, J., and Slevin, D., (1989). Strategic management of small firms in hostile and benign environments. *Strategic Management Journal* **10**(1), pp. 75–87.
- Covin, J., and Slevin, D. (1990). Content and performance of growth seeking strategies: A comparison of small firms in high and low technology industries. *Journal of Business Venturing* **5**(6), pp. 391–412.
- Damanpour, F., (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, **34**, pp. 555–590.
- Damanpour, F., Walker, R.M., Avellaneda, C.N., (2009). Combinative effects of innovation types and organizational performance: a longitudinal study of service organizations. *Journal of Management Studies* **46** (4), pp. 650–675.
- De Man, A.-P., & Duysters, G. (2005). Collaboration and innovation: A review of the effects of mergers, acquisitions and alliances on innovation. *Technovation*, **25**, pp. 1377–1387.
- Drucker, P.F., (1985). *Innovation and Entrepreneurship: Practice and Principles*. Harper Business, N.Y.
- Eddleston, K.A., Kellermanns, F.W., Sarathy, R., (2008). Resource configuration in family firms: linking resources, strategic planning and technological opportunities to performance. *Journal of Management Studies* **45**(1), pp. 26–50.
- Edquist, C. and Johnson, B. (1997). Institutions and organizations in systems of innovation, in Edquist, C. (Ed.): *Systems of Innovation: Technologies, Institutions and Organizations*, pp.41–63, Pinter Publishers, London.
- Ernst, H., (2001). Patent applications and subsequent changes of performance: evidence from time-series cross-section analyses on the firm level. *Research Policy* **30**, pp. 143–157.
- Fagerberg, J. and Srholec, M. (2008). National innovation systems, capabilities and economic development, *Research Policy* **37**(9), pp. 1417–1435.

- Feeser, H., and Willard, G. (1990). Founding strategy and performance: A comparison of high and low growth firms. *Strategic Management Journal* **11**(1), pp. 87–98.
- Freeman, C., Soete, L., (1997). *The Economics of Industrial Innovation*. Pinter, London.
- Griliches, Z., (1998). *R&D and Productivity: The Econometric Evidence*. The University of Chicago Press, Chicago.
- Hall, A., Rasheed Sulaiman, V., Clarck, N. and Yoganand, B. (2003). From measuring impact to learning institutional lessons: an innovation systems perspective on improving management of international agricultural research, *Agricultural Systems*, **78**(2), pp.213–241.
- Hargadon, A.B. (2002). Brokering knowledge: linking learning and innovation. *Research in Organizational Behavior*, **24**, pp. 41–85.
- Hart, D.M. (2009). Accounting for change in national systems of innovation: a friendly critique based on the U.S. case, *Research Policy* **38**(4), pp. 647–654.
- Hekkert, M.P., Suurs, R.A.A., Negro, S.O., Kuhlmann, S. and Smits, R.E.H.M. (2007). Functions of innovation systems: a new approach for analysing technological change, *Technological Forecasting and Social Change* **74**(4), pp. 413–432.
- Hindle, K., & Yencken, J. (2004). Public research commercialisation, entrepreneurship and new technology based firms: an integrated model. *Technovation* **24**(10), pp. 793–803.
- Kogut, B. and Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, **3**, pp. 383–397.
- Leonard-Barton, D. (1992). Core capabilities and core rigidities: a paradox in managing new product development. *Strategic Management Journal*, **13**, pp. 111–125.
- Liao, T.S., Rice, J., (2010). Innovation investments, market engagement and financial performance: a study among Australian manufacturing SMEs. *Research Policy*, **39**(1), pp. 117–125.
- Lo Storto, C. (2006). A method based on patent analysis for the investigation of technological innovation strategies: the European medical prostheses industry. *Technovation*, **26**, pp. 932–942.
- McDougall, P., and Robinson, R. (1988). New venture performance: Patterns of strategic behavior in different industries. In Kirchoff, B., Long, W., McMullan, W.E., Vesper, K. and Wetzel, W., eds., *Frontiers of Entrepreneurship*. Wellesley, MA: Babson College, pp. 477–491.
- McDougall, P., and Robinson, R. (1990). New venture strategies: An empirical identification of eight “Archetypes” of competitive strategies for entry. *Strategic Management Journal* **11**(6), pp. 447–467.
- McDougall, P., Covin, J., Robinson, R., and Herron, L. (1994). The effects of industry growth and strategic breadth on new venture performance and strategy content. *Strategic Management Journal* **15**(7), pp. 537–554.
- Naranjo-Gil, D., (2009). The influence of environmental and organizational factors on innovation adoptions: consequences for performance in public sector organizations. *Technovation* **29** (12), pp. 810–818^{SEP}.
- Nelson, R. and Rosenberg, N. (1993). Technical innovation and innovation systems, in Nelson, R.R., eds., *National Innovation Systems. A Comparative Analysis*, pp.3–21, Oxford University Press, New York.
- OECD (1997) *National Innovation Systems*, OECD, Paris.
- OECD (2008) *Open Innovation in Global Networks*, OECD, Paris.
- Patton, D., Warren, L., & Bream, D. (2009). Elements that underpin high-tech business incubation process. *Journal of Technology Transfer*, **34**(6), pp. 621–636
- Porter, M. E. (1990). *The Competitive Advantage of Nations*. Worchester: Billing and Sons Ltd.
- Rashman, L., Withers, E. and Hartley, J. (2009). Organizational learning and knowledge in public service organizations: a systematic review of the literature. *International Journal of Management Reviews*, **11**, pp. 463– 494.

- Rosenbusch, N., Brinckmann, J., Bausch, A., (2011). Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SMEs. *Journal of Business Venturing*, **26**, pp. 441–457.
- Samuelsson, M., Davidsson, P., (2009). Does venture opportunity variation matter? Investigating systematic process differences between innovative and imitative new ventures. *Small Business Economics*, **33**, pp. 229–255.
- Sandberg, W. (1986). *New Venture Performance: The Role of Strategy and Industry Structure*. Boston: D.C. Heath and Co.
- Scherer, F.M., Harhoff, D., (2000). Technology policy for a world of skew-distributed outcomes. *Research Policy*, **29**, pp. 559–566.
- Schumpeter, J. A., (1934), *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. Transaction Publishers, New Brunswick, New Jersey.
- Smith, K. G., Collins, C. J. and Clark, K. D., (2005). Existing knowledge, knowledge creation capability, and the rate of new product introduction in high-technology firms. *Academy of Management Journal*, **48**, pp. 346–357.
- Song, M., Podoymitsyna, K., van der Bij, H., Halman, J.I.M., (2008). Success factors in new ventures: a meta-analysis. *Journal of Product Innovation Management*, **25**, pp. 7–27.
- Stuart, R., and Abetti, P. (1988). Field study of technical ventures, part 3: The impact of entrepreneurial and management experience on early performance. In Kirchoff, B., Long, W., McMullan, W.E., Vesper, K. and Wetzel, W., eds., *Frontiers of Entrepreneurship*. Wellesley, MA: Babson College, pp. 177–193.
- Subrahmanya, M.H.B., (2005). Pattern of technological innovations in small enterprises: a comparative perspective of Bangalore (India) and Northeast England (UK). *Technovation*, **25** (3), pp. 269–280.
- Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, **15**(6), pp. 285–305.
- Teece, D.J., Pisano, G., Shuen, A., (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, **18**, pp. 509–533.
- Tranfield, D., Denyer D. and Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, **14**, pp. 207–222.
- Utterback, J. M. (1994). *Mastering the dynamics of innovation: How companies can seize opportunities in the face of technological change*. Boston, MA: Harvard Business School Press.
- Wang, C.L. and Chugh, H. (2014). Entrepreneurial learning: past research and future challenges. *International Journal of Management Reviews*, **16**, pp. 24–61.
- Weiss, M. and Gangadharan, G.R. (2010). Modeling the mashup ecosystem: structure and growth. *R&D Management*, **40**, pp. 40–49.
- Yam, R.C.M., Guan, J.C., Pun, K.F., Tang, E.P.Y., (2004). An audit of technological innovation capabilities in Chinese firms: some empirical findings in Beijing, China. *Research Policy* **33** (8), pp. 1123–1140.
- Zahra, S.A., George, G., (2002). Absorptive capacity: a review, reconceptualization, and extension. *Academy of Management Review*, **27**, pp. 185–203.

Strategic Innovation Outcomes and Competitive Advantage: a Comparative, Empirical Study

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Abstract

This paper explores the notion of strategic innovation and examines mediating mechanisms by which it ultimately contributes to competitive advantage for the firm. The underlying premise of the study is that an innovation effort may result in a variety of outcomes. For the purpose of this study, we narrow the possible outcomes to three possible outcomes: (1) differentiation, (2) learning and new knowledge creation, and/or (3) failed innovation effort. Further, the paper argues that the three outcomes are not mutually exclusive; that is to say, an innovation outcome typically encompasses elements of all three outcomes. The three innovation outcomes exhibit varying strategic and competitive impact and time horizons. Differentiation, typically manifests in a measurable, tangible outcome (e.g. a relatively short-term outcome enabling a premium-priced product or service) and is, of course, the sought-after outcome with most immediate strategic impact. However, innovation effort may, in fact, also result in secondary intangible outcomes such as learning, knowledge creation and (intelligent) failure (failure that enables the extraction of rich learning). This paper explores the proposition that despite often overlooked, these intangible innovation outcomes can, in fact, carry greater potential competitive impact for the firm in the long term, provided they are strategically managed. A conceptual model of strategic innovation is proposed that examines the critical linkages between the three innovation outcomes and mechanisms by which learning, knowledge creation and intelligent failure ultimately can contribute to competitive advantage. The conceptual model is tested empirically using a quantitative approach. Preliminary statistical analysis (factor analysis, regression analysis) identifies some key determining factors linking the various innovation outcomes, in particular, mechanisms by which intelligent failure can contribute to learning and knowledge creation in the firm. The analysis draws on empirical data derived from three different R&D organisations –differing in research intensity, size and maturity. The findings highlight key similarities and differences in how the three organisations manage their strategic innovation. The findings of this study are shown to be consistent with current thinking that links strategic innovation with organisational knowledge, practices and culture.

Keywords – innovation, learning, knowledge, competitive advantage, failure

Paper type – Academic Research Paper

1 Introduction

Innovation, while increasingly seen to play an important strategic role in firms' competitive positioning, remains a challenge, if not an enigma, for most firms. At least in part this has to do with the various expressions of innovation found in practice. Innovation traditionally has been associated with either improvements to existing ones or radically new products or processes. Increasingly, however, innovation is being linked to learning, capability development and organizational renewal. While the traditional view affords at least some degree of measurability of the innovation outcome, the one related to learning and organizational renewal recognises the largely intangible outcome of innovation which does not readily lend itself readily to assessment and evaluation. This notwithstanding, from a strategic perspective, arguably the learning and capabilities outcome of innovation has far greater implications for the competitiveness of the firm. A basic premise taken in this paper is that any successful innovation outcome has at least two outcome dimensions: (1) An outcome that (in the case of successful innovation) can be expressed in terms of a superior value offering that leads to 'measurable' competitive differentiation in the market in the immediate term, and (2) a second, much less visible though potentially far more important long-term outcome that manifests itself in terms of an innovation capability.

In this paper we explore the learning and capability outcome of innovation that expresses itself as a transformative dynamic capability. Whilst companies are looking to innovation as means of competitive differentiation in the traditional sense, only the fewest are deliberately and purposefully harnessing the innovation outcome that expresses itself in the form of a dynamic capability.

The thinking and research discussed in this paper is still in progress. Hence the purpose of this paper is to: (1) broadly describe the conceptual framework that underlies the approach to innovation as a dynamic capability, and (2) present the research methodology used in its examination, and (3) preliminary research findings based on the analysis of both quantitative field research emerging from this investigation

2 Strategic innovation – new perspectives and strategic implications

Innovation is increasingly being seen to be a key lever to strategic growth. Yet in reality, few companies succeed in leveraging innovation consistently for competitive advantage. In reality, much of the effort invested in innovation contributes little to the business bottom line of most firms. This view rings true across many industry sectors. Companies invest in innovation with low expectations of success. From a strategic perspective, therefore, the traditional view of innovation that underpins much of today's understanding of the role and rationale for innovation is ripe for fundamental rethinking. Innovation is changing irreversibly in nature, scope and impact – and so too must our understanding of it. First, it is by no means solely the domain of the firms' research and development function. Strategic innovation clearly extends beyond the traditional notion of innovation to include significantly more encompassing view that finds expression in

business model innovation. In this way, strategic innovation increasingly is embedded not only in all of the enterprise's operations; it is deeply embedded in the firm's very culture and mindset. Second, the nature and outcomes of innovation are increasingly manifested in the form of intangibles – whether in the form of improved service offering, or simply in the form of superior knowledge embedded in a product or process that has potential for value differentiation. Last, but not least, the impact of innovation needs to be recognised not only as a 'measurable' outcome, but also as a contribution to the development of a dynamic innovation capability. The strategic implications of this latter perspective for the enterprise are immense, though largely yet neglected in practice.

Definition: *Strategic innovation* is defined to be an orientation that seeks to maximise the competitive outcome of every innovation effort, whether incremental or frame-breaking, toward creating an (ideally) unique and superior value offering targeting relevant stakeholders. Outcomes of strategic innovation might be 'measurable', such as a clearly differentiated product or service offering; however, they might also be very difficult to 'measure' in a traditional sense (such as would be the case with a dynamic capability development).

Innovation outcomes Generally, innovation outcomes can take on a range of forms. Clearly, innovation that leads to a differentiated, superior value offering of a firm in its market place is one possible outcome. This is a highly desirable innovation outcome that the market richly rewards. Indeed, the potential for competitive differentiation through innovation captures the essence of the strategic rationale for innovation. This is where most organisations' view of innovation has been in the past and where it ends for all but a few firms. In this paper we deal with an innovation outcome that is more often than not overlooked: innovation that expresses itself in the form of learning and leading to the development of a dynamic innovation capability.

Therefore, innovation leading to a position of enhanced competitiveness necessarily has two components: one that is recognized as competitive differentiation in the market place, and one that expresses itself primarily as enhanced organizational capability. Whereas the first is recognised and characteristically rewarded in the marketplace in the near- to mid-term (for example, in first-mover time-to-market advantage), the latter outcome in the form of an improved innovation capability expresses itself in terms of a mid- to long-term competitive repositioning of the firm. This latter expression of innovation is largely intangible in nature; it is difficult to measure since its competitive impact often takes time to become apparent.

The conceptual model for strategic innovation explored in this paper views innovation outcomes to consist of the *sum* of both parts:

- (a) Innovation outcomes that lend themselves to 'measurement'; this might be thought of as the result of innovation effort leading to a differentiated value offering that finds acceptance in the market. Measures might include 'time-to-market', market share increase, revenues generated in the relevant market as a result of the product / service offering.

- (b) Innovation learning and capability building that emerges through activities carried out in the course of the innovation effort describe in (a). Measures of this outcome are difficult; they are much more long-term focused and are inextricably tied into the informal organisation structures, process and culture.

Innovation as a dynamic capability By extension of the outcome (b), the question explored in this research is:

Research question: To what extent can the learning, capability development and renewal outcome of innovation be thought of as an expression of a dynamic capability?

That is to say, to what extent does this expression of innovation exhibit the capacity to support the adaptation, renewal, reconfiguration and creation of new resources in response to changes in the firm's competitive environment (Helfat et al. 2007; Eisenhardt and Martin 2000; Teece 2009; Teece et al. 1997). Moreover, to what extent does this expression of innovation resonate with earlier work on distinctive competence (Selznick 1957); core competence (Prahalad and Hamel 1990); core capability and rigidity (Leonard-Barton 1992) and combinative capability (Kogut and Zander 1992)?

Following from this, the following models frames the approach explored for the purpose of this research:

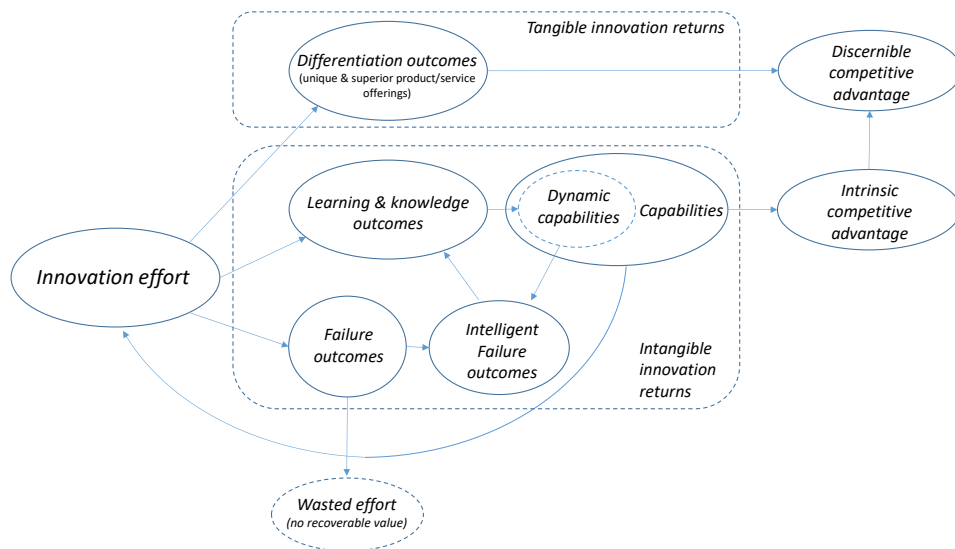


Figure 1. Innovation model: Key components linking innovation effort to competitive advantage

3 Empirical Approach

Innovation research targeting the investigation of innovation capability, particularly its expression as a dynamic capability is an emerging field of study. Some of the early studies reported include empirical research reported by Van Winkelen and Tovstiga (2010) and Tovstiga and Tulugurova (2009). In this work, innovation and its expression is tied to knowledge practices and intellectual capital practices, respectively.

3.1 Research Methodology

The exploratory research of this study is based on a quantitative analysis of data collected via a survey questionnaire that probes respondents' perceptions of innovation outcomes distributed between four possible expressions of the outcome – differentiation, neutralisation, learning, and an outcome with no discernible value.

Definitions:

Differentiation: outcome with clearly identifiable competitive impact in terms of potential for a uniquely superior value offering

Neutralisation: an outcome, while not nearly of the competitive impact of differentiation, still positive (in the sense of a 'second-mover' advantage); potential for mitigating success of a competitor's first-mover advantage

Learning: an outcome that expresses itself as benefit to the organisation; a bundling of the learning, insight and experience gained, toward building a capability that has potential for a competitive re-positioning of the firm

Failure or no-discernible value: covers innovation effort that does not lead to any identifiable value; in other words wasted effort. However, such outcomes need to be viewed critically against the possibility of an extraction of learning from that failed effort and conversion of that learning from failure to capability development.

The field investigation targeted three main sources of data; three organizations differing in size, maturity and intensity of R&D:

1. A research laboratory of a legacy, large multinational IT firm, based in Switzerland, that has brought forth four Nobel Prize – winning researchers since the research laboratory's founding in the early 1960s; 50 respondents.
2. An R&D and Technology organisation of a large UK-based telecommunications multinational; 58 respondents.
3. High-tech start-up enterprises associated with a Zurich (Switzerland) – based technology park; 84 respondents

The survey instrument developed for the empirical field research consists of a questionnaire consisting of a total of 49 items. The questionnaire consists of four main constructs; these comprise the possible outcomes of innovation: (1) differentiation, (2) neutralisation, (3) organisation learning, and (4) an outcome of no discernible value

(“wasted innovation effort”). The first four items query the estimated innovation returns in terms of a percentage distribution amongst the four possible outcomes. In a following sections of the questionnaire, 45 further items query the nature of the innovation outcomes associated with each of the four types of possible innovation returns on the basis of a 5-point Likert type scale.

The survey instrument was set up in the form of an e-survey format. Potential respondents were invited to access and respond to the survey the survey via an electronic link. In selected cases, the initial quantitative research was been followed up with qualitative research involving semi-structured interviews and workshop-type sessions with the purpose of deepening and substantiating the quantitative research findings.

Statistical analysis of the field data was carried out with the help of SPSS software. Reliability testing indicated a high degree of reliability overall. Statistical means of the scores relating to the items under each of the four main constructs were computed. Factor analysis (contributions to overall variance and factor loadings considered) was used to identify factors relating to the four main constructs. Item scores of two of the constructs (differentiation and learning) were then singled out and subjected to a joint factor analysis with the intent to identify those factors contributing to a positive innovation outcome. Some preliminary results emerging from this analysis are discussed below. In further analysis to be done, factors relating to these two constructs will be identified for further regression and correlation analyses.

4 Preliminary findings

The field research of this study has been completed; the statistical analysis of the data is still in progress. Hence this section is to provide a glimpse only of some of the results emerging from the analysis.

From the quantitative survey data the findings related to estimations of the breakdown of innovation returns between the four possible outcomes indicate that only about 30 percent of effort invested in innovation results in a differentiated product/service/concept offering. Approximately 25 percent of innovation effort results in a neutralisation outcome which, while not a differentiated outcome, is still a positive return that might, for example, challenge or mitigate a competitor’s first-mover advantage. Approximately 25 percent of innovation effort results in some form of organisational learning and capability development. Wasted effort or outcomes from investment in innovation that can be attributed to neither differentiation, neutralisation or organisation learning constitutes the remaining 20 percent. However, a comparison of this sort may be overly simplified. First, as suggested earlier, firms’ effort invested in innovation extends beyond mere R&D expenditure. Second, not everything attributed to wasted effort is necessarily that. Is a failed experiment necessarily wasted effort? Not if learning can be extracted from this ‘failed’ effort.

From the factor analysis of the construct clusters, the findings suggest some common determinants of an innovation capability; these relate to:

1. The *nature of the value offering* and the *degree of differentiation* afforded by that value offering (contributing 16.3 percent of the variance in one particular sampling of data);
2. The *strategic impact* of the value offering (15.3%)
3. *Innovation metrics* applied and *measurability* (13.2%)
4. Organisational context for the *innovation capability development* (12.7%)

Further analysis is to investigate the dependence of the differentiation outcome of innovation on the factors identified in the factor analysis.

5 Conclusions

While the analysis discussed in this paper is still in progress, preliminary findings nonetheless are consistent with recent research findings that provide empirical evidence suggestive of the link between innovation practices and organisational learning processes. Consistent with these findings, the preliminary findings of this research indicate that innovation as a learning outcome has attributes that align well with those of a firm's knowledge (or intellectual capital) base that is in turn linked to capability development and exploitation. The factor analysis suggests an approximation of some determinants that constitute the capability dimension of innovation. These provide evidence of a dynamic capability dimension of the innovation capability.

Clearly, more analysis needs to be done on the existing data set and further data needs to be gathered and analysed for confirmation of these preliminary findings. Nonetheless, the picture that emerges from the research findings of this work suggest a capability embedded in an organisation knowledge context that links innovation to knowledge in its various forms and the latter to the organisation's context such as its culture, processes and practices.

References

- Eisenhardt, K.M. and Martin, J.A. (2000). Dynamic capabilities: what are they? *Strategic Management Journal*, **21**, 1105 – 1121
- Helfat, C.E., Finkelstein, S., Mitchell, W., Peteraf, M.A., Singh, H., Teece, D.J., and Winter, S. (2007). *Dynamic capabilities*, Oxford: Wiley-Blackwell
- Kogut, B. And Zander, U. (1992). Knowledge of the firm, combinative capabilities and the replication of technology. *Organizational Science*, **3**, 383 - 397
- Leonard-Barton, D. (1992). Core capabilities and core rigidities: a paradox in managing new product development. *Strategic Management Journal*, **13** (Summer Special Issue), 111 - 125
- Prahalad, C.V. and Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review*, **68**, 79 – 91
- Selznick, P. (1957). *Leadership in Administration: A Sociological Interpretation*, Evanston, IL: Row, Peterson

- Teece, D.J. (2009). *Dynamic capabilities and strategic management*, Oxford: Oxford University Press
- Teece, D.J., Pisano, G. and Schuen, A. (1997). Dynamic capabilities and strategic management, *Strategic Management Journal*, **18**, 509 – 533
- Tovstiga, G. and E. Tulugurova, E. (2009). “Intellectual capital practices: a four-region comparative study”, *Journal of Intellectual Capital*, Vol. 10, No. 1
- Van Winkelen, C. and Tovstiga, G. (2009). “Understanding an Organisation’s Knowledge-Enabled Innovation Capability”, *International Journal of Knowledge Management Studies*, Vol. 3, Nos. 1-2, pp. 97-115

A Multi-Dimensional Framework to Promote Innovation Culture in a Large Size Company: Case of SNCF Réseau

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Abstract

The SNCF Group (French Railway company) splits into different small companies. One of them is “SNCF Réseau” that is in charge of the management and maintenance of the 33,000km network and the 3000 stations. SNCF Réseau is often considered as a bureaucratic and rigid system no longer responding to the changing external and internal environment. We have conducted investigations in various fields of research to understand how to turn SNCF Réseau into a hybrid and malleable system. Our literature review highlighted that organizational innovation could be a key concept in this organization's ability to evolve, renew, and perform. This paper presents the preliminary results of our study of factors influencing organizational innovation. This study is based on a systemic literature review and on an action research in collaboration with the digital direction and innovation of SNCF Réseau.

Keywords – Innovation Culture, Organizational Innovation, Multi-dimensional Framework

1 Introduction

Today, companies must innovate to exist in a volatile and moving environment (Chang and Hughes, 2010; Damanpour and Aravind, 2012; Camisón and Villar-Lopez, 2014; Iturrioz *et al.*, 2015). This quest for innovation has become an obsession: it is necessary to innovate, to transform oneself, to be digitalized, to be creative. So many injunctions that are daily present in strategies and speeches. However, it's difficult to concretize these injunctions. Beyond these injunctions and the pressure of the markets, the big companies must cope with the societal and climatic pressure: need durable and virtuous economy, scarcity of the resources, strong demographic pressure, global warming. Factors that force the implementation of many technological and non-technological innovations and a redesign of the societal role. The answers given to its stakes are mainly of a technological nature since the studies focus mainly on the role and results of technological innovations (Büschgens *et al.*, 2013; Kaur Kapoor *et al.*, 2014, Slater *et al.*, 2014; etc.). Nevertheless, non-technological innovation which contributes creating a sustainable competitive advantage that is difficult to replicate exists too (Pisano and Teece, 2007). The researches have increasingly focused on this non-technological dimension of innovation (Birkinshaw and Mol, 2006; Birkinshaw, all, 2008; Crossan and Apaydin, 2010; Damanpour and Aravind, 2012; Ganter and Hecker, 2013). The concept is called managerial innovation or administrative innovation (Birkinshaw *et al.*, 2008; Damanpour and Aravind, 2012, Kraus *et al.*, 2012). Our interdisciplinary literature review, nourished with works in management, management science, sociology, economics, information science and communication, allows us to identified a large number of factors influencing technological and non-technological innovation capacities of an enterprise. Researchers developed multidimensional framework of organizational innovation (OI) based on rigorous systematic review of the literature (Crossan and Apaydin, 2010; Khosravi, Newton and Rezvani *et al.*, 2019). These propositions are often theoretical ones and are not confronting to an empirical analysis. The purpose of the paper is to confront these models to the reality of our field of study: SNCF Réseau that is the "heart" of the French rail system with the management and maintenance of the 33,000km network and the 3000 stations. Principal objective of this research is the definition of a modelling approach of the organization to identify its strengths and limits and associated tools to allow evolution of the system (organization, management, human resources, etc.) to make the strategy of process of employees' idea generation and implementation a reality.

The main objective of this paper article is to present our first results of the using of existing models of OI (Crossan and Apaydin, 2010; Khosravi, Newton and Rezvani, 2019) in the real case study of a large company – SNCF Réseau. The paper is organized according to our scientific approach. In the first section we realize a literature analysis to define the OI concept and to identify the existing multidimensional frameworks of determinants of OI. In this section, we define the context and the elements on which we will base our research (step 1 of our approach). In the second and third sections we propose a preliminary analysis of the determinants of OI in the SNCF Réseau company in

accordance with theoretical models. The internal determinants are identified in the second section (step 2) and the external ones in the third section (step 3). This dual approach, theoretical and practical, will allow us to highlight the absence of certain factors, which can inhibit the system's ability to foster innovation. In the conclusion section, we therefore discuss about the opportunity to complete the models with new factors and open perspectives for a new definition of organizational innovation. The design of a model will perhaps allow us to have a systemic vision of the organization and the interactions between its components in order to pilot the innovation capacity of the successful company and adapted to its context. The definition of such a model, that is the last step of our research, is not presented in the paper.

2 Multidimensional Frameworks of determinants of OI

2.1 The Organizational Innovation Concept

Studies and literature on technological innovation abound mainly around three main themes: the diffusion of innovation, the adoption of innovation and the implementation of innovation. Technological innovation takes place in the technical system of the firm (Damanpour and Evan 1984; Yam, Lo, Tang and Lau, 2011). Moreover, more and more researches are also interested in non-technological innovation, particularly OI (Lam, 2005; Mol and Birkinshaw, 2009; Khosravi, Newton and Rezvani, 2019). But, the presence of works that synthesize knowledge on this concept is still lacking and accentuates the lack of knowledge on the subject (Damanpour and Aravind, 2012, Černe *et al.*, 2016). Non-technological innovation is equated with a complex social system composed of a network of actors and many internal and external relationships. Interactions occur on a daily basis in any relationship between members of the organization and between the organization and its environment. The tacit nature of these features makes the concept difficult to observe and define. Few studies have examined the diffusion, adoption and development of non-technological innovation and a great part of the research on non-technological innovation is primarily theoretical. The few empirical studies focus on the antecedents of non-technological innovations and adoption processes (Damanpour and Aravind, 2012; Volberda *et al.*, 2013). Among non-technological innovations, OI studies are recent and even contradictory. The concept is young, with several names "organizational innovation" - "managerial innovation" - "administrative innovation" (Birkinshaw *et al.*, 2008) and lacks stable references. Management studies the concept in two ways: Innovation within organizations and OI as a specific investigative object (Wolfe, 1994; Lam, 2005). Beyond the role of the OI, it is its scale of analysis and impact that are debated. Most of the time it is studied at the level of the company and its own characteristics: size, age, type of structure. But according to Damanpour (1991) this approach incorrectly uses the OI name. It should be called "organizational capacity for innovation". This confusion of names has led some authors to use the name "innovation management" (Birkinshaw *et al.*, 2008). It refers to new management practices put in place to achieve the organizational objectives of the company. This designation avoids

confusion with administrative innovation that is too restrictive. All of these variables complicate the definition of OI concept, especially since it is used without distinction in management science and management (Damanpour *et al.*, 2009, 2012). But we can rely on four characteristics:

- differs from technological innovation,
- is akin to novelty; is multidimensional,
- is systemic,
- comes from an intention to achieve a goal.

2.2 Multidimensional Framework to highlight determinant of OI in company

In the literature, innovation models and policy decisions are often focused on a single dimension or a limited number of dimensions of innovation (Rothwell, 1994; Tödtling and Trippel, 2005; Kroon *et al.* 2008; Berkhout *et al.*, 2010; Caetano and Amaral, 2011). This one-level approach does not match the reality of a company and of what could be OI. First of all, it makes complicated the construction and the analysis of the interfaces of the various levels. Second, company is a social fabric composed of individuals, groups, organizations, with a set of rules, practices, technological artifacts (ICTs) and discursive entities such as language and culture. Everything must be studied in terms of the firm's dynamic system, its strategy, its local and global context and the external environment. It is therefore necessary to have a systemic vision to develop a model of innovation multidimensional aspects. Van de Ven *et al.* (2007), considers innovation as a non-linear approach with a cycle of activities at different organizational levels. A recent study (Hughesa *et al.*, 2018) provides a more practical approach by presenting a review of empirical studies on leadership, creativity and innovation in business. This work offers a new perspective on the themes addressed and new definitions of creativity and innovation. It also highlights the main effects of leadership on creativity and innovation and that research in this area is very promising.

Based on our literature review and to consider dimensions, levels and parameters that could have an influence on OI in a company, we made the choice to work with the model built by Crossan and Apaydin (2010) (figure 1) completed with the model of Khosravi, Newton and Rezvani, 2019 (figure 2). These authors developed complete multidimensional frameworks of OI based on a review of the literature of last decades on the subject. Far from the completeness of the models, their other interest is the taking into account of the separation of the process of innovation (the how) which precedes the result (the what). This responds to the desire of (how) to create a process of organizational innovation that should lead to (what) an "innovative" system. The innovation process (how) is influenced by three main factors:

- the leadership of the organization and individuals,
- the managerial levers,
- the processes of the company (organizational learning, its knowledge management)

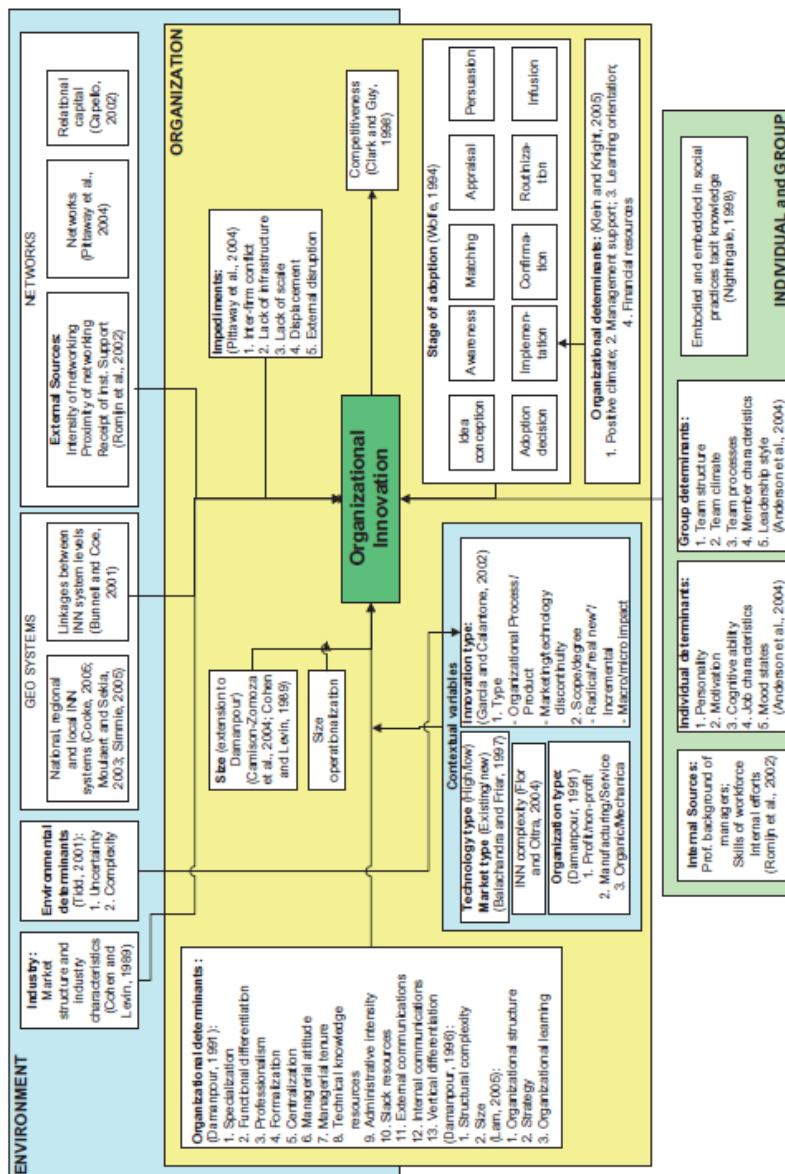


Figure 1. Determinants of OI (Crossan and Apaydin, 2010)

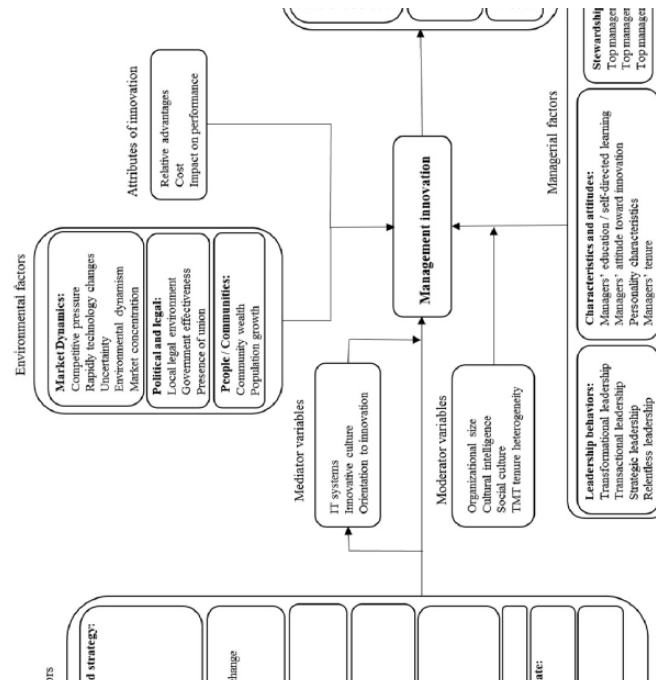


Figure 2. Drivers and outcomes on management innovation (Khosravi et al., 2019)

In the next section of the paper, we present our study within SNCF Réseau. Final objectives of our research are:

- to check if parameters defined in theoretical models in figures 1 and 2 are exploitable in real cases studies,
- to set up, thanks to the OI, a business system able to develop its innovation capabilities and fostering a culture of innovation.

In this paper, we just present the preliminary results of our study concerning the first objective of our research (to check if parameters defined in theoretical models in figures 1 and 2 are exploitable in real cases studies).

3 First step of our study – internal levels: organization and individual

3.1 Presentation of SNCF Réseau and synthesis of our observations

The French Public Rail Group is made up of SNCF, SNCF “Réseau” (Networks) and SNCF “Mobilités” (Mobilities), three public institutions that are inseparable and united. At the head of this group, SNCF provides strategic control and steering, economic coherence, industrial integration and social unity. The functions of infrastructure manager of the national rail network are entrusted to SNCF “Réseau”. Finally, SNCF “Mobilités” is responsible for all the rail transport service activities. In such a complex organization,

with a long history and specific culture and values, it is the “direction of innovation” of SNCF “Réseau” that promotes innovation and creativity strategies throughout the organization. This direction develops projects and researches focused on organizational innovation, new services, new different kinds of leadership (transformational and transactional leaderships for instance). SNCF Réseau that is the “heart” of the French rail system with the management and maintenance of the 33,000km network and the 3000 stations.

3.2 Initial internal study at organization, individual and group levels (figure 1)

Since 1938, SNCF has developed participatory innovation as about 75% of large companies in France today. This management system is very structured and generate routine (in accordance with Feldman and Pentland, 2003) and favor inertia (Montgomery, 1995). Since 2004, it is piloted at the central level that defines the rules and the procedures to all regions and institutions. It is a process that follows a precise logic: depositing ideas, instruction of the files, submission of the file to the hierarchical lines and to the technical experts then implementation of the idea with gratification. Initially it was driven by human resources and now by people who are not trained and have no time allocated to this function. This device nourishes the techno centered vision of innovation and the central place of the "expert". The setting up of such a process and its inefficiency puts into question the "process" factor. In the perspective of a new OI that allows to set up a self-adaptive system centered on humans, SNCF decided to question its model: what are the limits and benefits? Is not process operation a hindrance to innovation? How can this centralization "understand" the local context in which the idea emerges?

We began the internal initial analysis of SNCF Réseau since few months. We studied the organization of the company (hierarchical and functional organigrams, process models, etc.) and we conducted interviews of many employees. Objective was to focus on the endogenous factors mastered by the company. Preliminary results of our study highlight that:

- a. SNCF Réseau is a “bureaucratic” structure in which dominates rules, benchmarks standards, fixed and clear decision processes. Managers spend 40% of their time setting standards and controlling (Morieux, 2011). Thus, the organization develops a transactional leadership through which employees are rewarded (bonus, increase, echelons) or sanctioned. This type of leadership does not allow intrinsic motivation, and stifles creativity and innovation (Amabile, 1996).
- b. The company does not promote leadership capabilities from a collective and individual point of view. It applies a "command and control" management. This is reinforced by the supervision of the state, the main shareholder and the directives of the ministries of labor and transport which accentuate the pressure on the management and by streaming on the managers. This is a major problem when we know that managers influence the company's innovation capacities by 5% to 20% (Crossland and Hambrick, 2007), particularly by stimulating team

creativity. They also participate in the diffusion of innovations by creating favorable environments (Mumford and Licuanan 2004).

- c. We rarely talk about the organization of work and management of the company while everything is partitioned. This partitioning is due to its history, with the weight of a technical culture, disseminated by the engineers and a structured and abundant hierarchy. The set is based on several thousand standards and rules legitimized by the imperative of safety that protects agents and users. This allows each employee to know the answer to bring to a given situation when everything is "normally". The rules hamper the ability of employees and the system to cope with hazards, disrupted situations and take initiatives.
- d. In 2018, SNCR Réseau presented its new reorganization in 40 processes. The process of innovation is being thought through. In the opinion of the managers, this plan breaks a lot of questions in terms of application at the local level, strategy, vision, meaning, evolution of the business and organization. The structure continues to bear the brunt of bureaucratization because the business system does not change. Now, the question is about managers' perception of external factors and their motivation to change their approach.

Thanks to such an internal study, SNCF Réseau believes that factors influencing employee motivation are present in the company at different levels but are not explicitly mentioned:

- the organizational culture (Scott and Bruce, 1994),
- management relations (Janssen, 2005),
- the characteristics of the task (Shalley, 2008),
- relationships within the working group (Hülshwegert *et al.*, 2009),
- the differences between individuals (Raja and Johns, 2010),
- feeling of accomplishment in one's work, responding to a challenge or obtaining satisfaction in one's work (Aletraris 2010, Aselage and Eisenberger 2009),
- Extrinsic out-of-work objectives (Amabile, 1997, Malik *et al.*, 2015).

Our research seems to confirm the importance of these levers and the company continues its reflections. Nevertheless, according to the three factors described in the Crossan's model, SNCF Réseau is also interested by the influences and impacts of exogenous factors on the OI. The company asked us to particularly study these factors. So, we enlarged our scope by focusing on the external environment of SNCF Réseau, to integrate extra-organizational point of view in our study ("large-scale" notion of Armbruster *et al.*, 2008).

4 Second step of our study – high level of observation: exogenous factors

4.1 The global context of French rail transport

The opening to competition of French rail transport will be very gradually and will start in 2019 (Railway PACT). For the French Public Rail Group (SNCF) innovation and creativity in the workplace have become increasingly important determinants of

organizational performance, success, and longer-term survival in such a new competitive context. Beyond this “French” context, the new challenges for transport sector concern also climate change and societal issues. The majority of innovations that attempt to provide a sustainable solution are technological but SNCF Réseau is convinced that there are other answers. They can come from organizational, institutional and social innovations by proposing new collaborations with the aim of a transition towards a carbon-free economy for instance (Dunlap and Brulle, 2015). The climate challenge will force companies to have a long-term vision, opposed to the short-term vision (notably linked to the state). It will have to manage more uncertainties related to the climate, uncertainties in the investments, in the types of knowledge mobilized, in the crossing of the traditional horizons of management of the companies (Ageri and Cartel, 2017). Moreover, changes in societal behavior are the beginning of a profound change in society, the current paradigm and inevitably policies, corporate missions, employee behavior. Considering these changes, it is a big challenge for companies to transform themselves. They must be able to understand its external environment while meeting the expectations of its internal environment. Exogenous factors (government policy, social movements, geopolitical context, etc.) must be included in the management of the system. Even if the company cannot influence them all.

4.2 Railway PACT

The railway PACT opens to competition the transport of passengers in France. First the regions with the TER (smallest train lines connecting small towns) offer then the TGV (train lines connecting the French largest cities). SNCF will have to manage an opening to European and world competition with the emergence of China. The agents of SNCF Réseau will undergo many changes. Have a customer vision, interact with new interlocutors with different interests and requirements. His system is not ready for such rapid changes. This competition pushes the company to “innovate” in a disorganized and techno-centered way. The nature of work will change. Public service culture is being challenged in favor of profitability, efficiency and productivity.

4.3 Politic and social context

The juridical structure of SNCF will change in 2020 but it will keep a mission of public service. The presence of French State generates obligations and strong constraints for the railway group. The specifications are under the supervision of the French Ministries of Finance and Transport. The governance and strategy of the Group evolve according to policies and political parties: public tariffs, support to some agents of national economy (rail users, or its industrial suppliers), spatial planning, etc. So, the politic context influence strategy and firm system and is an important factor.

SNCF is also putting up with social pression. Two reasons: it's a very unionized company and not spared by customer dissatisfaction. Now, must review her societal role, take into account the new mobility law and the new innovation policy of the state. So many constraints to understand and master. The crisis of yellow vests questions its public service policy, its governance, its strategy of profitability classic lines, the mesh of the

territory. It is interesting to see new forms of governance emerge alongside traditional governance. These changes are also influenced by external pressures. This reinforces the hypothesis of a strong link between the company and its external ecosystem. Especially when the pressures are social. They indicate to the actors of the firm which actions envisaged in order to maintain a socioenvironmental balance. They act as governance mechanisms. The business can be likened to a network that interacts for a purpose. This network of actors makes it possible to study sustainable innovation.

The international relationships and politics have consequences too. Europe offers the possibility to have long services. SNCF should have an international destiny. But it is ahead of road transport on the European market. Freight is still not needed. Despite the creation of the EU Agency for Railways in 2006, it is difficult to organize European rail from a technical and commercial point of view. SNCF is not decided to separate from its power and keeps its industrial "protectionism".

4.3 Territorial context and OI

Study of barriers to innovation is mainly for technological innovation, with a few rare exceptions (Galia and Legros, 2004, Segarra-Blasco and Garcia-Quevedo, 2008). In the context of non-technological innovation research, the scope is the organizations, never the territory. Territory is an exogenous factor that the company needs to understand with SNCF's proximity issues. It is also an important factor in spreading and implementing an organizational innovation. The barriers are complex and numerous. The French school of proximity (Talbot, 2008) proposes a framework of study, with three components of the proximity.

- Geographic proximity to study spatial and location dimensions,
- The institutional proximity that studies the similarity of codes, rules, representations, shared values between employees. To better anticipate their respective behaviors,
- Organizational proximity, which studies the logic of belonging of employees.

According to Defélix et al. (2013), when the three proximities are combined, the adoption of innovative disposition is possible as part of joint activity. For the moment we have investigated this aspect. Nevertheless, Railway PACT will oblige SNCF to focus on territories because the company will have to decentralize its organization.

5 Conclusion

The innovation capacity of the enterprise system is a major topic within bureaucratic organizations. Beyond this capacity, innovation is too often studied through technology, the non-technological aspect is still too little present in the research. Nevertheless, some of them have been interested in organizational innovation and the factors that influence it. But few studies offer a systemic and empirical approach to the concept.

Preliminary results of our study allow us to confront the literature on the subject with a real case study. They confirm the importance of the internal factors of the organization put forward by the model and of considering influences and impacts of the external

factors. We presume that OI can only be generated and adopted by the company if the technical and social system takes into account the endogenous and exogenous factors. The new challenge of our research will be to clarify the framework of each factor and propose methodologies for the organization to seize.

References

- Aggeri, and Cartel., (2017) Le changement climatique et les entreprises : enjeux, espaces d'action, régulations internationales, *Entreprises et Histoire*, 86(1), pp. 6-20.
- Aletraris., (2010) How satisfied are they and why? A study of job satisfaction, job rewards, gender and temporary agency workers in Australia, *Human Relations*, 63, pp.1129-1155.
- Amabile., (1996) *Creativity in context* Westview Press, Boulder, CO.
- Amabile., (1997) Motivating Creativity in Organizations: On doing what you love and loving what you do, *California Management Review*, 40, pp. 39-58.
- Armbruster et al., (2008) Organizational innovation: The challenge of measuring non-technical innovation in large-scale surveys, *Technovation* 28(10), pp. 644–657.
- Aselage and Eisenberger., (2009) Perceived organizational support and psychological contracts: A theoretical integration, *Journal of Organizational Behavior*, 24, pp. 491-509.
- Berkhout et al., (2010) Connecting technological capabilities with market needs using a cyclic innovation model, *RD Manag.* 40, pp. 474–490.
- Birkinshaw and Mol., (2006) How management innovation happens, *MIT Sloan Management Review*, 47, pp. 81.
- Birkinshaw et al., (2008) J. Management innovation *Academy of Management Review*, 33, pp. 825–845.
- Büschgens et al., (2013) Organizational culture and innovation: A meta-analytic review, *Journal of Product Innovation Management*, 30, pp. 763-781.
- Caetano and Amaral., (2011) Roadmapping for technology push and partnership: a contribution for open innovation environments, *Technovation* 31, pp. 320–335.
- Camisón and Villar-López., (2014) Organizational innovation as an enabler of technological innovation capabilities and firm performance, *Journal of Business Research*, 67, pp. 2891-290.
- Černe et al., (2016) Non-technological innovation research: Evaluating the intellectual structure and prospects of an emerging field, *Scandinavian Journal of Management*, 32, pp. 69-85.
- Chang, and Hughes., (2012) Drivers of innovation ambidexterity in small-to medium-sized firms, *European Management Journal*, 30, pp. 1-17.
- Crossan and Apaydin., (2010) A multi-dimensional framework of organizational innovation: A systematic review of the literature, *Journal of Management Studies*, 47, pp. 1154-1191.
- Crossland and Hambrick., (2007) How national systems differ in their constraints on corporate executives: a study of CEO effects in three countries, *Strategic Management Journal* 28(8), pp.767–789.
- Damanpour and Aravind., (2012) Managerial innovation: Conceptions, processes, and antecedents, *Management and Organization Review*, 8 (2) (2012), pp. 423-454.
- Damanpour, and Evan., (1984) Organizational innovation and performance: The problem of organizational, lag *Administrative Science Quarterly*, pp. 392-409.
- Damanpour et al., (2009) Combinative effects of innovation types and organizational performance: A longitudinal study of service organizations, *Journal of Management Studies*, 46 (4) (2009), pp. 650-675
- Dunlap and Brulle., (2015). *Climate Change and Society: Sociological Perspectives*.

- Feldman and Pentland., (2003) Reconceptualizing Organizational Routines as a Source of Flexibility and Change, *Administrative Science Quarterly*, 48, pp.94-118.
- Galia and Legros D., (2004) Complementarities Between Obstacles to Innovation: Evidence from France, *Research Policy*, vol. 33, pp. 1185-1199.
- Ganter and Hecker., (2013) Deciphering antecedents of organizational innovation, *Journal of Business Research*, 66, pp. 575-584.
- Hughes et al., (2018) Leadership, creativity, and innovation: A critical review and practical recommendations, *The Leadership Quarterly*, Volume 29, Issue 5, pp. 549-569.
- Hülshager et al., (2009) Team-level predictors of innovation at work: A comprehensive meta-analysis spanning three decades of research, *Journal of Applied Psychology*, 94, pp. 1128-1145.
- Iturrioz et al., (2015) How to foster shared innovation within SMEs' networks: Social capital and the role of intermediaries, *European Management Journal*, 33, pp. 104-115.
- Janssen., (2005) The joint impact of perceived influence and supervisor supportiveness on employee innovative behaviour, *Journal of Occupational and Organizational Psychology*, 78(4), pp. 573-580.
- Kaur Kapoor et al., (2014) Innovation adoption attributes: A review and synthesis of research findings, *European Journal of Innovation Management*, 17, pp. 327-348.
- Khosravi, Newton, Rezvani., (2019) Management innovation: A systematic review and meta-analysis of past decades of research, *European Management Journal*.
- Kraus et al., (2012) Innovation in family firms: An empirical analysis linking organizational and managerial innovation to corporate success, *Review of Managerial Science*, 6, pp. 265-286.
- Kroon et al., (2008) Toward a sustainable chemical industry: cyclic innovation applied to ionic liquid-based technology, *Ind. Eng. Chem. Res.* 47, pp. 8517–8525.
- Lam., (2005) Organizational innovation. In Fagerberg, J., Mowery, D. C. & Nelson, R. R. (Eds.), *The Oxford handbook of innovation*, pp.115–147. Oxford University Press.
- Malik et al., (2015) Rewards and employee creative performance: Moderating effects of creative self-efficacy, reward importance, and locus of control, *Journal of Organizational Behavior*, 36(1), pp. 59–74.
- Mol and Birkinshaw., (2009) The sources of management innovation: When firms introduce new management practices, *Journal of Business Research*, 62, pp. 1269-1280.
- Montgomery, C.A., (1995), *Resource-based and evolutionary theories of the firm: towards a synthesis*, Kluwer, Boston, MA.
- Morieux, Y., (2011) *Smart Rules: Six ways to get people to solve problems without you*, Harvard Business Review.
- Mumford and Licuanan., (2004) Leading for Innovation: Conclusions, Issues, and Directions, *The Leadership Quarterly*. 15, pp. 163-171.
- Pisano and Teece., (2007) How to capture value from innovation: Shaping intellectual property and industry architecture, *California Management Review*, 50, pp. 278-296.
- Raja and Johns., (2010) The joint effects of personality and job scope on in-role performance, citizenship behaviors and creativity, *Human Relations*, 63, pp. 981-1005.
- Rothwell, R., (1994) Towards the Fifth-generation Innovation Process, *International Marketing Review*, Vol. 11 No. 1, 1994, pp. 7-31.
- Scott and Bruce., (1994) Determinants of innovative behaviour, A path model of individual innovation in the workplace, *Academy of Management Journal*, 37(3), pp 580-607.
- Segarra-Blasco and Garcia-Quevedo., (2008) Barriers to Innovation and Public Policy in Catalonia, *International Entrepreneurship Management Journal*, vol. 4, pp. 431-451.

- Shalley., (2008) Creating roles: What managers can do to establish expectations for creative performance. In J. Zhou & C. E. Shalley (Eds.), *Handbook of organizational creativity*, pp. 147-164.
- Shalley et al., (2008) Organizational creativity research: A historical overview. In C. E. Shalley & J. Zhou (Eds.), *Handbook of organizational creativity*, pp. 3-31.
- Slater et al., (2014) Radical product innovation capability: Literature review, synthesis, and illustrative research propositions, *Journal of Product Innovation Management*, pp. 552-566.
- Talbot., (2008) Les institutions créatrices de proximités, *Revue d'Économie Régionale et Urbaine*, n° 3, pp. 289-310.
- Tödtling and Trippl., (2005) One size fits all? Towards a differentiated regional innovation policy approach, *Res. Policy* 34, pp. 1203–1219.
- Van de Ven et al., (2007) *The Innovation Journey*. New York: Oxford University Press.
- Volberda, et al., (2013) Management innovation: Management as fertile ground for innovation, *European Management Review*, pp. 1-15.
- Walker et al., (2010) Management innovation and organizational performance: The mediating effect of performance management, *Journal of Public Administration Research and Theory*, 21 (2), pp. 367-386.
- Wolfe., (1994) Organizational innovation: review, critique and suggested research directions, *Journal of Management Studies*, 31, pp. 405-431.
- Yam, Lo, Tang and Lau., (2011) Analysis of sources of innovation, technological innovation capabilities, and performance: An empirical study of Hong Kong manufacturing industries *Research Policy*, pp. 391-402.

Developing Organisations Innovation Capacity through Innovation Labs

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Abstract

In the current political-economic scenario, creativity and innovation are even more considered as the key to the survival of organizations (Magadeley, W. & Birdy, K., 2009). Innovation is a high-risk process that hides various uncertainty factors and several barriers. The key challenge is how to innovate successfully and to cope with the innovation pace, rather than decide if it is worth innovating or not (Prajogo, D.I., & Ahmed, P.K., 2006). This paper aims to investigate the role of the creation and use of Innovation Laboratories to support companies' innovation. Drawing on a literature review, this research proposes a working definition of Innovation Laboratories and a conceptual framework that describes their key hallmarks.

This article is based on a literature review on Innovation Laboratories. Through a taxonomy it compares the most relevant studies that describe Innovation Laboratories and adopt different perspectives of analysis. The research is synthesised in a conceptual framework that helps to clarify the elusive concept of Innovation Lab and to formulate a working definition.

The interest on Innovation Lab is growing in economic markets (Burger, T., & Hermann, S., 2010). However, to date there is a lack of exhaustive studies on the topic (Meyer, L.P., 2014) and the term Innovation Lab does not have an agreed definition (Memon, A.B., et al., 2018). The paper, through a literature review, provides a clear definition of Innovation Labs. The definition does not consider, like other researches has been to date, only structural and service-based perspectives, but it considers also a scope-based one. Moreover, the paper provides insights on how Innovation Labs impact on innovation capacity development.

The paper provides a taxonomy of Innovation Labs that contributes to shed more light on a relevant phenomenon that is affecting the current innovation dynamics. Especially, the working definition of Innovation Lab offers valuable insights to all stakeholders involved in any way in building, deployment and exploitation of these peculiar innovation catalysers.

Keywords – innovation lab; innovation development; collaborative innovation, taxonomy framework

Nature of the proposed paper: Academic Research Paper

1. Introduction

In the new business landscape companies are confronted to become more and more flexible, intuitive, imaginative, resilient, and creative in order to face the increasing complexity, turbulence, unpredictability and pace of change of the competitive environment. More and more organizations have to face unexpected and unclear scenarios and to undertake unpredictable challenges. In this complex business environment organizations have to develop new competences by leveraging intuition and creative capabilities. So, both private and public organizations, independently from their for profit or not-for profit nature, have to define mechanisms and adopting approaches to support continuous learning and knowledge management for creativity and innovation. For this reason, the development of organisational innovation capacity is critical for any organisation looking to stay relevant and to be competitive and sustainable in the face of disruption and continuous turbulence of business landscape.

The organisational capacity is not simply about to decide if it is worth innovating or not and to embrace innovation, but rather than to equip the organisation with an ability for innovative thinking and successful innovation implementation (Prajogo, D.I., & Ahmed, P.K., 2006). This involves to put in place within organisations mechanisms to manage the innovation dynamics and then to face and overcome the risks associates to the innovation processes. The management literature has largely identified and discussed the factors hampering and affecting organisations' successful innovation processes. Many internal or external factors can prevent organisations' innovations, particularly in SMEs, such as the lack of qualified internal technical resources, the lack of knowledge and knowledge management practices, the difficulties in finding financial resources, the capacity of assessing the market, the conceptual barriers or dynamics that can inhibit the employees' creative thinking (Hadjimanolis, 1999; Madrid-Guijarro et al., 2009; Memon et al., 2018). In the last decade, in order to overcome some of the barriers and risks associated to the innovation management, many organisations have focuse their attention on the creation of an Innovation Lab as a way to deal with the obstacles to innovation and, particularly, create an organisational capacity for innovation. This practice is specifically characterising those organisations that are looking for new models to unpack the open

innovation paradigm and to sustain continuous innovation by shaping a resilient, proactive and creative organisational culture (Chesbrough et al., 2006).

In the academic literature the Innovation Labs can take different forms and present diverse characteristics that tend to be hydiosincritic to the context of application. There are various elusive definitions and different terms that refer to the concept of Innovation Lab (Lewis & Moultrie, 2005; Magadley, W., & Birdy, K., 2009; Gay, R., et al., 2013; Meyer, L.P., 2014; Van Golden, R., et al., 2014; Callaghan, V., et al., 2016; Schmidt, S., et al., 2016; Memon, A.B., et al., 2018).

Despite the growing attention in the business context to these kind of laboratories, the concept is still not structured and well explored (Burger, T., & Hermann, S., 2010). For this reason, this research aims to address the following leading research questions: how can an Innovation Lab be fully defined? What are the main features that characterize an Innovation Lab?

Drawing on a taxonomy of literature review, this research proposes a conceptual framework that, describing the key hallmarks of Innovation Labs, helps to advance the understanding in this field and provides a comprehensive working definition.

The paper is organized as follows. The section 2 explains the research methodology and the search strategy used. The section 3 focuses, through a taxonomy framework, on the carried out literature review and analyzes in detail the key aspects of an Innovation Lab. Then, in the section 5 a comprehensive working definition of Innovation Lab and a conceptual framework that support the theory are provided. Then insights, final remarks and possible future researches in this area are discussed.

2. Research Methodology

The objective of this paper is to identify the major works on Innovation Labs in order to categorize the key features of these kind of laboratories and to propose a comprehensive working definition. In this regard, a literature review is a valid approach, considered that it is a first essential step in structuring a field of research (Easterby-Smith, M., et al., 2002). This helps to define the conceptual content of the field (Meredith, J., 1993) and to develop the theory.

Relevant literature was identified from searches using the strings “*Innovation Laboratories*”, “*Innovation Laboratory*”, “*Innovation Lab*”. Searches were restricted to English language articles, books and or conference proceedings published within a 15-year period (2003-2018 inclusive). Studies were included in the review if they provided (1) definitions and or classification of Innovation Labs (2) empirical analysis, survey or case studies on existing Innovation Labs.

The selected studies were then categorized in a taxonomy framework (figure 1) according to *methodology* used for research, *definition* of Innovation Lab provided, *nature* (creative/physical/virtual spaces, hybrid/internal/external to an organization), *key resources* that characterize an Innovation Lab, *scope* that pushes to resort to an Innovation Labs and categories of *users* that resort to an Innovation Lab.

Then, drawing on the results of the literature review, a conceptual framework (figure 2) that organizes the key hallmarks of an Innovation Lab is proposed in order to advance understanding in this field and to provide a comprehensive working definition of Innovation Labs (par. 4).

3. Defining Innovation Lab

In the academic literature there are various definitions and different terms that refer to the concept of Innovation Lab. They can have different forms and characteristics that tend to be hydiosincrat to the context of application.

In this regard, this section shows the results of a literature review carried out by analyzing the most relevant academic studies in the field of Innovation Labs.

The results are categorized in a taxonomy framework (figure 1) according to *methodology* used for research, *definition* of Innovation Lab provided, *nature* (creative/physical/virtual spaces, hybrid/internal/external to an organization), *key resources* that characterize an Innovation Lab, *scope* that pushes to resort to an Innovation Labs and categories of *users* that resort to an Innovation Lab.

The analyzed studies are based on desk researches, case studies, surveys or interviews (Callaghan, V., et al., 2016; Gay, R., 2013; Van Golden, R., et al., 2014; Lewis, M., & Moultrie, J., 2005; Magadley, W., & Birdy, K., 2009; Memon, A.B., et al., 2018; Meyer, L.P., 2014; Schmidt, S., et al., 2016).

The review aimed to collect useful and common insights about the notion of Innovation Labs, that frequently has been fuzzy defined (Burger, T., & Hermann, S., 2010) and that is still not well and widely explored (Meyer, L.P., 2014). As shown in the Figure 1, the literature provides different but with some common features' definitions of Innovation Lab.

Below, the aspects examined in the literature review has been analyzed in detail. This in order to clearly map the State of the Art of the literature in this field, and to enable, in the next session, discussion that leads to propose a comprehensive working definition of Innovation Lab.

Therefore, considering the *scope* that an Innovation Lab aims to pursue, the literature suggests that Innovation Labs give users the possibility of enhancing their creativity and, through facilitation mechanisms, to think of problems, generate new ideas and brainstorm future opportunities in a dynamic, rapid and novel way (Callaghan, V., et al., 2016; Lewis, M., & Moultrie, J., 2005; Magadley, W., & Birdy, K., 2009). In these laboratories, institutions and organizations gain access to specialized expertise, knowledge, equipment, software, technologies and network in order to develop, test and enhance new products or services (Memon, A.B., et al., 2018; Meyer, L.P., 2014) to increase the capability of product development and decrease time to market (Gay, R., et al., 2013): Moreover organisations have the chance to stimulate business model innovation and develop a systematic approach for innovation processes (Van Golden, R., et al., 2014).

In order to fulfil the proposed aims of an Innovation Lab, the *nature*, in terms of the environment where an Innovation Lab take place, plays a relevant role. One of the

common features is that an Innovation Lab is a dedicated space (Lewis, M., & Moultrie, J., 2005; Magadley, W., & Birdy, K., 2009; Gay, R., 2013; Memon, A.B., et al., 2018) that could have a physical (Magadley, W., & Birdy, K., 2009; Meyer, L.P., 2014; Schmidt, S., et al., 2016; Memon, A.B., et al., 2018) or a virtual (Meyer, L.P., 2014) nature. In this regard, considering that one of the main purposes of an Innovation Lab is encouraging creative and innovative behaviour of people (Lewis, M., & Moultrie, J., 2005), each component of the laboratory has to be geared to this function. It is well known that layout and decor of physical environment, positively impact on creativity of people (Amabile, T.M., 1983; Gardner, G., 2001). At the same time, a physical Innovation Lab, built with the same principles and design studies aimed at eliminate the traditional environment in favour of 'creative spaces' (e.g. curved walls, moveable barriers, open spaces, etc.) positively stimulate an 'out-of-the-box' thinking (Lewis, M., & Moultrie, J., 2005; Magadley, W., & Birdy, K., 2009; Memon, A.B., et al., 2018). According to other studies (Callaghan, V., et al., 2016; Memon, A.B., et al., 2018), an Innovation Lab may also take a virtual or mobile/hybrid configuration. These location-independent forms of laboratories are oriented around technologies or people who facilitate the activities involved in the core functions of the Innovation Lab. Especially, virtual Innovation Labs, by exploiting technologies like virtual and/or immersive reality, cloud, and so on, give people the possibility of being actively involved in innovation processes directly from their own device and from anywhere in the world (Callaghan, V., et al., 2016). A mobile Innovation Lab, otherwise is an itinerant laboratory that could take place in different places, on the basis of the activity that needs to be done. For example, a brainstorming better fit with a creative space. On the contrary, an activity that requires an investigation on customer needs, could take place in a third-party site. According to Memon, A.B., et al. (2018) "*Their activities are not bounded by the lab premises rather the lab personnel carry the necessary equipment along to other sites and facilitate the innovation process therein*" (pag. 9).

Then, an Innovation Lab could be located internally or externally to an organization. Commonly big companies, multinationals, Public Institutions or those organizations that have enough resources (human and financial), build an in-house laboratory to be made available to employees. Differently, SMEs, individual entrepreneurs and those organizations that need to integrate their own resources take advantage of external Innovation Labs. Therefore, the *users* of an Innovation Lab are those public or private, profit or not for profit organizations (SMEs, firms, mass services, management team, individual employees/entrepreneurs, R&D Institutions, Academic Institutes, Universities, Government department, etc.) that aim to implement innovation dynamics in their operations (Lewis, M., & Moultrie, J., 2005; Magadley, W., & Birdy, K., 2009; Gay, R., 2013; Memon, A.B., et al., 2018).

Finally, to effectively guarantee the success of activities, *key resources* became fundamental. The literature groups the key resources of an Innovation Lab in many subcategories. Gay, R., et al., (2013) discuss on the importance of *human agents* distinguishing them in designers, operators and users. The designer is the one who imagine and design the environment and individuate the other resources needed in order

to guarantee effectiveness and efficacy of the innovation process. The operators work in the Innovation Lab and they are responsible for most of the activities conducted. There are various typologies of operators, such as functional or administrative, but the most important is the facilitator. The effectiveness of an Innovation Lab depends on the skills of the facilitator (Lewis, M., & Moultrie, J., 2005). A facilitator helps and supports people in every activity, from problem solving and brainstorming to the implementation of results (Magadley, W., & Birdy, K., 2009). Then, the users are the customers, so the people and/or organizations who need assistance and support in the development of innovation processes. According to the literature, users usually are academic or public institutions, firms (Gey, R., et al., 2013; Lewis, M., & Moultrie, J., 2005) especially SMEs (Van Golden, R., et al., 2014; Schmidt, S., et al., 2016) that generally want to innovate their business models or develop new product or services or big companies that wants to reconfigure their internal R&D department in order to stimulate employers' creativity and to develop internal innovation processes.

Human resources integrate their skills with technologies, equipment, method and tools (Memon, A.B., et al., 2018) such as brainstorming software, interactive screen, 3D oculus, whiteboards, multimedia tools, canvas, etc. This in order to improve the quality of the phases of generation, discussion and assessment of ideas (Thieme, M., & Meyer, K., 2011).

Finally, the *time* is a relevant component of an Innovation Lab. Time is one of the higher barriers to innovation for an organization, especially when they are overworked (Larsen, P., & Lewis, A., 2007). Give employees time to procrastinate and to go out from traditional boundaries of offices could be a good practice that increase creativity (West, M.A., 2000). In this regard, Innovation Labs “*give the users time for creative thinking*” (Schmidt, S., et al., 2016). (pag. 236). If continuous and repetitive interruptions may negatively affect employees' productivity, a dedicated Innovation Lab “*May clear employees' minds and allow them to focus solely on the creative task, free from disruptive interruptions*” (Magadley, W., & Birdy, K., 2009). (pag. 316).

Table 1. Taxonomy of Innovation Labs

Study	methodology	Definition	Components	Value Proposition	Users
Lewis, Moultrie 2005	Case study	An Innovation Lab is a dedicated facilities for encouraging creative behaviours and supporting innovative projects that support innovative activity through the provision of appropriate resources, visualization and model making facilities and the ability to reconfigure for new projects.	Structural and infrastructural	Create an environment in which strategies for business growth could be developed in a fun, dynamic, rapid and novel way	Mass services, government department, academic institutions
Magadley, Birdy 2009	Mixed-method approach: Case study and structured interviews	An Innovation Lab is a dedicated physical environments or facilities with collaborative workspaces in which groups and teams of	Time, Space and Technologies	Enhancing creativity and to explore user's attitudes; Facilitate individual and team creative thinking such as thinking of existing	Employees

		employees can engage with each other in order to explore and extend their creative thinking beyond and above normal boundaries		problems in a new ways, generating new ideas and thinking about how these ideas could be implemented	
Gay, Thieme 2013	Meta-structuring approach : Framework + Literature review	An Innovation Lab is a dedicated physical environment where suitable tools and methods are applied to assist in the process of idea creation or innovation development	Human agents: designer, operator, user and Material artifacts: space, tools and methods	Increase the capability of new product development and decrease time to market	Firms or Institutions
Meyer 2014	Web based study	An Innovation Lab is an ideal physical or virtual collaborative work environment where companies can develop, test and enhance innovations		Develop, test and enhance innovations	
Van Golden et al., 2014	Case-based approach	An Innovation Lab is a collaborative meeting ground between SMEs and business schools with a twofold objective: to stimulate business model innovation in SMEs and to develop a systematic approach for innovation processes		Stimulate business model innovation in SMEs; develop a systematic approach for innovation processes, adjusted to their limited financial and marketing resources	SMEs Academic Institutes
Callaghan et al., 2016	Case study	An Innovation Lab is a location-independent collaborative ideation spaces ... that requires three interlinking components namely the environment, the technology and the facilitation mechanisms to make it suitable for ideation and innovation activities	Environment, Technology and facilitation mechanisms	A specially designed environment that is conducive to creative thinking and to brainstorm future possibilities	Management team
Schmidt et al., 2016	Open and explorative desktop and online research	An Innovation Lab is a physical spaces for testing innovative ideas, alternative business models, new economic practices or flexible cooperation structures.	Spaces which temporally unite specialized competencies in a single place. Alongside technology and providing space, innovation labs also give the users time for creative thinking	Fields of experimentation and crystallization points for temporary practices that generate product, process, and organizational innovations ... New spatial configuration that gains access to specialized expertise/knowledge, equipment, software, technologies and networks	Enterprises, research and development institutions, universities

Memon, et al., 2018	In-depth expert interviews and definition of a service-based taxonomy	An Innovation Lab is a dedicated physical or mobile structure which mediates the innovation process and enables the effective development of innovations through the provision of collaborative services and necessary resources (equipment, methods and tools)'. Physical environment, Resources: soft skills such as the knowledge, technical and methodological expertise, hardware including the tangible operational and technological resources, and finance	-Enable the innovation process: generation of creative ideas; identification of the problem or need of innovation; exploration of market opportunities; assessment of end users' and/or market needs; analysis of the success or failure of innovation in marketplace -InnoLabs appear supporting innovations in three domains: product development, business processes, and service development
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4. Final Remarks

The literature review highlights several definitions of Innovation Labs. Most of them present common traits, but at the same time they have many differences. Over time this ambiguity contributed to create a fuzzy overview in this field that needed further studies and considerations.

In the light of the results of literature review, the paper proposes a working definition and a conceptual framework (Figure 2) of the Innovation Lab that summarizes and contains all the perspectives addressed in the previous studies in this area.

The framework provides a picture of an ideal Innovation Lab and consider every distinguishing feature. It shows the categories of users benefiting from an Innovation Lab, the key resources that operate inside such laboratories and the type of configurations and environment and that can host an Innovation Lab.

In this regard, *an Innovation Lab is a dedicated physical, virtual and/or mobile environment, internal or external to public or private, profit or not for profit organizations, where users benefit of a set of human and technological resources for stimulate business model innovations and support innovation processes.*

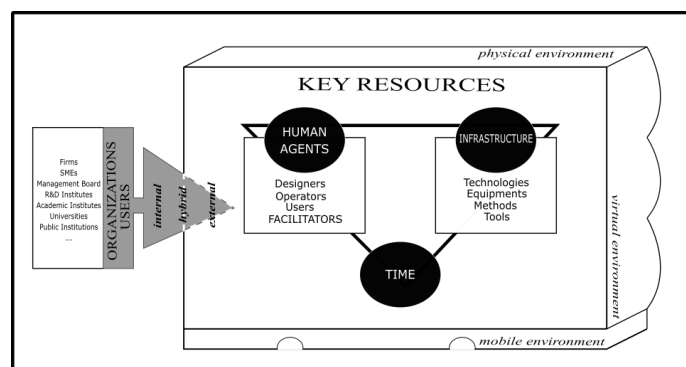


FIGURE 2. Conceptual Framework - Innovation Lab

The definition, according to the studies carried out to date, consider structural and service-based perspectives. It is about two perspectives that need to be further explored. In particular, there is a need of further studies aimed at mapping the state of the art and the presence and diffusion of Innovation Labs in local and global contexts. In this sense, some studies have already been carried out. Meyer, L.P., (2014), Schmidt, S., et al. (2016) and Memon, A.B., et al. (2018), conducted in-depth interviews and web-based studies on a relevant, but not yet representative sample. They individuate in their studies a series of service-based distinguishing categories for Innovation Labs. Schmidt, S., et al. (2016) on the basis of a research carried out among Innovation and Creative Labs in Berlin, list 5 categories: *Grassroots Lab*; *Co-working Lab*; *Firm-driven Innovation Lab*; *Academic-driven Innovation Lab* and *Incubators and Accelerators*. Memon, A.B., et al. (2018) conducted interviews with Innovation Lab facilitators. This research, based on a sample of 190 laboratories identified by Meyer, L.P., (2014) in their study, distinguish 9 not disjoint categories: *Service/Process Laboratory*; *Product/Production Laboratory*; *Consulting Laboratory*; *Co-working space*; *Business incubator*; *Network coordinator*; *Living Laboratory*; *Fabrication Laboratory* and *Research and Development Laboratory*.

Furthermore, the scope of Innovation Labs has been analysed. It can range from turning new ideas and problems into new business opportunities, to foster creative thinking to sustain organisational value creation dynamics and to develop a systematic approach for innovation processes.

This is the first attempt to define an Innovation Lab considering its scope or its intended purpose. This aspect opens the possibilities of new and in-depth research in this field, aimed at providing a scope-based categorization of Innovation Labs and to identify and define a generic and ideal *process/model/logical framework* that represents the key activities required to lead and manage an Innovation Lab.

Furthermore, this kind of categorization could also have practical implications for Innovation Lab's users, such as the possibility of helping them to better identify the best possible intervention and providers on the basis of their needs.

References

- Amabile, T.M. (1983) *The Social Psychology of Creativity*. Springer-Verlag, New York.
- Amabile, T.M. (1988) A Model of Creativity and Innovation in Organizations. *Research in Organizational Behaviour*, 10, 123–67.
- Burger, T., & Hermann, S. (2010). Innovative Dienstleistungen aus dem Labor. In *GI Jahrestagung (1)* (pp. 89-95).
- Callaghan, V., Davies, M., & Zhang, S. (2016). An online immersive reality innovation-lab. *iLRN*.
- Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.). (2006). *Open innovation: Researching a new paradigm*. Oxford University Press on Demand.
- Easterby-Smith, M. T., & Thorpe, R. (2002). R. and Lowe, A. (2002). *Management research: an introduction*, 2, 342.
- Gardner, G. (2001) *Lab Practicals*. FX: Design, Business and Society, February, 56–60.

- Gey, R., Meyer, L. P., & Thieme, M. (2013, September). A Conceptual Framework for Describing the Phenomenon Innovation Laboratory: A Structural Viewpoint. In *Proceedings of the XXIII International RESER Conference, Aix en Provence, France* (pp. 19-21).
- González, X., Jaumandreu, J., & Pazó, C. (2005). Barriers to innovation and subsidy effectiveness. *RAND Journal of Economics*, 930-950.
- Hadjimanolis, A. (1999). Barriers to innovation for SMEs in a small less developed country (Cyprus). *Technovation*, 19(9), 561-570.
- Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research policy*, 35(5), 715-728.
- Larsen, P., & Lewis, A. (2007). How award-winning SMEs manage the barriers to innovation. *Creativity and innovation management*, 16(2), 142-151.
- Lewis, M., & Moultrie, J. (2005). The organizational innovation laboratory. *Creativity and innovation management*, 14(1), 73-83.
- Madrid-Guijarro, A., Garcia, D., & Van Auken, H. (2009). Barriers to innovation among Spanish manufacturing SMEs. *Journal of Small Business Management*, 47(4), 465-488.
- Magadley, W., & Birdi, K. (2009). Innovation labs: an examination into the use of physical spaces to enhance organizational creativity. *Creativity and innovation management*, 18(4), 315-325.
- Memon, A. B., Meyer, K., Thieme, M., & Meyer, L. P. (2018). Inter-InnoLab collaboration: An investigation of the diversity and interconnection among Innovation Laboratories. *Journal of Engineering and Technology Management*, 47, 1-21.
- Memon, A. B., Meyer, L. P., Meyer, K., & Fähnrich, K. P. (2014). An Insight Survey of Innovation Laboratories Worldwide. *Advances in The Human Side of Service Engineering*, 1, 174-185.
- Meredith, J. (1993). Theory building through conceptual methods. *International Journal of Operations & Production Management*, 13(5), 3-11.
- Meyer, L. P. (2014). *Innovation Laboratories Worldwide: Insights Gathered Through the Analysis of the Representation in the World Wide Web*. Universität Leipzig, Inst. für Angewandte Informatik.
- Prajogo, D. I., & Ahmed, P. K. (2006). Relationships between innovation stimulus, innovation capacity, and innovation performance. *R&D Management*, 36(5), 499-515.
- Schmidt, S., Brinks, V., & Brinkhoff, S. (2014). Innovation and creativity labs in Berlin. *Zeitschrift für Wirtschaftsgeographie*, 58(1), 232-247.
- Thieme, M., & Meyer, K. (2011, March). Innovation through collaboration: a case-study based strategy to connect research institutions and enterprises. In *SRII Global Conference (SRII), 2011 Annual* (pp. 622-629). IEEE.
- Van Goolen, R., Evers, H., & Lammens, C. (2014). International Innovation Labs: An innovation meeting ground between SMEs and business schools. *Procedia Economics and Finance*, 12, 184-190.
- West, M. A. (2002). Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups. *Applied psychology*, 51(3), 355-387.

Framework for Digital Innovation Capacity Development

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Abstract

In the last years the competitive landscape is experiencing a transition process from the industrial to the digital age. Digital innovations and digital transformation processes are increasingly influencing the productive system impacting in a disruptive way and revolutionizing it, modifying traditional operative system, introducing new forms of value and generating or innovating business models. Therefore, organisations that want to keep up with changing times have to implement as soon as possible digital transformation processes. So, they have to acquire culture, competence and digital skills that could allow them to continue to profitably innovate and interact with the innovative ecosystem within which they operate. In this regard, understanding what are the key factors influencing the organisation's digital innovation capacity is becoming a relevant research topic. Based on a literature review, the study describes the key factors that allow an organisation to develop its digital innovation capacity and proposes a conceptual framework describing how organisation's innovativeness turns into digital innovation capacity by leveraging and managing these key factors.

This paper is based on a literature review on the concepts of innovativeness and innovation capacity. It analyses the most relevant studies that describe these concepts and proposes a definition of digital innovation capacity and a conceptual framework that describes how to lead an organization in the process of transformation of innovativeness into digital innovation capacity.

In the current competitive scenario, the interest on digital innovation capacity is growing. However, to date there are few attempts of revising the concept of innovation capacity under a digital perspective. Based on the results of a literature review, the study proposes

a first definition of digital innovation capacity and analyses the factors underpinning its development.

The paper offers valuable insights to organisations that want to embrace digital transformation challenges and that aim to develop a digital innovation capacity.

Keywords – innovativeness; innovation capacity; digital innovation; digital innovation capacity

Nature of the proposed paper: Academic Research Paper

1. Introduction

The actual competitive scenario is characterized by continuous changes and massive competition. It is therefore essential for organisations to assume proactive and resilient attitudes, and to focus and invest in innovation in order to remain competitive. Over the years, understanding how and why an organization is more innovative than others and what are the factors affecting organisation's innovative capacity, have been topics of interest for many scholars (Hii, & Neely, 2000; McGrath, 2001; Porter & Stern, 2001; Koc, & Ceylan, 2007; Neely & Hii, 2012).

In the last years the competitive landscape is experiencing a transition process from the industrial to the digital age, where intelligent and connected products and devices are becoming increasingly popular and where data are even more accessible (Carlucci, & Schiuma, 2018). Digital innovations and digital transformation processes are increasingly influencing the productive system impacting in a disruptive way and revolutionizing it, also modifying traditional operative system, introducing new forms of value and generating or innovating business models. Therefore, organisations that want to keep up with changing times have to implement as soon as possible digital transformation processes, acquire culture, competence and digital skills that could allow to continue to profitably innovate and interact with the innovative ecosystem within which they operate.

In this regard, as the processes and operating systems must be reviewed in a digital perspective, also the innovation capacity of organisations need to be framed under a digital lens.

In the light of this, this research aims to address the following leading research questions: what are the key factors determining innovation capacity and digital innovation capacity? How to translate organisation's innovativeness in digital innovation capacity? How can an organization develop its digital innovation capacity?

Drawing on the results of a literature review, this research proposes a conceptual framework that describes the key factors that properly exploited and managed allows to turn organisation's innovativeness into a great digital innovation capacity.

The paper is organized as follows. The section 2, through a literature review, describes the concept of innovativeness. The section 3, analyses the concept of innovation capacity and those factors underpinning its development. Section 4 revises the previous concepts

under a digital perspective and then, in the section 5 a conceptual framework describing how to translate innovativeness in digital innovation capacity is provided. Then final remarks are briefly presented.

2. Innovativeness

Over the years, the concept of innovativeness has been widely addressed under different perspectives of analysis by many scholars. The first attempt of defining innovativeness was made by Rogers (1962), who considered it at the individual level as the attitude and the speed of an individual to adopt new ideas compared to others. In this regard, Rogers and Shoemaker (1971) defines innovativeness as “the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than the other members of a system” (p. 27)

Looking at the organisation as a unit of adoption, innovativeness is considered its propensity to innovate (Neely & Hii, 2012). It is related to the organisation’s capacity to pursue innovation. This in terms of introduction of new processes, products, services and or ideas in the organisation (Hult, 2004; Kamaruddeen et al., 2010). Looking at the product, innovativeness expresses the attitude of an organisation to buy, adopt and gain acceptance for new products or services (Foxall, 1984), or ideate and disseminate them into existing or new markets (Wang & Ahmed, 2004). In this regard it is interesting to underline that the concept of innovativeness can be distinguished from entrepreneurial orientation (Lumpkin & Dess, 1996) because innovativeness not necessarily requires introduction to the market (Hult, 2004). Moreover, innovativeness can be considered as “the capacity of an organization to improve the existing products, services and/or processes, and the capacity to utilize the creative resources of the organization to the fullest” (Gebert, et al., 2003). So, incremental innovation is considered as part of firm innovativeness (Kamaruddeen, A.M., et al., 2010).

Kitchell (1995) considers innovativeness as the organization’s propensity to adopt new technologies and digital approaches, also looking at the environmental opportunities. Under this perspective, innovativeness represents a need to keep up to date and to aim to achieve a sustainable competitive advantage.

The concept of innovativeness has also and above all, a behavioural sense. In Hult et al., (2004), innovativeness is defined as cultural readiness and appreciation for innovation and considered as cultural precursor that facilitates innovative behaviour that characterizes innovative organisations. Innovative organisations are those that manage to overcome innovation barriers (D’Este et al., 2012), among which the openness to the innovation (Zaltman, 1973) that is the attention to understand the need for new ideas and strategies inside the organizations, the ability of combining new ideas with existing elements in order to create value for stakeholders (Hurley & Hult, 1998).

Innovativeness is also related to the culture of an organization aimed at promoting a shared mindset oriented to spread and support new ideas, approaches and tests (Keskin, H., 2006). Moreover, it also linked to “high tolerance for ambiguity, taking risk, and evaluating uncertain situation more favourably” (Garcí, & Calantone, 2002).

Summarising the numerous definitions and characterisation of innovativeness, it seems possible to describe the innovativeness as *the degree to which an organization is open, propense and ready to understand, adopt, stimulate and disseminate innovation*.

Innovative organisations are those that assume an innovative behaviour overtime and not just for a short period (Subramanian & Nilakanta, 1996). An organisation is considered innovative when it adopts innovation, but the magnitude to which the organisation is innovative is strictly related to the number of innovations adopted (Kamaruddeen et al., 2010).

In such a view, understanding how innovativeness translates into organisation's innovation capacity is worthwhile.

3. Innovation Capacity: definition and key factors

Avlonitis et al. (1994) assert that adopting a behavioural willingness and intention to innovate is not enough to be considered an innovative organization. Neely (2000; 2012) defines the innovation capacity of an organization as "the potential to generate new ideas, identify new market opportunities and implement marketable innovations by leveraging on existing resources and capabilities". Szeto (2000) defines innovation capacity as a continuous improvement of the overall capability of organisations to generate innovation for developing new products to meet market needs.

In a broader sense, the innovation capacity of an organization can be defined as "the potential of that organization to generate innovative outputs" (Neely, & Hii, 2012, p. 49)

Several factors affect organisation's innovative capacity (Barney, 1986; Teece & Pisano, 1994; Hii & Neely, 2000). These factors are discussed below.

First of all, the *organizational capital* (Tomer, 1987), defined as the combination of explicit and implicit knowledge that characterizes the organizational activities of an organization and its elements, including culture, structure and organizational learning, can positively affect the innovation capacity of an organization (Martin-de-Castro et al., 2006). The organizational capital "influences the way things are done within the organization" and the relationship among the stakeholders (Hii, & Neely, 2000). Innovative companies, from this point of view, are characterized by a strong openness and commitment to innovation, to the continuous improvement and also have a strong culture and a shared mission (Neely & Hii, 2012).

Another relevant aspect that can improve the innovation capacity of an organization is the *knowledge management* (Nonaka & Takeuchi, 1995; Antonelli, 1999; Carneiro, 2000; Darroch, 2005; Du Plessis, 2007; Mehrabani, 2012) because knowledge is one of the fundamental components of the innovation process which, if well managed, exploited and integrated within the organization, acts by reducing uncertainties and complexity in innovative activities and helping decision making, data integration and broad collaboration (Cong & Pandya, 2003; Cavusgil, et al., 2003). Knowledge management positively impacts on organisation's innovation capacity if considered as a continuous process that supports the organisation's needs in terms of knowledge creation, knowledge organization, knowledge dissemination, and knowledge application (Mehrabani, &

Shajari, 2012). Strictly related to knowledge management are those *competences* that can enable innovation processes within organisations (Teece & Pisano, 1994; Hii & Neely, 2000). Organisation's core competence are classified by Tidd (2000) into three categories: organizational competence, that include knowledge, innovation capabilities (e.g. creativity, idea generation capability, risk taking, problem solving, teambuilding, empowerment) value, norms and managerial systems; market competence, that refer to the ability to understand and exploit its markets and consumers' needs and habits; and technological competence that also derived from R&D activities. The role of management is to understand the scenario dynamics, employer's and consumer's needs, and market opportunities and combine them with internal competences in order to increase innovation capacity.

To really increase the organisation's innovation capacity, it is required to systematize and codify *internal processes* that also take into account the above mentioned tangible and intangible factors and that create the prerequisites to implement innovative processes. An innovative organization has to guarantee the systematic and continuous realization of internal processes, such as idea generation and capture, brainstorming sessions, performance measures and training (Hii, & Neely, 2000). This in order to facilitate the generation, adoption and dissemination of innovative outputs. This is possible by favouring the creation of an agile working climate and environment where employees scheme suggestions were widespread, successful ideas were highly thought and failure was regarded as essential to the learning process (Hii & Neely, 2000). These internal processes need to dialogue and to operate within the *innovation ecosystem*, conceived as "the complex relationships that are formed between actors or entities whose functional goal is to enable technology development and innovation" (Jackson, 2011, p. 2) and including material resources (funds, equipment, facilities, etc.) and stakeholders (customers, competitors, suppliers, strategic partners, investors, government etc.) (Neely & Hii, 2012; Oh et al., 2016). Consequently, the *stakeholder management* becomes a strategic process for improving the innovation capacity of organisations. This is possible by developing active collaborations with other organisations to share and integrate knowledge, to optimize costs and resources and to contain risks; by activating dialogues and working in partnership with investors and government and having a proactive approach with customers in order to stimulate innovations able to satisfy common and shared needs.

4. Digital Innovation Capacity: definition and key factors

Nowadays, digital innovations and digital transformation dynamics are having a disruptive impact on business performance and on traditional operating models. A recent report by MIT Sloan Management Review and Deloitte (2015) found that nearly 90% of interviewed managers state that their industry is likely to be disrupted by digital technologies. Consequently, organisations need to renew their innovation capacity (Karimi & Walter, 2015) and to develop a digital innovation capacity, in order to face this incumbent digital disruption.

According to Fichman et al., (2014), digital innovation is “a product, process, or business model that is perceived as new, requires some significant changes on the part of adopters, and is embodied or enabled by IT” (p. 330). Neely & Hii, (2012) define innovation capacity as “the potential of an organization to generate innovative outputs”.

In line with the main features associated to the concepts of innovation capacity and digital innovation in the literature, this work provides the following working definition of digital innovation capacity: it is *the potential of an organization to generate innovative outputs that are embodied or enabled by IT*.

The development of a digital innovation capacity requires the exploitation and management of several factors underpinning organisation’s innovation capacity. Especially these factors have to allow the generation of innovative outputs that are embodied or enabled by IT.

The development of a digital innovation capacity requires a balance of new and established innovation competence and skills (Svahn, et al., 2017).

Digital innovative organizations make efforts in forming IT and technical skills of employees. They invest to integrate in their staff new digital specialists, such as developers and/or data scientists to support their digital ambitions and to harness the new opportunities provided by digital technology (DeNisco Rayome, A., 2019).

To stimulate and implement digital innovation capacity, in organisation knowledge management has to be oriented towards the creation of a culture that embraces change and that looks to new digital approaches, such as for example the agile methods. Moreover, organisation needs to cross-fertilize the existing innovation ecosystem also under an open innovation approach which could allow it to acquire the needed data, technologies or services to gain more effective results (DeNisco Rayome, 2019; Svahn, et al., 2017). A profitable dialogue with the innovation ecosystem in the Digital Age is not possible without a digital infrastructure, intended as the collection of technological and human components, networks, systems, and processes that build a bridge between organization and ecosystem in order to allow open, intelligent and integrated access to the immense amount of data available nowadays and to fully exploit its potentials, opening new opportunities for innovation (Braa, et al., 2007; Tilson, et al., 2010).

5. Digital Innovation Capacity development: A Conceptual Framework

In the light of the results of literature review in the field of innovativeness, innovation capacity and digital innovation, in this section a conceptual framework (figure 1) aimed at explain how to translate innovativeness in digital innovation capacity is proposed.

Framework for Digital Innovation Capacity Development

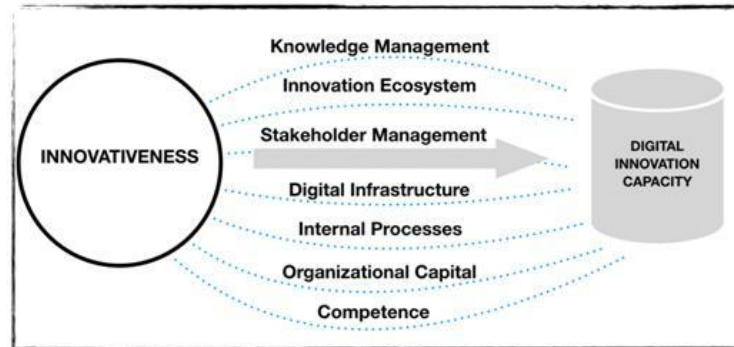


Figure 1 - source: own elaboration

The proposed conceptual framework reflects the results of the literature analysed in the previous sections and provides a picture of how the organisation's innovativeness, combined with some key factors properly deployed and exploited, i.e. knowledge management, Innovation Ecosystem, Stakeholder Management, Digital Infrastructure, Internal Processes, Organizational Culture, Competence, can contribute to the development of an organisation's digital innovation capacity.

6. Final Remarks

Drawing on the results of a literature review, the paper focuses on definitions and key factors characterizing the concepts of innovativeness, innovation capacity and digital innovation capacity.

In particular, the paper analyses factors that can help an organization to develop its digital innovation capacity and offers a conceptual framework that depicts how organisation's innovativeness can turn into digital innovative capacity by leveraging several organisational factors.

This study represents a first attempt to define the concept of digital innovation capacity, based on the recent literature. More research is needed around this topic in order to better understand, in addition to the analysed key factors, the key processes that can lead an organization to develop a digital innovation capacity.

References

- Antonelli, C. (1999), "The evolution of the industrial organization of the production of knowledge", *Cambridge Journal of Economics*, Vol. 23, pp. 243-60.
- Avlonitis, G. J., Kouremenos, A., & Tzokas, N. (1994). Assessing the innovativeness of organizations and its antecedents: Project Innovstrat. *European Journal of Marketing*, 28(11), 5-28.

- Barney, J. B. (1986). Organizational culture: can it be a source of sustained competitive advantage?. *Academy of management review*, 11(3), 656-665.
- Braa, J., Hanseth, O., Heywood, A., Mohammed, W., & Shaw, V. (2007). Developing health information systems in developing countries: the flexible standards strategy. *Mis Quarterly*, 381-402.
- Carlucci, D., Schiuma, G., & Santarsiero, F. (2018). Toward a data-driven world: Challenges and opportunities in arts and humanities. *Big data in the arts and humanities: Theory and practice*, 15-26.
- Carneiro, A. (2000). How does knowledge management influence innovation and competitiveness?. *Journal of knowledge management*, 4(2), 87-98.
- Cong, X., & Pandya, K. V. (2003). Issues of knowledge management in the public sector. *Electronic journal of knowledge management*, 1(2), 25-33.
- D'Este, P., Iammarino, S., Savona, M., & von Tunzelmann, N. (2012). What hampers innovation? Revealed barriers versus deterring barriers. *Research policy*, 41(2), 482-488.
- Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of knowledge management*, 9(3), 101-115.
- Du Plessis, M. (2007). The role of knowledge management in innovation. *Journal of knowledge management*, 11(4), 20-29.
- Fichman, R. G., Dos Santos, B. L., & Zheng, Z. E. (2014). Digital innovation as a fundamental and powerful concept in the information systems curriculum. *MIS quarterly*, 38(2).
- Foxall, G. (1984). *Corporate Innovation: Marketing and Strategy*, New York: St.
- Garcia, R., & Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: a literature review. *Journal of Product Innovation Management: An International Publication of the Product Development & Management Association*, 19(2), 110-132.
- Gebert, D., Boerner, S., & Lanwehr, R. (2003). The risks of autonomy: Empirical evidence for the necessity of a balance management in promoting organizational innovativeness. *Creativity and innovation management*, 12(1), 41-49.
- Hii, J., & Neely, A. (2000). Innovative capacity of firms: on why some firms are more innovative than others.
- Hult, G. T. M., Hurley, R. F., & Knight, G. A. (2004). Innovativeness: Its antecedents and impact on business performance. *Industrial marketing management*, 33(5), 429-438.
- Hurley, R. F., & Hult, G. T. M. (1998). Innovation, market orientation, and organizational learning: an integration and empirical examination. *Journal of marketing*, 62(3), 42-54.
- Jackson, B. D. J. (2011). What is an innovation ecosystem?, Washington DC.
- Kamaruddeen, A. M., Yusof, N. A., & Said, I. (2010). Innovation and innovativeness: Difference and antecedent relationship. *The Icfai University Journal of Architecture*, 2(1), 12.
- Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2015). Strategy, not technology, drives digital transformation. *MIT Sloan Management Review and Deloitte University Press*, 14, 1-25.
- Karimi, J., & Walter, Z. (2015). The role of dynamic capabilities in responding to digital disruption: A factor-based study of the newspaper industry. *Journal of Management Information Systems*, 32(1), 39-81.
- Keskin, H. (2006). Market orientation, learning orientation, and innovation capabilities in SMEs: An extended model. *European Journal of innovation management*, 9(4), 396-417.
- Kitchell, S. (1995). Corporate culture, environmental adaptation, and innovation adoption: a qualitative/quantitative approach. *Journal of the Academy of Marketing Science*, 23(3), 195-205.

- Koc, T., & Ceylan, C. (2007). Factors impacting the innovative capacity in large-scale companies. *Technovation*, 27(3), 105-114.
- Lumpkin, G. T., & Dess, G. G. (1996). Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of management Review*, 21(1), 135-172.
- Martín-de-Castro, G., Emilio Navas-López, J., López-Sáez, P., & Alama-Salazar, E. (2006). *Organizational capital as competitive advantage of the firm*. *Journal of Intellectual Capital*, 7(3), 324-337.
- McGrath, R. G. (2001). Exploratory learning, innovative capacity, and managerial oversight. *Academy of management journal*, 44(1), 118-131.
- Mehrabani, S. E., & Shajari, M. (2012). Knowledge management and innovation capacity. *Management Research*, 4(2), 164.
- Neely, A., & Hii, J. (2012). The innovative capacity of firms. *Nang Yan Business Journal*, 1(1), 47-53.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford university press.
- Oh, D. S., Phillips, F., Park, S., & Lee, E. (2016). Innovation ecosystems: A critical examination. *Technovation*, 54, 1-6.
- Porter, M. E., & Stern, S. (2001). National innovative capacity. *The global competitiveness report, 2002*, 102-118.
- Rogers, E. M. (1962). Diffusion of innovativeness. NY: *The Free Press of Glencoe*.
- Rogers, E. M., & Shoemaker, F. F. (1971). Communication of Innovations; A Cross-Cultural Approach.
- Subramanian, A., & Nilakanta, S. (1996). Organizational innovativeness: exploring the relationship between organizational determinants of innovation, types of innovations, and measures of organizational performance. *Omega*, 24(6), 631-647.
- Svahn, F., Mathiassen, L., Lindgren, R., & Kane, G. C. (2017). Mastering the digital innovation challenge. *MIT Sloan Management Review*, 58(3), 14.
- Szeto, E. (2000). Innovation capacity: working towards a mechanism for improving innovation within an inter-organizational network. *The TQM Magazine*, 12(2), 149-158.
- Tamer Cavusgil, S., Calantone, R. J., & Zhao, Y. (2003). Tacit knowledge transfer and firm innovation capability. *Journal of business & industrial marketing*, 18(1), 6-21.
- Teece, D. J., & Pisano, G. (1994). The dynamic capability of firms: An introduction. *Industrial and Corporate Change*, 3(3), 537-556.
- Tidd, J. (2000). *From Knowledge Management to Strategic Competence: Measuring technological, market and organizational innovation*. World Scientific Publishing Co. Pte. Ltd..
- Tilson, D., Lyytinen, K., & Sørensen, C. (2010). Research commentary—Digital infrastructures: The missing IS research agenda. *Information systems research*, 21(4), 748-759.
- Tomer, J. F. (1987). Organizational capital: *The path to higher productivity and well-being*. New York: Praeger.
- Wang, C. L., & Ahmed, P. K. (2004). The development and validation of the organisational innovativeness construct using confirmatory factor analysis. *European journal of innovation management*, 7(4), 303-313.
- Wayne Gould, R. (2012). Open innovation and stakeholder engagement. *Journal of technology management & innovation*, 7(3), 1-11.
- Zaltman, G. (1973). R. Duncan, and J. Holbek. *Innovation and Organizations*.

Consumer Objective and Subjective Knowledge Discrepancy Scenarios: Added Sugar Case

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Abstract

Consumer knowledge is a crucial organizational resource which can help advance research and development or create processes which facilitate effective management of the organization-consumer relationship. Consumer objective and subjective knowledge discrepancy is one of the critical factors influencing consumer attitudes to product / brand and buying behaviour. This study aims to reveal the consumer knowledge discrepancy about added sugar discrepancy scenarios. Knowledge discrepancy can go in two scenarios: a consumer's subjective knowledge is greater than their objective knowledge (overestimation), or their subjective knowledge is lower than their objective knowledge (underestimation). Both underestimation and overestimation may negatively affect consumer's attitudes and behaviour. Therefore, it is important for organisations to proactively identify a possible knowledge discrepancy scenario, as well as manage negative impact on consumer attitudes to product and brand and buying behaviour.

Empirical research was grounded by a positivist approach and quantitative strategy. Consistent with the quantitative, descriptive research design, a questionnaire was designed to measure the relevant constructs. The questionnaire consisted of three sections measuring objective and subjective added sugar knowledge and information related to the potential antecedent variables. Most of the variables were measured through a multi-item scale and were extracted and adapted from previous research. The data were collected from 432 residents of Lithuania. The findings have revealed that five possible knowledge discrepancy scenarios exist in the study case.

The results of research increase understanding and ability to identify and manage consumer knowledge discrepancy. Following it, organizations become more flexible and gain sustainable competitive advantage.

Keywords – objective knowledge, subjective knowledge, knowledge discrepancy, consumer behaviour, scenario.

Paper type – Academic Research Paper.

1 Introduction

A differentiation is made between subjective knowledge (what consumers believe they know) and objective knowledge (what consumers actually know). It has been theorized that these concepts have different implications on purchasing behaviour, making such a distinction necessary (Pieniak et al., 2010; House et al., 2004; Ellen, 1994). A measurement of discrepancy is also constructed to visualize the gap between consumers' subjective and objective knowledge.

According to its nature, knowledge can be objective or subjective. (Philippe & Ngobo, 1999). Carlson et al. (2009) conceptualise consumer's objective knowledge as accurate stored information, and subjective – as consumer's self-beliefs about his/her own knowledge. In other words, objective knowledge depicts what consumers know, and subjective what they think they know. Park, Garden & Thukral (1988) emphasise that empirical findings indicate that there is often a discrepancy between one's actual knowledge and one's self-assessment of that knowledge.

Knowledge discrepancy, or consumer “illusion of knowing”, as Raju et al. (1995) state, “knowledge about one's own knowledge plays an important role in a wide variety of processing tasks, including recognition, perceptual identification and insight problem solving”. To understand consumers' attitudes and buying behaviour, it is important to understand the distance between one's objective and subjective knowledge.

In research, great emphasis is put on the classification of consumer knowledge according to its nature, i.e. on subjective and objective knowledge as well as its investigation. Consumer knowledge research most often focuses on objective and subjective knowledge relation (Aertsens et al., 2011; Dodd et al., 2005), subjective knowledge impact on consumer attitude and behaviour (Selnes, Gronhaug, 1986; Feick et al., 1992; Ellen, 1994), objective and subjective knowledge influence on the sources of information relied on by consumers [14], subjective and objective knowledge as determinants of consumption (Verbeke, 2008; Pieniak et al., 2010). Ellis and Caruana (2018) point out the segments of wine consumers, based on the combination of objective and subjective consumer knowledge, etc. There is also a clear research trend on the impact of consumer personal characteristics on structural alterations of knowledge: numerous studies have found consumer knowledge and self-confidence to be influential (Flynn, Goldsmith, 1999; Alba, Hutchinson, 2000).

As Khan et al. (2017) emphasise, knowledge discrepancy can go in two scenarios: consumer's subjective knowledge is greater than their objective knowledge (overestimation), or their subjective knowledge is lower than their objective knowledge (underestimation). Both underestimation and overestimation may negatively affect consumer's attitudes and behaviour. Focusing on consumer knowledge discrepancy scenarios organizations may have a great opportunity. They can proactively identify a possible knowledge discrepancy scenario, as well as manage negative impact on consumer attitudes to product and brand and buying behaviour.

To summarize, this paper's contributions to the literature are as follows: first, it introduces the construct of consumer knowledge discrepancy and grounds a principal

methodological proposition that consumer self-confidence operates as an antecedent to subjective knowledge perception. The work substantiates the idea that consumer confidence level conditions the heterogeneity of consumer behaviour both in overestimation and underestimation of knowledge. It also demonstrates consumer discrepancy scenario definition and main scenario content characteristics. Finally, the empirical research establishes that five, not two, knowledge discrepancy scenarios may exist, depending on the degree of manifestation of knowledge discrepancy; it also outlines directions for consumer knowledge discrepancy future research.

2 Knowledge discrepancy conceptualisation

According to its nature, knowledge can be objective or subjective (Philippe & Ngobo, 1999). Carlson et al. (2009) conceptualise consumer objective knowledge as accurate stored information, and subjective – as consumer's self-beliefs about his/her own knowledge. In other words, objective knowledge depicts what consumers know, and subjective – what they think they know.

Knowledge discrepancy, or consumer “illusion of knowing”, as Raju et al., (1995) state, “knowledge about one's own knowledge plays an important role in a wide variety of processing tasks, including recognition, perceptual identification and insight problem solving”. The above definition allows for presumption that knowledge discrepancy is tightly connected with consumer self-confidence level. Veale (2008) claims that there are parallels between consumer self-confidence level and product evaluation: individuals with low level of self-confidence usually lack self-belief if faced with strong opposing opinion, and alternatively, consumers with high level of self-confidence usually possess strong attitudes that are very difficult to change. Park et al. (1994) in their theoretical and empirical research reveal that there is a positive relation between the amount of product class information stored in memory, the amount of product-related experience and level of self-assessed knowledge. Knowledge assessment is viewed as a judgement process in which individuals scan memory for cues that will help them evaluate their level of product-class knowledge (Park et al., 1994). Park et al. (1994), following DeNisi & Shaw (1977), argue that consumers knowledge assessment may be influenced by a general feeling of self-confidence, independent of what is actually known: level of general self-confidence is positively associated with level of self-assessed knowledge. These insights lead to the general statement that the consumer assesses cues in their memory subjectively as they use not the objective information in the memory, but the level of self-confidence; therefore, self-confidence operates as an antecedent to marketplace choices and subjective knowledge perceptions. This entails that self-confident customers have a high level of “illusion of knowing”, and according to Bearden et al. (2001), consumer confidence reflects subjective evaluation of one's ability to generate positive experiences as a consumer in the marketplace.

Khan et al. (2017) emphasise the idea that knowledge discrepancy can go in two scenarios: a consumer subjective knowledge is greater than their objective knowledge (overestimation), or their subjective knowledge is lower than their objective knowledge

(underestimation). Thus hypothetically a consumer with high self-confidence will overestimate, whereas that with lower self-confidence will underestimate their knowledge about products.

3 Knowledge discrepancy scenarios

3.1 Knowledge discrepancy scenario definition

Scenarios can be defined as narratives about possible future based on which future-related decisions can be taken (Ogilvy, Schwartz, 2004). In other words, a scenario in academic and practical papers is understood as a detailed and explicated possible future portrait including proactive managerial decisions adequate to such future pictures (Schwab et al., 2003). Thus knowledge discrepancy scenarios can be defined as consistent and explicated narratives about underestimation and overestimation of consumer knowledge in the future. Knowledge discrepancy scenarios should integrate customer behaviour picture and CKM decisions identifying knowledge discrepancy extent.

3.2 Knowledge discrepancy scenario content

In academic literature, characteristics of scenario content are classified into three groups: scenario goal (why?), design of scenario development process (how?) and scenario content (what?) (van Notten, 2002). This paper focuses on scenario content characteristics, those most relevant to the purpose of the work. According to van Notten (2002), in their content, scenarios should reveal instantaneous or chain events, embrace heterogeneous and homogeneous problems and, depending on how integrated they are, be integrated or fragmented.

The current external environment is characterised by turbulence, a dimension of which is complexity of continuous change. Following the insights by Levy, Lichtenstein (2011), Mason (2007), the complexity of such turbulent environment manifests itself in complex relationships between the interested parties in the external environment shaping continuous change there. As consumers interact with their environment in the context of continuous change, subjective and objective knowledge composition and knowledge assessment varies too, which affects the level of knowledge discrepancy. Thus scenarios developed in the context of current external environment cannot include only momentous pictures of the manifestation of elements expressing consumer self-confidence because knowledge creation is ongoing and cyclical (Nonaka, Konno, 1988). Content of knowledge discrepancy scenarios should be integrated as it is important not only to reveal how interacting elements develop but also to identify consumer knowledge management decisions reducing knowledge discrepancy level. Knowledge discrepancy scenarios are heterogeneous, taken globally, contemporary customers act in a turbulent external environment, which is complex, and heterogeneity is characteristic of complexity (Levy, Lichtenstein, 2011). It is also critical to identify if consumer behaviour underestimating and overestimating their knowledge is homogeneous or heterogeneous. Consumer self-

confidence is expressed by the aspects of customer behaviour distinguished by Bearden et al. (2001).

Information Acquisition and Processing reflect the individual's confidence in his or her ability to obtain needed marketplace information and to process and understand that information (Bearden et al. 2001). The construct of self-confidence in the perspective of taking a buying decision can be defined as an ability to make effective decision by acquisitive and applied information (Aghdaie, Khatami, 2014). According to Erasmus et al. (2015), self-confident consumers are selective, yet focussed on their information search because they either already possess the knowledge about product or know where to find and access the information they require. Self-confident consumers also know how to evaluate product alternatives and how to reduce purchase risk (Loibl et al., 2009). This entails that customer self-confidence is based on the ability to acquire and process market information, in order to identify selecting options, attracting positive reactions to the purchase, and effective exchange of this process, by self-preservation against misleading or unfair behaviours towards them (Aghdaie, Khatami, 2014). The ability to acquire and process the right amount of information prior to further decision making is an important antecedent to affective buying decision making (Alba, Hutchinson, 1987). Thus in the overestimation scenario, consumers experience lower risk of taking a wrong buying decision than those underestimating their knowledge. Customers tend to purchase items with the brand names they know more about, which reduces the risk of disappointment (Cheung, Chan, 2009).

Consideration-Set Formation represents confidence in one's ability to identify acceptable choice alternatives including products and brands (Bearden et al., 2001). This aspect is closely related to consumer variety-seeking behaviour in buying decisions. In knowledge discrepancy research, the concept of variety-seeking behaviour is most effectively defined by Hirschman (1980) as an internal drive or motivating force that motivates the individual to seek out novel information. Consumers' aspiration for more new information at the stage of product or brand consideration assessment becomes an internal motive to cover a wider spectrum of alternatives in the evaluation set, even if the customer was satisfied with a purchase or brand, and to be less committed and attached to definite products / brands. Ju's (2015) research shows that information scarcity is stimulating the tendency of variety seeking, so consumers with low information will show a higher tendency to pursue variety seeking than higher information group. Moreover, the assumption is made that individuals vary in confidence regarding their ability to construct consideration sets that contain choice alternatives for effectively satisfying consumption goals (Bearden et al., 2001). Thus in the overestimation scenario, variety seeking behaviour is less distinct because, as mentioned, consumers find and process more information at the second stage and are able to apply it more effectively to reduce the risk of buying decision-taking.

The link between variety-seeking behaviour and customer confidence level via knowledge discrepancy scenarios allows for more thorough analysis of personal characteristics of knowledge overestimating and underestimating consumers. Scientific works identify a number of characteristics typical of customers with variety-seeking

behaviour. Following Olsen's et al. (2015) generalisation, variety-seekers are more likely to seek change, more prone to brand switching and avoid repetitive behaviours; high sensation seeker who possesses a stronger than average need to seek out activities which are novel, complex or more intense. According to Kingent (2016), the enumerated characteristics show internal motivation of consumers to seek out a wide set of product or brand alternatives. From the perspective of socio demographic characteristics variety-seeking consumers tend to be younger, better educated and employed (Raju, Venkatesan, 1980; Wang et al., 2006), and with higher incomes (Wang et al., 2006). Deductive logic, however, raises the question whether a knowledge underestimating consumer can be characterised by a higher level of education. Olsen et al. (2015) present the assessment scale of personality trait of sensation seeking as formulated by Zuckerman et al., (1978), Zuckerman (1994), where one of assessment subscales is seeking experience. This can explain why customers with a relatively high level of education underestimate their knowledge and why they seek product or brand variety. According to the interpretation of Maslow's theory of needs, in the context of underestimation scenario, consumers seek self-esteem and its realisation through shaping subjective knowledge, i.e. through gaining experience.

Personal and Social outcomes dimension reflects confidence in one's ability to meet purchase objectives so that choices are personally satisfying and generate positive outcomes in the form of the reactions of others. The analysis of the dimensions discussed above shows that from the perspective of information acquisition and processing dimension in the overestimation scenario consumers experience lower risk of taking wrong decisions than those attributed to the underestimation scenario. Thus knowledge overestimating consumers in the post-purchase stage of buying decision-taking will have a higher level of satisfaction and receive more appreciation from the public members important to them than the knowledge underestimating consumers. Trivedi (1999) segments customers by the intensity and consistency of their variety-seeking behaviour and shows that more preferred brands were hurt the most by variety-seeking behaviour. Olsen et al. (2015) support this by stating that variety-seeking behaviour may have a negative effect on brand loyalty. Therefore, from the perspective of consideration-set formation dimension, in the underestimation scenario consumers are less satisfied with a purchase and this negatively affects their brand loyalty. In the underestimation scenario, dissatisfaction with a purchase incites cynicism toward the brand name. Academic studies define customer cynicism as dissatisfaction and disconfirmed expectations (Chylinski, Chu, 2010). Chylinski, Chu (2010) specify the concept of customer cynicism in marketing context as a process consisting of related reactions of recognition, behaviour and emotions, displayed through consumer suspicion, defence against marketing actions and non-purchase of a certain branded item or product. Yet it should be noted that empirical research by Keng, Richmond & Han (2008) shows that even self-confident customers exhibit one aspect of cynicism – greater complaint behaviour because they are self-confident enough to express their negative opinion about products and brands.

Consumer self-confidence is displayed in their ability to understand marketing actions applied by an organisation and to defend themselves against these actions (*Persuasion*

Knowledge) and to defend their values and attitudes dealing with others in marketplace (**Marketplace Interfaces**) (Bearden et al., 2001).

Within the classical marketing theory, trust between the organisation and the consumer is an essential prerequisite for long-term relationships. The use of persuasion in sales settings is a method that organizations utilize in training sales personnel, developing advertising campaigns within the promotional mix (Taylor, Barber, 2012). According to Friestad & Wright (1994), over time consumers develop personal knowledge about the tactics used in these persuasion attempts. This knowledge helps them identify how, when, and why marketers try to influence them. It also helps them adaptively respond to these persuasion attempts so as to achieve their own goals and consider possible courses of actions. According to Taylor & Barber (2012), coping behaviours assert when a consumer recognizes a marketing agent's attempt to skilfully modify their beliefs, their emotions, their attitudes, their decisions, and their thought processes, thereby altering the course of their lives.

Bell (1967) discusses Cox & Bauer's (1964) research findings which show that customers with low and high self-confidence were least affected by persuasion efforts, whereas customers with moderate self-confidence were the most susceptible to persuasion. Very confident consumers are difficult to persuade due to their positive experience in buying decision-making and therefore trust their opinion, whereas consumers who are more unconfident than confident tend to protect themselves from any influences. Since those with moderate self-confidence were neither secure with their own judgment nor highly defensive, they were the most persuadable (Bell, 1967). Boush et al. (1994) stress that customer ability to cope with persuasion efforts is a growing phenomenon because customers keep gaining new experience.

Both overestimation and underestimation scenarios of consumer knowledge discrepancy will display consumer coping behaviour against persuasion attempts, which will potentially increase their mistrust with the organisation and brand. Consumer confidence construct is critical to brand value: a consumer mistrusting a definite brand will not be loyal to it (Ball et al., 2004; Balester, Aleman, 2001). Thus an outcome of the development of these scenarios is deteriorated or lost loyalty of customers who underestimate or overestimate their knowledge.

According to Bearden et al. (2001) definition of Market Interface dimension, it can be stated that it is essentially expressed through consumer power in relation to organisations and brands. Consumer power in the digital age is inseparable from the Internet and the opportunities it provides (Knott et al., 2006; Kucuk, 2009; Labrecque et al., 2013); therefore, this paper relies on the definition by Labrecque et al. (2013): "power as the asymmetric ability to control people or valued resources in online social relations". Today's world however has seen a turnaround where consumers are driving the way marketing works. One of the main sources of contemporary consumer power is information (Labrecque et al., 2013). In the overestimation scenario, consumers are more likely to seek information on products and are more confident than in the underestimation scenario, hence the hypothetical statement that knowledge overestimating consumers

when interacting with the organisation or brand in the market are more inclined to defend their attitudes and values.

It can be concluded that two different scenarios of consumer knowledge discrepancy show through different consumer behaviours in attempting to satisfy their needs and expectations in buying decision-taking.

- The behaviour of consumers overestimating their knowledge about a product / brand is less marked by risky buying decision-taking and seeking variety before purchase. However, satisfaction and cynicism in post-purchase behaviour is more manifest. The buying behaviour of the latter consumers is sustained by persuasion knowledge and digital power.
- The behaviour of consumers underestimating their product / brand knowledge before purchase is more marked by risky prior-purchase decision-taking and seeking variety before purchase. This tendency conditions less marked consumer satisfaction and more distinctly expressed cynicism in post-purchase behaviour. The buying behaviour of the latter consumers is more supported by their persuasion knowledge and less by digital power.

4 Research methodology

Research method. Yin (2003), on the basis of constructivist paradigm, states that truth is relative and subject to perspective. According to him, as one looks for answers to questions “how” and “why” and realizes answers to these questions depend on the phenomenon researched, i.e. on contextual conditions, the best method is case study. To understand deeper the discrepancy between objective and subjective knowledge, to reveal gaps in objective knowledge, the case study method was selected for and applied to the research.

Case study. The context of added sugar was chosen as the problem of added sugar consumption is a global one. According to the current EU Labelling Regulations, consumers can determine added sugar amounts only from ingredient lists, which are complicated because food industry presents added sugars in terms unknown to consumers. Today’s nutrition environment creates a default aggravating the world-wide problem – the spread of obesity and other related medical conditions. Research show that the public understand that their nutrition is their own responsibility but say that food and drinks industry could make more effort to promote healthy nutrition (Bailey et al., 2017). Presently, consumer education and preventive measures receive considerable attention, yet few researches have been conducted on consumer understanding of added sugar (Tierney et al., 2017).

Research questionnaire. A questionnaire was used for empirical data collection. The categories of variables and measurement aspects are presented in table 1.

Table 1. Research questionnaire substantiation

Categories of variables	Measurement of variables	Authors substantiating measurement of variables
Respondents' interest in added sugar and its consumption	Respondents' interest in added sugar, attitudes and consumption.	Tierney et al. (2017)
Subjective knowledge	<ul style="list-style-type: none"> Subjective knowledge was measured by asking one general self-assessment question: "How well do you know facts and problems related to<...>?". Five-point Likert scale was used. 	House, et al. (2004), Aleksejeva (2014)
Objective knowledge	<ul style="list-style-type: none"> To identify objective knowledge a few structurally different questions suitable to check consumer knowledge were formulated. Structure of questions measuring objective knowledge was developed following consultations with a senior researcher at Kaunas University of Technologies Institute of Food Science Objective knowledge was measured as a total number of correct answers to all questions assessing objective knowledge. 	Tierney et al. (2017), Tanius, Seng (2015), Dodd et al. (2005), Bailey et al., (2017)
Independent variables	Age, education, sex, social level, family status and place of residence	-

Data collection. The research was conducted in Lithuania in April 2018. Overall, 432 respondents participated in the online survey.

Data analysis. All statistical analyses were done with SPSS software (version 17.0). a new variable was created when analysing the discrepancy between subjective and objective knowledge. Consumer subjective knowledge was measured by one question in five-point Likert scale, while objective knowledge – according to the number of correct answers to three types of questions. To compare two different measurement levels, Z estimators were calculated for each type of knowledge taking into account their deviation from mean according to the following formula (Gunne, Matto, 2017 cited from Burns, Burns, 2008):

$$Z = (x - \text{mean}) / \text{standard deviation},$$

where x means occurrence of value

Positive deviation points have shown that respondents have higher subjective knowledge than objective, whereas negative ones have indicated the opposite case.

One-way ANOVA was used to assess the impact of independent (demographic) variables on objective and subjective knowledge discrepancy, followed by a posteriori (Post-Hoc) comparison test.

Research limitations. Empirical research is limited to one country because the survey was done only in Lithuania. Analysis of demographic characteristics of the survey has revealed an uneven distribution of respondents into groups according to demographic parameters.

5 Research results

5.1. Respondents' (consumers') interest in added sugar and its consumption

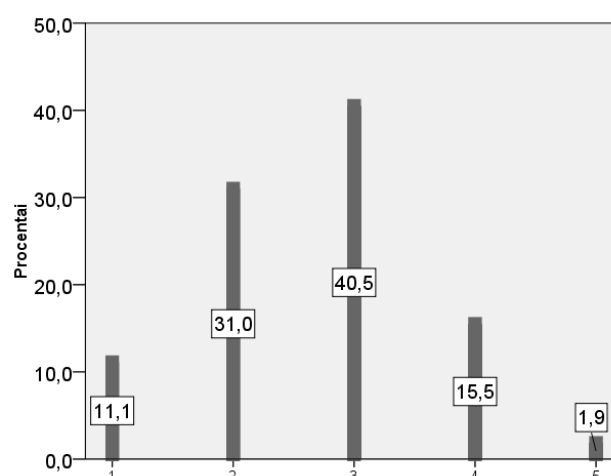
The data presented in table 2 show that the participants in the survey display average interest in added sugar: always or often – 28.4% of women and 14.6% of men; never – 24.3% and 34.1% respectively. Only 2.4% of men and 5.6% of women were very strictly against consuming products with added sugar. 33 respondents stated they neither try to limit amounts of the substance nor are interested in it. Thus a rather considerable part of consumers are rather sceptical toward limiting added sugar. The findings show that a lot of consumers are not interested in choosing products labelled “no added sugar” or “unsweetened” with 43.9% of men and 38.6% of women only sometimes noticing such information on food products. Least attention is paid types of added sugar; 43.9 % of men and 43.5% of women never note it. Yet, this is quite important, for various types of sugar are used by the body differently and can increase the risk of certain diseases.

Table 2. Respondents' answers to statements about added sugar consumption and interest in it (N=432)

Statement	Sex	Never	Sometimes	Often	Always
		%	%	%	%
I strictly avoid added sugar in food products	Male	26.8	48.8	22.0	2.4
	Female	21.7	48.8	23.8	5.6
I am trying to limit consumption of added sugar	Male	19.5	31.7	41.5	7.3
	Female	14.6	35.8	34.5	15.1
I am interested in added sugar	Male	34.1	51.2	7.3	7.3
	Female	24.3	47.3	20.2	8.2
I choose products labelled “no added sugar” or “unsweetened”	Male	19.5	43.9	31.7	4.9
	Female	16.1	38.6	34.0	11.3
I choose products by the type of added sugar used	Male	43.9	41.5	9.8	4.9
	Female	43.5	32.2	16.6	7.7

5.2. Analysis of consumer subjective and objective knowledge about added sugar

Evaluation of respondents' subjective knowledge. Picture 1 shows that respondents were critical enough in assessing their knowledge about added sugar.



Picture 1. Subjective knowledge about added sugar (N=432)

The analysis of respondents' subjective knowledge established that 40.5% of them assessed their knowledge about added sugar with three points, 31% – with two points, while 11.1% said they knew nothing about it, and 17.4% assessed their knowledge as good and very good. The calculated mean of subjective knowledge is 2.66; thus it can be stated that consumers assessed their knowledge about added sugar as approximately average.

Assessment of respondents' objective knowledge. On average a respondent collected 10.3 points (standard deviation – 3.1), when the maximum total was 25 points. This means that on average respondents provided less than half correct answers to the questions on added sugar, which implies that consumers have many gaps in knowledge about it. The data analysis of the empirical study showed the following:

- Evaluation of consumer ability to classify various types of sugar and sweeteners correctly showed that only 2.5% classified all of the presented ones correctly, while 60% could identify five or fewer kinds out of 11.
- The findings demonstrated that a significant part of respondents recognise natural sugars in such products as milk (66.3%), fruit (91.5%).
- Research findings revealed the fact that about half of consumers know acceptable daily intakes of sugar recommended by the World Health Organisation and the European Union.
- Most respondents say they know that food products with added sugar often have high calorie contents but low nutrition value (89.1%). They also know that consumption of too high amounts of added sugar cause cardio-vascular diseases, Type 2 diabetes and contributes to obesity
- and 74.1% respondents believe that it is possible to feed on products with no processed sugar
- However, only 55.9% of respondents know that added sugar is more widely used than sweeteners in manufacturing food products.

5.3. Analysis of the extent of knowledge discrepancy

The analysis of research findings has shown that 25.7% of consumers underestimated their knowledge about added sugar, 28.2% overestimated their knowledge and 46.1% estimated it adequately. Consumers felt self-confident enough when expressing opinions on their knowledge about added sugar as about a third of all respondents assessed themselves better than the questionnaire results showed.

Consumer subjective and objective knowledge discrepancy varied from – 4.15 to 4.20. Based on discrepancy estimators, the respondents were grouped into categories with identical ranges. Table 3 shows five levels of discrepancy from large positive to large negative.

Table 3. Levels of consumer objective and subjective knowledge discrepancy (N=432)

Discrepancy level	Range (from-to)	Proportion of respondents	Interpretation
Large negative discrepancy	-4.2 – 2.52	5.3 %	Underestimated knowledge
Small negative discrepancy	-2.52 – 0.84	20.4 %	
No discrepancy	-0.84 – 0.84	46.1 %	No knowledge overestimation
Small positive discrepancy	0.84 - 2,52	24.5 %	Overestimated knowledge
Large positive discrepancy	2.52 – 4.2	3.7 %	

The method of one-way ANOVA was used and Tukey's post-hoc test was done to determine whether there are any statistically significant differences between objective and subjective knowledge discrepancy and demographic characteristics. The findings have established that the factors having positive impact on higher result were age ($p=0.021$) and education ($p=0.011$). Differences by sex, social level, family status and place of residence were not statistically significant.

6. Conclusions and future research

To summarise the results, it can be concluded that consumer subjective (what they think they know) and objective knowledge (what they actually know) differ; therefore, the discrepancy identified can affect selection of food products. This means that the consumer in choosing a healthier product can make a wrong decision because their subjective knowledge does not correspond to their objective knowledge.

The analysis of added sugar case in Lithuania also showed that some consumers tend to underestimate their knowledge, while others tend to overestimate it. However, they imply that there are some consumers whose objective and subjective knowledge correspond, and the extent of knowledge discrepancy can be different – knowledge underestimation and overestimation can be of lower and higher extent. These results entail that in order to identify knowledge discrepancy and its manifestation through consumer behaviour, organisations should develop scenarios for all the above-mentioned cases of knowledge discrepancy.

Future research should identify consumer behaviour in cases of each of the five possible knowledge discrepancy scenarios so that organisations could react proactively to knowledge discrepancy and make adequate product and brand development decisions using CKM. Based on Ahmad (2015), increasingly, for developing their consumers, companies are adopting extensive Consumer Knowledge Management practices that deal with knowledge for, from and about the users. Focusing on consumer knowledge management organization may have a great opportunity. They can proactively identify possible knowledge discrepancy scenarios. As well as manage negative impact on consumer attitudes about product / brand and buying behaviour.

References

- Aertsens, J., Mondelaers, K., Verbeke, W., Buysse, J. & Van Huylenbroeck, G. (2011) "The influence of subjective and objective knowledge on attitude, motivations and consumption of organic food", *British Food Journal*, Vol. 113, Issue: 11, pp.1353-1378.
- Aghdaie, S. F. A., Khatami, F. (2014) "Investigating the Role of Self Confidence and Self-Image Proportion in Consumer Behavior", *International Journal of Marketing Studies*, Vol. 6, No. 4, pp. 133 – 144.
- Ahmad, A. D. N. (2015) "User development through proactive knowledge transfer", *Industrial Management & Data Systems*, Vol. 115, Issue: 1 pp. 158 – 181.
- Alba, J. W., Hutchinson, W. J. (2000). "Knowledge Calibration: What Consumers Know and What They Think They Know", *Journal of Consumer Research*, Vol. 27, Issue: 2, pp. 123 – 156.
- Alba, J. W., Hutchinson, W. (1987) "Dimensions of Consumer Expertise," *Journal of Consumer Research*, Vol. 13, No. 4, pp. 441-454.
- Aleksejeva, I. (2014) "Latvian consumers' knowledge about genetically modified organisms", *Organizacijų vadyba: sisteminiai tyrimai*, Vol. 1, No. 71, pp. 7-16.
- Bailey, P., Ernes, C., Duffy, B., & Shrimpton, H. (2017) "Sugar what next? ", retrieved from <https://www.ipsos.com/sites/default/files/ct/news/documents/2017-11/ipsos-sugar-what-next-full-report.pdf>
- Ball, A. D., Coelho, P. S., & Machás, A. (2004) "The Role of Communication and Trust in Explaining Customer Loyalty: an extension to the ECSI Model", *European Journal of Marketing*, Vol. 38, No. 9/10, pp. 1272-1293.
- Ballester, D. E., Alemán, J. L. M. (2001) "Brand trust in the context of consumer loyalty", *European Journal of Marketing*, Vol. 35, No. 11/12, pp. 238 – 1258.
- Bearden, W. O., Hardesty, D. M., & Rose, R. L. (2001) "Consumer self-confidence: Refinements in conceptualization and measurement", *Journal of Consumer Research*, Vol. 28, No. 1, pp. 121-134.
- Bell, G. D. (1967) "Self-Confidence and Persuasion in Car Buying", *Journal of Marketing Research*, Vol. 4, No. 1, pp. 46–52.
- Boush, D. M., Friestad, M., & Rose, G. M. (1994) "Adolescent skepticism toward TV advertising and knowledge of advertiser tactics", *Journal of Consumer Research*, No. 21, Issue: 1, pp. 165–175.
- Brucks, M. (1986) "Typology of Consumer Knowledge Content", *Advances in Consumer Research*, Vol. 13, pp. 58-63.
- Carlson, J. P., Vincent, L. H., Hardesty, D. M. & Bearden, W.O. (2009) "Objective and subjective knowledge relationships: a quantitative analysis of consumer research findings", *Journal of Consumer Research*, Vol. 35, No. 5, pp. 864-876.

- Cheung, M., Chan, A. S. (2009) "Measures for brand knowledge: Comparison of testing formats languages and product categories" In Asian Textile Conference, September 7-9, 2009, Ueda, Japan, 24 p.
- Chylinski, M., Chu, A. (2010) "Consumer cynicism: antecedents and consequences. European Journal of Marketing", Vol. 44, No. 6, pp. 796 – 837.
- Dodd, T. H., Laverie, D. A., Wilcox, J. F. & Duhan, D. F. (2005) "Differential Effects of Experience, Subjective Knowledge, and Objective Knowledge on Sources of Information used in Consumer Wine Purchasing", Journal of Hospitality & Tourism Research, Vol. 29, Issue: 1, pp. 3-19.
- Ellen, P. (1994). "Do We Know What We Need To Know? Objective and Subjective Effects on Pro-ecological Behaviors," Journal of Business Research, Vol. 30, No. 1, pp. 43-52.
- Ellis, D., Caruana, A. (2018) "Consumer wine knowledge: components and segments", International Journal of Wine Business Research, Vol. 30, Issue: 3, pp. 277-291.
- Erasmus, A. C., Donoghue, S., & Fletcher, L. (2015) "Proposing Persuasion Knowledge as the Antecedent of Consumers' Self-Confidence during a Complex Purchase Decision", Journal of Marketing Management, Vol. 3, No. 2, pp. 27-38.
- Feick, L., Park, C. W. & Mothersbaugh, D. L. (1992) "Knowledge and knowledge of knowledge: What we know, what we think we know and why the difference makes a difference", Advances in Consumer Research, Vol. 19, Issue: 1, pp. 190-192.
- Flynn, L. R., Goldsmith, R. E. (1999) "A Short, Reliable Measure of Subjective Knowledge", Journal of Business Research, Vol. 46, Issue: 1, pp. 57 – 66.
- Friestrad, M., Wright, P. (1994) "The Persuasion Knowledge Model: How People Cope with Persuasion Attempts", Journal of Consumer Research, Vol. 21, Issue: 1, pp. 1-31.
- Gunne, I., & Matto, S. (2017) "The influence of subjective and objective knowledge of ecolabels on consumers' green purchasing practices", Lund University, School of Economics and Management, retrieved from <http://lup.lub.lu.se/luur/download?func=downloadFile&recordId=8919592&fileId=8919594>
- Hirschman, E. C. (1980) "Innovativeness, novelty-seeking, and consumer creativity", Journal of Consumer Research, Vol. 7, No. 3, pp. 283-295.
- House, L., & Lusk, J. L., Jaeger, S., Traill, W. B., et al. (2004) "Objective And Subjective Knowledge: Impacts On Consumer Demand For Genetically Modified Foods In The United States And The European Union," 2004 Annual meeting, August 1-4, Denver, CO 20125, American Agricultural Economics Association (New Name 2008: Agricultural and Applied Economics Association).
- House, L., Lusk, J., Jaeger, S., Traill, W., Moore, M., Valli, C., et al. (2004) "Objective and subjective knowledge: impacts on consumer demand for genetically modified foods in the United States and the European Union", The Journal of Abrobiotechnology Managment and Economics, Vol. 7, No. 3, pp. 113-123.
- Ju, X. (2015) "Consumers' Variety Seeking: From an Information Perspective", International Business Research, Vol. 8, No. 3, pp. 42-53.
- Keng, K. A., Richmond, D., & Han, S. (1995) "Determinants of complaint behaviour: A study of Singapore consumers", Journal of International Consumer Marketing, Vol. 8, No. 2, pp. 59–76.
- Khan, M. N., Rothwell, D. W., Cherney, K. & Sussman, T. (2017). "Understanding the Financial Knowledge Gap: A New Dimension of Inequality in Later Life", Journal of Gerontological Social Work, Vol. 60, Issue: 6-7, pp. 487 – 503.
- Knott, J. D., Zwick, D., & Schroeder, J. E. (2006) "Mapping consumer power: an integrative framework for marketing and consumer research", European Journal of Marketing, Vol. 40, Issue: 9/10, pp. 950-971.

- Kucuk, S. U. (2009) "Consumer empowerment model: from unspeakable to undeniable", *Direct Marketing: An International Journal*, Vol. 3, Issue: 4, pp. 327-342.
- Labrecque, L. I., von Eschen, J., Mathwick, C., Novak, T. P., & Hofacker, C. F. (2013) "Consumer power: Evolution in the digital age", *Journal of Interactive Marketing*, Vol. 27, No. 4, pp. 257-269.
- Levy, D., Lichtenstein, B. (2011) "Non-linear Meltdowns and the Potential for Emergence: Complex Systems Theory and Social-Environmental Sustainability" In Hoffman, A., Dacin, T. *Oxford Handbook on Business and the Environment*, pp. 591-610.
- Loibl, C. Cho, S.H., Diekmann, F., Batte, M.T. (2009) "Consumer self-confidence in searching for information", *Journal of Consumer Affairs*, Vol. 43, No. 1, pp. 26-47.
- Mason, R. B. (2007) "The external environment's effect on management and strategy. A complexity theory approach", *Management Decision*, Vol. 45, no. 1, pp. 10-28.
- Mohammad Nuruzzaman Khan, M. N., David W. Rothwell, D. W., Cherney, K. & Sussman, T. (2017) "Understanding the Financial Knowledge Gap: A New Dimension of Inequality in Later Life", *Journal of Gerontological Social Work*, Vol. 60, No. 6-7, 487-503, pp. 487 – 503.
- Nonaka, I., & Konno, N. (1998) "The concept of „Ba“: building a foundation for knowledge creation", *California Management Review*, Vol. 40, No. 3, pp. 40-54.
- Notten van, Ph. (2002) "Foresight in the face of scenario diversity", In *International Conference Probing the Future: Developing Organizational Foresight in the Knowledge Economy*, July 11-13, Glasgow, UK.
- Ogilvy, J., Schwartz, P. (2004) "Plotting your scenarios: An introduction to the art and process of scenario planning", retrieved from website http://www.meadowlark.co/plotting_your_scenarios.pdf
- Olsen, J. E., Atkin, T., Thach, L., Steve S. Cuellar, S. S. (2015) "Variety seeking by wine consumers in the southern states of the US", *International Journal of Wine Business Research*, Vol. 27, Issue: 4, pp. 260-280.
- Park, C. W., Mothersbaugh, D. L., Feick, L. (1994). "Consumer Knowledge Assessment", *Journal of Consumer Research*, Vol. 21, No. 1, pp. 71-82.
- Park, W. C., Gardner, M. P. & Thukral, V. K. (1988) "Self-perceived Knowledge: Some Effects on Information Processing for a Choice Task", *American Journal of Psychology*, Vol. 101, No. 3, pp. 401-424.
- Philippe, A., Ngobo, P. V. (1999) "Assessment of Consumer Knowledge and Its Consequences: a Multi-Component Approach", *Advances in Consumer Research*, Vol. 26, pp. 569-575.
- Pieniak, Z., Aertsens, J. & Verbeke, W. (2010) "Subjective and objective knowledge as determinants of organic vegetables consumption", *Food Quality and Preference*, Vol. 21, pp. 581–588.
- Raju, P. S., Lonial, S. & Mangold, G. (1995) "Differential Effects of Subjective Knowledge, Objective Knowledge, and Usage Experience on Decision Making: An Exploratory Investigation", *Journal of Consumer Psychology*, Vol. 4, No. 2, pp. 153-180.
- Raju, P.S. & Venkatesan, M. (1980) "Exploratory behavior in the consumer context: a state of the art review", in Olson, J. (Ed.), *Advances in Consumer Research*, 7th ed., Association for Consumer Research, Ann Arbor, MI, pp. 258-263.
- Schwab, P., Cerutti, F., von Reibnitz, U. H. (2003) "Foresight – using scenarios to shape the future of agricultural research ", *Foresight*, Vol. 5, No. 1, pp. 55-61.
- Selnes, F. & Gronhaug, K. (1986) "Subjective and objective measures of product knowledge contrasted", *Advances in Consumer Research*, Vol. 13, Issue: 1, pp. 67-71.
- Tanius, E., & Seng, S. W. (2015) "Consumers awareness towards genetically modified (GM) foods", *International Journal of Business*, Vol. 6, No. 2, pp. 17-26.

- Taylor, D. Ch., & Barber, N. (2012) "Measuring the Influence of Persuasion Marketing on Young Wine Consumers", *Journal of Food Products Marketing*, Vol. 18, No.1, pp. 19-33.
- Tierney, M., Gallagher, A. M., Giotis, E. S., & Pentieva, K. (2017) "An Online Survey on Consumer Knowledge and Understanding of Added Sugars", *Nutrients*, Vol. 9, No. 37, pp. 1-13.
- Trivedi, M. (1999) "Using variety seeking based segmentation to study promotional response", *Journal of the Academy of Marketing Science*, Vol. 27, No. 1, pp. 37-49.
- Veale, R. (2008). "Sensing or knowing? Investigating the influence of knowledge and self-confidence on consumer beliefs regarding the effect of extrinsic cues on wine quality", *International Journal of Wine Business Research*, Vol. 20, Issue: 4, pp. 352-366.
- Verbeke, W. (2008) "Impact of communication on consumers' food choices", *Proceedings of the Nutrition Society*, Vol. 67, No. 3, pp. 281-288.
- Wang, G., Dou, W. & Zhou, N. (2006), "Consumption attitudes and adoption of new consumer products: a contingency approach", *European Journal of Marketing*, Vol. 42, No. 1/2, pp. 238-254.
- Yin K. R. (2013) "Case Study Research: Design and Methods (Applied Social Research Methods)", 5th Edition, 312 p.

Knowledge Perspective on Consumer Digital Performance Research

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Abstract

Active development of the digital economy influences all market agents, including consumers. Moreover, consumers become a driving force behind adoption of technology in their economic activities. They learn through this adoption process, developing both objective and subjective knowledge components. As an outcome, consumers' satisfaction, trust, value and overall perception of a win-win nature of economic interaction are affected, influencing consumer performance, e.g. causing innate dissatisfaction or stimulating inferences of manipulative intent. Current conceptual paper addresses and critically revises existing research on measuring consumer digital activities, decomposing existing indices and screening them for consumer knowledge components. Most of the indices are biased towards objective consumer knowledge, while the large body of consumer research on the relevance of subjective components, associated, for example, with the overall marketplace perception, persuasion knowledge and skepticism are omitted and thus represent potential contribution to strengthening our understanding of the knowledge perspective of consumer digital performance.

Keywords – Consumer knowledge, Digital marketplace, Consumer performance, Digital competences.

Nature of the proposed paper: Academic Research Paper

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1. Introduction

The development of the digital economy requires all market agents, including those on the demand side and the supply side, to change their behavior. However, it is consumers who make an ultimate decision whether to adopt and integrate technologies into their economic activities or leave them unattended. The willingness of consumers to accept and actively use digital technologies is associated with the development of consumer resources. These resources are based upon prior consumer experiences, accumulated knowledge and abilities, as well as prevailing motivation and behavioral patterns. These internal motivational, cognitive and competence-based resources are considered the three-composite set of drivers which help consumers exhibit more confident and engaged economic behavior.

The issues of consumer engagement into the digital marketplace are being raised by researchers in various areas – information and communication technology studies, consumer research, and finally cognitive psychology. The various studies reflect on the consequences of the digital overload and technological sophistication for consumer wellbeing. The fundamental pillar of consumer wellbeing under the circumstances of digital transformation is a possibility to adjust to undergoing changes and realize consumption-related tasks in the new digital environment efficiently and effectively. This gives a rise to the notion of consumer performance, which is the quality to fulfil the consumer tasks.

Consumer performance can be defined as an integrated outcome of consumer activities in a marketplace, including satisfaction, trust, value, win-win approach in market interactions while being subject of consumption-related activities. The positive performance is associated with positive outcomes, while in case of market inefficiencies negative outcomes might include low satisfaction (e.g. innate dissatisfaction (Bearden et al., 2001)), distrust, resulting in skepticism and inferences of manipulative intent, perception of loss instead of gaining value, doubts in obtained results of market interaction. Analogous to overall consumer performance **consumer digital performance** assumes regular consumer involvement in interaction in a digital marketplace.

Current conceptual study aims to integrate existing models in the area of consumer performance research and consumer digital competences research in order to suggest a framework with attention to various types of consumer knowledge (e.g. digital literacy, marketing literacy, persuasion knowledge, etc.). The given framework is thought to provide a platform for integration of the streams of research which are currently to large extent isolated and thus provide a biased perspective on consumer behavior in the digital marketplace and its performance – assessed both through the lenses of a market/economy and consumer's own interests and motivation. An absence of such framework can lead to the situation whereas consumers are being increasingly motivated to be involved in the consumption and interaction in the digital marketplace, however do not obtain the required knowledge and skills, as well as do not perceive themselves as being able to cope with potential risks, leading to potential consumer knowledge discrimination (Pillai, Brusco, Goldsmith, & Hofacker, 2015). This approach is meant to represent a holistic

perspective on the consumer experience and implications for the market actors' strategies, reflecting on the outcomes for all the involved sides and higher consumer engagement in digital marketplace (Dessart, Veloutsou and Morgan-Thomas, 2016).

2. Existing approaches to measure consumer digital performance

Existing frameworks and indices that evaluate consumer digital performance focus on a set of activities consumers implement online suggesting that a mere fact of performance implies the presence of consumer digital knowledge (e.g. ROCIT Digital Literacy Index, Technographics model, and Euromonitor's Digital Consumer Index), however do not provide an integrative picture.

Multiple digital competence frameworks have been developed recently. Some frameworks are universal and can be applied to assess general digital competences that are necessary for individuals to realize a number of activities online. For instance, the European Digital Competence Framework for Citizens, known as DigComp, identifies five key components of digital competence—information and data literacy, communication and collaboration, digital content creation, safety, and problem solving – with 21 related competences. Consumer Savvy Index delineates six broad characteristics which enable consumers interact effectively with organizations: technological sophistication and innovative expertise, interpersonal network competence, online network competence, marketing literacy, complaining and specifying self-efficacy, and information flow expectations. The aspects of consumers' ability to adopt certain patterns of digital activities according to their psychographic profile were adopted in the Technographics model, developed by E. Forrest who suggested that the profiling of technology consumers should be based on variables which focuses on the motivations, ownership, use patterns, and attitudes toward information, communication and entertainment technologies as well as measures of a person's fundamental values and lifestyle perspective.

An overview of existing approaches to measure consumer digital performance is presented in Table 1. The comparison is based on the M-O-A framework (motivation – opportunity – ability).

Table 1. A comparative overview of existing measures of consumer digital performance

Framework	Motivation	Opportunity	Ability	Actual performance
DigCompConsumers framework			√	√
Consumer Savvy Index			√	√
Technographics model	√			√
ROCIT Digital Literacy Index		√	√	√
Digital Intelligence (World Economic Forum)	√		√	√
A Global Framework to Measure Digital Literacy (UNESCO)		√	√	√

Digital Capability Framework (JISC)	√	√	√
The Irish Digital Skills Framework		√	√

Most indices measure Internet access and track various activities that consumers undertake in the digital marketplace. However, these frameworks do not focus on the actual consumer ability to critically process the increasing information load, to feel efficient and effective as consumer in the marketplace, to be involved not only in information consumption, but also in creation or co-creation. In other words, these frameworks measure the linear progress, not the related evolution of consumer knowledge, critical thinking and resulting confusion. As T.V. Chernigovskaya (2019), everything has collapsed in our society – people hardly know what to trust, and can be named “homo confusus”.

Multiple frameworks, measuring and tracking various aspects of digital activities (such as competences, literacies and motivations), have appeared over time. Surprisingly, however, there is no consensus regarding how these aspects are related, and how they can drive or deter consumers’ digital performance. Consequently, there is a high risk that the application of the any of existing digital adoption framework without critical assessment will result in incomplete or, even worse, wrong representation of digital development stance, which can lead to wrong managerial applications of the results. Notwithstanding, while existing literature provides for a systematically evolving area of studies on consumer competences and their perception of a marketplace [Nijssen, Singh, Sirdeshmukh, & Holzmüller, 2003] and marketing literacy (Garnier & Macdonald, 2009; Macdonald & Uncles, 2007), mainstream investigation and conceptual development in the area of consumers’ digital competences and digital literacy are substantially more fragmented, overemphasize the technology aspect and fail to integrate other aspects of consumer behavior and competences, influencing how consumers think, feel and act in a digital marketplace. Still, beyond adopting the technology, consumers are using it for various purposes, integrate it in their multifaceted lives and increasingly interact in the digital marketplace. To develop an integrative framework of consumers’ digital competences, there is primarily a need to review existing frameworks of general digital competences.

To sum up, existing indices are strongly biased towards examining digital technologies access opportunities and merely tracking various types of digital behavior. The consumer research or cognitive psychology advances have hardly been considered, i.e. the lenses of consumer emotional state (e.g. skepticism), consumer beliefs, and consumer persuasion knowledge. As a result, the effect of digital technologies, information clutter, increase of information load on consumer, change in the ability to critically process information and create information due to increase passive information consumption– all of these studies are being ignored in the modern digital competence indices, which integrate all the measures through the lenses of modernism paradigm, where the progress is considered positive.

3. Consumer knowledge dimensions as a driver of consumer performance

Digitalization of the world economy brings forward the role of individuals' knowledge and competences to be successfully involved in the digital marketplace. Following the trend numerous approaches have been developed in order to investigate whether population in various countries is catching up with the opportunities, possesses basic competences, is involved in regular activities using digital technologies, understands grounds of intellectual property rights and ethical behavior (Bettiga, Lamberti, and Noci, 2018; Brečko and Ferrari, 2016).

Consumer behavior in the digital market place represents probably the largest part of all the digital activities, and while the above mentioned aspects, included in existing indices of digital competences, are crucial for the new digital global marketplace to function, the tradition of consumer research has a substantially wider perspective on conceptualizing what makes a consumption experience successful and effective, how consumers perceive their own performance in the marketplace.

This large research stream focuses on the balance between the rich stream of information, directed at consumers, and their ability to process information (e.g. marketing literacy, persuasion knowledge), their feelings and sentiment toward the marketplace (e.g. consumer skepticism, cynicism, etc.) (Macdonald and Uncles, 2007; Garnier and Macdonald, 2009). Through development of own knowledge base and a sentiments towards the marketplace, consumer experiences and service encounters consumers develop and adopt own coping strategies (Dommeyer and Gross, 2003), purchase decision styles, habitual decision making journeys (Edelman, 2010) and motivation to be engaged in various spectrum of digital activities (Fleming, Reitsma, Pappafotopoulos, Duan and Birrel, 2017). Addressing these angles constitutes actual consumer performance – both through the lenses of a wider range of stakeholders, and self-perceived consumer performance, and goes beyond the factors of adopting the use of digital technologies per se.

Consumer performance may be realized with different degrees of efficiency. Some consumers might encounter multiple troubles or spent excessive resources when undertaking digital activities, while others successfully complete digital tasks with no waste of financial, time and psychological resources. Notwithstanding, many frameworks will refer to all consumers who eventually realized those actions as literate, which definitely provides a biased estimation of digital knowledge. Adding consumer knowledge perspective to measuring consumer digital performance suggests adding the knowledge dimensions to existing framework. The proposed framework is different from existing ones in several ways. First, it goes beyond the mere registration of consumers' digital performance, but aims to estimate its efficiency.

Substantial area of consumer knowledge studies refers to shaping consumer sentiment as a result of perceived persuasion attempt, in other words – *consumer persuasion knowledge*. Consumer persuasion knowledge is activated in response to the consumer's awareness of persuasion tactics as a result of repeated exposure to the same tactic, added pressure of the salesperson's negotiation strategy, flattery of the spokesperson, excessive

use of rhetorical questions, negative comparisons, and other tactics (Main, Dahl, & Darke, 2007; Campbell & Kirmani, 2000). As an outcome, the consumer may reassess the marketer's attempts to influence him or her in deciding whether or not to purchase a product (Main, Dahl, & Darke, 2007) by regarding the marketer's claims with greater suspicion and inferring manipulative intent (Boush, Friestad, & Rose, 1994).

Consumer suspicion can be defined as a dynamic state in which a consumer considers that the marketer has an ulterior motive, such as the desire to persuade (Campbell & Kirmani, 2000). Such suspicion can be triggered by a surprising, inconsistent, or self-serving situational cue in an attempt to understand and cope with the marketer's actions, and form valid opinions about the marketer (Friestad & Wright, 1994). Once suspicion is evoked, the consumer becomes more cautious and attempts to look for alternate explanations concerning the persuader's agenda (DeCarlo, Laczniak, & Leigh, 2013). Moreover, according to Kramer (1999), if the consumer becomes overly suspicious, it can undermine information that is indicative of the truth, and lead to judgments that could verify initial suspicions (Main, Dahl, & Darke, 2007). While suspicion is a consequence of persuasion knowledge, which describes a state of mind resulting in the redistribution of attention towards brand-related information, inferences of manipulative intent describe the realization resulting in perception adjustment.

Inferences of manipulative intent are understood as consumer implications that the marketer is attempting to persuade her/him by inappropriate, unfair, or manipulative means (Campbell, 1995). As a result, such consumers are likely to detach themselves from the narrative and to evaluate the ad more analytically (Cotte, Coulter, & Moore, 2005). Studies indicate that the realization that the marketer is engaging in manipulative actions, such as creating fake positive product reviews, leads to consumers adjusting their perceptions by questioning the quality of the product (Zhuang, Cui, & Peng, 2018). This might also lead to negative behavioral responses, such as negative word of mouth and a desire for revenge (Joireman et al., 2013).

Table 2 presents results of an additional investigation of the same consumer digital performance frameworks through the lens of consumer knowledge dimensions. While cited frameworks include various elements of consumer knowledge, related to digital literacy (e.g. data, software literacy), mostly the focus is made on understanding the technical side of the usage and the variety of existing tools and opportunities. Consumer performance is thus mainly conceptualized from the perspective of potential involvement and embracing existing opportunities. The exception is represented by the need to protect consumer information and privacy, included in most of the frameworks, as well as the required understanding of the guidelines for the legal use of copyright and licenses. Probably the closest to the above mentioned classification of additional types of consumer knowledge is the Digital Intelligence (World Economic Forum), which is focused on the pace and extent of the damage to consumer choice and its performance outcomes. The central aspects for the consumer knowledge component include consumer understanding of possible online manipulation, poor awareness of one's personal data and reduced online privacy. However, the overall balance of the consumer knowledge components in already existing models provides extensive opportunities for their enrichment through

adding the consumer knowledge elements, which would reflect a balanced and holistic approach to the prospective consumer digital performance outcomes – not just involving consumers in the digital interaction, but also providing for a win-win, balanced outcomes of both consumption and co-creation processes.

Table 2. An overview of the consumer knowledge dimensions of existing consumer digital performance frameworks

Framework	Example of consumer knowledge dimensions
DigCompConsumers framework	Information and data literacy; Basic knowledge of hardware; software
Consumer Savvy Index	Digital consumption awareness & literacy
Technographics model	Knowledge on social networking, blogs and digital content creation
ROCIT Digital Literacy Index	Knowledge on digital services available to consumers
Digital Intelligence (World Economic Forum)	Understanding of possible online manipulation, poor awareness of one's personal data and reduced online privacy
A Global Framework to Measure Digital Literacy (UNESCO)	Knowledge of how to use copyright and licenses; software knowledge
Digital Capability Framework (JISC)	An understanding of basic concepts in computing, coding, and information processing/An understanding of how digital technology is changing practices at work, at home, in social and in public life
The Irish Digital Skills Framework	Knowledge on online security & consumer identity

4. Conclusion

Suggested approach assumes that measuring consumer digital performance requires inclusion of various consumer knowledge dimensions in existing indices. As most indices combine the perspective of the actual consumer behavior, existing motivation, opportunity and ability; adding consumer knowledge dimensions – e.g. persuasion knowledge, consumer skepticism and inferences of manipulative intent – will help understanding the whole range of consumer decisions on coping with existing digital opportunities. Acknowledging the variety of potential consumer coping strategies, behaviors and attitudes in the digital marketplace is required in order to develop strategies for a more successful digital interaction, including consumption of products, services, information and co-production of value, information.

References

- Antoninis, M. and Montoya S., (2019) "A Global Framework to Measure Digital Literacy", <http://uis.unesco.org/en/blog/global-framework-measure-digital-literacy>, last accessed 2019/01/10
- Bettiga, D., Lamberti, L. and Noci, G., (2018) "Investigating Social Motivations, Opportunity and Ability to Participate in Communities of Virtual Co-creation," *International Journal of Consumer Studies*, Vol. 41, No.1, pp. 155-163.
- Boush, D. M., Friestad, M., & Rose, G. M. (1994). Adolescent skepticism toward TV advertising and knowledge of advertiser tactics. *Journal of consumer research*, 21(1), 165-175.
- Brečko, B. and Ferrari, A., (2016) "The digital competence framework for consumers", Joint Research Center (JRC) Science for Policy Report, EUR28133EN.
- Campbell, M. C., & Kirmani, A. (2000). Consumers' use of persuasion knowledge: The effects of accessibility and cognitive capacity on perceptions of an influence agent. *Journal of consumer research*, 27(1), 69-83.
- Chernigovskaya, T.V. (2019). Interview at the Gaidar Forum 2019, access through: <http://izbrannoe.com/news/mysli/v-mire-rukhnulo-srazu-vsye-tatyana-chernigovskaya-o-nedoverii-k-informatsii-i-rasteryannom-cheloveke//>.
- DeCarlo, T. E., Laczniak, R. N., & Leigh, T. W. (2013). Selling financial services: the effect of consumer product knowledge and salesperson commission on consumer suspicion and intentions. *Journal of the Academy of Marketing Science*, 41(4), 418-435.
- Dessart, L., Veloutsou, C. and Morgan-Thomas, A., (2016). "Capturing Consumer Engagement: Duality, Dimensionality and Measurement", *Journal of Marketing Management*, Vol. 32, No. 5-6, pp. 399-426.
- Dommeier, C. J. and Gross, B. L., (2003) "What Consumers Know and What They Do: An Investigation of Consumer Knowledge, Awareness, and Use of Privacy Protection Strategies", *Journal of Interactive Marketing*, Vol. 17, No.2, pp. 34-51.
- Edelman, D.C., (2010) "Branding in the Digital Age", *Harvard Business Review*, December, pp. 62-69.
- Fleming, G., Reitsma, R., Pappafotopoulos, Th., Duan, X. and Birrel, R., (2017) "The State of Consumers and Technology: Benchmark 2017, US", Forrester Research report "North American Consumer Technographics".
- Garnier, M. and Macdonald, E. K., (2009) "The Savvy French Consumer: A Cross-Cultural Replication", *Journal of Marketing Management*, Vol. 25, No.9-10, pp. 965-986.
- Kovalev, G.A., (1987), "Three paradigms in psychology – three strategies of psychological impact", *Voprosy Psichologii*, No. 3, pp.41-49.
- Labrecque, L. I., vor dem Esche, J., Mathwick, C., Novak, T. P., Hofacker, C. F., (2013) "Consumer power: Evolution in the digital age", *Journal of Interactive Marketing*, Vol. 27, No. 4, pp. 257-269.
- Macdonald, E. K. and Uncles, M. D., (2007) "Consumer Savvy: Conceptualisation and Measurement", *Journal of Marketing Management*, Vol. 23, No. 5-6, pp. 497-517.
- Nijssen, E., Singh, J., Sirdeshmukh, D., Holzmüller, H. (2003). Investigating industry context effects in consumer-firm relationships: preliminary results from a dispositional approach. *Journal of the Academy of Marketing Science* 31(1), 46-60.
- Pillai, K.G., Brusco, M., Goldsmith, R. and Hofacker, C., (2015) "Consumer Knowledge Discrimination", *European Journal of Marketing*, Vol. 49, No. 9, pp. 82-100.

Perspectives of UTAUT2 Development: Insights from a Pilot Study

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Abstract

In this paper we investigate the existing limits of explanatory power of UTAUT2 as a source of consumer experiences and customer knowledge structuring. We apply a structured analysis of existing UTAUT2-based research to identify an extended conceptualization of UTAUT2 components in various contexts and with specific contextual add-ons. Based on pilot data collected in 2018 on digital wallets adoption (study 1) and barriers on musical streaming services adoption (study 2) we analyse 2 extended UTAUT2 models with PLS-SEM. The results of the analysis demonstrate consumer tendency to risk aversion (added variable) significance in the context of digital technologies usage, whereas effort expectancy and gender effects (original UTAUT2 variables) turned out insignificant in both studies. The results of the pilot studies preliminary confirm the research idea of UTAUT2 possible contextual limitations.

Keywords – UTAUT2, Consumer behaviour, Consumer knowledge, Digital marketplace

Paper type – Academic Research Paper

1 Introduction

Digitalization is reshaping the industries dramatically, leading to new consumer experiences and adoption strategies emergence. In recent years, the system of market interaction is facing new challenges, including worsen economic conditions and global

economic challenges. However, the most serious is the global technological challenge associated with the development and widespread adoption of digital technologies, which include the Internet, mobile communications, and digital manufacturing. Key elements of the digital economy are e-commerce, online banking, electronic payments, online advertising, online games, etc.

However, it is consumer who is the driving force behind the adoption of technologies and their integration into her economic activities. The dynamics of introducing digital technologies in all sectors of the economy is large-scale, which can be illustrated by the growth rate of Internet users in the world from 6.7 to 45.8 per 100 people since 2000 (World Bank, 2018). The rates of change and their scale are so great that researchers have got a good deal of investigation and interpretation of the whole range of technological influence on various spheres of human activity and its role in the development of economy and society ahead of them. The question remains open about the possibility and ability of market participants, including consumers, entrepreneurs, employees and regulators, to adapt to new requirements and receive benefits from technological changes.

2 UTAUT2 in extant research

The willingness of consumers to accept and actively use digital technologies is associated with the development of consumer knowledge, the formation of digital literacy and knowledge of the digital ecosystem. The modern toolkit for understanding of mechanisms behind technology adoption includes a wide range of theories, including Theory of Reasoned Action and Theory of Planned Behavior, Technology Acceptance Models and Unified Theory of Acceptance and Use of Technology (UTAUT) (Al-Mamary et al., 2016; Lai, 2017; Shaikh, Karjalainen, 2015; Venkatesh et al., 2012). Although original UTAUT has been widely recognized as a baseline for research on acceptance of technologies, its limitation on being more focused on organizational perspective (job performance) decreases its value to customer experiences understanding (Rondan-Cataluña, Arenas-Gaitán, and Ramírez-Correa, 2015). As a more customer-centric approach UTAUT2 relies on psychology of human behavior (Venkatesh et al., 2012), which became a baseline model for research on adoption of new technologies by end consumers.

Since UTAUT2 has been introduced in 2012 the original paper (Venkatesh et al., 2012) received more than 1500 citations in Scopus. For the purposes of our analysis we selected from the Scopus database the papers published till the end of 2017 that indicated UTAUT2 in the key words and utilized the approach in the empirical development. With that our search was limited to only 45 papers, with 35 with full text available and representing a quantitative empirical study (some papers were eliminated from the sample representing a pilot preceding a full-scale study). It should be noted that the list of selected publications was almost evenly arranged between 2015, 2016 and 2017.

Based on the conducted analysis we may divide suggestions for improvement of the UTAUT2 model into several directions. The most frequently used solution is extension of the model with variables influencing behavioral intention and/or use behavior that may

indicate either consumer trust (Slade et al., 2015; Lian, 2015; Tarhini, 2017; Alalwan et al., 2017, Trojanowski, Kułak, 2017; Shareef et al., 2017) towards provider or technology or consumer risk-related strategies and preferences, i.e. perceived risk (Slade et al., 2015; Lian, 2015; Tandon et al., 2016), security concerns (Morosan, DeFranco, 2015; Juaneda-Ayensa, 2016; Oliveira et al., 2016; Alharbi et al., 2017) and privacy concerns (Lai, Shi, 2015; Anuar et al., 2015; Morosan, DeFranco, 2015). Other studies prove that cross-cultural (Baptista, Oliveira, 2015; Khan, 2017; Blake et al., 2017) and cross-country (Tavares, Oliveira, 2017) context may also play its role in shaping the model although this type of model modification is yet not widely represented. Some authors test (however, mostly unsuccessfully) the moderating effects of educational level (Hew et al., 2015; Munyoka, Maharaj, 2017).

3 Pilot studies

In order to understand the possible directions for UTAUT2 extensions we additionally analyse 2 pilot studies on digital wallets adoption (study 1) and barriers on musical streaming services adoption (study 2) testing 2 extended UTAUT2 models using PLS-SEM. Both studies were carried out in Spring 2018 with data collected in St. Petersburg, Russia, via online questionnaires. Data was analysed using WARP-PLS.

Study 1 was focused on specificities of adoption of digital wallets by Russian consumers. Hedonic motivation, price-value and facilitating conditions were intentionally excluded from the study taking the rational nature of the service under analysis and developments of prior research. Consistently with the extant research on mobile payment technologies the security, trust and perceived risk variables were added to the model. As can be seen on figure 1, effort expectancy and social influence of the original model turned out insignificant which is quite typical and consistent with existing empirical evidence.

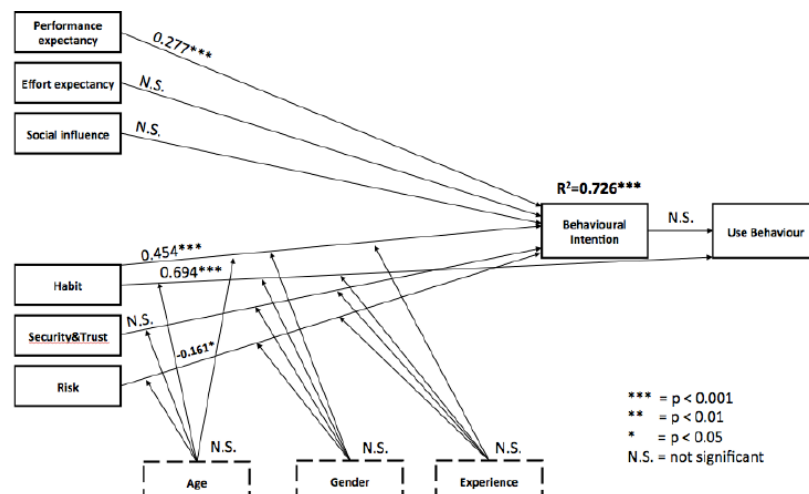


Figure 1. Pilot study on digital wallets adoption results (Voronenko, 2018)

In study 2 UTAUT2 was used to identify whether there are possible barriers that prevent adoption of the musical streaming services so tangibility preference and piracy preference were introduced by the author. As we may observe on Figure 2, the introduced variables turned out insignificant, together with the effort expectancy, facilitating conditions, hedonic motivation and price value. The study highlights the role of habit which is rarely confirmed significant in the analysed studies in forming behavioural intention and use behavior.

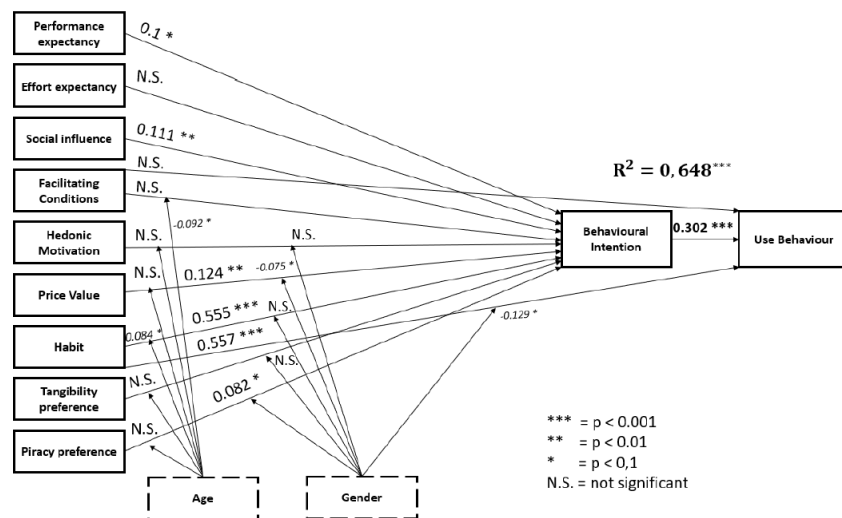


Figure 2. Pilot study on musical streaming services adoption results (Bobrov, 2018)

Both studies also show absence of moderation effects of age and gender which as well is quite typical of UTAUT2 empirical evidence observed across extant research.

4 Conclusions

This study aimed to integrate existing research experiences in UTAUT2 application in such fields as computer science, business research and engineering in order to suggest directions for improvement of UTAUT2 framework with attention to both types of consumer knowledge (e.g., digital literacy) and behavioral strategies (e.g., risk aversion), leading to implications for the market actors' strategies on introduction of new digital products to the market and improvement of consumer engagement in digital marketplace (Dessart, Veloutsou and Morgan-Thomas, 2016).

We investigate the existing limits of explanatory power of UTAUT2 as a source of consumer experiences and customer knowledge structuring. We apply a structured analysis of existing UTAUT2-based research to identify an extended conceptualization of UTAUT2 components in various contexts and with specific contextual add-ons. Based on pilot data collected in 2018 on digital wallets adoption (study 1) and barriers on musical

streaming services adoption (study 2) we test 2 extended UTAUT2 models using PLS-SEM. The results of the analysis demonstrate consumer tendency to risk aversion (added variable) significance in the context of digital technologies usage, whereas effort expectancy and gender effects (original UTAUT2 variables) turned out insignificant in both studies. The results of the pilot studies preliminary confirm the research idea of UTAUT2 possible contextual limitations.

Based on the results of the analysis of extant research we may suggest the following ideas for further development of the UTAUT2:

1. For technology-based solutions that may utilize consumer private data extension with trust, security concern and privacy concern variables will increase explanatory power of the model and may help identify consumer strategies.
2. As is proved by several studies, the results of the UTAUT2 application are subject to cultural context influence which means cultural dimensions moderators may be used to improve the model when adoption of foreign technology is considered.
3. Age and gender although initially introduced to UTAUT2 do not prove to be consistent moderators across various contexts. That

References

- Alalwan, A.A., Dwivedi, Y.K., and Rana, N.P. (2017) Factors influencing adoption of mobile banking by Jordanian bank customers: Extending UTAUT2 with trust. *International Journal of Information Management*. Vol. 37, No. 3, pp. 99-110
- Al-Mamary, Y.H., Al-Nashmi, M., Ghaffar, Y. H. and Shamsuddin, A., (2016) A Critical Review of Models and Theories in Field of Individual Acceptance of Technology. *International Journal of Hybrid Information Technology*, Vol. 9, No.6, pp. 143-158.
- Dessart, L., Veloutsou, C. and Morgan-Thomas, A., (2016). "Capturing Consumer Engagement: Duality, Dimensionality and Measurement", *Journal of Marketing Management*, Vol. 32, No. 5-6, pp. 399-426.
- Lai, P.C., (2017) "The literature review of technology adoption models and theories for the novelty technology", *Journal of Information Systems and Technology Management*, Vol. 14, No. 1, pp. 21-38.
- Lian, J.-W. (2015) Critical factors for cloud based e-invoice service adoption in Taiwan: An empirical study. *International Journal of Information Management*. Vol. 35, No. 1, pp. 98-109
- Morosan, C., DeFranco, A. (2016) It's about time: Revisiting UTAUT2 to examine consumers' intentions to use NFC mobile payments in hotels. *International Journal of Hospitality Management*. Vol. 53, February, pp. 17-29.
- Rondan-Cataluña, F.J., Arenas-Gaitán, J. and Ramírez-Correa, P.E., (2015) "A comparison of the different versions of popular technology acceptance models: A non-linear perspective", *Kybernetes*, Vol. 44, No. 5, pp. 788-805.
- Shaikh, A.A. and Karjaluoto, H., (2015) "Mobile banking adoption: A literature review", *Telematics and Informatics*, No. 32, pp. 129-142.
- Shareef, M.A., Dwivedi, Y.K., Kumar, V., and Kumar, U. (2017) Content design of advertisement for consumer exposure: Mobile marketing through short messaging service. *International Journal of Information Management*. Vol. 37(4), pp. 257-268

- Slade, E., Williams, M., Dwivedi, Y. and Piercy, N. (2015) Exploring consumer adoption of proximity mobile payments. *Journal of Strategic Marketing*, Vol. 23, No. 3, pp. 209-223.
- Tarhini, A., Deh, R.M., Al-Busaidi, K.A., Mohammed, A.B., and Maqableh, M. (2017). Factors influencing students' adoption of e-learning: A structural equation modeling approach. *Journal of International Education in Business*. Vol. 10, No. 2, pp. 164-182.
- The World Bank Group, (2018) "Individuals using the Internet (% of population)", <https://data.worldbank.org/indicator/IT.NET.USER.ZS>, last accessed: January 15, 2019.
- Trojanowski, M., Kułak, J. (2017) The impact of moderators and trust on consumer's intention to use a mobile phone for purchases. *Journal of Management and Business Administration*. Central Europe. Vol. 25(2), pp. 91-116.
- Venkatesh, V., Thong, J.Y.L. and Xu, X., (2012) "Consumer Acceptance and Use of Information Technology: Extending Unified Theory of Acceptance and Use of Technology", *MIS Quarterly*, Vol. 36, No. 1, pp. 157-178.
- Wong, C.-H.a, Tan, G.W.-H.b, Loke, S.-P.c, and Ooi, K.-B. (2014) Mobile TV: A new form of entertainment? *Industrial Management and Data Systems*. Vol. 114, No. 7, pp. 1050-1067.
- Ain, N., Kaur, K., Waheed, M. 2016 The influence of learning value on learning management system use: An extension of UTAUT2. *Information Development* . 32(5), c. 1306-1321
- Alharbi, N., Papadaki, M., Dowland, P. The impact of security and its antecedents in behaviour intention of using e-government services 2017 *Behaviour and Information Technology* 36(6), c. 620-636
- Anuar, F.I., Ismail, K., Yulia, A. Implication of privacy concerns and safety awareness of tourism location-based services (LBS) applications among college students. *Advanced Science Letters*. Volume 21, Issue 5, May 2015, Pages 1234-1238
- Arenas-Gaitán, J., Peral-Peral, B., Ramón-Jerónimo, M.A. Elderly and internet banking: An application of UTAUT2. *Journal of Internet Banking and Commerce* Volume 20, Issue 1, 1 April 2015, 23p
- Baptista, G., Oliveira, T. Understanding mobile banking: The unified theory of acceptance and use of technology combined with cultural moderators. *Computers in Human Behavior*. Volume 50, 1 September 2015, Pages 418-430
- Baptista, G., Oliveira, T. Why so serious? Gamification impact in the acceptance of mobile banking services 2017 *Internet Research* 27(1), c. 118-139
- Blake, B.F., Neuendorf, K.A., LaRosa, R.J., Hudzinski, K., Hu, Y. E-Shopping Patterns of Chinese and US Millennials 2017 *Journal of Internet Commerce* 16(1), c. 53-79
- Hew, J.-J., Lee, V.-H., Ooi, K.-B., Wei, J. What catalyses mobile apps usage intention: An empirical analysis. *Industrial Management and Data Systems*. Volume 115, Issue 7, 10 August 2015, Pages 1269-1291
- Juaneda-Ayensa, E., Mosquera, A. Email Author, Murillo, Y.S. Omnichannel customer behavior: Key drivers of technology acceptance and use and their effects on purchase intention
- Khan, I.U., Hameed, Z., Khan, S.U. 2017. Understanding online banking adoption in a developing country: UTAUT2 with cultural moderators. *Journal of Global Information Management* . 25(1), c. 43-65
- Kovářiková, L., Grosová, S., Baran, D. Critical factors impacting the adoption of foresight by companies. 2017. *Foresight* . 19(6), c. 541-558
- Lai, I.K.W., Shi, G. The impact of privacy concerns on the intention for continued use of an integrated mobile instant messaging and social network platform. *International Journal of Mobile Communications*. Volume 13, Issue 6, 2015, Pages 641-669
- Lian, J.-W. Critical factors for cloud based e-invoice service adoption in Taiwan: An empirical study. *International Journal of Information Management*. Volume 35, Issue 1, 1 May 2015, Pages 98-109

- Macedo, I.M. Predicting the acceptance and use of information and communication technology by older adults: An empirical examination of the revised UTAUT2. 2017. *Computers in Human Behavior* . 75, c. 935-948
- Morosan, C., DeFranco, A. It's about time: Revisiting UTAUT2 to examine consumers' intentions to use NFC mobile payments in hotels. *International Journal of Hospitality Management*. Volume 53, February 01, 2016, Pages 17-29
- Munyoka, W., Maharaj, M. 2017. The effect of UTAUT2 moderator factors on citizens' intention to adopt e-government: The case of two SADC countries. *Problems and Perspectives in Management* . 15(1), c. 115-123
- Oliveira, T., Thomas, M., Baptista, G., Campos, F. Mobile payment: Understanding the determinants of customer adoption and intention to recommend the technology. 2016. *Computers in Human Behavior*. 61, c. 404-414
- Oliveira, T., Thomas, M., Baptista, G., Campos, F. Mobile payment: Understanding the determinants of customer adoption and intention to recommend the technology. 2016. *Computers in Human Behavior*. 61, c. 404-414
- Slade, E., Williams, M., Dwivedi, Y., Piercy, N. Exploring consumer adoption of proximity mobile payments. *Journal of Strategic Marketing*. Volume 23, Issue 3, 16 April 2015, Pages 209-223
- Tandon, U., Kiran, R., Sah, A.N. Understanding online shopping adoption in India: Unified theory of acceptance and use of technology 2 (UTAUT2) with perceived risk application. 2016 *Service Science* 8(4), c. 420-437
- Tarhini, A., Deh, R.M., Al-Busaidi, K.A., Mohammed, A.B., Maqableh, M. Factors influencing students' adoption of e-learning: A structural equation modeling approach 2017 *Journal of International Education in Business* 10(2), c. 164-182
- Tavares, J., Oliveira, T. Electronic Health Record Portal Adoption: A cross country analysis. 2017 *BMC Medical Informatics and Decision Making* 17(1),97
- Yuan, S., Ma, W., Kanthawala, S., and Peng, W. (2015) Keep Using My Health Apps: Discover Users' Perception of Health and Fitness Apps with the UTAUT2 Model. *Telemedicine and e-Health*. Volume 21, Issue 9, Pages 735-741

Knowledge Ecosystems and Closed Loop Supply Chain: Developing a Conceptual Model

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Abstract

Although some researchers tried to differentiate the term knowledge ecosystem (KE) from other types of the ecosystem (such as business, innovation) the exact meaning and definition of the term remains still blurred. The indefiniteness of KE is caused partially by the fact that not much research that would specifically mention KE has been published. In WoS, only 41 articles that use the term knowledge ecosystem in the title were indexed, and only 17 from them investigate KE in the knowledge management context. When searching not only in title but more broadly in the topic, 88 articles were found, and 28 were eligible. Thus, to truly investigate KE, the focus should be on other management disciplines which are interrelated with KE through knowledge intensity. Customer Knowledge Management or Closed Loop Supply Chain are disciplines that will be used in this study to suggest how KE can be conceptualised for further research. This paper is theoretical, and the main output is a conceptual model.

Keywords – Knowledge Ecosystem, Closed Loop Supply Chain, Absorptive Capacity, Customer Knowledge Management, Reverse Logistics

Paper type – Academic Theoretical Paper

1 Introduction

With increasing virtualisation of business activities, dispersed teams, remote workplaces, and other shifts in current business, knowledge management needs to evolve together with changes in the whole economy. Since the formulation of the Knowledge-Based View (KBV) from Resource-Based View (RBV; see Curado and Bontis, 2006 for more details), the focus of organisational research was on how knowledge can be acquired, used, shared, and created. Furthermore, RBV was extended by formulating the theory of dynamic capabilities (Teece et al., 1997). Among many dynamic capabilities, absorptive capacity (AC) of the firm is the closest one to KBV (Zahra and George, 2002). Other concepts helped in the evolution of Knowledge Management (KM), such as knowledge management systems (Alavi and Leidner, 2001) or customer knowledge management (Davenport et al., 2001). Lately, it seems that further evolution of KM

theory will be through the concept of Knowledge Ecosystems (KEs) which promises to generalise the behaviour of companies connected to knowledge transfer at the inter-organisational level.

However, this concept is still novel and unresearched. In the recent extensive systematic literature review that focused on ecosystems in business, Sacringella and Radziwon (2018) identified only three articles that investigated knowledge ecosystems. Although they reviewed articles that were published before 2016 (current WoS database searches do not extend the number of studies significantly), this indicates that the research domain of KEs is significantly unexplored. Moreover, the concept of KE is not properly defined, conceptualised, and operationalised in different levels (ecosystem, firm, individual) for further analysis.

Therefore, this study starts with comparing various definitions of KE and draw conclusions which subsequently showed that absorptive capacity of the firm could be a useful bridge between KE (inter-organisational KM) and KM (intra-organizational KM). Because most of KE research is focused on the main KE nodes (usually research institutions), further development of the field should investigate different business settings where the concept of KE can be of use. Additionally, members of KE cannot efficiently function without the unobstructed flow of information inside their structure. Thus, conceptualise KE in the context of Closed Loop Supply Chain (CLSC) could allow to conduct subsequent research and bring a new understanding of how knowledge transfer in KE works.

Therefore, the goal of this study is to show how the understanding of the KE field can be extended by the research conducted in CLSC area considering knowledge and information feedback and concept of absorptive capacity of the firm. The output of this paper is a conceptual model that can be further developed and used in subsequent research. The rest of the paper describes the theoretical background in section 2, which is followed by a discussion of the conceptual paper in section 3.

2 Theoretical Background

In the following sections, the theoretical background of the presented conceptual model of CLSC Knowledge Ecosystem. First, the concept of KE, which theoretically encompasses the whole model, is introduced and discussed. The second section explains how the Absorptive Capacity, which is used as a theoretical concept for explaining how the knowledge transfers between parts of CLSC, connects Knowledge Ecosystems and the organisational processes. The third section outlines the research focusing on how the knowledge in terms of feedback is embedded in organisational processes.

2.1 Knowledge Ecosystems

Knowledge Ecosystems (KEs) were gradually derived from other ecosystems, namely business, innovation, and entrepreneurial ecosystems (Scaringella and Radziwon, 2018). Valkokari (2015) enhanced the set of different ecosystem terms by industrial and service ecosystem that partially overlap between each other. Although various scholars agree on

several specific attributes of KEs, no generally accepted definition of KE exists. Therefore, Table 1 summarises various definitions of KEs to clarify in detail what the term KE means in different studies and contexts.

Although the understanding (see Table 1) of Knowledge Ecosystem (KE) refers mainly to an inter-organisational system (Jarvi et al., 2018), the individual firm level cannot be omitted. Mainly because the processes at the individual firm level cyclically influence the processes at the ecosystem level (Borgh et al., 2012). Additionally, while specific influential parts (at the micro level) of KE can impact the whole ecosystem (e.g. Bell Labs), the way how the whole ecosystem at the macro level influences the micro level (firm level) deserves attention (Noennig et al., 2014). An example of how the macro level influences the micro level can be illustrated by the absorptive capacity of the firm.

Article	Definition
Borgh et al. (2012)	Heterogeneous set of knowledge-intensive companies and other participants that depend on each other for their effectiveness and efficiency, and as such need to be located in close proximity.
Clarysse et al. (2014)	The flow of tacit knowledge between companies and the mobility of personnel have been advanced as the main advantages of geographic colocation which characterize these hotspots. Such hotspots have been characterized as knowledge ecosystems where local universities and public research organizations play a central role in advancing technological innovation within the system.
Noennig et al. (2014)	Knowledge Ecosystems describe environments that trigger intellectual interaction and innovative production. The term indicates a dynamic relationship between knowledge work and environmental conditions, hinting at cross-scale processes between diverse agents and agencies. These actors benefit from, and contribute to, synergetic networks which continuously transform and develop the resource 'knowledge'.
Valkokari (2015)	Knowledge ecosystems have their main interest and outcome in creation of new knowledge through joint research work, collaboration, or the development of knowledge base..... knowledge ecosystems focus on the generation of new knowledge, and research institutes and innovators, such as technology entrepreneurs, play a central role in these ecosystems.
Jarvi et al. (2018)	A knowledge ecosystem consists of users and producers of knowledge, organized around joint knowledge search.... conceptualized as searching for the knowledge domain; that is, the search for the field of action where program-level knowledge creation and individual-level knowledge work will eventually take place.

2.2 Absorptive Capacity

Absorptive Capacity (AC) of the firm can be defined as: “*a set of organisational routines and strategic processes by which firms acquire, assimilate, transform, and exploit knowledge for value creation*” (Zahra and George, 2002, p. 198). The idea of absorptive capacity of the firm originated from dynamic capabilities theory formulated by Teece et al. (1997) who built it upon the Resource-Based View (RBV) of the firm (see Wernerfelt, 1984) and Knowledge-Based View (KBV) of the firm (Grant, 1996; Kogut and Zander, 1992). AC can be explained as a sponge and water which, similar to an organisation and knowledge, when released from pressure, absorbs water (Roberts et al., 2012). This absorbed knowledge allows the organisations to create value through innovation and thus to acquire the long-term competitive advantage (Zahra and George, 2002).

Although the usual focus of AC is on the individual firm's internal capability, it was shown that it could be used (together with a relational view of the firm) as a theoretical

framework on a higher level of analysis, namely in the supply chain context (Malhotra et al., 2005). Furthermore, AC promises to be a theoretical framework that can be used for conceptualising the knowledge transfer in KE. Indeed, Miller et al. (2016) investigated how knowledge transfer is performed in university (knowledge) ecosystem within the AC perspective (see their conceptual model in Figure 1). Thus, showing that AC can be used in networked companies and KE context, the research of (knowledge and information) feedback in Closed-loop Supply Chains can extend understanding of KEs and their behaviour and management (more in section 2.3).

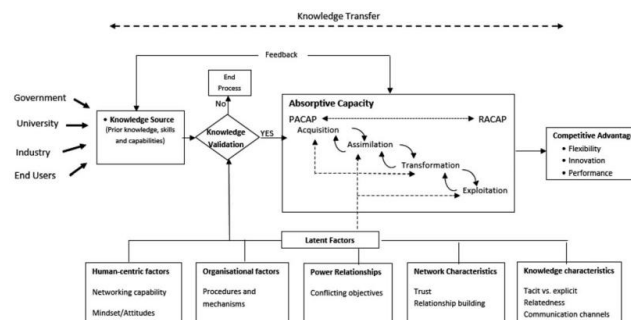


Figure 1: Absorptive capacity in Knowledge Ecosystems by Miller et al. (2016)

Besides the information and knowledge that resides within CLSC, the role of AC in CLSC can relate to Customer Knowledge Management (CKM). This concept is a combination of Customer Relationship Management (CRM) and Knowledge Management (KM) (Davenport et al., 2001). In the conceptual model, knowledge from and about customers is being absorbed by parts of the supply chain and by the producer (the main node of the KE). Incorporating CKM into KE can bring competitive advantage (Taherparvar et al., 2014). Subsequently, the customer knowledge positively influences product or service innovations (García-Murillo and Annabi, 2002), marketing results (Fidel et al., 2015), and organisational performance (Shieh, 2011).

2.3 Feedback in Closed-Loop Supply Chain

Supply Chain Management (SCM) evolved throughout the time from a “simple” logistics management into a complex management discipline. The current complex view on SCM is the concept of Closed Loop Supply Chain (CLSC) which is “the design, control, and operation of a system to maximize value creation over the entire life cycle of a product with dynamic recovery of value from different types and volumes of returns over time” (Govindan et al., 2015, p. 604). For CLSC to work, various forward and backward flows of information and knowledge need to be performed. Especially the reverse (backward) flows contain valuable information/knowledge. They are part of Reverse Logistics (RL) which is “the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal” (Tibben-Lembke and Rogers, 2002).

Some studies of RL showed the importance of information and knowledge that is embedded in reverse flows (Daugherty et al., 2005; Hosseini et al., 2015; Richey et al., 2005) which can be used for innovation (Krčál, 2018; Krčál and Škapa, 2017). In a recent study, the positive impact of KM on RL effectiveness was empirically demonstrated (Škapa and Klapalová, 2019). Therefore, all parts of the CLSC could benefit greatly from behaving by KE “rules”. In the conceptual model, reverse information flows are depicted as RF, and they consist of any information and knowledge that is connected to product or packaging returns (i.e. reverse logistics). The forward flows of a typical supply chain are depicted as FF, and they represent the information and knowledge connected with the product that moves forward.

When treating CLSC as a meta-organisation, the behaviour regarding knowledge transfer can be described with the help of KE findings (see Jarvi et al., 2018). Their study distinguishes between two modes of behaviour, (i) search for a knowledge domain, (ii) search within a knowledge domain. The first mode “involves probing and formulating a common goal”, the second mode “involves selectively revealing and reinforcing the common goal” (Jarvi et al., 2018, p. 1524).

3 Conceptual Model

In the following two figures, the conceptual model based on previously outlined theory depicts how knowledge transfer in CLSC can be integrated and extended by KE. Figure 2 shows how consequent research can frame the macro level of KE of CLSC together with studies that can be used for operationalising the variables. Figure 3 presents the possible conceptualisation of the micro level of KE, which is an individual firm level.

The macro level of KE of CLSC is based on the flow and seeking knowledge that originates either from the end user through customer knowledge, or the reverse flows invoked by product or package returns that contain information or knowledge about the product. The close collaboration of members of CLSC results first in a search for a common goal (e.g. why customers return products), and second in revealing the common goal (e.g. collaboratively finding the reasons for the returns and through which innovation it is possible to resolve the problem).

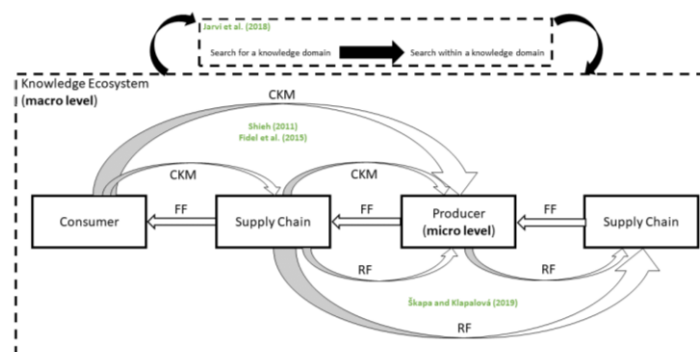


Figure 2: Conceptual model of KE macro level.

The micro level of the node in the KE is based on the previous research (Klapalová and Krčál, 2017; Krčál, 2018; Krčál and Škapa, 2017) that was conducted by a research team which the author of this study is part. Specifically, it focused on how the knowledge obtained as feedback from customers is gathered and then subsequently used. AC can be conceptualised similarly (processes of acquiring, assimilate, transform, exploit the knowledge) as was done in the study by Limaj et al. (2016).

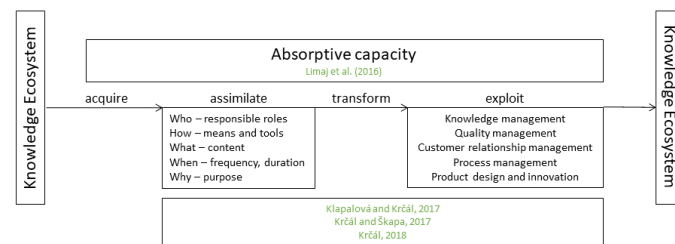


Figure 3: Conceptual model of KE micro level.

4 Conclusions

The goal of this study was to introduce a conceptual model that will allow developing the understanding of KE both on macro and micro level. Figure 2 introduces a model that shows how KE could be conceptualised at a macro level. Figure 3 shows how knowledge transfer can be explained in the nodes of KE. Because the knowledge of KE is scattered and any unification of this concept is far from being done, the introduced conceptual models could either help with deepening the knowledge of KE or being further developed as the body of knowledge of KE will grow.

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References

- Alavi, M., Leidner, D.E., 2001. Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly* 25, 107–136. <https://doi.org/10.2307/3250961>
- Borgh, M. van der, Cloudt, M., Romme, A.G.L., 2012. Value creation by knowledge-based ecosystems: evidence from a field study. *R&D Management* 42, 150–169. <https://doi.org/10.1111/j.1467-9310.2011.00673.x>
- Clarysse, B., Wright, M., Bruneel, J., Mahajan, A., 2014. Creating value in ecosystems: Crossing the chasm between, knowledge and business ecosystems. *Res. Policy* 43, 1164–1176. <https://doi.org/10.1016/j.respol.2014.04.014>
- Curado, C., Bontis, N., 2006. The knowledge-based view of the firm and its theoretical precursor.

- Daugherty, P.J., Richey, R.G., Genchev, S.E., Chen, H., 2005. Reverse logistics: superior performance through focused resource commitments to information technology. *Transportation Research Part E: Logistics and Transportation Review* 41, 77–92. <https://doi.org/10.1016/j.tre.2004.04.002>
- Davenport, T.H., Harris, J.G., Kohli, A.K., 2001. How do they know their customers so well? *MIT Sloan Manage. Rev.* 42, 63–73.
- Fidel, P., Schlesinger, W., Cervera, A., 2015. Collaborating to innovate: Effects on customer knowledge management and performance. *Journal of Business Research*, Special issue on The Spirit of Strategy Special issue on The Spirit of Strategy 68, 1426–1428. <https://doi.org/10.1016/j.jbusres.2015.01.026>
- García-Murillo, M., Annabi, H., 2002. Customer Knowledge Management. *The Journal of the Operational Research Society* 53, 875–884.
- Govindan, K., Soleimani, H., Kannan, D., 2015. Reverse logistics and closed-loop supply chain: A comprehensive review to explore the future. *European Journal of Operational Research* 240, 603–626. <https://doi.org/10.1016/j.ejor.2014.07.012>
- Grant, R.M., 1996. Toward a knowledge-based theory of the firm. *Strategic Management Journal* 17, 109–122. <https://doi.org/10.1002/smj.4250171110>
- Hosseini, M.R., Chileshe, N., Rameezdeen, R., Lehmann, S., 2015. Integration of design for reverse logistics and harvesting of information: a research agenda. *International Journal of Logistics Systems and Management* 20, 480–515. <https://doi.org/10.1504/IJLSM.2015.068490>
- Jarvi, K., Almpantopoulou, A., Ritala, P., 2018. Organization of knowledge ecosystems: Prefigurative and partial forms. *Res. Policy* 47, 1523–1537. <https://doi.org/10.1016/j.respol.2018.05.007>
- Klapalová, A., Krčál, M., 2017. Product returns – interdisciplinary interfaces between knowledge, quality and product innovation management, in: Dahlgaard -Park, S.M., Dahlgaard, J.J. (Eds.), *Proceedings from 20th International Conference on Quality and Service Sciences (QMOD): Challenges and Opportunities of Quality and Sustainability in the 4th Industrial Revolution*. Lund University Library Press, Lund, pp. 1–14.
- Kogut, B., Zander, U., 1992. Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. *Organization Science* 3, 383–397. <https://doi.org/10.1287/orsc.3.3.383>
- Krčál, M., 2018. Using knowledge from customers to product innovation and reverse flows decrease: a conceptual model, in: Han van der Meer, G.S., Guido Enthoven (Ed.), *Societal Impact of Knowledge and Design*. IFKAD, Delft, pp. 873–880.
- Krčál, M., Škapa, R., 2017. How Knowledge from Customers Affects Product Design and Process Management: Initial Evidence from Systematic Literature Review, in: Lenka Janošová, M.C., Ladislava Kuchynková (Ed.), *Proceedings of the International Scientific Conference of Business Economics, Management and Marketing*. Masaryk University, Brno, pp. 138–148.
- Limaj, E., Bernroider, E.W.N., Choudrie, J., 2016. The impact of social information system governance, utilization, and capabilities on absorptive capacity and innovation: A case of Austrian SMEs. *Information & Management, Information Technology and Innovation: Drivers, Challenges and Impacts* 53, 380–397. <https://doi.org/10.1016/j.im.2015.12.003>
- Malhotra, A., Gosain, S., El Sawy, O.A., 2005. Absorptive Capacity Configurations in Supply Chains: Gearing for Partner-Enabled Market Knowledge Creation. *MIS Quarterly*; Minneapolis 29, 145–187.
- Miller, K., McAdam, R., Moffett, S., Alexander, A., Puthusserry, P., 2016. Knowledge transfer in university quadruple helix ecosystems: an absorptive capacity perspective. *R D Manage.* 46, 383–399. <https://doi.org/10.1111/radm.12182>
- Noennig, J.R., Scheler, A.-M., Piskorek, K., Barski, J., 2014. Towards Knowledge Ecosystems: Modelling Knowledge Dynamics in Environmental Systems. *Procedia Computer Science, Knowledge-Based and Intelligent Information & Engineering Systems 18th Annual*

- Conference, KES-2014 Gdynia, Poland, September 2014 Proceedings 35, 1360–1369. <https://doi.org/10.1016/j.procs.2014.08.179>
- Richey, R.G., Genchev, S.E., Daugherty, P.J., 2005. The role of resource commitment and innovation in reverse logistics performance. *International Journal of Physical Distribution & Logistics Management* 35, 233–257.
- Roberts, N., Galluch, P.S., Dinger, M., Grover, V., 2012. Absorptive Capacity and Information Systems Research: Review, Synthesis, and Directions for Future Research. *MIS Quarterly* 36, 625–648. <https://doi.org/10.2307/41703470>
- Scaringella, L., Radziwon, A., 2018. Innovation, entrepreneurial, knowledge, and business ecosystems: Old wine in new bottles? *Technol. Forecast. Soc. Chang.* 136, 59–87. <https://doi.org/10.1016/j.techfore.2017.09.023>
- Shieh, C.-J., 2011. Study on the relations among the customer knowledge management, learning organization, and organizational performance. *The Service Industries Journal* 31, 791–807. <https://doi.org/10.1080/02642060902960818>
- Škapa, R., Klapalová, A., 2019. The Effectiveness of Reverse Logistics: the empirical test of its factors for product returns reduction. *Ekonomický časopis* 67.
- Taherparvar, N., Esmaeilpour, R., Dostar, M., 2014. Customer knowledge management, innovation capability and business performance: a case study of the banking industry. *Journal of Knowledge Management* 18, 610–591.
- Teece, D.J., Pisano, G., Shuen, A., 1997. Dynamic Capabilities and Strategic Management. *Strategic Management Journal* 18, 509–533. <https://doi.org/10.2307/3088148>
- Tibben-Lembke, R.S., Rogers, D.S., 2002. Differences between forward and reverse logistics in a retail environment. *Supp Chain Mnagmnt* 7, 271–282. <https://doi.org/10.1108/13598540210447719>
- Valkokari, K., 2015. Business, Innovation, and Knowledge Ecosystems: How They Differ and How to Survive and Thrive within Them. *Technol. Innov. Manag. Rev.* 17–24.
- Wernerfelt, B., 1984. A resource-based view of the firm. *Strat. Mgmt. J.* 5, 171–180. <https://doi.org/10.1002/smj.4250050207>
- Zahra, S.A., George, G., 2002. Absorptive Capacity: A Review, Reconceptualization, and Extension. *AMR* 27, 185–203. <https://doi.org/10.5465/amr.2002.6587995>

Corporate Governance and Performance: an Empirical Analysis of a Sector of Listed in Italian Stock Exchange

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Abstract

Studies on corporate governance have undergone rapid development since the last decades of the twentieth century, when both entrepreneurs and company men began to pay considerable attention to the subject. However, the actual debate began in the early nineties when, following the numerous financial scandals, companies were forced to better define the control mechanisms within them. Most reported cases of corporate failure are attributed to corporate governance practices (Appiah, 2013). We have begun to assist on a global scale, the important role attributed to the mechanisms of Corporate Governance as their correct application is closely related to company performance (Donaldson, 2003).

On the basis of these considerations, the idea of the present work arises which, through a quantitative approach, investigates how the different composition and structure of the board influences the performance of the companies. The companies being analyzed are the mechanical companies listed on the Milan stock exchange for the three-year period 2015-2016-2017. We chose to analyze the mechanical companies thanks to the role they play in our country, in terms of employment, in terms of international trade and above all with reference to the strategic role they fulfill, strongly contributing to the development of the country and to the preservation of the levels of competition from the entire industrial sector. In the elaboration of the dataset, with regard to the governance data, the analysis of the corporate governance relations published annually by each company was used. To relate the governance variables to company performance we used a single financial statement indicator: the ROE (accounting measure), the most popular financial measure

was used.

I risultati del presente lavoro dimostrano che la dimensione del Consiglio di amministrazione ha un'influenza positiva sulla redditività delle società ed anche la maggiore presenza di donne all'interno del CdA.

This study intends to examine how board diversity in companies operating in engineering, impact on performance.

After a brief introduction to Corporate governance and firm performance, the work shows an adequate review of the most significant national and international literature on the subject. The research method used to analyze the topic is empirical using governance variable from corporate governance reports.

This work tries to study deeply the impact of board diversity on firm performance by some listed company.

Keywords – governance, board diversity, performance.

Paper: Academic Research Paper

1 Introduction

Corporate Governance is a fundamental lever for the competitiveness of companies because it represents a key through which to maximize management efficiency and more generally to optimize performance. Furthermore, it is from the corporate governance model that the level of accountability of the companies depends, that is to say the extent of responsibility given to the company decision makers and the effectiveness of the control to which they are subjected. Performance and accountability are the main key factors of business attractiveness for investors. Only in the nineties following numerous events such as the privatization process of many companies, the increase in the weight of institutional investors in the risk capital of large companies, the progressive integration of international financial markets, the failure of some important companies, the poor transparency of relations between managers, property and other stakeholders has elevated governance to a distinctive element of the company. The competitiveness of each company, regardless of the sector to which it belongs, cannot ignore clear and efficient rules on the roles and responsibilities of those who manage and above all those who invest their resources in the production system. Hence the need in many industrialized countries to seek effective models of corporate governance with related codes of conduct: the Best Practice Codes. Corporate Governance is crucial to build a trust marketplace and attract investors in the corporation, as well as corporate governance encourage investors' confidence by ensuring the existence of an independent board of directors. (Guo & Kumara, 2012).

Despite the attention received by scholars, to date there is no single definition of Corporate Governance that can be universally applied to all companies, in fact, in doctrine it is defined in numerous ways, highlighting different aspects; however, scholars and researchers generally classify corporate governance in either narrow or broad terms. The narrow view is based on shareholder satisfaction. Wider definitions extend the

objective of corporate governance to the satisfaction of all stakeholders (ie suppliers, employees and government) (Gillan 2006).

The board of directors of corporate governance is a link between those who provide capital (ie shareholders or owners) and users of that capital to create value (ie managers) Huse (2007) gives four definitions of corporate governance which provide different objectives. First, agency and stewardship theories deem that the main governance objective is to enhance shareholders 'value. Second, stakeholder theory. Reckons that corporate governance. Third, based on managerial hegemony, the objective may be regarded as "doing what is the best for management". Fourth, according to resource dependence theory, the main corporate governance objective is to do what is best for the company. Theories do not in fact, identify corporate governance objectives but the dairy are inferred from the different boards which change the basis of the theory adopted.

Corporate governance is a set of mechanisms with the help of outsiders safeguarding themselves against expropriation by the insiders. Insiders includes both managers and controlling shareholders. Or we can still define the mechanisms of corporate governance Generally when we talk about governance we analyze two dimensions that together contribute to and give rise to corporate governance mechanisms: the internal dimension and the external one. The internal dimension differs from company to company and can be defined as the set of rules, organs and activities that aims at the transparency and correctness of management's work. To carry out an analysis on governance in its internal dimension it is necessary to base the attention on the Board of Directors. External governance, on the other hand, depends on various factors such as the degree of development of the economy, of the capital market, of labor, of the legislative and regulatory system that differs between countries.

Bain and Band, (2016) explains that governance is essential for any organization that wants to maximize the firm effectiveness.

Bain, N. and Band, D. (2016) *Winning ways through corporate governance*. Springer. Metrick and Ishii (2002) for example, define corporate governance from the investor as well as the promise to repay to return on capital invested and committed to operating efficiently with a given investment. According to Mayer (1999), corporate governance is concerned with ways of bringing.

2 Governance in Italy. Origin and trend

Italy, compared to other countries, has particular characteristics of corporate governance which are to be attributed to the constant research of our country to become an economically strong and competitive international power. Because of this, many entrepreneurs have made extensive use of external indebtedness, though encountering a capital market that is little developed compared to the rest of the world. The small investors who fed our market until a few years ago were moving towards forms of investment that were certainly less profitable, but certainly more protected. There were no best practices as a governance model to refer to. Only since the nineties, following the increasing globalization of financial markets, the exchange of goods and services, the

development of technology that facilitated the communication of information, has there been a change since the legislator, the academics and the authorities supervisory authorities have begun to understand the usefulness of forming a corporate governance system.

Among the most important innovations in the legislative sphere we recall: the legislative decree n. 385/1993 the so-called Banking Consolidation Act; the law n. 332/1994 for privatizations; the legislative decree n. 58/1998, that is the Consolidated Law on Finance; the reform of company law, decree n. 6/2003; the establishment of the Corporate Governance Code for listed companies; the provisions for the protection of savings for the regulation of financial markets with the relative law n. 262/2005.

The credit intermediation sector was literally revolutionized with the Banking Consolidation Act in that the separation regime between banks and businesses was eliminated by introducing in the Italian system the "universal bank" model that allowed the establishment of bank-business relationships stronger.

The privatization law has placed restrictions on share ownership and has drawn attention to the importance of governance and shareholder protection. With the legislative decree n. 58/1998 it was decided to combine the rules and principles on financial markets and intermediaries in a single legislative text. The reform required the definition of new circumstances that could favor the development of investment demand and supply, within which corporate financiers could have the opportunity to see their interests protected.

The TUF has made several important changes, including:

The introduction of rules that protect the minority, such as the possibility for minority shareholders to be able to choose a member of the Board of Statutory Auditors, and in general the possibility of having greater consideration in the decision-making choices of the company.

The introduction of the mandatory disclosure of the existence of shareholders' agreements and the time limit of their duration.

There are no direct interventions or rules regarding the functioning or composition of the Board of Directors, but indirectly the rules on the Board of Statutory Auditors affect you. The Consolidated Law on Finance also reads about the independence of directors. In 1999, a special committee was set up whose objective was to create a report on the corporate governance of listed companies and prepare the Corporate Governance Code. The corporate law reform of 2003 essentially concerns the simplification of the regulation of corporations, the introduction of a system articulated in flexible models, the enhancement of statutory autonomy, the regulation of groups of companies.

The need for an adjustment of the legislative framework to market dynamics and developments has led our country to adopt measures aimed at restructuring the sector's top management (Law No. 262 of 2005, the "Savings Law"). The Savings Law has further extended the powers of intervention of Consob: for example the possibility of determining the limits to the accumulation of positions of the members of the control bodies of listed companies and the rules that guarantee access to such bodies of an express component by minorities or, again, the power to determine the share ownership requirements necessary for the presentation of minority lists for the election of a member

of the Board of Directors. With the Savings Law, the thesis that entrusted to the majority the appointment of the decisions and a management the relative management activity was definitively overcome, with the consequence that the powers of the minority were considered as residual, due to the mere action of opposition to resolutions of the command group. The renewed attention of the legislator has led to recognizing to minority shareholders a position of greater importance than that recognized with the Consolidated Law on Finance.

In short, the provision provides for an operation that concerns: the administrative body the control body, the publicity and disclosure on governance

In the Italian legal system there is the possibility of adopting three alternative systems of governance: the traditional, dualistic and monistic system.

3 Literature review

Although studies on corporate governance are a relatively recent phenomenon, which has experienced rapid development during the last decades of the 20th century, entrepreneurs in general and company administrators have always paid considerable attention to the issue of corporate governance. In recent times. Regardless of the particular definition, the importance of corporate governance arises in a company due to the separation between those who control it and those who own it in terms of share capital (Epps, Cereola and Ruth, 2008; (Masood Fooladi, 2012) .

Taking a historical overview, the topic of governance is already noted by the first classical economists: Adam Smith and Marshall. The evolution of corporate governance has allowed an increase in institutional communications. This for the precise purpose of establishing effective relationships with the social partners through the ability to prefigure concrete, understandable, truthful and exhaustive answers to the cognitive-evaluative requests expressed by the stakeholders. This has led companies to integrate corporate communication tools and classic accounting balance prescribed by law, and other voluntary documents have been added, such as the social report, the sustainability report, the report on corporate governance, etc. In terms of Corporate governance there are several strands of institutional theory, from sociological approaches, which focus mainly on internal organizational dynamics (DiMaggio & Powell, 1991) to economic and socio-economic approaches. The board of directors is considered to be the most powerful mechanism of corporate governance as a link between those who provide capital (ie shareholders or owners) and users of capital to create value (ie managers) (Hermanson and Rittenberg, 2003). Even more important is the c.d. board diversity, or the heterogeneity of the Board of Directors. In general, many studies refer to heterogeneity in terms of ethnicity, nationality, age and gender of the Board members. The literature generally shows (with the exception, among others, of Rose, 2007) of the existence of a positive relationship between the heterogeneity of the Board and the economic performance of companies (see Erhardt et al, 2003 and Hillman et al , 2003), social performance (Siciliano, 1996) and reputation (Miller and Triana, 2009) (Marco Fasan, 2012).

The board is expected to play an active role in the strategic process of firms, defining company purposes (Monks and Minow, 2004; Garratt, 2007a). It follows that the board's role is very complex; indeed it has to face several tensions arising from the interaction of different actors; the executives who work towards the implementation of their policies, non-executives who are there to monitor insiders, and the chairman acting as the arbiter of disputes and center of internal tensions. Some research suggests that lower-sized BODs in members may produce better corporate performances than larger BODs (Nguyen, Faff, 2006-07), but these seem to produce more stable and less variable performances (Cheng, 2008).

The empirical literature shows that a lot of studies try to measure the corporate governance influence on firm performance. Among the studies that focus, specifically on the correlation between governance and performance, we must refer to those conducted by Airoldi, Brunetti and Coda (1998), Masini (1959), Bianco and Casavola (1999). The works of the works of Bebchuk & Cohen (2004), Bebchuk, and Cohen & Ferrell (2004), show that well-governed companies perform better.

Some studies state that effective corporate governance reduces the "control rights" that shareholders and creditors give to managers, increasing the likelihood that managers will invest in projects of positive net worth, (Shleifer and Vishny, 1997). Even Antunovich et al (2000) and that of Business week (2000) show that investors are oriented in their choices towards well-governed companies.

Other studies analyze the duality of the CEO which refers to the non-separation of roles between Chief Executive Officer (CEO) and Chairman of the Board. Mohamed Moustafa Soliman, and Mohamed Abd Elsalam, 2012, show that the duality of the roles of CEO and president are apt to improve the mechanisms for monitoring performance related to business management. Other studies analyze the presence of executive administrators and while some researches come to the conclusion that the presence of the administrators contributes to increase the company performances (for example Perry, Peyer, 2005; El Mehdi, 2007; Line et al., 2009), some others arrive at opposite conclusions (eg Choi, Hasan, 2005; Cho, Kim, 2007), (Gianpaolo Abatecola, Andrea Caputo, Michela Mari, Sara Poggesi, 2011).

In summary, however, we can conclude that, on the one hand, part of the literature suggests that the overall quality of a corporate governance system, measured through the composition of specific baskets of variables, generally contributes to increasing the economic and financial value of the companies listed (Alexander et al., 2007; Schmid, Zimmermann, 2008; Renders et al., 2010). On the other hand, the understanding of the impact that the specific variables included in this system can have in more detail on company performances still seems to require a substantial deepening (Gianpaolo Abatecola, Andrea Caputo, Michela Mari, Sara Poggesi, 2011).

4 Research method

In Italy, studies on Corporate Governance are less numerous than in the other countries of the world; what has been said stems from the fact that the national literature

on the subject is quite recent. Tendentially, the studies are articulated in particular on three aspects: analysis of the problems linked to the structure of the Italian economic system; analysis on the size and composition of the Board of Directors; analysis of the correlations between governance and performance.

In recent years, several researches have been conducted aimed at verifying the hypothesis that the increase in Corporate Governance Best Practices affects corporate performance. The empirical analyzes conducted, however, did not allow us to arrive at completely unambiguous interpretations.

The dataset analyzed in the following study, examines some companies related to the engineering company sector listed on the Milan stock exchange that operate purely on the national territory in a particularly complex and engineering regulatory and competitive framework. The engineering industry plays a particularly important role in Italy both in terms of employment and international exchanges, and for the strategic role it fulfills, contributing decisively to the development of the country and to the preservation of the levels of competition of the entire industrial sector. The study conducted covers the three-year period 2015, 2016 and 2017; specifically, the sample of companies surveyed has a number of companies. In the elaboration of the dataset, as far as governance data is concerned, the analysis of the corporate governance reports published annually by each company was used, while, for the performance data, only one important financial statement indicator was used, ie the ROE; specifically, ROE is a measure that shows an investor how much profit a company generates from the money invested by its shareholders (Masood Fooladi, 2012), calculated for each company, at the end of each year.

The variables taken into consideration were divided into tables according to a criterion that led to interesting conclusions, proceeding to a regression and correlation analysis. The study also found the presence of dummy variables; in this regard, a selection was made of those variables that could be more significant than others.

For each table subsequently processed, the independent variables, ie those of corporate governance, and the dependent variable which, in this analysis, is the ROE are explained.

Research Questions

The research question put forward is to understand how in Italy the board of directors, considered a fundamental asset for company, may influence firm performance. This can be expressed as follows:

How can Board of Directors affect firm performance in Italian listed companies?

5 Results

In recent years, several researches have been carried out aimed at verifying the hypothesis that the increase in Corporate Governance best practices influence corporate performance. The empirical analyzes conducted, however, did not allow us to arrive at completely unambiguous interpretations.

The analyzed dataset examines the engineering companies listed on the Italian Stock Exchange, in particular ten of them, and covers the three-year period 2015, 2016 and 2017. The variables taken into consideration were divided into tables according to a criterion that led to interesting conclusions.

In the elaboration of the dataset, as far as governance data is concerned, the analysis of the corporate governance reports published annually by each company was used, while, for the performance data, only one important financial statement indicator was used, ie the ROE calculated for each company at the end of each year. We then proceeded with a regression and correlation analysis using excel (the data were compared with Stata13). There are also dummy variables and a selection was made of those variables that could be more significant than others.

For each table the independent variables are explained ie those of corporate governance and the dependent variable which, in this analysis, is the ROE.

For a quicker examination of each table, the relative graph is displayed as well as the summary table of the multiple regression analysis and the correlation analysis.

BSIZE	Numero Riunioni	ETA' MEDIA	Ownership	ammmin	Anuovi	Ainuovi	ROE
12	19	54	25%	3	1	8	-1,75
12	20	54	25%	3	1	8	7,31
12	20	55	25%	3	5	5	9,92
9	10	53	51%	4	4	2	15,5
9	10	53	51%	4	1	0	10,61
13	7	60	65%	0	1	1	14,96
7	11	55	84%	1	7	7	-8,3
7	12	55	84%	1	1	0	0,72
8	13	48	84%	1	8	3	4,26
5	16	49	62%	1	2	2	10,8
5	13	49	62%	1	2	2	12,82
6	18	46	62%	1	3	1	10,93
10	6	58	99%	0	2	2	-5,94
9	9	58	99%	0	3	3	-2,63
9	9	58	99%	0	0	0	1,09
9	15	62	26%	3	1	1	6,52
9	13	62	26%	3	0	0	7,22
9	15	62	26%	3	1	1	10,22
12	10	52	56%	1	0	0	1,41
12	9	52	56%	1	0	0	7,22
12	8	52	56%	1	0	0	11,02
14	10	54	9,73%	3	0	0	7,75
13	11	55	9,73%	3	0	0	8,6
15	12	50	9,73%	4	8	8	9,86
13	19	56	33,30%	2	1	1	6,7
13	19	55	33,30%	2	7	5	8,1
13	20	56	33,30%	2	0	0	10,6
11	2	45	22,09%	1	0	0	-14,55
9	3	50	22,09%	2	7	5	-53,56
6	4	46	71,03%	0	4	2	0,25
9	9	50	29,85%	3	1	0	17,79

9	9	51	29,85%	3	0	0	17,66
9	12	52	29,85%	3	3	2	18,13
9	11	51	45,31%	0	1	0	4,58
9	10	51	42,46%	0	3	0	2
8	19	53	42,46%	0	3	1	-188,07
10	10	52	60%	1	0	0	3,6
11	11	53	60%	1	1	0	0,39
12	14	54	60%	1	3	3	6,44

OUTPUT RIEPILOGO

Statistica della regressione								
R multiplo	0,528795804							
R al quadrato	0,279625002							
R al quadrato corretto	0,11695968							
Errore standard	31,08299677							
Osservazioni	39							
ANALISI VARIANZA								
	gdl	SQ	MQ	F	Significatività F			
Regressione	7	11625,85304	1660,836149	1,719020367	0,140961705			
Residuo	31	29950,73333	966,1526881					
Totale	38	41576,58637						
	Coefficienti	Errore standard	Stat t	Valore di significatività	Inferiore 95%	Superiore 95%	Inferiore 95,0%	Superiore 95,0%
Intercepta	-19,28315591	69,8056575	-0,276240589	0,784196642	-161,652733	123,0864212	-161,652733	123,0864212
BSIZE	3,218056466	2,514733946	1,279680688	0,210152172	-1,91077723	8,346890163	-1,91077723	8,346890163
Numero Riunioni	-0,64076617	1,207649778	-0,530589399	0,599484119	-3,103784131	1,822251791	-3,103784131	1,822251791
ETA' MEDIA	-1,256150367	1,416400087	-0,886861261	0,381982461	-4,144917389	1,632616656	-4,144917389	1,632616656
Ownership	80,15901673	32,80136511	2,443770754	0,020423559	13,26019154	147,0578419	13,26019154	147,0578419
ammin	17,84311751	5,8316494	3,059703402	0,004543306	5,949390143	29,73684487	5,949390143	29,73684487
Anuovi	-3,229081869	3,015348157	-1,070881935	0,292489558	-9,378924981	2,920761243	-9,378924981	2,920761243
Ai nuovi	0,061915479	3,050509894	0,020296764	0,983936717	-6,159640468	6,283471426	-6,159640468	6,283471426

Table n.1- Correlation matrix

	BSIZE	Numero Riunioni	ETA' MEDIA	Ownership	Ammin	Anuovi	Ainuovi	ROE
BSIZE	1							
Numero Riunioni	0,115187	1						
ETA' MEDIA	0,267528	0,240307648	1					
Ownership	-0,47544	-0,249488654	0,015258117	1				
Ammin	0,313431	0,272144327	0,151169795	-0,700833	1			
Anuovi	-0,12516	0,070670338	-0,24983607	0,08298576	0,034629	1		
Ainuovi	0,151571	0,314958309	-0,03325845	-0,1226601	0,255189	0,656176	1	
ROE	0,149199	-0,07933948	0,058193401	0,00483381	0,29297	-0,15592	-0,03364	1

In the first table the regression and correlation between the size of the BoD, the number of meetings, the average age of the directors, the shares held by the first shareholder, the number of minority directors, the number of new directors appoints the newly appointed independent ones with the ROE. Following an R2 equal to 0.488 we can say that the regressors very well predict the value of the dependent variable.

The table also shows a very high significance value of the number of meetings equal to 0.888, of the minority directors equal to 0.824 and ownership equal to 0.451 compared to the other governance variables taken into consideration. The correlation between ROE and the size of the Board of Directors is positive and assumes a good value, equal to 0.278, ie the increase in the number of members of the Board increases the profitability of the companies. In fact, a larger Board has greater supervisory power over managers due to the greater number of people who control management operations and the behavior of managers. The number of meetings of -0.053 is negatively correlated to the ROE.

Even the average age correlates negatively to the dependent variable of -0.029, while minority directors positively correlate for a value of 0.132. The percentage of shares held by the first shareholder has a negative influence on the ROE for a value of -0.203.

The highest negative correlations amount to -0.441 and -0.343 and the newly appointed directors and the newly appointed independent directors and the performance variable are among the newly appointed directors. Obviously, there is a negative correlation between the two governance variables such as the first shareholder and the minority shareholder and an excellent correlation between newly appointed directors and newly appointed independent directors amounting to 0.956.

In fact, these variables affect the composition of the Board of Directors. The average age of the Board of Directors is negatively correlated with the entry of newly appointed directors and therefore with the increase of one, the other decreases.

Table n.2

AE	ANE	AI	Numero AD	AddivP	Chair esecutivo	ROE
2	10	8	1	1	1	-1,75
2	10	8	1	1	1	7,31
2	10	8	1	1	1	9,92
2	7	5	1	1	1	15,5
2	6	4	1	1	1	10,61
1	12	5	1	0	1	14,96
1	6	3	1	1	1	-8,3
1	6	3	1	1	1	0,72
3	5	3	3	1	1	4,26
1	4	3	1	0	1	10,8
1	4	3	1	0	1	12,82
1	5	3	1	0	1	10,93
1	9	3	1	1	0	-5,94
1	8	3	1	1	0	-2,63
1	8	3	1	1	0	1,09
1	1	7	1	1	0	6,52
1	8	7	1	1	0	7,22
1	8	7	1	1	0	10,22
3	2	5	1	1	1	1,41
3	2	5	1	1	1	7,22
3	9	4	1	1	1	11,02
2	12	11	1	1	1	7,75
2	12	11	1	1	1	8,6
2	13	13	1	1	1	9,86
3	10	6	1	1	1	6,7
3	10	9	1	1	1	8,1
3	10	9	1	1	1	10,6
3	8	6	1	1	1	-14,55
3	5	6	1	0	1	-53,56
3	3	2	1	0	1	0,25
1	8	6	1	1	0	17,79

1	8	6	1	1	0	17,66
1	8	6	1	1	0	18,13
4	2	3	3	0	1	4,58
3	2	4	3	0	1	2
3	2	3	1	0	1	-188,07
1	9	4	1	1	1	3,6
1	10	4	1	1	0	0,39
2	10	6	1	1	1	6,44

Table n.2- Regression

OUTPUT RIEPILOGO								
Statistica della regressione								
R multiplo	0,532095777							
R al quadrato	0,283125916							
R al quadrato corretto	0,148712025							
Errore standard	30,5190398							
Osservazioni	39							
ANALISI VARIANZA								
	<i>gdl</i>	<i>SQ</i>	<i>MQ</i>	<i>F</i>	<i>Significatività F</i>			
Regressione	6	11771,40909	1961,9015	2,106373933	0,079941369			
Residuo	32	29805,17728	931,41179					
Totale	38	41576,58637						
	<i>Coefficienti</i>	<i>Errore standard</i>	<i>Stat t</i>	<i>Valore di significatività</i>	<i>Inferiore 95%</i>	<i>Superiore 95%</i>	<i>Inferiore 95,0%</i>	<i>Superiore 95,0%</i>
Intercetta	-41,11799962	22,99155422	-1,7883958	0,083184468	-87,95026302	5,714263778	-87,95026302	5,714263778
AE	-16,7149381	7,920030131	-2,110464	0,042726118	-32,84751155	-0,582364641	-32,84751155	-0,582364641
ANE	1,203137238	2,19597844	0,5478821	0,587574625	-3,269924468	5,676198943	-3,269924468	5,676198943
AI	1,350632772	2,59569395	0,5203359	0,60641132	-3,936622785	6,637888328	-3,936622785	6,637888328
Numero AD	23,2696255	11,09526546	2,0972572	0,043959202	0,669309323	45,86994167	0,669309323	45,86994167
AddivP	25,4411788	14,72288542	1,7280022	0,093628275	-4,548357425	55,43071503	-4,548357425	55,43071503
Chair esecutivo	14,0470029	15,15889728	0,9266507	0,361044481	-16,83066042	44,92466621	-16,83066042	44,92466621

Table n.2- Correlation matrix

	AE	ANE	AI	Numero AD	AddivP	Chair esecutivo	ROE
AE	1						
ANE	-0,24394	1					
AI	0,092195	0,614056	1				
Numero AD	0,444126	-0,37625	-0,24286	1			
AddivP	-0,17875	0,488907	0,413813	-0,29865956	1		
Chair esecutivo	0,591341	-0,0668	0,070907	0,169515876	-0,32163	1	
ROE	-0,26747	0,304939	0,194279	0,034172848	0,341141	-0,131232387	1

Table 2 analyzes the governance variables such as the number of executive directors, non-executive directors, the number of independent directors, the number of managing directors, if the role of CEO is different from that of chairman or not and, if the president is an executive director. A multiple regression analysis is performed on thirty observations, placing the ROE as a dependent variable and constructing the scatter plot to see, directly and immediately, the influence that one variable has on the other.

The regression analysis leads to the achievement of homogeneous results, ie all the governance variables have very high significant values except for the variable indicating the number of executive directors.

The determination coefficient is equal to 0.117 and this means that the proportion of total variation of the dependent variable explained by the independent variable is modest.

The number of executive directors is positively correlated with the ROE and is equal to 0.133, therefore, as the number of executive directors increases, the profitability of the company increases. The number of non-executive directors is also positively correlated with $r = 0.157$. There is a positive correlation of 0.139 between the number of independent directors and the ROE. This positive influence is due to the fact that the Boards of Directors, composed of a significant number of independent members, reduce the managerial power and the information asymmetry, increasing the vigilance on any opportunistic behavior of the management and appropriately protecting the interests of all the shareholders.

Among the managing directors and the ROE, there is a positive correlation, but rather low, equal to 0.046 and therefore it is agreed that the increase in the managing directors on profitability is not particularly significant. There is a negative correlation $r = -0.042$ among managing directors who can also play the role of chairman and ROE.

This result is in line with the studies carried out in 2011 by Dey et al. which documents the lower return that is achieved by not dividing the role of chief executive officer from that of chairman, resulting in the reduced possibility of making investments to the advantage of shareholder capital.

The CEO duality, in fact, reduces the performance of the company because the CEO could filter the information available to the other members of the Board, preventing an effective control. It could also happen that the CEO duality, taking advantage of its decision-making and operational power, can undertake opportunistic behaviors in contrast with minority shareholders. There is also a negative correlation of -0.063 between the executive chair and the ROE.

Table n.3

Donna	D_P	D_AE	D_ANE	D_ANEI	DONNE DI FAMIGLIA	DF_P	DF_AE	DF_ANE	DF_ANEI	ROE
4	0	0	1	1	0	0	0	0	0	-1.75
4	0	0	1	1	0	0	0	0	0	7.31
4	0	0	1	1	0	0	0	0	0	9.92
5	0	1	1	1	0	0	0	0	0	15.5
3	0	1	1	1	0	0	0	0	0	10.61
4	0	0	1	1	1	0	0	1	1	14.96
2	0	0	1	1	0	0	0	0	0	-8.3
2	0	0	1	1	0	0	0	0	0	0.72
3	0	0	1	1	0	0	0	0	0	4.26
0	0	0	0	0	0	0	0	0	0	10.8
0	0	0	0	0	0	0	0	0	0	12.82
0	0	0	0	0	0	0	0	0	0	10.93
2	0	0	2	1	0	0	0	0	0	-5.94
5	0	0	5	1	0	0	0	0	0	-2.63
3	0	0	3	3	0	0	0	0	0	1.09
3	1	0	8	8	0	0	0	0	0	6.52
3	1	0	8	8	0	0	0	0	0	7.22
3	1	0	8	8	0	0	0	0	0	10.22
3	0	0	0	0	0	0	0	0	0	1.41
3	0	0	0	0	0	0	0	0	0	7.22
3	0	0	0	0	0	0	0	0	0	11.02
2	0	0	1	1	0	0	0	0	0	7.75
3	0	0	1	1	0	0	0	0	0	8.6
5	0	0	1	1	0	0	0	0	0	9.86
3	0	0	1	1	0	0	0	0	0	6.7
6	0	0	1	1	0	0	0	0	0	8.1
6	0	0	1	1	0	0	0	0	0	10.6
4	0	1	1	1	0	0	0	0	0	-14.55
4	0	1	1	1	0	0	0	0	0	-53.56
3	0	0	1	1	0	0	0	0	0	0.25
2	1	0	1	1	0	0	0	0	0	17.79
2	1	0	1	1	0	0	0	0	0	17.66
4	1	0	1	1	0	0	0	0	0	18.13
2	0	0	1	0	0	0	0	0	0	4.58
3	0	1	1	0	0	0	0	0	0	2
2	0	1	1	0	0	0	0	0	0	-188.07
3	0	0	1	1	1	0	0	1	0	3.6
3	0	0	1	1	1	0	0	1	0	0.39
5	0	0	1	4	1	0	0	1	0	6.44

Table n.3- Regression

OUTPUT RIEPILOGO								
Statistica della regressione								
R multiplo	0,55323642							
R al quadrato	0,306070536							
R al quadrato corretto	0,052602593							
Errore standard	30,50712148							
Osservazioni	39							
ANALISI VARIANZA								
	gdl	SQ	MQ	F	Significatività F			
Regressione	10	12725,36808	1272,536808	1,953304049	0,079479589			
Residuo	31	28851,21829	930,6844611					
Totale	41	41576,58637						
	Coefficienti	Errore standard	Stat t	Valore di significatività	Inferiore 95%	Superiore 95%	Inferiore 95,0%	Superiore 95,0%
Intercetta	-3,661461089	12,49072873	-0,293134305	0,771372878	-29,13647028	21,8135481	-29,13647028	21,8135481
Donna	3,998800211	3,706990509	1,078718762	0,289035359	-3,561656778	11,5592572	-3,561656778	11,5592572
D_P	12,42413295	18,67732549	0,665198717	0,510842485	-25,66852354	50,51678944	-25,66852354	50,51678944
D_AE	-44,85568524	14,15057037	-3,169885316	0,003422013	-73,71596379	-15,99540669	-73,71596379	-15,99540669
D_ANE	-7,284619914	6,336659393	-1,149599412	0,259101041	-20,20832195	5,639082124	-20,20832195	5,639082124
D_ANEI	5,691448255	6,68155343	0,851815123	0,400849491	-7,935669809	19,31856632	-7,935669809	19,31856632
DONNE DI FAMIGLIA	-11,62241628	20,60172274	-0,564147787	0,576712753	-53,63990683	30,39507427	-53,63990683	30,39507427
DF_P	0	0	65535	0	0	0	0	0
DF_AE	0	0	65535	0	0	0	0	0
DF_ANE	0	0	65535	0	0	0	0	0
DF_ANEI	15,84184818	35,89416115	0,44134889	0	-57,36477613	89,0484725	-57,36477613	89,0484725

Table n.3- Correlation matrix

	Donna	D_P	D_AE	D_ANE	D_ANEI	DONNE DI FAMIGLIA	DF_P	DF_AE	DF_ANE	DF_ANEI	ROE
Donna	1										
D_P	-0,08246	1									
D_AE	0,121727	-0,1818182	1								
D_ANE	0,124355	0,61501392	-0,1181686	1							
D_ANEI	0,138043	0,64187042	-0,161139	0,9122501	1						
DONNE DI FAMIGLIA	0,157215	-0,14415	-0,14415	-0,093687	0,05216664	1					
DF_P	0	0	0	0	0	0	1				
DF_AE	0	0	0	0	0	0	0	1			
DF_ANE	0,157215	-0,14415	-0,14415	-0,093687	0,05216664	1	0	0	1		
DF_ANEI	0,104571	-0,0691714	-0,0691714	-0,044956	-0,034739	0,479857435	0	0	0,47985743	1	
ROE	0,082394	0,17206058	-0,493125	0,0404245	0,12376282	0,068328423	0	0	0,06832842	0,0755782	1

Table 3 deals with the corporate governance variables relating to the presence of women at the top management related to the performance variable represented by the ROE. These governance variables, in particular, are: the number of women in the Board of Directors, the presence or not of women holding the office of president, female executive director, non-executive director and non-executive independent director. In the regression analysis, only the variable that explains the number of women on the Board of Directors is significant and this value is 0.117.

The coefficient of determination R² is equal to 0.153 and indicates an average proportion of the total variation of the performance variable explained by those of corporate governance. The presence of women on the Board of Directors is very positively correlated with the profitability of the companies for a value of r equal to 0.328.

It also experiments how, as women become more executive directors, the ROE increases, in fact, the correlation value is equal to 0.250.

This value comes out because the entry of women on the Board of Directors has brought some improvement on the boards: the female representation has brought an

increase in the percentage of graduates in addition to the decrease in the average age. But the most important consideration is precisely what this analysis revealed: the improvement in the companies' economic performance. The motivation is to be found in the fact that a selection process was carried out which did not fully take into account the gender but, rather, the competencies.

The presence of women in the family, that is related to the property, causes an increase in ROE although the coefficient is not very high, that is, equal to 0.149; likewise for the same value there is a positive correlation between women tied to the property who hold the role of executive director and the index of company profitability. From the analysis emerge many values equal to $r = 0$ that express a certain independence between the variables.

Table n.4

F_P	F_AE	F_ANE	F_ANEI	ROE
0	0	0	0	-1,75
0	0	0	0	7,31
0	0	0	0	9,92
0	0	0	0	15,5
0	0	0	0	10,61
0	0	0	0	14,96
0	0	1	1	-8,3
0	0	1	1	0,72
1	1	1	1	4,26
0	0	0	1	10,8
0	0	0	1	12,82
0	0	1	1	10,93
1	1	1	1	-5,94
1	1	1	1	-2,63
1	1	1	1	1,09
0	0	0	0	6,52
0	0	0	0	7,22
0	0	0	0	10,22
0	0	0	0	1,41
0	0	0	0	7,22
0	0	0	0	11,02
0	0	0	0	7,75
0	0	0	0	8,6
0	0	1	1	9,86
0	0	0	0	6,7
0	0	0	0	8,1
0	0	0	0	10,6
0	1	0	0	-14,55
0	0	0	0	-53,56
0	0	0	0	0,25
0	0	1	0	17,79
0	0	1	0	17,66
0	0	1	0	18,13
0	0	0	0	4,58
0	0	0	0	2
0	0	0	0	-188,07
0	0	0	0	3,6
0	0	0	0	0,39
0	0	0	0	6,44

Table n.4- Regression

OUTPUT RIEPILOGO								
Statistica della regressione								
R multiplo	0,153519267							
R al quadrato	0,023568165							
R al quadrato corretto	-0,091306168							
Errore standard	34,55460407							
Osservazioni	39							
ANALISI VARIANZA								
	gdl	SQ	MQ	F	Significatività F			
Regressione	4	979,8838561	244,970964	0,205164761	0,933781301			
Residuo	34	40596,70252	1194,02066					
Totale	38	41576,58637						
	Coefficienti	Errore standard	Stat t	Valore di significatività	Inferiore 95%	Superiore 95%	Inferiore 95,0%	Superiore 95,0%
Intercepta	-2,242047478	6,786762427	-0,33035597	0,743158096	-16,03440816	11,5503132	-16,03440816	11,5503132
F_P	1,598249258	42,33103785	0,03775597	0,970103072	-84,42876999	87,6252685	-84,42876999	87,6252685
F_AE	-12,30795252	35,21478108	-0,34951098	0,728861359	-83,87299802	59,25709298	-83,87299802	59,25709298
F_ANE	11,29910979	17,25164901	0,65495825	0,516901555	-23,76045919	46,35867877	-23,76045919	46,35867877
F_ANEI	0,84764095	18,298137	0,04632389	0,963323122	-36,3386475	38,0339294	-36,3386475	38,0339294

Table n.4- Correlation matrix

	F_P	F_AE	F_ANE	F_ANEI	ROE
F_P	1				
F_AE	0,881557064	1			
F_ANE	0,53935989	0,441389	1		
F_ANEI	0,575698334	0,4774	0,67589154	1	
ROE	-0,00572783	-0,038784	0,11577274	0,06497588	1

Table n. 4 shows the independent variables that concern the number of non-Italian directors, whether foreign directors are presidents, executive, non-executive and non-executive independent directors. As a dependent variable the ROE is always obtained and a regression analysis is carried out which leads to having a very high significance value for the governance variables except for the case in which the foreign administrator is chairman or executive director. The observations on which the analysis is carried out are thirty.

The coefficient of determination R² is rather small, but it is, in any case, positive. The correlation analysis shows that the number of foreign directors correlates positively with ROE for a value of 0.208.

Bringing together very different members in the Board of Directors can improve business results because it stimulates creativity, innovation and the ability to solve problems. This is what emerges from the analysis.

The non-executive directors also correlate positively with the profitability of the companies for a $r = 0.186$.

In fact, the presence of non-executive directors with different professional profiles, personal data or instructions can optimize the control capacity of the Board of Directors.

The same applies to foreign directors who hold non-executive and independent positions, the correlation that emerges from the analysis is 0.190.

However, it is analyzed, how the degree of diversity changes considerably between executive and non-executive directors, in favor of the latter and, in fact, the correlation analysis between these and the ROE is negative for a value of -0.00094.

In the companies under investigation, only one company has a foreign president in the BoD and the correlation with the ROE is negative for $r = -0.00094$.

Among the governance variables there is a strong influence between foreign directors and non-executive and non-executive independent foreign directors which is equal to as much as 0.947 in the first case and 0.833 in the second.

Table n.5

nammai	mediaai	AI_P	AI_AE	AI_ANE	AI_ANEI	ROE
3	2	0	1	10	9	-1,75
3	2	0	1	10	9	7,31
5	1	0	1	10	9	9,92
3	4	1	1	16	10	15,5
4	4	0	0	8	8	10,61
8	3	2	2	37	7	14,96
1	1	1	0	0	0	-8,3
2	1	1	0	1	0	0,72
2	1	0	0	2	2	4,26
0	0	0	0	0	0	10,8
0	0	0	0	0	0	12,82
2	2	2	2	3	2	10,93
9	5	6	6	37	5	-5,94
8	5	6	2	35	5	-2,63
8	5	6	2	38	5	1,09
2	1	2	0	4	4	6,52
2	2	3	0	6	6	7,22
3	2	3	0	2	2	10,22
8	3	2	4	6	10	1,41
10	2	2	4	6	10	7,22
8	3	3	4	19	8	11,02
2	1	1	0	1	1	7,75
6	2	0	0	14	13	8,6
3	2	0	0	5	5	9,86
12	4	1	8	31	19	6,7
12	4	1	6	28	22	8,1
11	3	1	8	20	18	10,6
6	3	0	5	8	5	-14,55
9	6	1	17	22	22	-53,56
3	4	2	5	0	4	0,25
4	2	1	8	9	7	17,79
5	2	1	0	8	5	17,66
6	2	1	0	14	10	18,13
3	1	1	0	2	0	4,58
2	1	1	0	1	0	2
3	1	1	0	2	0	-188,07
7	2	2	0	8	3	3,6
7	2	2	0	9	5	0,39
9	2	2	0	9	6	6,44

Table n.5- Regression

OUTPUT RIEPILOGO								
Statistica della regressione								
R multiplo	0,290367832							
R al quadrato	0,084313478							
R al quadrato corretto	-0,087377745							
Errore standard	34,49235412							
Osservazioni	39							
ANALISI VARIANZA								
	gdl	SQ	MQ	F	Significatività F			
Regressione	6	3505,466604	584,2444	0,491076228	0,810099642			
Residuo	32	38071,11977	1189,722					
Totale	38	41576,58637						
	Coefficienti	Errore standard	Stat t	Valore di significatività	Inferiore 95%	Superiore 95%	Inferiore 95,0%	Superiore 95,0%
Intercetta	-4,021636086	13,55056085	-0,29679	0,768546724	-31,62322531	23,57995314	-31,62322531	23,57995314
nammai	-1,748216098	3,322175698	-0,52623	0,602359488	-8,51526655	5,018834353	-8,51526655	5,018834353
mediaai	-2,769478819	7,954853927	-0,34815	0,73000785	-18,97298602	13,43402839	-18,97298602	13,43402839
AI_P	3,622793921	6,494527159	0,557823	0,580847408	-9,606125	16,85171284	-9,606125	16,85171284
AI_AE	-3,067088445	2,474413096	-1,23952	0,224166211	-8,107302985	1,973126095	-8,107302985	1,973126095
AI_ANEI	0,214566272	0,948560799	0,226202	0,822483043	-1,717588847	2,146721391	-1,717588847	2,146721391
AI_ANEI	2,790800394	2,250704466	1,239968	0,224003419	-1,79373458	7,375335367	-1,79373458	7,375335367

Table n.5- Correlation matrix

	nammai	mediaai	AI_P	AI_AE	AI_ANE	AI_ANEI	ROE
nammai	1						
mediaai	0,657656158	1					
AI_P	0,356516506	0,520199767	1				
AI_AE	0,581039085	0,650955716	0,104754	1			
AI_ANE	0,736332712	0,762211317	0,56584538	0,44932353	1		
AI_ANEI	0,734742585	0,597271174	-0,093919598	0,69404609	0,54841994	1	
ROE	0,034011004	-0,007583055	0,009220229	-0,114116	0,07496731	0,09022357	1

Table n.5 analyzes the corporate governance variables that concern the number of directors with other offices, in particular those that employ the Chairman, the executive director, the non-executive director, the non-executive and independent director. Another independent variable that has been analyzed is the average of the other tasks.

The corporate governance variables are analyzed with the performance variable which is the ROE, on a number of observations equal to thirty.

The variables that have a higher significance value are those that concern the other offices of the executive directors and the non-executive ones equal respectively to 0.948 and 0.983. The coefficient of determination is quite high, that is, equal to 0.738 and this means that the regressors well predict the value of the dependent variable.

The number of directors with other positions is very positively correlated with the ROE for a value of $r = 0.129$ while the average of the other positions negatively influences the profitability of the companies for $r = -0.303$.

The positive correlation between directors with other positions and performances is linked to the greater experience and expertise that the directors acquire from other Boards of Directors.

The possibility that presidents may have other tasks has a negative influence on the ROE of $r = -0.008$. The other positions held by the executive directors are positively correlated although of a very low value equal to 0.00047. With regard to non-executive

directors, as this governance variable increases, performance performance decreases by - 0.049. There are better performances in companies where there is a greater presence of non-executive and independent directors who have other offices, for a value of $r = 0.120$.

After having verified the research hypotheses, it is necessary to make considerations on the most important variables involved in the empirical analysis.

In the event that, both the positions of CEO and Chairman of the Board converge into a single member, we speak of CEO duality.

Although many years have passed since the first empirical study on the correlation between CEO duality and performance, this relationship is still a cause of debate in the discussions concerning corporate governance.

In the past few years, stock market management companies and companies in charge of controlling listed companies have pressed companies to avoid overlapping roles in a single person. But not all companies have highlighted these considerations as there are empirical evidences that show positive effects for the companies that adopt this governance.

This hypothesis holds that the directional unit is promoted, especially in the decision-making phase. But more recent studies (2016), as well as the aforementioned, show how the duality CEO has a negative influence on performance because the CEO could hide useful information from other members of the Board.

As for independent administrators, recent studies have begun to show different results compared to those of the past.

The empirical studies of Nguyen (2010) show that independent directors are an added value for companies and that they are capable of showing good managerial performance in the Board of Directors and shareholders.

A topic that is very interesting to scholars is that of having board members, directors who have other positions in more than one company.

Differently from what emerged years ago, more recent studies have shown a negative influence between other assignments and business value, just as this analysis demonstrates.

The size of the Board of Directors is positively correlated to the performance variable because more numerous human capital increases the skills in the company. Another point of analysis is the presence of women in the Board of Directors.

The study by Byron and Post (2016) highlights the positive correlation between women in the Board of Directors and company performance.

In fact, women are considered positively as a precious element for companies above all because they are able to provide creativity, allowing them to find innovative solutions to corporate problems.

In conclusion, from the analysis of economic literature it can be deduced, for almost all the variables taken into consideration in the analysis, the presence of often conflicting results. However, it is evident that those companies, with weak governance structures and poor shareholder protection, have agency problems. Therefore, only by having an effective Board of Directors can managers diminish or avoid opportunistic behavior, trying to outline the management's objectives with those of the stakeholders.

Among the various empirical studies, however, different results could be obtained attributable to various differences, such as, for example, the choice of the variables used to measure corporate governance, differences in the institutional context, the period under consideration or the sample of companies analyzed.

5 Limits of the research

One of the limits that the research presents is certainly the limited composition of the sample under analysis as well as the period of time taken into consideration. A longer time frame would have been more interesting.

However, we reckon that as a first study, a period of three years is sufficient to understand relations, insights and mechanisms existing within the board. Our study also does not take into consideration variables that could be just as important as the different composition of the committees that we hope to be able to investigate in the future. As we aim to investigate the percentage of properties that in this context could not be done due to the lack of information. Another interesting indicator could be that related to the level of education and / or the age of the board. Despite these limitations, it seems reasonable to assume that this research can contribute to increasing knowledge on corporate governance issues, in particular with regard to the board of directors in this particular sector where the engineering companies that are not present in Italy are included. studies in this direction.

6 Discussion and conclusion

This study can contribute to fostering an understanding and awareness of board mechanisms impacting on corporate performance and thus increase their contribution towards enhancing corporate governance

References

- Abatecola G., Caputo a., Mari M., Poggesi S., 2011 Corporate governance e performance delle società per azioni. Un'analisi empirica delle public utilities quotate alla Borsa Valori di Milano, Finanza Marketing e Produzione
- Bain, N. and Band, D. (2016) Winning ways through corporate governance. Springer.
- Bebchuk, L. A., and Cohen, A. (2005) "The Costs of Entrenched Boards", in Journal of Financial Economics, vol.78, pp. 409-433. Bebchuk & Cohen (2004),
- Bianco, M., and Casavola, P. (1999) "Italian corporate governance: Effects on financial structure and firm performance", in European Economic Review, vol. 43, pp. 1057-1069.
- Cadbury, A. (1992): Report of the Committee on the Financial Aspects of Corporate Governance. Gee Publishing, London
- Cheng S. (2008), "Board size and the variability of corporate performance", Journal of Financial Economics, 87(1), pp. 157-176
- Cho D.S., Kim J. (2007), "Outside directors, ownership structure and firm profitability in Korea", Corporate Governance: An International Review, 15(2), pp. 239-250.

- Choi S., Hasan I. (2005), "Ownership, governance, and bank performance: Korean experience", *Financial Markets, Institutions and Instruments*, 14(4), pp. 215-242.
- El Mehdi I.K. (2007), "Empirical evidence on corporate governance and corporate performance in Tunisia", *Corporate Governance: An International Review*, 15(6), pp. 1429-1441.
- Epps, Ruth W., and Sandra J. Cereola. 2008. "Do Institutional Shareholder Services (ISS) Corporate Governance Ratings Reflect A Company's Operating Performance?." *Critical Perspectives on Accounting* 19.8, 1135-1148.
- Erhardt N.L., Werbel J.D., Shrader C.B. (2003), "Board of director diversity and firm financial performance", *Corporate Governance: An International Review*, 11, pp. 102-111.
- Garratt, B. (2007a) *Corporate Governance and Board Development*, Cass Business School, London City University
- Fooladi, Masood, Board Characteristics and Firm Performance (May 28, 2012). *Journal of Modern Accounting and Auditing*, Vol. 8, No. 5, 688-694
- Gillan, Stuart L. 2006. "Recent Developments In Corporate Governance: An Overview" *Journal of corporate finance* 12.3: 381-402.
- Guo, Z., & Kga, U. K. (2012). "Corporate governance and firm performance of listed firms in Sri Lanka". *Procedia-Social and Behavioral Sciences*, 40, 664-667.
- Hermanson, S. R., and Rittenberg, L. E. (2003) "Internal audit and organizational governance", in Bailey, A. D., Gramling, A. A., and Ramamoorti, S. (ed.) *Research Opportunities in Internal Auditing*, Altamonte Springs (FL): The Institute of Internal Auditors
- Hillman, A. J., and Dalziel, T. (2003) "Boards of directors and firm performance: Integrating agency and resource dependency perspectives", in *Academy of Management Review*, vol. 28, no. 3, pp. 383-396
- Huse M. (2007), *Boards, governance and value creation: The human side of corporate governance*, Cambridge University Press, Cambridge
- Mayer C. (1999) , *Corporate governance in the UK*, Oxford university
- Metrick, A. and J. Ishii, (2002): "Firm level corporate governance", *Global Corporate Governance Forum, Research Network*
- Miller T., and M. del Carmen Triana, (2009), Demographic diversity in the board room: mediators of the board diversity firm performance relationship, *Journal of Management study*
- Mohamed Moustafa Soliman, and Mohamed Abd Elsalam, "Corporate Governance Practices and Audit Quality: An Empirical Study of the Listed Companies in Egypt", *World Accademy of Science, Engineering and Technology* 71, 2012.
- Monks, R. A. G., and Minow, N. (2004) *Corporate Governance*, 3rd edition, Oxford: Blackwell Publishing.
- Nguyen H., Faff R. (2006-07), "Impact of board size and board diversity on firm value, Australian experience", *Corporate Ownership and Control*, 4(2), pp. 24-32.
- Perry, T., and Peyer, U. (2005) "Board seat accumulation by executives: a shareholder's perspective", in *Journal of Finance*, vol. 60, no. 4, pp. 2083-2123
- Renders A., Gaeremynck A., Sercu P. (2010), "Corporate governance ratings and company performance: A cross-European study", *Corporate Governance: An International Review*, 18(2), pp. 87-106.
- Schmid M.M., Zimmermann H. (2008), "Leadership structure and corporate governance in Switzerland", *Journal of Applied Corporate Finance*, 20(1), pp. 109-120.
- Shleifer A., Vishny R.W. (1997), "A survey of corporate governance", *Journal of Finance*, 52(2), pp. 737-783

A Methodology for Measuring Performance of Academic Spin-Offs and Application on Spin-Offs at the University of Calabria

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Abstract

The debate on performance evaluation of start-ups, especially the academic-based ones, is still open. The traditional assessment methods are designed for companies that operate in a structured manner, in which analysts have developed a certain experience and benchmarking capabilities.

Therefore performance measurement systems suitable for this context have to be still identified and 'calibrated': stakeholders need specific tools in evaluating investments towards a spin-off rather than another.

The paper proposes a partly qualitative and partly quantitative methodology to evaluate the performance of a spin-off. The methodology has been developed within an Erasmus+

research project, co-funded by the European Commission, called SOLA (Spin-off Lean Acceleration). The partners involved in this project are 9 European and Latin-American universities and their Technology Transfer Offices (TTOs).

A new Canvas model (the so-called LAC- Lean Acceleration Canvas) was developed and tested, more specific and suited to the context of academic spin-offs. The methodology proposes to monitor the main risk areas (market, technological, implementation, governance, and financial risk). For each of these areas, at first a framework is proposed that can support the qualitative assessment of the potential. In the second part, a set of metrics is proposed that helps to monitor the performances and to understand if the spinoff is growing in the right direction. Moreover, the methodology was applied to the spin-offs at the University of Calabria (Italy). This paper describes the first results obtained by the application of the methodology.

Keywords – Spin-off, technology transfer, canvas, performance measure, spin-off ecosystem

Paper type – Academic Research Paper

1 Introduction

The academic debate on innovation and technology transfer has underlined the role of high-tech startup companies, in particular, the academic spin-offs.

The academic spin-offs have peculiar characteristics of respect to other start-up companies: being founded within the university by researchers and teachers, they offer an innovative product/service resulting from university research. For this reason, they typically have great potential in terms of research and innovation but not management and commercial skills. The success and growth of an academic startup depends mainly on the ability: (i) to combine technological skills with the real needs of the market, (ii) to manage the relationship with stakeholders (investors, universities, commercial and industrial partners) and (iii) to develop operational and management skills that often lack the founders (typically more focused on their technical skills).

The debate on start-up performance evaluation, especially those of an academic nature, is still open. The traditional assessment methods are designed for companies that operate in a structured manner, in which analysts have developed a certain experience and benchmarking capabilities.

Therefore performance measurement systems suitable for this context have to be still identified and 'calibrated': stakeholders need specific tools in evaluating investments towards a spin-off rather than another.

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A new Canvas model (the so-called LAC- Lean Acceleration Canvas) was developed and tested, more specific and suited to the context of academic spin-offs. Moreover, the methodology was applied to the spin-offs at the University of Calabria (Italy) and the paper reports the first results obtained.

2 Literature review: measuring the performance of academic spin-offs

Literature debate on academic spin-offs, that are companies created with the aim of commercializing academic discoveries as well as developed technologies, is still open and evolving.

2.1 Factors affecting the performance of academic spin-off

A significant number of papers on the performance measurement of academic spin-offs are focused on identifying the factors that influence the performances themselves (Bigliardi et al., 2013; Hayter, 2013; Iacobucci and Micozzi 2015; Helm et al., 2016; Poponi et al. 2017).

Visintin and Pittino (2014), suggests that business performance may be affected by the composition of the entrepreneurial team (see also Rodríguez-Gulías 2017).

Evers et al. (2016) argue that the international relationships of involved researchers, typical of the academic world, strongly influence the internationalization of an academic spin-off.

Other researchers argue that the calculation of spin-off performance depends also on the technological transfer systems implemented and the ‘incubators’ available in the University of origin (Sternberg 2013; Carrasco and Aceytuno, 2015; Furlan and Grandinetti, 2014; Minguillo and Thelwall 2014; Vinig and Lips, 2015; Rodríguez-Gulías et al., 2016; Soetanto and Jack, 2016).

Poponi et al. (2017) identified nine factors associated with the performance: sustaining the start-up, the heterogeneity of the founding skills, access to finance, environmental richness, network capital, size, reliability, innovation, and motivation.

Many studies discuss the barriers and the reasons that hinder the growth of spin-offs (Ayoub et al. 2016; Galati et al. 2016; Neves and Franco 2016), taking into account that creating an academic spin-off is relatively simple, more difficult is supporting the growth, especially if the economic and social context is not favorable.

Barbieri et al. (2016) compare the work of the researchers, in terms of the number of publications made and the number of patents filed, before and after the creation of the company, as well as of the possible change of relationship with other companies.

Another critical point is to decide the right time, for a spin-off, to leave the university. The premature exit can lead to the failure of the company (Müller 2008).

Furlan and Grandinetti (2014) identify, in the early years of a start-up, two development phases: incubation and emergency phase. They focus on the factors, for each of the phases, that influence the survival and early growth of start-ups.

2.2 Methodology for measuring academic spin-off performance

Research-based spin-offs are a particular case of start-ups: they are firms strongly based on an innovative product, as it directly derives from research. Academic spin-offs are potentially the most efficient way to transfer new technological knowledge into business, i.e., into new products and services. This kind of start-ups has a great advantage, over patents or other transfer mechanisms, that the tacit knowledge of the academics, which is otherwise so difficult to transfer, is indeed transferred – straight into a new company (Sternberg, 2013)

Many scholars analyzed methods for evaluating the performance of spin-offs, as well as the impact these have on the surrounding environment both in terms of economic and social development (Cesaroni and A Piccaluga 2015; Iacobucci and Micozzi 2015; Brown 2016; Del Giudice et al. 2016; Helm, et al. 2016; Wai Fong Boh, et al. 2016; Fini et al. 2017). Some authors studied the value creation measurement in knowledge-based organizations (Iazzolino and Laise, 2016).

Helm et al. (2016) compare different kinds of indicators (not only financial and economic) to measure the performance of companies. They propose a theoretical framework for evaluating the performance from a different point of view, but it is still not clear if the spin-off classification varies according to the index used.

Cesaroni and Piccaluga (2015) identify the variables necessary to evaluate the efficiency of the KTO (Knowledge Transfer Office). They measure it in terms of the success in commercializing the generated technology and, more in general, to concretize the so-called "third mission". The amount of KT generated by Italian, European and US universities was compared.

Vinig, and Lips (2015) present an innovative approach to measuring university technology transfer performance using meta-data analysis. In particular, they use the research products (patents, licensing deals and spin-offs) as meta-data to estimate the potential for technology transfer.

However the analysis carried out shows that a methodology has not yet been developed specifically for the rating of academic spin-offs.

3 The proposed methodology for evaluating and measuring academic spin-off performance

The debate on start-up performance evaluation is still open. The traditional assessment methods are designed for companies that operate in a structured manner: vice versa startups are by definition looking for a more stable definition of the product, market, business model, organizational structure, partners. Academic startups are often more focused on the innovative technology developed by researchers and less oriented to the market.

Various kind of stakeholders are interested to understand as soon as possible which spinoffs are more promising and where to invest and allocate the resources supporting their growth: these stakeholders can be both private investors (as business angels, venture

capitalist) and public actors (as Universities interested in increasing their ‘third mission’ through, for example, the Technology Transfer Office (TTO).

Therefore these stakeholders are looking for performance measurement systems ‘calibrated’ for this context and suitable both for recognizing the potential in the early stage and for measuring if the growth is going towards a sustainable and scalable path in the next stages.

The starting point is that, before measuring quantitative performance, the critical point for an academic spin-off is to understand as soon as possible if the main typical risk areas are adequately managed. Market analysis, partnerships and managerial operating issues are frequently underestimated from researchers more oriented to technical matters.

Another critical point is to adequately consider the age class of companies, taking into account that before arriving at complete consolidation, the spin-off goes through specific stages in the first years of life (Furlan and Grandinetti, 2014) that need to be analyzed by using different indicators.

Thus, it is important to design a performance evaluation system taking into account both the potential and the actual results of an academic startup (and the lifecycle stage).

Therefore the research questions can be summarized in the following:

Q1) How to measure the performance of academic spin-offs which by their nature have different characteristics from other companies?

Q2) How to build a methodology for constructing an academic spin-off ranking?

Q3) How to evaluate the impact, from an economic and social point of view, that a spin-off has on the territory?

The methodology proposed in this paper is both *qualitative* and *quantitative*.

3.1 The first part of the proposed methodology: the fit analysis through the "Lean Acceleration Canvas" (LAC) framework

The first part of methodology (qualitative part) starts from the ‘Business Model Canvas’ proposed by Osterwalder (2004) and the ‘Lean Canvas’ proposed by Mauraya (2012) – based on ‘Lean Startup’ approach (Ries, 2011) and Blank (2013). These models allow to visually represent the way a company creates, distributes and captures value (Fig.1).

The most widespread model of Lean Canvas focuses particularly on three aspects of the risk/value of a startup: product, customer and market.

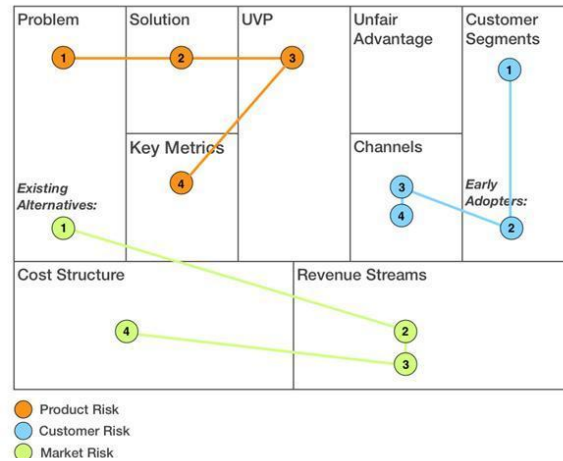


Figure 1: Lean Canvas based on Ries (2011) and Mauraya (2012).

Following an analysis carried out jointly by the TTOs involved in the project, it was found that the latter presents critical features, additional to those of the generic startups, which the general Lean model Canvas underestimate:

- *Governance and Organization*: what are the expected roles in the startup and how is the leadership distributed on the most important decisions?
- *Networking & Stakeholders*: which stakeholders are needed to make the project sustainable? How can we meet the expectations of the stakeholders involved?
- *Management skills*: what are the currently available skills and which ones are missing and should be acquired?
- *Motivation and commitment*: how much have they decided to invest the founder, not only monetarily but also in terms of commitment?
- *Scientific research and / or underlying technology*: what are the researches underlying the startup? Which intangibles are connected to the underlying research and / or technologies and how can they be valorized and defended?
- *Project Timing*: how long will it be possible to obtain a first Minimum Viable Product?

Due to the nature of the spin-offs and their characteristics, the proposed methodology is focused on a Canvas model based on 5 fundamental risk areas, 3 of which specifically cover the criticalities of the spin-offs while the remaining 2 refer to the critical risk elements already considered by the Lean Canvas:

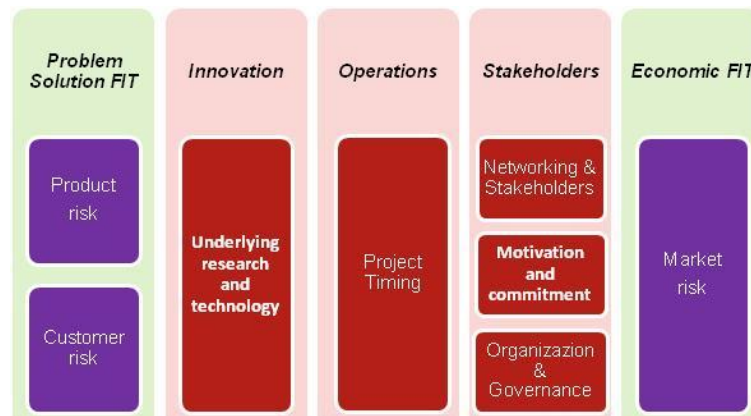


Figure 2: Lean Acceleration Canvas: the 5 risk area (Greco et al. 2016, 2017).

Therefore, to respond more directly to the spin-off ecosystem and try to provide a more exhaustive analysis and acceleration tool, the "Lean Acceleration Canvas" (LAC) has been developed (Greco et al., 2016; Greco et al. 2017), (fig. 2):

Each of the areas identified is necessary to achieve a dynamic balance in the development of the business (Fig. 3):

1. *Problem-Solution FIT*: market risk;
2. *Innovation FIT*: technological risk;
3. *Operations FIT*: risk of implementation;
4. *Stakeholders FIT*: risk of governance ;
5. *Economics FIT*: economic and financial risk.

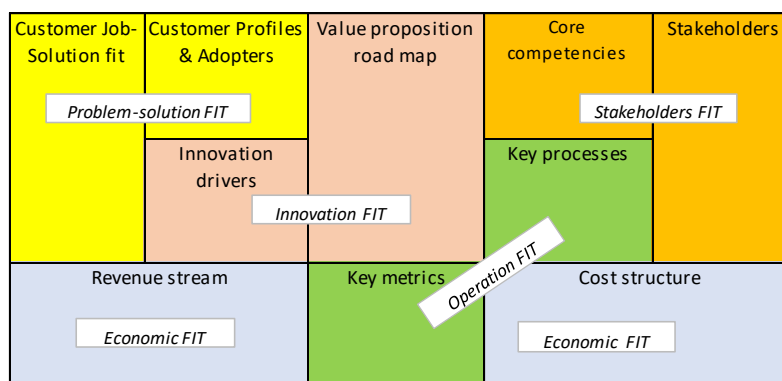


Figure 3: Lean Acceleration Canvas: the 5 FIT to be analyzed (Greco et al. 2016, 2017).

This part of the methodology has been tested through in-depth interviews with spin-offs to verify if this tool helps the founders for learning and becoming more aware of the critical aspects of their projects. The information obtained from the interviews served to provide an overview of the company situation and to know its evolution over time.

Table 1 illustrates the topics to be explored during the interviews.

The interviews have to be conducted by at least three evaluators who, first individually, and then as an evaluation group, express a qualitative judgment on each of the aspects investigated, both by giving a score from 1 to 6 and by noting relevant aspects. Table 2 and Table 3 are an example of the evaluation sheets held by the evaluators during the interview.

The weights of the various aspects considered change as the age class of the startup being evaluated varies. They are decided jointly by the team of evaluators before to start. The numerical evaluations of the individuals are appropriately normalized and summed in order to arrive at an overall score and to the overall judgments to be given to the founders.

Table 1: First part of proposed methodology: the issue to be analyzed through in-depth interview.

<i>Problem-Solution FIT</i>	<i>Innovation FIT</i>	<i>Operations FIT</i>	<i>Stakeholders FIT</i>	<i>Economics FIT</i>
Problem to be solved Solution offered Early adopters Targeting Market potential	Central innovation Mega-trends Intangibles Protectability Minimum Viable Product (MVP)	Development and prototyping Production process CRM Metrics Priority	Team skills Team compactness Partnerships The clarity in agreements and programs Involvement	Revenue Stream Cost Structure Resource Plan Business scalability The readiness of the investment

For example, the evaluators, within the SOLA project in which the methodology was developed and applied, were members of a Technology Transfer Office interested in monitoring the progress of incubated startups to support them in the growth process and the allocation of resources.

Table 2: An example of the evaluation sheet on market risk.

	1. Problem-Solution FIT: market risk	<i>Qualitative evaluation (scale from 1 to 6)</i>	<i>Weight (depending on age group)</i>
	<i>Focus on the problems to be solved</i>		
1	How good were they to identify the most important market target problems to be solved?		
	<i>Focus on the solutions to offer</i>		
2	How good they were in defining the solutions they intend to offer to solve the problems of the target		
	<i>Focus on Early Adopters</i>		
3	How good are they in defining and identifying early adopters?		
	<i>Focus on targeting</i>		
4	How well have they been able to identify and describe their market targets practically?		
	<i>Market potential</i>		
5	How important is the market potential to which the startup can aspire?		
	Total Evaluation		

Table 3: An example of the evaluation sheet on technological risk.

	2. Innovation FIT: technological risk	<i>Qualitative evaluation (scale from 1 to 6)</i>	<i>Weight (depending on age group)</i>
1	<i>Central innovations in the solution</i>		
	How do we evaluate the uniqueness of the innovations made?		
2	<i>Mega-trend</i>		
	How do we evaluate the correlation between the proposed innovation and the current social and market trends?		
3	<i>Intangibles</i>		
	How much awareness is there regarding intangibles related to innovation?		
4	<i>Protectability</i>		
	How much do we think they were good at defending innovation?		
5	<i>Minimum Viable Product (MVP)</i>		
	What skills do in predicting MVPs and the resulting iterations?		
	Total Evaluation		

3.2 The second part of the proposed methodology: the performance indicators coherent with the "Lean Acceleration Canvas" (LAC)

The second part of the methodology (quantitative part) aims to define appropriate quantitative indicators (monetary and non-monetary) that refer to the various areas identified in the LAC model.

This part aims to provide an evaluation of the sustainability and scalability of the business model pursued by the existing startups.

Coherently with the multidimensional approach before adopted, the key performance indicators and the metrics measured have been organized following a balanced scorecard approach based on the 5 dimensions identified in the LAC model (Tab. 4).

Table 5 and Table 6 are an example of the metrics considered for two of the five dimensions here proposed. Data have to be collected both through a survey and public data.

The weights of the various aspects considered change as the age class of the startup being evaluated varies. The resulting values are appropriately normalized and weighed to obtain the appropriate rankings by dimension, company and the distance from the reference threshold values.

Table 4: Second part of proposed methodology: the KPIs to be measured and monitored.

Problem-Solution FIT	Innovation FIT	Operations FIT	Stakeholders FIT	Economics FIT
Commercial independence Strong customer relationships Customer Traction Product traction	Efficiency in innovation Investment in innovation Human capital Continuity in research Implementation efficiency Validation	Efficiency in product development Customer Traction Operational growth Efficiency of HR Management	Relationship with the University Social structure Skills in spinoff	EBITDA Revenue Asset turnover Value-added % Research Capitalization Intangible assets

Table 5: KPIs and metrics for market risk.

<i>Problem-Solution FIT</i>	
<i>KPI</i>	<i>Metrics</i>
Commercial independence Strong customer relationships Customer Traction Product traction	1 /% Turnover main client % Relevant turnover Turnover last year/number of years of activity (last balance sheet) Turnover last year / no. Products TRL 5-9

Table 6: KPIs and metrics for technological risk.

<i>Innovation FIT</i>	
<i>KPI</i>	<i>Metrics</i>
Efficiency in innovation Investment in innovation Human capital Continuity in research Implementation efficiency Validation	Number of IPR titles/years of seniority Intangibles / Total Fixed Assets The number of project. funded / years of seniority Number of people employed with Ph.D. or master / total workers Number products TRL 5-9 / years of seniority N ° customers / N ° products TRL 5-9

The application of the methodology ends with a joint analysis of the qualitative and quantitative aspects, and therefore with the ranking of companies.

The qualitative first part of the proposed methodology refers to the potential of the business model the quantitative second part validates the results obtained by the considered startup.

Cross-referencing these two dimensions (qualitative-potential evaluation and quantitative-validation evaluation) we can define an overall evaluation matrix (fig. 4), that allows us to get important suggestions on how to support the growth and how to eventually correct the startup's choices.

Quantitative-validation evaluation	High	Low potential and high validation Maintain/ correct	High potential and high validation Develop
	Low	Low potential and low validation Revalue	High potential and low validation Maintain/ correct
		Low High Qualitative-potential evaluation	

Fig. 4: The overall evaluation matrix.

4. An application of the proposed methodology on spin-offs at the University of Calabria: the first results

The University of Calabria, in the south of Italy, is a medium university with near 30.000 students and 900 research assistant and professors. A TTO coordinates the technology transfer activities, and various startups can be hosted in an incubator. This methodology has been proposed to a sample represented by 37 spin-offs from the University of Calabria (of which 35% in the 0-3 years range, 19% in the 4-6 age range and the remaining 46% in the upper-end group at 6 years). Following the proposed methodology these startups have been subjected to a questionnaire aimed at investigating the data related to 2015 and a series of in-depth interviews voluntarily.

The startups completing all the process are 8 and table 7 summarizes their characteristics.

Table 7: The sample of startups analyzed

<i>Start up</i>	<i>Main activity</i>
DTOK LAB SRL	Big data analysis on the cloud
Entropica SRL	Food processing technologies
KIMICAL S.R.L.	Construction of industrial chemical additives
MACROFARM SRL	Cosmetic and pharmaceutical
NANOSILICAL DEVICES SRL	Processing of anticancer therapies
SIGMAWATER SRL	Software Innovation Engin. Modeling Analysis
SPRING RESEARCH SRL	Design of sensors for structural failure monitoring
TIFQLab SRL	Food safety testing services

Table 8: The results obtained for each area

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
	<i>Qualitative evaluation</i>							
<i>Product-Market FIT</i>	0,89	0,65	0,99	0,96	1,00	1,00	0,81	0,82
<i>Innovation FIT</i>	0,76	0,54	0,91	0,99	1,00	1,00	0,56	0,65
<i>Operations FIT</i>	0,41	0,63	0,84	1,00	0,99	0,93	0,61	0,66
<i>Stakeholders FIT</i>	0,44	0,63	0,54	0,87	0,95	0,84	0,61	0,59
<i>Economics FIT</i>	0,03	0,51	0,80	0,82	1,00	0,86	0,58	0,70
	<i>Quantitative evaluation</i>							
<i>Product-Market FIT</i>	0,12	0,31	0,29	0,30	0,09	0,22	0,46	0,72
<i>Innovation FIT</i>	0,42	0,30	0,28	0,37	0,80	1,00	0,49	0,24
<i>Operations FIT</i>	0,36	0,48	0,24	0,54	0,42	0,29	1,00	0,70
<i>Stakeholders FIT</i>	0,47	0,87	0,15	0,72	1,00	0,79	0,80	0,93
<i>ECO FIT</i>	0,05	1,00	0,30	0,58	0,74	0,30	0,24	0,20

Table 8 summarizes the results obtained within the two phases of the proposed methodology (company names are hidden for confidentiality reasons). The data have been appropriately normalized so as to make them comparable by area and for an overall evaluation (Table 9).

Table 9: The overall evaluation

	<i>Qual. Score</i>	<i>Quant. Score</i>	<i>Suggestion</i>	<i>Notes</i>
Case 2	3,11	3,67	Develop	Convergent assessments High potential and good validations
Case 5	4,33	3,33		
Case 3	1,22	3,33	Maintain- correct	Prospective business model not clearly defined
Case 7	1,89	3,67		
Case 8	1,78	3,22		
Case 6	4,22	2,78	Maintain- correct	Market validations to be improved
Case 4	4	2,78		
Case 1	1,89	1,67	Revalue	Stalemate

These values can be positioned on a graph, as shown in figure 5. by positioning the axes along with the value of the medians, it can be observed that the analyzed sample of academic spin-offs is distributed among the 4 quadrants identified by the proposed overall evaluation matrix. The suggestions deriving from the application of the matrix are consistent with the qualitative evaluations emerged during the analysis phase.

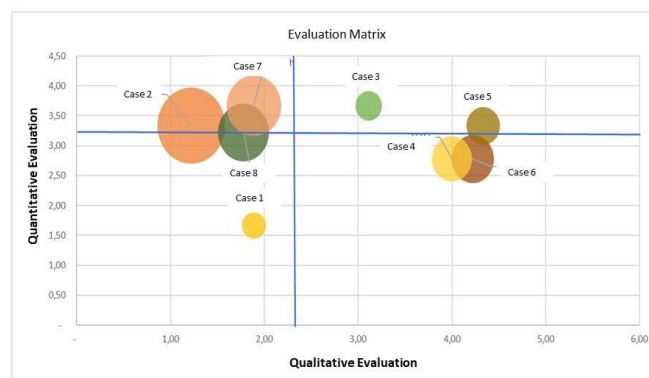


Figure 5: The matrix evaluation

5 Conclusions

A new Canvas model (the so-called LAC- Lean Acceleration Canvas) was developed and tested, more specific and suited to the context of academic spin-offs.

Moreover, the methodology was applied to the spin-offs at the University of Calabria (Italy), and the paper reports the first results obtained.

The proposed methodology tries to face the typical problems that characterize the growth of an academic spin-off: (i) the excessive attention to the technological aspects with respect to the commercial and managerial ones, (ii) the need for evaluation systems that try to evaluate all risk areas and to highlight any misalignment, in particular between the market and academic research. A problematic approach to the market, in fact, leads to limited turnover which consequently limits the balanced development and the resources for becoming autonomous from the "protective" context of a university environment.

The methodology proposes to monitor the main risk areas (market, technological, implementation, governance, and economic-financial risk). For each of these areas, a framework and a checklist are proposed that first helps the qualitative assessment of the potential and of any areas not properly managed. In the second part, a set of metrics is proposed that help to monitor the performances and to understand if the spinoff is developing in the right direction.

In this context, the crucial role of TTOs emerges: they can help spinoffs in assessing the major risk areas and in focus the strategical priorities to be faced. Moreover they can offer services and advice in typically weaker areas for this type of companies.

All this is accomplished with the primary objective to support the spin-offs growth, but more deeply contributing to the economic and social growth of the territory, thus concretizing the "third mission" of the university (Brown 2016).

One of the main limitations of this work is the limited size of the analyzed sample.

This is due also because of the difficulty to collect homogeneous quantitative data, above all with companies at the first stage of their lifecycle, when the development path is often very specific.

Another critical point is the decision about the weights to give on different areas and to the different class ages: to have an overall evaluation and ranking is very useful, but the results strongly depend from these weights.

Further future development is the extent the results testing the methodology on academic spin-offs coming from other Universities, or on sample homogeneous for industry and technology.

References

- Ayoub, M., Gottschalk, S., Muller, B. (2016), "Impact of public seed-funding on academic spin-offs", *The Journal of Technology Transfer*, 40 (2), pp. 1-25.
- Barbieri, E., Rubini, L., Pollio, C., Micozzi, A. (2016), "What are the trade-offs of academic entrepreneurship? An investigation on the Italian case" *Journal of Technology Transfer*, pp. 1-24
- Bigliardi, B., Galati, F., Verbano, C., (2013) "Evaluating performance of university spin-off companies: Lessons from Italy", *Journal of Technology Management and Innovation*, 8(2), pp. 178-188
- Blank, S. (2013). Why the lean start-up changes everything. *Harvard business review*, 91(5), 63-72.
- Brown, R. 2016, "Mission impossible? Entrepreneurial universities and peripheral regional innovation systems", *Industry and Innovation*, 23(2), pp. 189-205.
- Carrasco, F.R.C., Aceytuno, M.-T., (2015) "Academic spin-offs incubation strategies: The case of the Andalusian region", *Cuadernos de Gestion*, 15(2), pp. 113-142.

- Cesaroni, F., Piccaluga, A. (2015), "The activities of university knowledge transfer offices: towards the third mission in Italy", *Journal of technology transfer*, 41(4), pp. 753-777.
- Del Giudice, M., Nicotra, M., Romano, M., Schillaci, C.E. (2016), "Entrepreneurial performance of principal investigators and country culture: relations and influences", *Journal of Technology Transfer*, pp. 1-18.
- Evers, N., Cunningham, J.A., Hoholm, T. (2016), "International entrepreneurship in universities: Context, emergence and actors", *Journal of International Entrepreneurship*, 14(3), pp. 285-295.
- Fini, R., Fu, K., Tuft, M., Einar, M., Rasmussen, E., Wright, M. (2017), "Institutional determinants of university spin-off quantity and quality: a longitudinal, multilevel, cross-country study", *Small Business Economics*, 48(2), pp. 361-391.
- Furlan, A., Grandinetti, R. (2014), "Spin-off performance in the start-up phase—a conceptual framework", *Journal of Small Business and Enterprise Development*, 21 (3), pp. 528-544.
- Galati, F., Bigliardi, B., Petroni, A., Marolla, G. (2016), "Which factors are perceived as obstacles for the growth of Italian academic spin-offs?", *Technology Analysis and Strategic Management*, 29 (1), pp.84–104
- Greco, D., Attanasio A., Carravetta G. and Paturzo M (2016), "Guia de Elaboracion de un lean canvas", *Proceedings SOLA Project Conference*, Liaison Office, University of Calabria, December 2016.
- Greco, D, Attanasio, A., Carravetta, Dayrell Andrade N., Zanatta Inglez M., Gurgel do Amaral E., Reboló González J.M., Cotos Yáñez J.M. (2017), "Módulo Lean Acceleration Canvas", <http://www.spinoffleanacceleration.org/sites/default/files/descargas/moduloleanaccelerationcanvas.pdf>
- Hayter, C.S., (2013) "Harnessing University Entrepreneurship for Economic Growth: Factors of Success Among University Spin-offs", *Gender and Society*, 27(1), pp. 18-28.
- Helm, R., Mauroner, O., Pöhlmann, K., (2016) "Towards a better understanding of performance measurements: the case of research-based spin-offs", *Review of Managerial Science*, 10(1), pp. 1-32.
- Iacobucci, D., Micozzi, A. (2015), "How to evaluate the impact of academic spin-offs on local development: an empirical analysis of the Italian case.", *The Journal of Technology Transfer*, 40(3), pp. 434-452.
- Iazzolino, G., Laise, D. (2016), "Value creation and sustainability in knowledge-based strategies", *Journal of Intellectual Capital*, 17 (3), pp. 457-470.
- Maurya, A. (2012), *Running Lean*, O'Reilly Media
- Minguillo, D., Thelwall, M. (2014), "Which are the best innovation support infrastructures for universities? Evidence from R&D output and commercial activities", *Scientometrics*, 102(1), pp. 1057-1081.
- Müller, K. 2008, "Academic spin-off's transfer speed—Analyzing the time from leaving university to venture", *Research Policy*, 39(2), pp. 189-199.
- Neves, M., Franco, M. (2016) "Academic spin-off creation: barriers and how to overcome them", *R&D Management*, 46, (S2).
- Poponi, S., Braccini, A.M., Ruggieri, A., (2017) "Key Success Factors Positively Affecting Organizational Performance of Academic Spin-Offs", *International Journal of Innovation and Technology Management*, 14 (5).
- Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. Crown Books.
- Rodríguez-Gulías, M.J., Rodeiro-Pazos, D., Fernández-López, S., (2016) "The Regional Effect on the Innovative Performance of University Spin-Offs: a Multilevel Approach", *Journal of the Knowledge Economy*, 7(4), pp 869-889.

- Rodríguez-Gulías, M.J., Rodeiro-Pazos, D., Fernández-López, S. (2017), "The effect of university and regional knowledge spillovers on firms' performance: an analysis of the Spanish USOs", *International Entrepreneurship and Management Journal*, 13(1), pp. 191-209.
- Soetanto, D., Jack, S., (2016) "The impact of university-based incubation support on the innovation strategy of academic spin-offs", *Technovation*, (50)-(51), pp 25-40.
- Sternberg, R. (2013), "Success factors of university-spin-offs: Regional government support programs versus regional environment", *Technovation*, 34(3), pp. 137-148.
- Tietz, R., (2013), *Executive teams in research-based spin-off companies: An empirical analysis of executive team characteristics, strategy, and performance*, Springer Gabler.
- Vinig, T., Lips, D., (2015) "Measuring the performance of university technology transfer using meta data approach: the case of Dutch universities", *Journal of Technology Transfer*, 40(6), pp. 1034-1049.
- Visintin, F., Pittino, D. (2014), "Founding team composition and early performance of university—Based spin-off -companies.", *Technovation*, 34(1), pp. 31-43.

Activating Methods of Teaching in MBA Professional Training of Managers Focused on Project Management

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Abstract

The essential of presented paper is to introduce the outcomes of own research based on questionnaire survey, interviews, observation, analysis of educational events and experimental lessons, which aims to understand the principles and complexity of teaching in the MBA professional study programs in the context of application of activation methods of teaching towards the support of desirable managers' competencies gaining.

Keywords – MBA professional training, manager, competences, activation teaching methods.

Paper type – Practical Paper.

1 Introduction

At present, the project has become a part of everyday life of many individuals and groups - projects are being managed to develop new products, technologies, to build highways, or to provide an education. Until recently, project management has not been practiced in the Czech Republic, but it is currently becoming more and more used in IT and automotive. Its very gradual arrival could also be due to the fact that education in the area of project management has not entered the universities too much, even where it is

very desirable - for technical and economic fields, and project management has not entered the curriculum of secondary schools at all. In recent years, project management has partially penetrated the lifelong professional training for managers, for example at the Business Institute in Prague is possible to complete the whole and in Czech Republic the only one professional training in study program Project Management and Planning.

In carrying out the research in the context of meeting the objective of the submitted paper we start from the fact that the training of the managers must correspond with the content and methodology of the complex profile of the manager. It should lead to an increase in managerial technical skills, improved leadership, communication, strategic planning, absolutely indispensable managerial competencies, especially personality profiling. To these premises are other necessary topics, depending on the situation in the enterprise, associated.

It is necessary to realize that the current labor market requires greater flexibility of employees, higher adaptability, and greater ability to learn in a rapidly changing environment. Great emphasis is placed on communication skills, knowledge of foreign languages and ability to work in a team. At the same time, there is an unprecedented increase in information technology in our lives, including education. Also, it is not to be forgotten that students attending courses of managerial professional education are coming to school with diverse expertise and skills, with diverse learning experiences with methods in teaching.

Paper's results and conclusion will help to understand the principles and complexity of teaching in MBA professional training study programs. We would like to gather sufficient and relevant information on selected learning methods, technologies and practices in the context of project management teaching in managerial professional training.

2 The current state of the problem solved

Lots of various teaching methods were described by different authors, for example by Pasternáková (2015), Kotrba and Lacina (2015), Maňák and Švec (2003), Petty (2013) or Silbermann and Lawson (1997). The lecturers are thus given the opportunity to choose from a wide range of methods those who are convinced that they will bring the best results in their conditions. *"The lecturer is fully competent to use specific teaching methods to bring the student to use his / her maximum potential. Previously, the lecturer was the only source of knowledge he gave to his students. Now there are more information resources, the lecturer should not pass the knowledge, but "accompany" the student in their acquisition"* (Malach, 2003). The primary reflection is therefore the change in the lecturer's view on the role of education at present. This brings with it the need for new methods, hence the need for a necessary and rapid identification of each lecturer with these methods. Lecturers have to reconcile diverse groups of students so that each of them can use their abilities and reach their maximum. This requires the lecturers to have not only professional erudition but also a great deal of empathy, human maturity and balanced authority, ability to resist stress, solve potential conflicts and good

pedagogical skills, including a pedagogical tact where the society rightly expects the MBA school to adapt and satisfy changing needs of groups and individuals.

The lecturer should mobilize the students, the groups to think, he should teach students to express their own opinion, to help them to build a healthy self-confidence, to rid of the stage-fright, he should teach the teamwork, to affect the ability to remember (Plamínek, 2014), i.e. exactly everything what builds the required competencies of students, future MBA graduates. Lecturer and student of the present, perhaps the future, are partners on the path to development, learning and mutual understanding.

The choice of teaching methods is based on the professional decisions of the lecturer, following the very good knowledge of the students and the state of the specific educational process. Therefore, activation methods of teaching are the right choice of contemporary and future educational process in within the framework of managerial professional training. Therefore, active problem-based and participative methods based on problem solving, accompanied by the use of modern didactic means, especially computer technology, are considered as the most suitable methods of training of managers. This helps to develop the knowledge, management activities and authority of the managerial personality, i.e. the global development of personality.

Finance spent by managers on their training is their investment for a better future and increased competitiveness. Therefore, it is necessary to develop the potential and level of managerial education for individual segments of the market, which differ with their needs and habits. It is necessary to emphasize that the provided managerial trainings should be targeted to the strategies of specific companies, segments and should be focused on the managers' business assignment. The purpose of such education is to ensure that the managers do not study for themselves but they want to develop the specific competencies that are needed for the development of their company on the basis of specific activities linked to their role.

Most professional publications such as by Bartoňková (2010), Bednaříková (2007), Horčíčka and Jelínková (2013), Mužík (2000), (2005) or Veteška and Tureckiová (2011), are filled with philosophical considerations and theoretical guidelines. If they already propose or refer to applicable learning practices and methods, they usually only describe processes that, by their functionality and content, no longer correspond to the technical level and the difficulty of spreading knowledge among MBA students.

It is undisputed that the present time makes claims and demands on the graduates of MBA study programs quite differently than in the past. Among the key competencies, that MBA graduates should acquire, belong especially required (professional economic and managerial) expression and ability to reason, to present, to communicate, to manage opposition and conflicts, to resist stress, to listen to, to ask questions, to learn new things, to perceive the needs of others empathically, to have respect for the partner's opinion, to know, how to acquire the necessary data, to do researches and analysis, to be able of independent work and team work, as is cited in Makovský (2010), Kubeš et al. (2004), Rennie (2018) or Lajčín (2014). In this context, the cardinal question, which has become the basis of our research, arises: *Does the current concept of project management*

teaching within the framework of the MBA study programs in Czech Republic focus on acquiring of these required competencies?

3 Paper Methodology

The primary goal of presented paper is to analyze the system of teaching on MBA study programs in Czech Republic focused on project management in the context of the use of activation teaching methods. The essential of the problem solving is to contribute to the pedagogical theory and practice the findings supporting the necessity of qualitative changes in the process of selection and application of teaching methods in current managerial professional training. The legitimacy and necessity of their inclusion in managerial professional training on a much wider scale than it is at present, is confirmed by the findings of available surveys, researches and experiments such as cited in Kamarudin (2018), Makovský (2010), Forwarczná (2010) or Veteška and Tureckiová (2011). We would like to collect sufficient and relevant information on selected teaching methods, technologies and practices in the context of project management teaching in MBA study programs in Czech Republic. Below we formulate the secondary goals of the research:

- **To perform an analysis of information sources related to the issues of project management teaching, adult's education, managerial education and application of activation teaching methods.** There were detected all secondary information (data) relating to knowledge on these topics, those have already been carried out by other institutions or organizations and have been also evaluated and published by other Czech and foreign authors.
- **To evaluate the practical applicability and effectiveness of activation teaching methods of project management** within the framework of managerial professional training at the Business Institute in Prague. Current status in the use of various teaching methods by project management lecturers, acting on the Project management and planning study program and on other study programs containing the module Project Management and Planning or Project Management, including the knowledge of the usability of activation teaching methods and verification of their effectiveness in fulfilling the educational objectives of the managerial professional training in comparison with traditional methods and the identification of conditions, requirements and barriers that determine the choice of activation methods of teaching, is mapped and evaluated through quantitative (structured questioning of lecturers via questionnaire) as well as qualitative (controlled interview with project management lecturers) methods of empirical pedagogical research. This represents the main part of the work for subsequent conclusions to be drawn. This reduces the absence of scientifically validated outcomes related to the problem solved. The paper further analyses and evaluates the barriers in the application of activation teaching methods to what extent these methods contribute to building the required competencies of MBA students in professional training.

- **To analyse the educational event:** An analysis of the educational event is a tool that helps to verify the quality and effectiveness of an educational event. Based on the result, we can set up measures to optimally secure the goal, which is in our case some knowledge, skill or the required behaviour. The goal of the analysis of educational event is to confirm or disprove whether the educational event, due to the lecturer, organizational form and methods used, is effective. It is about the controlling and evaluation of the monitored aspects of the lecture meetings held in within the MBA professional training at Business Institute in Prague and the analyse is implemented from two perspectives: firstly the perspective of the authors of presented paper based on the sitting in on classes and authors' own observation and secondly the lecturer meeting participant's perspective. The criteria of the control take into account the principles of effectiveness and described theoretical aspects, and point to the fact that a professionally qualified lecturer and the correct application of the methods lead to an effective set-up of educational event. We analyse the lecture meetings of MBA professional training at Business Institute in Prague, which were led by one lecturer and were focused on project management. The activation teaching methods (the experimental lesson was realised) were included in the content of the lecturer meetings, namely the Tower Challenge managerial game, the Obelisk ZIN simulation and the case study solution from the field of the project realization.

Here are the key issues of our research:

1. Do project management lecturers encourage students to develop the creativity, imagination, teamwork, ability to present and to promote their opinion?
2. Do project management lecturers use an appropriate scale of activation teaching methods to build managers' required competencies?
3. What are the most frequent barriers in the application of activation methods in project management training within the framework of managerial professional education?

Within the research methodology we used these methods:

- **Analysis:** We used the analysis to analyse the information sources, to analyse the educational event and to evaluate the practical applicability and effectiveness of the activation methods in project management teaching in within the framework of MBA professional training.
- **Observation:** Observations were carried out at lecture meetings in within to meet the identified secondary goals of presented paper. The lecturers and the students of the relevant study programs containing the module Project Management and Planning or Project Management and the students of the study program Project Management and Planning were the targeted group. We recorded the observed aspects into the pre-prepared documents. The major observations were made in experimental lessons. Experimental lessons were conducted on a total of 25 lecturers meetings (three-hour lessons in January 2016 - August 2018) by including the Obelisk ZIN simulation, the Tower Challenge managerial game, and case studies.
- **Comparison:** We used the comparison to compare our findings with the results of the analysis of information sources.

- **Synthesis:** Facts identified during the analysis of information sources and from the evaluation of practical applicability and effectiveness of activation methods in project management teaching in within the framework of MBA professional training we have synthesized into the form of suggestions and recommendations to improve the current state of the problem solved and at the same time these facts resulted into the fulfilling of the primary goal of this paper.
- **Pedagogical research:** We have chosen a method of quantitative research that works with the numerical values and determines the quantity, extent or frequency of occurrence of the analysed phenomenon, it maintains the distance from the analysed phenomenon, and the data can then be processed by mathematical and statistical methods, enabling generalization and drawing of objective conclusions, but also the realisation of consequent qualitative research.
- **Structured questioning:** Structured questioning of the lecturers was carried out in order to fulfil the formulated secondary goals and thus to evaluate the practical applicability and effectiveness of the activation methods in project management teaching in within the framework of MBA professional training at Business Institute in Prague.
- **Structured interview:** A structured interview is a qualitative research method. We conducted structured interviews with the lecturers of modules of Project Management and Project Management and Planning.

Selected and subsequently practically used methods of research work have provided sufficient data, which were then processed through the mathematical-statistically procedures with the definition of absolute frequency. Within the framework of a questionnaire survey in the team of project management lecturers, the opened and semi-closed questions were evaluated according to the frequency, expert, knowledge and logical level of answers. For the closed questions, the frequency of choice of the offered answers was evaluated with the determination of their absolute and relative extent. Data from realized interviews with project management lecturers has been carefully evaluated and summarized in response to the stated objectives and key questions and assumptions. All results were tabulated and interpreted verbally, then compared with the findings of similar researches and evaluated globally in the context of the key issues taking into account our experience.

4 Evaluation of key issues

Based on our findings, we can evaluate the formulated key issues:

Key issue 1: Do project management lecturers encourage students to develop the creativity, imagination, teamwork, ability to present and to promote their opinion? Based on the results of pedagogical research, we find that lecturers do not sufficiently motivate students to develop the creativity, imagination, teamwork, ability to present and to promote their opinion, and this in particular on the basis of the following findings:

- Just less than half of the respondents (lecturers) monitors the fulfilment of the key educational goals of the MBA professional trainings where the validity and

objectivity of this conclusion is supported by the fact that this finding was achieved on the basis of self-assessment of the lecturers and not by the controlling activity (sitting on in a class) of their teaching,

- just 29% of the respondents (lecturers) considers the activation methods to be the right methods that appropriately motivate the students, and just 10% of the responded lecturers are of the opinion that activation methods can be used more quickly and efficiently to achieve the educational goals in MBA professional training,
- responded lecturers are aware only of some effects of activation methods (the learning revival, the elimination of passivity), underlining their inexperience with wider use of these methods and active verification of their key effects in achieving of educational goals in MBA professional training. The lecturers are reluctant to change their obvious rules, they are afraid of any change, they are unwilling to invest some time and effort to innovate the methods and forms of their teaching, towards the reaching of teaching goals they still use others, often not effective, teaching methods that lead to mere memorization of the subject matter and not to a deeper understanding and adopting of solutions to managerial issues and necessary contexts. This issue results from the realised interviews with the lecturers.

Key issue 2: Do project management lecturers use an appropriate scale of activation teaching methods to build managers' required competencies? On the basis of the findings, it can be concluded that project management lecturers use the activation teaching methods to support the development of the required competencies of students only minimally, sporadically. Only 6% of lecturers stated that they frequently and actively use 6 from the 22 analysed activation methods in the project management training in within MBA study programs (brainstorming, mind maps, project learning, free writing, staging - role playing, discussion spider work), some activation methods are rarely used by lecturers, most lecturers do not use or even do not know most of the analysed activation teaching methods.

The building of the required competencies of the students is monitored by the lecturers only at the average level, which shows considerable reserves. Only 6% of the tested students stated that in the project management training the lecturer uses the mapping, learning software, in 11% the lecturer uses the simulation games, in 18% the lecturer uses the project teaching, the lecturers mostly use the group work (34%) and discussion (58%), which shows the significant reserves in the use of activation methods in project management training in within MBA study programs. This should become a signal for not only project management lecturers but also other lecturers, with the necessity to accentuate these findings and to correct the preparation and planning of teaching.

We note, therefore, that almost 94% of the analysed lecturers prefer a combined teaching unit with predominant frontal interpretation, where activation methods only play a complementary role. The traditional way of project management teaching (frontal teaching) is dominant. Only a small percentage of lecturers prefer active learning with the permanent building of a student's autonomy, supporting his / her own initiative, thus a

form of teaching based on a wide use of activation methods and targeted at fulfilling of the mandatory educational goals in managerial professional training.

Thus this empirical research has confirmed that the analysed lecturers still prefer the traditional teaching methods, especially the verbal reproduction and the activation methods are used irregularly, occasionally as a complement to traditional teaching methods.

Key issue 3: What are the most frequent barriers in the application of activation methods in project management training within the framework of managerial professional education?

Being the main barrier to the use of the activation methods, the lecturers consider the lack of time and lack of time subsidies of the subject (module). However, the objective barrier is the minimal knowledge of activation methods and their effects in teaching. A frequent argumentation of the analysed lecturers, why the activation methods cannot be used, is the difficulty of the lectured issue in their opinion. The lecturers do not understand the role and the effectiveness of activation methods in project management training. They do not know that in frame of the activation methods application, these methods are able meet the required content for the subject (module), as well as to deepen the curriculum and to achieve the required educational goals in managerial professional training. Many of the lecturers' arguments (lack of time, necessity to meet the content requirements of the module, etc.) can be considered as secondary and in no way inhibiting the inclusion of activation methods into the project management training in MBA study programs.

The lecturers' approach to activation methods, a low level of willingness to self-educate, and subsequently to modify and to innovate the teaching, to adapt to the current needs of managerial professional training, to accept a change of the lecture's role are objective and overwhelming barrier for the activation methods application in within the managerial professional training. After all, the content requirements of the subject (module) can be fulfilled with the use of activation methods, as well as it is possible to deepen the curriculum with the using of the appropriately chosen activation methods.

The essential barrier for activation teaching methods application is the passivity of the lecturers to discover, to acquire and then to include the activation methods in active project management training or in the entire system of managerial professional training.

5 Discussion

Teaching methods are one of the most important aspects of the learning process. The ability to select adequate teaching methods and didactic means, the ability to use them efficiently and purposefully in the teaching process, including the personality integrity of the lecturer and the building of his / her authority, decides on the success of demanding pedagogical work within the framework of managerial professional training.

The research confirmed that the project management lecturers of managerial professional training are not sufficiently familiar with the activation teaching methods and are concerned about their application to project management teaching. This situation is

because of lecturers (there is a low level of willingness to change the rules and to modify the course of lecturers' meetings, to accept a change of the lecture role, to apply the activation methods to the lessons for often completely substitutive reasons - lack of time, the need to fulfil the content plans etc.), of management of educational institutions (there are reserves in motivation of lecturers, in creation of conditions for application of activation teaching methods, in evaluation criteria of teaching quality), of publication background (there is a lack of suitable publications illustrating activation teaching methods, including examples).

We also found and the experimental lessons verified that activation tasks, i.e. exercises included into the experimental lessons (Obelisk ZIN simulation, Tower Challenge managerial game, case studies) were easy to understand for the students, the lessons were fun and interesting (86% of analysed students confirmed this finding) and, above all, such lessons contributed to the students' higher level of knowledge. Thus, we can state that the effectiveness of the activation teaching methods in project management teaching in frame of the fulfilment of the educational goals of the managerial professional training significantly exceeded the traditional methods of teaching, the activation teaching methods have brought students much more enjoyment in learning, they activated and motivated them, finally students preferred them, these methods are highly effective in the concrete use of the learned curriculum, and in the persistence of the learned curriculum preservation. The legitimacy and necessity of their inclusion into the project management teaching and into the managerial professional training on a much wider scale, than it is at present, is confirmed. Our findings are validated with similar researches and experiments cited in Bickerstaffe and Ridgers (2007), Cao and Sarchutchawan (2011) or Forrssen-Nyberg and Hakamaki (1998) and Thompson and Gui (2000).

The teaching of project management within the framework of managerial professional education, which corresponds to the current demands on human resources on the labor market, is not possible without the activation methods of teaching. Our research found and in the context of findings published by Pecina and Zormanová (2009, p. 99) or Veteška and Vacínová (2011) confirmed, that the activation methods undoubtedly require intensive lecturers' work, there is more time for preparation and organization, and they require better technical equipment of classrooms than traditional methods, some are only usable on the basis of lecturer's own experience and talent to work with new methods, some methods are also associated with certain risk. The measurable effects of activation methods should become a pivotal incentive for educational institutions, lecturers and textbook authors.

6 Conclusion

The conclusions presented within this paper lead to the statement that the project management teaching in managerial professional training that corresponds to the current demands made on project managers on the labor market cannot be avoided without the use of activation teaching methods. Their successful application must be based on the

professional decisions of the lecturer, based on a very good knowledge of the activation methods, but also on the knowledge of the students, because only in such a way the good results of learning can be expected. The essential is that the lecturer is fully aware of the role he / she has in the current process of building key competencies of managers, so he / she can choose adequate teaching methods.

It is clear from our findings that not every lecturer and educational institution are capable of self-reflection and awareness of their required roles in the context of current educational needs. One of the primary factors of successful application of activation methods to the MBA trainings is the willingness of lecturers to change their attitudes, pathways, forms, and teaching methods that will lead to the current educational goals of managerial professional training. With the gradually changing lecturer's role we mean the moving of the lecturer's role from the owner of knowledge to the lecturer as a facilitator, who will support the learning process by organizing of teaching material, by highlighting of the essentials, by helping to set goals and by monitoring of goals' achievement, next to the lecturer as a coordinator who organizes the common activities of the students, creates a space for knowledge sharing and cooperation, oversees the use of the potential of the social dimension learning processes and, finally, to the lecturer who participates in the learning process, engages in learning activities, becomes a model, a model of a learner. What methods he / she chooses is, and remains, in the competence of each lecturer, when the importance and the merit of the inclusion of activation methods into the process of managerial professional training in frame of MBA study programs has proved and verified this work. The management of MBA schools and of other educational institutions, authors of textbooks and methodical aids, the universities and educational institutions preparing future teachers and lecturers, and as well the feedback from the students, who are involved in proper teaching methods application, play the strategic role in this process. It should be remembered that changes cannot happen from day to day, but it is necessary to reach them in a long and dynamic process.

The presented paper does not offer normative outputs, but represents the current level of solved problems and brings knowledge about use and effectiveness of activation teaching methods in project management in frame of managerial professional training. Selected research procedures and methods provided a relatively large amount of data, the processing of which allowed for a deeper insight into the role, effectiveness and applicability of activation teaching methods.

References

- Bartoňková, H. (2010). *Firemní vzdělávání. Strategický přístup ke vzdělávání pracovníků*. Praha: Grada Publishing.
- Bednaříková, I. (2007). *Metodika vzdělávání dospělých*. Jihlava: VŠPJ ICV.
- Bickerstaffe, G. and Ridgers, B. (2007). Ranking of business schools. *Journal of Management Development*, 26 (1).
- Cao, Y. and Sakchutchawan, S. (2011). Online vs. Traditional MBA: An Empirical Study of Students' Characteristics, Course Satisfaction, and Overall Success. *The Journal of Human Resource and Adult Learning*, 7 (2).

- Forssén-Nyberg, M. and Hakamäki, J. (1998). Development of the production using participative simulation games: Two case studies. *International Journal of Production*, 56-57, 169-179.
- Forwarczna I. (2010). *Rozvoj a vzdělávání manažerů*. Praha: Grada Publishing.
- Horčíčka, A. and Jelínková L. (2013). Zvyšování výkonnosti lidských zdrojů zavedením manažerské hry. *Trendy v podnikání*. (3), 51-52. Plzeň: fakulta ekonomická.
- Kamarudin, D. A (2018). Qualitative Analysis on the Perceptions and Impact of the MBA Program to Life Long Learning Skills. *A Qualitative Analysis on the Perceptions and Impact of the MBA Program to Life Long Learning Skills*. s. 67-72.
- Kotrba, T., and Lacina, L. (2011). *Aktivizační metody ve výuce: příručka moderního pedagoga*. Brno: Barrister & Principal.
- Kubeš M., Spillerová D. and Kurnický R. (2004). *Manažerské kompetence - Způsobilosti výjimečných manažerů*. Praha: Grada Publishing.
- Lajčín, D. (2014). Social intelligence as a significant predictor of managerial behavior. *Ekonomický časopis*. 62(6), s. 646-660.
- Makovský P. (2010). *Vývoj a implementace nových manažerských kurzů MBA a LLM jako součást vzdělávání dospělých*. Praha: Univerzita Jana Amose Komenského Praha.
- Malach, J. (2003). *Klíčové kompetence lektora*. Ostrava: Ostravská univerzita.
- Maňák, J., and Švec, V. (2003). *Výukové metody*. Brno: Paido.
- Mužik, J. (2000). *Management ve vzdělávání dospělých*. Praha: Eurolex Bohemia.
- Mužik, J. (2005). *Didaktika profesního vzdělávání dospělých*. Plzeň: Fraus.
- Pasternáková, L. (2015). Specifics of innovative teaching. *Turkish Online Journal of Education and Technology*. s. 481-483.
- Pecina, P. and Zormanová, L. (2009). *Metody a formy aktivní práce žáků v teorii a praxi*. Brno: Coprint.
- Petty, G. (2013). *Moderní vyučování*. Praha: Portál.
- Plamínek, J. (2014). *Vzdělávání dospělých: průvodce pro lektory, účastníky a zadavatele*. Praha: Grada Publishing.
- Rennie, K. (2018). Strategic Communication in MBA Curricula: A Qualitative Study of Student Outcomes. *Journal of management education*. 42(5), 594-617.
- Silberman, M. L., and Lawson, K. (1997). *101 metod pro aktivní výcvik a vyučování: osvědčené způsoby efektivního vyučování*. Praha: Portál.
- Thompson, E. R. and Gui, Q. (2000). Hong Kong Executive Business Students' Motivations for Pursuing an MBA. *Journal of Education for Business*, 75 (4).
- Veteška J. and Tureckiová, M. (2011). *Trendy v oblasti profesního vzdělávání dospělých*. Praha: ROZLET.
- Veteška J. and Vacínová, T. (2011). Aktuální otázky vzdělávání dospělých. *Andragogika na prahu 21. století*. Praha: Univerzita Jana Amose Komenského.

Efficiency Assessment of Knowledge Intensive Business Services Industry in Italy: Data Envelopment Analysis (DEA) and Financial Ratio Analysis

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Abstract

Knowledge Intensive Business Services (KIBS) are private enterprises or organizations mainly concerned with providing knowledge-intensive inputs to the business processes of other organizations, including private and public sector clients, that rely heavily on professional knowledge and which involve economic activities intended to result in the creation, accumulation or dissemination of knowledge. KIBS firms, such as advertising and market research, accountancy and management consulting, IT services, engineering and technical services, represent a core feature of the knowledge-based economy functioning as innovation carriers, knowledge facilitators and innovations sources. KIBS play, also, an important role in local and regional economies as source of added value and their growing importance as emergent players is a major attribute of knowledge economy and more generally in the debate about innovation systems, knowledge driven economic dynamics and competitiveness. Their role, as co-producers of innovation, in enhancing Small and MEdium-sized enterprises (SMEs) is particularly relevant because of their prominent support in enabling SMEs to innovate in a more effective, cost-effective, and/or timely manner.

The paper investigates the application of Data Envelopment Analysis (DEA) in conjunction with Financial Ratios Analysis (FRA) to estimate and compare the performance of KIBS industry in Italy over the period 2012-2017. In particular, we evaluated the three main NACE (Nomenclature générale des Activités économiques dans les Communautés Européennes) segments that identify KIBS services: NACE 72 (computing services), NACE 73 (research and development) and NACE 74 (other professional business activities).

FRA, for its simplicity, has been achieved a widespread use in practice. A financial or accounting ratio is a relative magnitude of two selected numerical values taken from an enterprise's financial statements. DEA is a mathematical programming technique that estimates the relative efficiency of production units (Decision Making Units - DMU), computing a comparative ratio of weighted outputs to weighted inputs for each DMU and identifies best-practice frontiers over the examined data.

The results obtained from the efficiency estimates and the financial ratios are used to rate firms according to these performances. The empirical investigation proposed reveals that the results of FRA approach do not provide sufficient and complete information on the efficiency of KIBS firms, while major advantages behind using of DEA are related to its structural characteristic in measuring performance and identifying opportunities for possible efficiency improvements by looking at the differences between efficient companies and inefficient ones. The empirical results obtained from the analysis of the general sector of KIBS can be further extended and focused to the comparison of firms belonging to a more specific industry sub-sector in order to benefit managers of those companies to gain insight from the industry financial performance benchmarking process.

Keywords – Data Envelopment Analysis (DEA), Financial Ratios Analysis, Knowledge Intensive Business Services (KIBS), performance measurement.

Paper type – Academic Research Paper

1 Introduction

Knowledge Intensive Business Services (KIBS) are private enterprises or organizations mainly concerned with providing knowledge-intensive inputs to the business processes of other organizations, including private and public sector clients, that rely heavily on professional knowledge and which involve economic activities intended to result in the creation, accumulation or dissemination of knowledge (Miles et al., 1995; Hertog, 2000; Muller and Doloreux, 2009). KIBS firms, such as advertising and market research, accountancy and management consulting, IT services, engineering and technical services, represent a core feature of the knowledge-based economy functioning as innovation carriers (i.e. knowledge transfer across firms), knowledge facilitators (i.e. support for improved process or knowledge-intensive tasks) and innovations sources (i.e. co-production of innovation) (Hertog, 2000; Fischer, 2015). KIBS play, also, an important role in local and regional economies as source of added value (Toivonen, 2006; Corrocher et al., 2012; Savic, 2016) and their growing importance as emergent players is a major attribute of knowledge economy and more generally in the debate about innovation systems, knowledge driven economic dynamics and competitiveness (Ferreira

et. al., 2013; Hu et al., 2013; Pina et al., 2016). Their role, as co-producers of innovation, in enhancing Small and MEduum-sized enterprises (SMEs) is particularly relevant because of their prominent support in enabling SMEs to innovate in a more effective, cost-effective, and/or timely manner (Alvisi, 2012).

According to Corrocher et al. (2012), the three main NACE (Nomenclature générale des Activités économiques dans les Communautés Européennes) segments that identify KIBS are: NACE 72 (computing services), NACE 73 (research and development) and NACE 74 (other professional business activities).

The purpose of the paper is to evaluate the financial performances of a large sample of Italian firms, operating over the period 2012-2017 and belonging to industries commonly associated with KIBS activities, applying and comparing Data Envelopment Analysis (DEA) and Financial Ratios Analysis (FRA) approaches. This analysis has never been addressed by previous studies, and we want to fill this gap in literature.

FRA, for its simplicity, has been achieved a widespread use in practice. A financial or accounting ratio is a relative magnitude of two selected numerical values taken from an enterprise's financial statements (Heidari, 2012). It is valuable tool of interpreting the financial statements that enables analysts to conduct a certain degree of comparison across firms of different sizes and of firms related to a specific industry sector.

DEA is a mathematical programming technique that estimates the relative efficiency of production units (Decision Making Units - DMU), computing a comparative ratio of weighted outputs to weighted inputs for each DMU and identifies best-practice frontiers over the examined data. Scores equal to 1 are indicated as being technically efficient, whereas if a DMU (e.g. a firm) has a technically efficient value of less than 1, this suggests that the DMU is technically inefficient (Charnes et al., 1978).

The results obtained from the efficiency estimates and the financial ratios are used to rate firms according to these performances.

The next Section (2) describes the dataset (2.1) and discusses the methodology (2.2). Finally, Section 3 points out the results and conclusions.

2 Materials and Methods

2.1 Materials

In our analysis, DEA-based Malmquist indices are calculated at firm level to measure the change in productivity between 2012 and 2017. Thus, in a preliminary step of the overall analysis a list of KIBS companies were identified as actively operating firms during the time frame indicated. The primary source of information was the Bureau van Dijk AIDA database. AIDA contains comprehensive data about financial statement, activity, location and ownership of small, medium and large Italian companies. A preliminary group of organizations were extracted from the AIDA database matching the next selecting criteria:

- according to Corrocher et al. (2012), KIBS business activity related to three main NACE segments: NACE 72 (computing services), NACE 73 (research and development) and NACE 74 (other professional business activities);
- companies with legal status classified as active;
- firms with the complete availability of financial statement data for all the time frame proposed (2012-2017);
- companies that employed between 2 and 250 persons (Small and Medium Enterprises/SME), for all the selected periods;
- firms with value of revenues from sales and services of 100 thousand euro or more, for all the time frame used.

On the basis of the previous search strategy, the research sample was composed of 1.674 firms representative of the KIBS sector and actively operating from 2012-2017. Table 1 provides a summary of the distribution of firms among Italian regional geographical areas and their relative grouping based on the three different NACE activity code adopted.

Table 1 – Geographical distribution of KIBS sample

Regional Area	number of KIBS	%	NACE 72 (computing services)		NACE 73 (research and development)		NACE 74 (other professional business activities)	
			n.	%	n.	%	n.	%
Abruzzo	15	0.9%	1	0.5%	4	0.6%	10	1.2%
Basilicata	4	0.2%	0	0.0%	0	0.0%	4	0.5%
Calabria	6	0.4%	1	0.5%	2	0.3%	3	0.4%
Campania	50	3.0%	10	4.6%	12	1.8%	28	3.5%
Emilia-Romagna	165	9.9%	29	13.2%	42	6.5%	94	11.7%
Friuli-Venezia Giulia	39	2.3%	9	4.1%	5	0.8%	25	3.1%
Lazio	179	10.7%	32	14.6%	83	12.8%	64	8.0%
Liguria	31	1.9%	6	2.7%	8	1.2%	17	2.1%
Lombardia	637	38.1%	51	23.3%	292	44.9%	294	36.5%
Marche	30	1.8%	1	0.5%	7	1.1%	22	2.7%
Molise	2	0.1%	1	0.5%	0	0.0%	1	0.1%
Piemonte	137	8.2%	18	8.2%	62	9.5%	57	7.1%
Puglia	53	3.2%	12	5.5%	21	3.2%	20	2.5%
Sardegna	13	0.8%	2	0.9%	2	0.3%	9	1.1%
Sicilia	32	1.9%	2	0.9%	13	2.0%	17	2.1%
Toscana	69	4.1%	14	6.4%	25	3.8%	30	3.7%
Trentino-Alto Adige	36	2.2%	8	3.7%	11	1.7%	17	2.1%
Umbria	25	1.5%	6	2.7%	9	1.4%	10	1.2%
Valle d'Aosta	3	0.2%	2	0.9%	0	0.0%	1	0.1%
Veneto	148	8.8%	14	6.4%	52	8.0%	82	10.2%
Total	1674	100.0%	219	100.0%	650	100.0%	805	100.0%
% of KIBS per sector	1674		13.1%		38.8%		48.1%	

In order to examine the methodological issues raised in the next section, for each company, the general and financial items collected were: company name, related NACE code, geographical region in which the firms is located, number of employees, total assets, value of revenues from sales and service, Return On Equity (ROE) and Leverage Ratio.

In line of the choice of inputs and outputs adopted in some empirical studies computing firms financial performance using a combination of accounting-based income statement and balance sheet data (Oberholzer, 2014; Oberholzer, 2013; Ho et al., 2009; Lo and Lu, 2006; Tsai et al., 2006; Luo, 2003; Zhu, 2000), for each organization we defined two inputs (number of employees and total assets) and identified one output (revenues from sales and service). Total assets was defined as the year-end total amount from the balance sheet; the value of revenues from sales and service was computed as the year-end total amount of revenues income from the income statement. Table 2 exhibits some descriptive statistics of data collected (inputs, outputs and financial ratio).

Table 2 – Basic statistics of the whole sample

Item observed	Years			
	2012		2017	
	mean	sd	mean	sd
number of employees	14.3	23.3	18.4	28.7
total assets (th EUR)	3,743.7	10,653.5	4,579.0	14,309.9
revenues from sales and service (th EUR)	3,192.8	8,373.5	3,828.7	10,466.0
return on equity (%)	14.1	30.7	14.4	25.9
leverage ratio	8.5	12.3	7.2	16.6

Even if various financial ratios can be used to evaluate firm' performance from different univariate perspective (Edirisinghe et al., 2007), such as solvency, capital structure, profitability and liquidity, we selected ROE and leverage ratio in order to validate the result of the overall DEA-based Malmquist productivity analysis and to better characterize differences in financial management and efficiency among geographic-based groups of KIBS firms sampled.

As a pure bottom line measure for the shareholders (Yaw-Shun et al., 2013), ROE, defined as net income generated per unit of common shareholders equity, is the ratio that computes a firm's profitability and reveals how much profit a firm generated with the money invested in the firms stocks. The higher of this ratio the higher is the efficiency from the profitability perspective. On the other hand, the Leverage Ratio, defined as the total assets value divided by shareholders equity, is a measure used to understand a company's financial standing. A company with no debt would have a ratio of one; the higher the ratio the more is the debt used to finance the firm and, consequently, the financial leverage.

As previously stated, the linear programming model used assumed constant returns to scale and, because firms observed have a given amount of resources (employees and

assets value) and have to maximise the final results (revenues), we adopt an output orientation. The results of DEA based Malmquist productivity analysis are obtained through the use of FEAR (Wilson, 2008), a software package for frontier efficiency analysis that can be linked to the general-purpose statistical package R.

2.2 Methods

In this study we examine the efficiency of the knowledge intensive business service firms by applying constant return to scale DEA model to compute the Malmquist Productivity Index (Färe et al., 1992). The DEA-based global Malmquist productivity analysis is then used to characterize KIBS firm financial performance through the analysis of productivity patterns grouped by Italian geographical regions.

DEA is a non-parametric optimization-based method that, starting from data on inputs and outputs of a selected sample of Decision-Making Units (DMU), such in our case firms, allow to construct a piece-wise linear surface over data points named best production frontier (or envelopment). The frontier surface is defined by the solution of a sequence of linear programming problems, one for each DMU. The distance between this frontier and the observed data point (DMU input/or output) measures the relative technical efficiency. Relative efficiency ratio is expressed by a score between 0 and 1 for each decision making unit, allowing to rank the organizations on the bases of an increasing efficiency order (i.e. score of 1 for efficient units). Since the pioneer work of Charnes et al. (1978) and because its suitability for multiple-inputs multiple-outputs business context, DEA has become one of the most popular technique for benchmarking analysis. It has been developed in various extended models in many applications and extensively employed in empirical studies to assess performance in different industrial sectors in the field of industrial economics and management (e.g. Tsai et al., 2006; Yang, 2006; Zhu, 2000), and in particular has also been proposed as a model to evaluate the overall efficiency of small and medium-sized enterprises business (Marjanovic et al., 2014; Yang, 2006) and professional service firms (Hsiao et al., 2017; Hsiao et al., 2014; Wang, 2014). In order to further study changes that occurred in efficiency measures in two different time periods t and $t+1$, one of most applied extension is represented by the multi-period efficiency analysis model (e.g. Jianguo et al., 2017; Majumdar et al., 2017).

The concept of Malmquist Productivity Index (MPI) was first introduced by Malmquist (1953) and has further been studied and developed in the non-parametric framework by several authors, where the term productivity is generally used as a metric to evaluate a company's performance over a period and it is also defined as the ratio of the generated outputs to the input used (Egilmez et al., 2013). Caves et al. (1982) applied Malmquist's approach extending the MPI measure by a multi-input multi-output point of view. Combining the measurement of productivity based on MPI with basic measurement of efficiency (Farrel, 1957), Färe et al. (1992) defined an MPI directly from input and output data using DEA, and further decomposed the index into two mutually exclusive and exhaustive components: changes in productivity over time (or efficiency changes - Effch) and shifts in technology over time (or technology changes - Techch). In general terms, the relative efficiency of a decision making unit over time, defined by a relative

distance using DEA, will depend on both its position relative to the corresponding frontier (technical efficiency) and the position of the frontier itself (technological change). In other words, The Malmquist Productivity Index compute firms' deviation of productivity in two different time periods, assuming common technological involvement.

Using an output-orientated model (i.e. to measure the maximal proportional expansion of the outputs given a set of inputs), the Malmquist Productivity Index between periods t and $t + 1$, can be defined as (Färe et al., 1992, Färe et al., 1995):

$$M_{t+1}^t(y_{t+1}, y_t, x_t) = \frac{d_{t+1}(y_{t+1}, x_{t+1})}{d_t(y_t, x_t)} \times \left[\frac{d_t(y_{t+1}, x_{t+1})}{d_{t+1}(y_{t+1}, x_{t+1})} \times \frac{d_t(y_t, x_t)}{d_{t+1}(y_t, x_t)} \right]^{1/2}$$

Where d represent the distance, x and y respectively inputs and outputs, and M is the Malmquist productivity index in time $t+1$ using the $t+1$ technology relative to the production in t using the t technology. The overall equation represents the Malmquist productivity growth of a firm between two periods. A value greater than one will indicate a positive productivity growth from period t to period $t+1$ while a value lesser than one will indicate a decrease in efficiency relative to the previous year. The first term of the equation defines changes in technical efficiency (Effch) from period t and $t + 1$ and the second expression, inside the brackets, indicates changes in technology (Techch). If a firm fails to achieve an output combination on its production possibility frontier and fails beneath this frontier, it can be said to be inefficient (or technological inefficient). Over time the level of output an organization is capable of producing will increase due to technological changes. These variations cause the production possibility frontier to shift upward, as more output are obtainable from the same level of inputs. Thus, for any firm in a specific industry, productivity improvement over time may be either technical efficiency improvement or technological improvement or both.

3 Results and conclusions

The results of the analyzes were reported in Tables 3 (qualitative results) and 4 (quantitative results).

Table 3 – Qualitative results

Regional Area	No. of KIBS	%	MPI 2012-2017					Number of employees 2012-2017		Total assets 2012-2017 (th. EUR)		Total revenues 2012-2017 (th. EUR)		ROE	LEVERAGE
			mean	min	max	Effch avg	Techch avg	growth	mean	growth	mean	growth	mean	growth	growth
Abruzzo	15	0.9%	1.024	1.049	1.907	1.321	0.789	MEDIUM	HIGH	LOW	HIGH	LOW	HIGH	MEDIUM	MEDIUM (Dec)
Basilicata	4	0.2%	1.258	0.851	1.883	1.658	0.757	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH
Calabria	6	0.4%	1.114	0.426	2.269	1.494	0.797	LOW	HIGH	LOW (Dec)	LOW	LOW	LOW	LOW (Dec)	MEDIUM (Dec)
Campania	50	3.0%	0.962	0.225	2.344	1.265	0.763	MEDIUM	LOW	MEDIUM	LOW	LOW	LOW	MEDIUM	MEDIUM
Emilia-Romagna	165	9.9%	1.004	0.397	4.603	1.312	0.771	MEDIUM	LOW	MEDIUM	MEDIUM	LOW	MEDIUM	MEDIUM	MEDIUM
Friuli-Venezia Giulia	39	2.3%	1.087	0.185	2.628	1.438	0.754	LOW	MEDIUM	LOW	LOW	LOW	LOW	HIGH	MEDIUM (Dec)

Lazio	179	10.7%	0.933	0.158	2.780	1.179	0.803	HIGH	MEDIUM	MEDIUM	MEDIUM	LOW	HIGH	MEDIUM	MEDIUM
Liguria	31	1.9%	0.916	0.236	1.454	1.205	0.765	LOW	HIGH	MEDIUM	MEDIUM	LOW	HIGH	MEDIUM	MEDIUM
Lombardia	637	38.1%	0.966	0.208	3.566	1.230	0.791	MEDIUM	MEDIUM	MEDIUM	HIGH	LOW	HIGH	HIGH	MEDIUM
Marche	30	1.8%	0.915	0.403	1.394	1.241	0.736	MEDIUM	LOW	MEDIUM	LOW	LOW	LOW	MEDIUM	HIGH
Molise	2	0.1%	3.374	0.529	6.219	4.677	0.718	HIGH	MEDIUM	HIGH	LOW	HIGH	LOW	MEDIUM	LOW (Dec)
Piemonte	137	8.2%	0.988	0.252	4.496	1.261	0.792	MEDIUM	HIGH	HIGH	MEDIUM	LOW	MEDIUM	MEDIUM	MEDIUM
Puglia	53	3.2%	0.970	0.252	2.479	1.220	0.796	MEDIUM	LOW	HIGH	MEDIUM	LOW	LOW	MEDIUM	HIGH
Sardegna	13	0.8%	1.021	0.041	2.743	1.209	0.832	HIGH	HIGH	HIGH	HIGH	LOW	HIGH	MEDIUM (Dec)	MEDIUM (Dec)
Sicilia	32	1.9%	0.904	0.274	1.622	1.199	0.773	MEDIUM	LOW	MEDIUM	LOW	LOW	LOW	HIGH	HIGH
Toscana	69	4.1%	0.979	0.312	3.373	1.274	0.771	MEDIUM	LOW	MEDIUM	MEDIUM	LOW	LOW	MEDIUM	MEDIUM (Dec)
Trentino-Alto Adige	36	2.2%	1.032	0.315	1.894	1.333	0.787	MEDIUM	MEDIUM	LOW	MEDIUM	LOW	HIGH	MEDIUM (Dec)	MEDIUM (Dec)
Umbria	25	1.5%	0.921	0.506	1.365	1.244	0.744	MEDIUM	LOW	MEDIUM	LOW	LOW	LOW	LOW (Dec)	HIGH
Valle d'Aosta	3	0.2%	1.216	0.833	1.497	1.724	0.703	LOW (Dec)	LOW	LOW	LOW	LOW	LOW	MEDIUM	LOW (Dec)
Veneto	148	8.8%	0.909	0.212	2.278	1.196	0.767	MEDIUM	LOW	MEDIUM	LOW	LOW	LOW	MEDIUM	MEDIUM
ITALY	1674	100.0%	0.974			1.248	0.783								

Table 4 – Quantitative results

Regional Area	No. of KIBS	%	MPI 2012-2017						Number of employees 2012-2017		Total assets 2012-2017 (th. EUR)		Total revenues 2012-2017 (th. EUR)		ROE	LEVERAGE
			mean	min	max	Effch avg	Techh avg	growth	mean	growth	mean	growth	mean	growth	growth	growth
Abruzzo	15	0.9%	1.024	1.049	1.907	1.321	0.789	36.0%	24.6	31.2%	5,621.4	24.4%	4,609.9	285.3%		-6.4%
Basilicata	4	0.2%	1.258	0.851	1.883	1.658	0.757	30.3%	13.9	23.7%	838.2	57.1%	1,191.1	743.1%		46.7%
Calabria	6	0.4%	1.114	0.426	2.269	1.494	0.797	25.5%	24.7	-2.5%	2,298.7	13.1%	1,795.1	-720.5%		-5.2%
Campania	50	3.0%	0.962	0.225	2.344	1.265	0.763	61.4%	11.3	60.8%	1,793.0	34.6%	1,076.6	147.3%		1.9%
Emilia-Romagna	165	9.9%	1.004	0.397	4.603	1.312	0.771	55.6%	13.9	42.4%	3,263.6	36.0%	2,648.3	77.0%		4.2%
Friuli-Venezia Giulia	39	2.3%	1.087	0.185	2.628	1.438	0.754	27.5%	15.3	24.6%	2,397.5	26.7%	1,802.9	1056.2%		-1.4%
Lazio	179	10.7%	0.933	0.158	2.780	1.179	0.803	97.2%	16.3	49.7%	4,316.9	30.1%	3,839.2	96.3%		6.5%
Liguria	31	1.9%	0.916	0.236	1.454	1.205	0.765	24.6%	20.5	52.1%	3,736.3	16.6%	3,933.9	202.3%		8.2%
Lombardia	637	38.1%	0.966	0.208	3.566	1.230	0.791	50.2%	18.6	49.1%	5,572.3	36.8%	4,914.8	464.8%		7.6%
Marche	30	1.8%	0.915	0.403	1.394	1.241	0.736	37.2%	12.5	59.9%	1,431.5	42.0%	1,749.4	411.0%		18.1%
Molise	2	0.1%	3.374	0.529	6.219	4.677	0.718	136.1%	14.5	113.8%	1,285.7	499.7%	1,303.6	83.3%		-52.7%
Piemonte	137	8.2%	0.988	0.252	4.496	1.261	0.792	68.1%	19.7	103.7%	4,191.3	105.2%	3,372.3	74.4%		4.1%
Puglia	53	3.2%	0.970	0.252	2.479	1.220	0.796	52.9%	12.9	78.9%	3,156.1	49.8%	1,649.6	416.8%		16.0%
Sardegna	13	0.8%	1.021	0.041	2.743	1.209	0.832	102.9%	19.8	85.3%	6,717.7	33.0%	4,157.2	-3.8%		-18.7%
Sicilia	32	1.9%	0.904	0.274	1.622	1.199	0.773	76.4%	13.4	44.9%	2,549.1	31.6%	1,280.2	571.2%		27.6%
Toscana	69	4.1%	0.979	0.312	3.373	1.274	0.771	46.3%	10.8	44.0%	3,330.1	36.1%	1,641.1	444.2%		-2.2%
Trentino-Alto Adige	36	2.2%	1.032	0.315	1.894	1.333	0.787	34.9%	17.3	16.3%	4,659.0	17.5%	4,494.2	-98.9%		-11.7%
Umbria	25	1.5%	0.921	0.506	1.365	1.244	0.744	57.1%	10.4	41.8%	1,292.0	28.9%	1,271.1	-169.0%		20.6%
Valle d'Aosta	3	0.2%	1.216	0.833	1.497	1.724	0.703	-18.0%	9.0	21.9%	887.5	45.1%	799.1	63.9%		-23.7%
Veneto	148	8.8%	0.909	0.212	2.278	1.196	0.767	54.0%	11.8	51.7%	2,139.0	27.9%	1,909.4	66.8%		11.5%
ITALY	1674	100.0%	0.974			1.248	0.783	56.9%	16.3	52.9%	4,161.4	40.3%	3,510.8	285.6%		6.6%

The results obtained from the efficiency estimates and the financial ratios are used to rate firms according to these performances.

The empirical investigation proposed reveals that the results of FRA approach do not provide sufficient and complete information on the efficiency of KIBS firms, while major advantages behind using of DEA are related to its structural characteristic in measuring performance and identifying opportunities for possible efficiency improvements by looking at the differences between efficient companies and inefficient ones.

The results of the analysis show, in the 2012-2017 period, average productivity values lower than one for the Italian regions having significance (or larger number of KIBS) in the examined sample (Lombardia, Lazio, Veneto and Piemonte), with the exception of Emilia Romagna (which has an average productivity value slightly greater than one), with a negative impact on the Italian national level.

The aforementioned may find justification in a poor support of technological innovation in production processes, as confirmed by the techch avg values lower than one for all regions.

The financial indicators (ROE and Leverage) show values that are not always congruent with the average productivity values detected, and for this reason specific in-depth studies are needed to better understand the regional business dynamics that can be subsequently correlated with the average productivity values obtained: this is left to future research.

The empirical results obtained from the analysis of the general sector of KIBS can be further extended and focused to the comparison of firms belonging to a more specific industry sub-sector in order to benefit managers of those companies to gain insight from the industry financial performance benchmarking process.

References

- Alvisi, A., (2012) KIBS Roles in KIBS Industries, in *Exploring Knowledge-Intensive Business Services*, ed. Di Maria, E., Grandinetti, R. and Di Bernardo, B., Palgrave Macmillan, London.
- Charnes, A., Cooper, W. W. and Rhodes, E., (1978) "Measuring the inefficiency of decision making units", *European Journal of Operational Research*, Vol. 2, No. 6, pp. 429-444.
- Corrocher, N., Cusmano, L. and Morrison, A., (2012) *Competitive Strategies in Knowledge-Intensive Business Services: Evidence from Lombardy*, in *Exploring Knowledge-Intensive Business Services*, ed. Di Maria, E., Grandinetti, R. and Di Bernardo, B., Palgrave Macmillan, London.
- Caves, D. W., Christensen, L. R., Diewert, W. E., (1982) "The Economic Theory of Index Numbers and the Measurement of Input, Output, and Productivity", *Econometrica*, Vol. 50, No. 6, pp. 1393-1414.
- Edirisinghe, N., Zhang, X. (2007) "Generalized DEA model of fundamental analysis and its application to portfolio optimization", *Journal of Banking & Finance*, Vol. 31, No. 11, pp. 3311-3335.
- Egilmez, G., McAvoy, D., (2013) "Benchmarking road safety of U.S. states: A DEA-based Malmquist productivity index approach", *Accident Analysis & Prevention*, Vol. 53, No. 1, pp. 55-64.

- Färe, R., Grosskopf, S., Lindgren, B., Roos, P., (1992) "Productivity changes in Swedish pharmacies 1980-1989: a non parametric Malmquist approach", *Journal of Productivity Analysis*, Vol. 3, No. 1-2, pp. 85-101.
- Färe, R., Grosskopf, S., Roos, P., (1995) "Productivity and quality changes in Swedish pharmacies", *International Journal of Production Economics*, Vol. 39, No. 1-2, pp. 137-144.
- Farrell, M. J., (1957) "The measurement of productive efficiency", *Journal of the Royal Statistical Society*, Vol. 120, No. 3, pp. 253-290.
- Ferreira, J. J., Raposo, M. L. and Fernandes, C. I., (2013) "Does innovativeness of knowledge-intensive business services differ from other industries?", *The Service Industries Journal*, Vol. 33, No. 7-8, pp. 734-748.
- Fischer, B. B., (2015) "On the Contributions of Knowledge-Intensive Business-Services Multinationals to Laggard Innovation Systems", *Brazilian Administration Review*, Vol. 12, No. 2, pp. 150-168.
- Heidari, I., (2012) "Ratings of Iranian Cement Companies Based on Financial Ratio Analysis", *Life Science Journal*, Vol. 9, No. 4, pp. 540-544.
- Hertog, P. D., (2000) "Knowledge-intensive business services as co-producers of innovation", *International Journal of Innovation Management*, Vol. 4, No. 4, pp. 491-528.
- Ho, C. T. B., Wu, D. D., Chou, C., Olson, D.L., (2009) "A risk scoring model and application to measuring internet stock performance", *International Journal of Information Technology and Decision Making*, Vol. 8, No. 1, pp. 133-149.
- Hsiao, B., Shu, L. C., Chou, F. Y., (2014) "Assessing the efficiency of accounting firms using data envelopment analysis with multi-activity networks", in proceedings of 18th Pacific Asia Conference on Information System (PACIS), June 24-28, Chengdu, China.
- Hsiao, B., Shu, L., Chou, F. Y., (2017) "Assessing the efficiency of the accounting industry using multiactivity network DEA: evidence from Taiwan", *International Transactions in Operational Research*, <https://doi.org/10.1111/itor.12416>.
- Hu, T. S., Lin, C. Y. and Chang, S. L., (2013) "Knowledge intensive business services and client innovation", *The Service Industries Journal*, Vol. 33, No. 15-16, pp. 1435-1455.
- Jianguo, W., Qamruzzaman, M., (2017) "An Assessment of Total Factor Productivity (TFP) of SME Business in Bangladesh using DEA based Malmquist Productivity Index (MPI)", *ABC Journal of Advanced Research*, Vol. 6, No. 1, pp. 31-40.
- Lo, S. F., Lu, W. M., (2006) "Does size matter? Finding the profitability and marketability benchmark of financial holding companies", *Journal of Operational Research*, Vol. 23, No. 2, pp. 229-246.
- Luo, X., (2003) "Evaluating the profitability and marketability efficiency of large banks: an application of data envelopment analysis", *Journal of Business Research*, Vol. 56, No. 8, pp. 627-635.
- Malmquist, S., (1953) "Index Numbers and Indifference Curves", *Trabajos de Estadística*, Vol. 4, No. 2, pp. 209-242.
- Majumdar, S., Asgari, B., (2017) "Performance Analysis of Listed Firms in the UAE - using DEA Malmquist Index Approach", *American Journal of Operations Research*, Vol. 7, No. 2, pp. 133-151.
- Marjanovic, D., Sarkocevic, Z., Misic, M., Stojcetovic, B., (2014) "Data envelopment analysis application for assessing the efficacy of MSP", in proceedings of 8th International Quality Conference, Center for Quality, 23 May, Faculty of Engineering, University of Kragujevac.
- Miles, I., Kastrinos, N., Bilderbeek, R., Den Hertog, P., Flanagan, K., Huntink, W., Bouman, M., (1995) "Knowledge-intensive business services: Users, carriers and sources of innovation", Report to the EC DG XIII Sprint EIMS Programme, Luxemburg.
- Muller, E. and Doloreux, D., (2009) "What we should know about knowledge-intensive business services", *Technology in Society*, Vol. 31, No. 1, pp. 64-72.

- Oberholzer, M., (2013) "A non-parametric comparison among firms' income statement-based and balance sheet-based performance", *International Business & Economics Research Journal*, Vol. 12, No. 11, pp. 1467-1478.
- Oberholzer, M., (2014) "A Model To Estimate Firms Accounting-Based Performance: A Data Envelopment Approach", *International Business & Economics Research Journal*, Vol. 13, No. 6, pp. 1301-1314.
- Pina, K. and Tether, B. S., (2016) "Towards understanding variety in knowledge intensive business services by distinguishing their knowledge bases", *Research Policy*, Vol. 45, No. 2, pp. 401-413.
- Savic, M., (2016) "What role for knowledge-intensive business services (KIBS) in de-industrialized regions?", *Regional Studies, Regional Science*, Vol. 3, No. 1, pp. 446-455.
- Toivonen, M., (2006) "Future prospects of knowledge-intensive business services (KIBS) and implications to regional economies", *ICFAI Journal of Knowledge Management*, Vol. 4, No. 3, pp. 18-33.
- Tsai, H. C., Chen, C. M., Tzeng, G. H., (2006) "The comparative productivity efficiency for global telecoms", *International Journal of Production Economics*, Vol. 103, No. 2, pp. 509-526.
- Zhu, J., (2000) "Multi-factor performance measure model with an application to Fortune 500 companies", *European Journal of Operational Research*, Vol. 123, No. 1, pp. 105-124.
- Wang, W-K., Lu, W-M., Kweh, Q. L. and Cheng, I-T. (2014) "Does intellectual capital matter? Assessing the performance of CPA firms based on additive efficiency decomposition DEA", *Knowledge-Based Systems*, Vol. 65, pp.38-49.
- Wilson, P. W., (2008) "FEAR 1.0: A Software Package for Frontier Efficiency Analysis with R", *Socio-Economic Planning Sciences*, Vol. 42, No. 4, pp. 247-254.
- Yang, J. C., (2006) "The efficiency of SMEs in the global market: Measuring the Korean performance", *Journal of Policy Modelling*, Vol. 28, No. 8, pp. 861-876.
- Yaw-Shun, Y., Ambrosio, B., Wen-Hsiang, W., (2013) "Data Envelopment Analysis and Financial Ratio: A new approach to estimate the efficiency of Taiwan Computer's Peripheral Industry", *Journal of Information and Optimization Sciences*, Vol. 34, No.1, pp. 69-84.

20 years of VAIC – Value Added Intellectual Coefficient

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Abstract

The paper analyzes the VAIC (Value Added Intellectual Coefficient) and the subsequent developments 20 years after the first formulation made by Ante Pulic. The paper deeply analyzes the concept and proposes future directions for research and applications of the methodology. Three main directions for research are described: (i) value creation for stakeholders and investment in human capital; (ii) sustainability of knowledge-based strategies from an economic and social point of view; (iii) a framework for continuous increase of knowledge work productivity. Two real applications of calculation of the Knowledge Work Productivity are described.

Keywords – VAIC, Value added, Value Creation, Knowledge worker productivity, Sustainable strategies, Performance measurement

Paper type – Academic Research Paper

1. Introduction: the problem of the Knowledge worker productivity

It is generally accepted that a strategy based on investment in knowledge workers is the greatest competitive weapon of today's organizations; furthermore, it is a kind of strategy that can lead to a sustainable advantage (Grant, 2010, Ch. 6: 150-173). By sustainable growth strategies we generally mean the firm behaviors that in the long run tend to legitimize the social, environmental and economic expectations of all

stakeholders, both internal and external (Donaldson and Preston, 1995; Drucker, 1999b). The necessary condition to create wealth for all stakeholders is, according to Drucker, the growth in productivity of knowledge workers.

In fact, P. Drucker believes that “knowledge worker productivity is the biggest of the 21st-century management challenges. In the developed countries, it is their first survival requirement”. He argues that “the ability of organizations...to survive will come to depend on their comparative advantage in making the knowledge worker more productive” (Drucker, 1999b: 94). But, how can we increase the productivity of knowledge workers? Drucker sets the agenda of things to do and lists the major factors affecting the increase in the productivity of knowledge workers (Drucker, 1968; 1999a; 1999b):

- a) knowledge workers themselves have to plan what the task is or should be. In fact, in knowledge work, unlike manual work, the task does not program the worker;
- b) knowledge workers have to manage themselves (autonomy);
- c) knowledge work requires continuous innovation and learning;
- d) knowledge workers have to plan the quality of their output;
- e) knowledge workers productivity requires that the knowledge worker is seen and treated as an asset rather than a cost.

The supply and the productivity of people educated and trained for knowledge work are the only possible advantages that developed countries can hope to have.

But, can this productivity advantage be measured or is purely an “intangible thing”? Drucker does not offer an answer to this question.

The problem of measuring the productivity of knowledge workers is a very practical need for the s.c. knowledge-based firms, also in terms of incentives and rewards to be assigned to employees. But the first step is to measure the productivity of knowledge workers. How can I assign a reward to employees if I am not able to measure their productivity?

The author who accepts the challenge of measuring the productivity of knowledge workers is A. Pulic (2000; 2004; 2008). The main objective of Pulic is to find a productivity “measuring model” for the knowledge economy which will serve employees, management, investors, and business partners (Pulic, 2008: 6).

He believes that the method for measuring the productivity of knowledge workers is the same as the one used to measure the productivity of manual workers. The productivity of knowledge workers is equal to the ratio between the Value Added and the wages of workers. Other authoritative scholars share the same opinion (Kaplan and Norton, 1996).

From a methodological point of view, therefore, there is no relevant news, because everything we need is the Value Added Income Statement (VAIS). However, Pulic and Drucker think that the VAIS must be reinterpreted, and this requires a “change of mentality”, namely a new “semantic” of the value creation.

We have to start from the premise that “people are investment and not cost anymore” and that the cost of labor (intellectual), in the income statement, measures the investment in human capital rather than a cost.

If this change of mentality is accepted, then the Value Added measures the value created by knowledge workers for the whole economy, namely the value added measures the value creation from the stakeholders' point of view. Then, to increase the productivity of knowledge workers we have to increase their value added. This is Pulic's answer to the problem left open by the seminal Drucker's effort.

The original definition of the VAIC is based on variables extracted from the Value Added Income Statement as in the following table:

Tab. 1. "Value Added" Income Statement

Sales	OUT
- Costs	IN
= Value Added	VA
- Salary and wages	HC
= Structural Capital (EBITDA)	SC
- Depreciation and Amortization	D + A
= Operating Profit	P

VAIC (Value Added Income Statement) was defined as follows:

$$VAIC = HCE + SCE + CEE \quad [1]$$

where:

HCE = Human Capital Efficiency or work productivity = VA/HC

SCE = Structural Capital Efficiency = SC/VA

CEE = Capital Employed Efficiency = VA/CE (where CE = book value of Capital Employed)

In the following sections three main directions for future research and applications are described: (i) value creation for stakeholders and investment in human capital; (ii) sustainability of knowledge-based strategies from an economic and social point of view; (iii) a framework (with applications) for continuous increase of knowledge work productivity.

2. A first direction of research: value creation for stakeholders and investment in human capital

In this section an analysis of (i) value creation from the stakeholder point of view and (ii) the investment in human capital is carried out. These two items are the main theoretical topics at the basis of the VAIC concept.

2.1 Stakeholder point of view and Value Added

In the traditional way of measuring the company performance of an organization the focus is mainly on value creation for the shareholder (*shareholder point of view*) (Jensen, 2002). But, as already seen, a strategy that is socially sustainable has to create value not only for the shareholder, but also for the other stakeholders and, in particular, for the employees.

A strategy that only considers the shareholder's interests is a strategy that can only be satisfactory for a part of society. The idea underlying performance measurement in terms of satisfaction only from the point of view of the shareholder is based on the idea that by maximizing profit (NOPAT, EVA, Dividends, etc.), also social wellbeing is maximized. But it is immediately evident that the economic facts of the last twenty years, dominated by the *shareholder value analysis*, have not brought social benefits for everyone, as promised. Mass unemployment, a characteristic of the current world economy, does not confirm that the "philosophy" of *shareholder value analysis* has brought socially sustainable benefits.

The reason, as Pulic (2000; 2004; 2008) states, is that value creation has not been correctly measured. Value from the social sustainability point of view cannot be measured only by EBITDA or by other measures such as EVA which are based, on final analysis, on NOPAT which is a variant of EBITDA.

In fact, the EBITDA measures the value created for all capital investors (within which category there is also the shareholder) whereas value created for all the stakeholders is measured by Value Added. This is the fundamental criticism that Pulic (2000; 2004; 2008) makes to traditional value measurement methodologies.

According to Pulic, in addition to value created for capital investors and for the shareholder, it is necessary also to consider value created for employees, which is measured by wages and salaries, that is by the capital invested in acquiring human resources. Value Added is, therefore, the adequate measure of value creation from a stakeholder point of view.

According to Pulic (2000; 2004, 2008), from the point of view of society as a whole, value created is equal to:

$$VA = HC + EBITDA \quad [2]$$

where:

VA = Value Added

HC= Human Capital (= Cost of Employees = wages and salaries)

EBITDA = Earnings Before Interest, Taxes, Depreciation and Amortization

Expressing EBITDA in terms of its components, it holds that:

$$EBITDA = \text{Interest expenses} + \text{Taxes} + \text{Depreciation/Amortization} + \text{Net Income}.$$

The latter definition stresses the fact that in EBITDA, less taxes, there are the remunerations of various capital investors, understood in the physical sense and in the financial sense (and therefore also shareholders).

Some elucidation is needed to link the equations [2] with the themes of Knowledge Management. Knowledge that creates value is incorporated in Human Capital (people). Pulic states that: "People are the main carriers of knowledge" (Pulic, 2008). If this observation is correct then expenditure on human resources has to be seen as an investment and not as a cost: "it is only reasonable to give this resource the status it deserves of investment and not cost anymore" (Pulic, 2008). But: "employees, who are treated as investment, are the beginning and the end of the new, knowledge-based,

economy” (Pulic, 2008). The reason for investing in human resources is that they are “the main value creators of the contemporary economy” (Pulic, 2008).

Now, considering human resources as an investment and not just a cost, needs a change in managerial mentality. In fact, costs owing to their nature have to be cut and the traditional performance measurements are based on a logic of “cost cutting”. To increase the EBITDA the cost of human resources is also cut. But, if human resources are the source of value creation then cutting them can be a “short-sighted” strategy in the long term. Maybe the saying: “the lower the cost, the higher the profit” can be fine for the cost of raw materials and energy costs, but not when it refers to human resources. The reason is obvious: human resources create value.

2.2. Investment in Human Capital: a type of investment in living knowledge

Knowledge can be understood as the ability to act for survival implemented by organizations (Maturana and Varela, 1992). The actions for survival are solutions to problems and require creative thinking and ability for innovation. Knowledge is therefore a typical human characteristic that should not be confused with the knowledge embedded in machines. For this reason we distinguish the knowledge incorporated in the human mind (*living knowledge*) as distinct from the knowledge embedded in technology investments (*dead knowledge*).

The strategy based on investment in knowledge, suggested by Drucker and Pulic, can be better described by using the distinction cited above.

When investing in human resources, trust is placed in “*living knowledge*”, which is incorporated in the employees, that is, in people. It is believed that only human beings are able to create new knowledge and, therefore, produce Value Added in such a way to justify investment. Only qualified and educated human resources are, in fact, able to create patents, copyrights, know-how, etc. Moreover, only highly-trained human resources are able to increase the quality and quantity of intangible assets (organizational relations and relations with customers).

Value creation for all stakeholders therefore necessitates heavy investments in highly trained and skilled human resources. It is from this type of resource that comes value added suitable to make investment in HC convenient.

The other more traditional strategy places its trust in “*dead knowledge*” incorporated in ever more perfected machinery whose use is “labor saving”. The machine, as far as it is technologically advanced and innovative, is to be considered as an archive, a “record” of human work previously provided. It is “stored”, crystallized knowledge that is no longer vital. Furthermore, *dead knowledge* cannot self-activate but, in order to be used, it requires other *living knowledge*.

The problem with this value creation model is that it can determine problems at the overall level in terms of social sustainability.

The model based on *dead knowledge* results in a low use of workforce and in particular of skilled workforce. It can be good for the firm in itself but not for the overall economic system. The more firms using the *dead knowledge* model, the less the social

sustainability at an overall level. Therefore, there has to be a high number of industries using the *living knowledge* model in order to assure overall sustainability.

The model based on living knowledge (human resources) is the one that determines sustainability in social terms of the global system.

At a global and social level, it is necessary to understand what is the fundamental driver of value creation. That is, it is necessary to place human resources at the center of management and understand that the following factors are crucial:

1. first and foremost, it is necessary to aim at innovation, which is able to continuously increase the knowledge content of products and services. Continuous innovation is nothing other than new knowledge for the growth of value added.
2. secondly, it is necessary to develop and increase employees' skills with the aim to develop value added of products and services.

It is necessary, definitively, to abandon the idea that profits are low because the costs are high and think instead that profits are low because the Value Added is low.

3. A second direction of research: sustainability in knowledge based strategies

Using formula [3] the significance of fundamental strategies for value creation can be explained.

The basic strategies are:

1. grow the “cake” (VA) in such a way as to increase both HC and EBITDA;
2. redistribute the “cake” (VA) reducing HC and increasing EBITDA;

In the first case, the increase in work productivity is obtained with a labor intensive strategy. In the second case, on the contrary, the increase in work productivity is obtained with a labor saving strategy.

This concept can be illustrated in the following way.

Equation [3] can be rewritten in the following way in terms of variations:

$$\Delta VA = \Delta HC + \Delta EBITDA \quad [3]$$

If we invest in human resources ($\Delta HC > 0$) and if there is an increase in the VA such that $\Delta VA > \Delta HC$, then there is also an increase in working profits ($\Delta EBITDA > 0$).

Note that the condition $\Delta VA > \Delta HC$ is the main feature of investment in human capital. Note, also, that this is what Drucker and Pulic intend when saying “invest in people”.

This is an example of Economic/Social Sustainable Strategy (ESS) because it creates new value for employees ($\Delta HC > 0$) and for capital investors ($\Delta EBITDA > 0$). It could be said that such a strategy is an example of “Win-Win” strategy that does not dissatisfy anyone, since it creates new value for everyone.

In order to allow the knowledge worker productivity to be increased, the win-win strategy has to further satisfy the condition $\Delta VA\% > \Delta HC\%$. In this case, also VA/HC will be increased.

It is for this reason that it can be understood as a socially sustainable strategy. Using the metaphor of a “cake” (Pulic, 2004), it can be said that a *Win-Win* strategy does not dissatisfy anyone because there is an increase in the size of the “cake” (Value Added) and, therefore, an increase in the size of the “slice” apportioned to human resources (HC) and in the one apportioned to all investors (EBITDA).

Therefore one should ask: why is the *Win-Win* strategy not adopted by all firms?

The reason can be explained using, again, equation [3].

If one invests in human resources ($\Delta HC > 0$) which however have a low knowledge content and a low professional qualification, the growth of Value Added, as a result of investment, may be insufficient, and in particular can be lower than the investment realized ($\Delta VA < \Delta HC$). In this case there is a reduction in profits for all investors ($\Delta EBITDA < 0$). This is what happens in some sectors that, for their nature, do not invest in human resources but in machinery.

In these sectors, in order to make profits grow, there is often a reduction of the workforce (destruction of the value quota of employees) through a growth in work productivity obtained by investing in *labor saving* plants. In these cases the growth of value only for investors ($\Delta EBITDA > 0$) and the growth of the work productivity (VA/HC) is obtained by the destruction of investment in human resources ($\Delta HC < 0$) by means of reducing employment. This is an example of occupational strategy of the “*Lose-Win*” type, since there is the creation of value only for capital investors.

The “*Lose-Win*” value creation model is mainly based on *dead knowledge*, while the “*Win-Win*” model is based on *living knowledge*, as will be clarified in the next section. But the *Lose-Win* strategy is not socially sustainable in the long term since it destroys jobs and income for employees.

The characteristics of the two strategies are represented in the following table.

Tab. 2. Characteristics of the two strategies

	Shareholders	Win	Lose
Workers			
Win		<i>Win – Win</i>	<i>Win - Lose</i>
Lose		<i>Lose – Win</i>	<i>Lose-Lose</i>

where, for the strategies in the first column, we have:

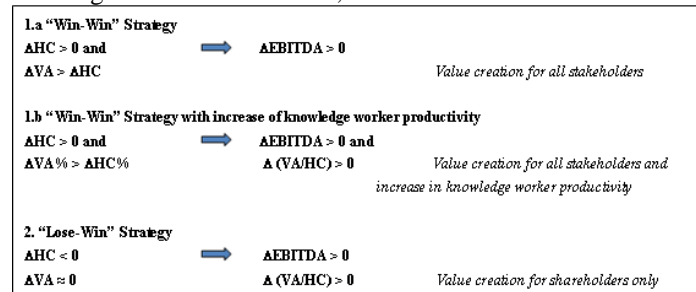


Fig. 1. The two main strategies of value creation

Note that a Win-Win strategy is not a utopian strategy. In fact, there are concrete examples of Win-Win strategy (Iazzolino et al., 2017).

4. A third direction of research: a Framework for Continuous Increase of Knowledge Work Productivity

Today, almost 20 years later the sentence by Drucker: “In terms of actual work on knowledge-worker productivity, we will be in the year 2000 roughly where we were in the year 1900 in terms of the productivity of the manual worker“ (Drucker, 1999b), the situation has not changed significantly and the same challenge is still present.

However, before a possible solution can be presented, it is necessary to clarify some facts. First, knowledge work (KW) takes place in a very different environment:

Tab. 3. From industrial to knowledge economy (Gleeson and Hargaden, 2014)

Industrial Economy	Knowledge Economy
Manufacturing Cell	Workgroup
Production Line	Business Process
Factory	Organization

What is the main difference between these two epochs? Value creation in the past was a function of economies of industrial scale: mass production and the high efficiency of repeatable tasks. **Value creation today is based on economies of creativity and innovation:** mass customization and the high value of bringing a new product or service improvement to the market. The ability to find a solution to customer’s problems or the way a new product or service is sold and delivered (Huges, 2013). All this brings the knowledge workers in foreground. They are today the dominant creators of values. Therefore, it is essential to keep track of their value creation efficiency.

There has been one big change during Taylor’s era that enabled the "productivity revolution". Namely, it was based on improving the work of the individual, manual, workers. On the other hand, today, knowledge workers create value through team work, within business processes.

Knowledge Worker Productivity can be defined as:

$$HCE = \frac{VA}{HC} \quad [4]$$

where:

HCE = Human Capital Efficiency

VA = Value Added = Sales – External Costs

HC = Human Capital, i.e. Cost of employees (Salaries and wages)

In the following two examples of calculations of KWP, on business processes and on a project team, are shown.

Case 1: Process efficiency and Knowledge Work Productivity

This process has its own input that consists of material and KW. At the end there is output whereby everything can be shown in the following way:

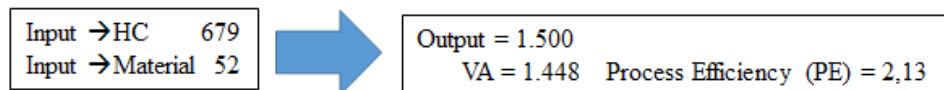


Fig. 2. Process of Food Safety Analysis

In order to accomplish the task, the required resources for the process are established. Since the client paid the agreed price it was possible to calculate VA and PE. So far, this data does not yet tell us whether the efficiency of the process can be improved.

Therefore, the next step would be to analyse the process from the point of view of its components or sub processes. The task was to make an analysis for the customer, in which auxiliary activities, laboratory and analytical work took place. Thus, the process was divided into three sub-processes.

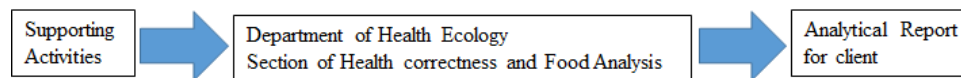


Fig. 3. Sub-processes

As mentioned in the previous section for the entire process, it was necessary to first determine the required resources: material and KW and their output: revenue, value added and KWP for each sub-process. In this way we got the following amounts (all in €) and the financial results achieved.

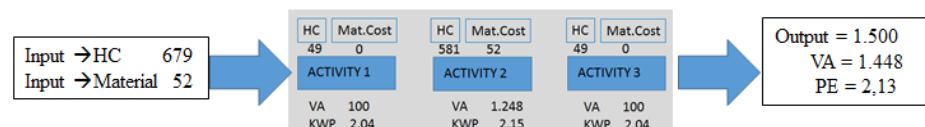


Fig. 4. Input and output for the process and its sub-processes

After the determined results were obtained, their analysis could begin. We found out that at process level, with the material resources, consisting of the chemicals used in the analysis, some reductions that would significantly affect productivity could not be made. It is evident that this is a very small amount, which accounts for only 7% of the total input.

Therefore, in order to improve the efficiency of the process, KW had to be looked for. As can be seen, Activities 1 and 3 do not require a lot of KW, about each 14% of the total used in the process. That is why it was necessary to make a more detailed analysis of Activity 2.

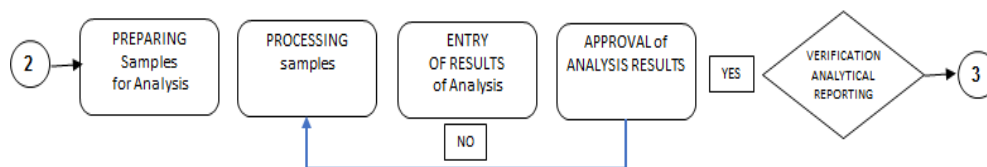


Fig 5. Flow chart of Activity 2

Based on this it was determined how many knowledge work were needed:

Sub – Process Analysis	ACTIVITY 2 – KW Structure	Before	Head of Department = 2 h	Expert Worker = 3 h	Laboratory Worker = 2,5 h
		After	Head of Department = 1,5 h	Expert Worker = 2 h	Laboratory Worker = 2 h

Fig. 6. Analysis by type of knowledge work used

This is a key part of the approach. Three different types of knowledge work were involved in the analysis: routine work, mixed work, non-routine work. Sub-process (Activity 2) spent 7.5 hours of KW. After the conducted analysis, the same job was done in 5.5 hours. This means that in this sub-process there were 2 hours of non-value added work.

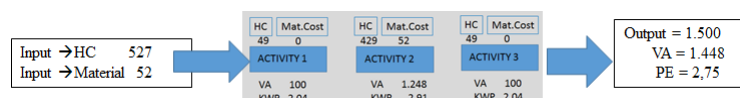


Fig. 7. An enhanced process with higher KWE

Thus, the reconstruction of the sub process labelled "Activity 2" achieved the same result, 1.248 created VA, but with a reduced amount of KW, resulting in an increase in productivity of PE = 2.75.

Now, it remains to be seen how the knowledge workers will be rewarded for this productivity increase. Before the process has been upgraded he made Earning Pure (EP) in the amount of 200. After the improvement, the EP was increased to 352 so the ΔEP was 152. Productivity premium (PP) is calculated: $PP = \Delta EP * KWP / 100$ (with the condition that $EP > 0$). So follows:

$$PP = 152 * 2,75 / 100$$

$$PP = 4,22$$

which is the amount that will be rewarded to the employees, who have achieved productivity gains. Although it may seem at first glance that this is a small amount, it is not the case. When the same calculation is made on an annual level, a decent amount of 13,010 is obtained (only for that process). That is why Taylor's and Drucker's requirements have been met by allowing employees to be rewarded for efficiency increases. But, it is no less important to note that PP is a motivating factor for all employees in the process to look for ways to increase overall productivity.

All of the above has been tested on a lot of examples. So I can repeat what Shiego Shingo, the master of lean manufacturing, said: "My medicine works, but only if the patient takes it"

Case 2: Knowledge Work Productivity for a project team in a knowledge-based firm

The considered firm is an Italian spin-off operating in business simulations for education and recruiting. The firm is based on scientific and professional competences of founders, academics and practitioners, in the fields of ICT and Business Economics.

The employees of the firm are 6:

- 2 Computer Engineers
- 2 Management Engineers
- 1 Project Manager
- 1 Graphic and Web Designer

The calculation of the productivity of knowledge workers has been implemented for the case of the development of a new product. The new product is an innovative software to be used in education and evaluation of human resources. It is a “web in-basket”, an individual role-playing simulating a particular organizational scenario, in which decisions are requested to be made for different levels of complexity. The following steps were implemented for the new product development:

- construction of the simulation scenario
- development of the software
- development of graphics
- launch on the market and sales

The development of the new product was assigned to a specialized project team, composed by a subset of the employees of the firm that assumed the following roles within the team:

- 1 Business Analyst (a management engineer)
- 1 Software Developer (a computer engineer)
- 1 Graphic (the graphic and web designer)
- 1 Technical-Sales person (a management engineer)

The software developer and the graphic developed respectively the software and the graphic of the product (Gui – Graphical user interface), after the business analyst has designed and implemented the scenario. The task of the technical-sales person was particularly important as he was engaged in sales. A successful approach to the customer needs the operator to be deeply aware of the technical characteristics of the product and in

particular of the innovation content of the same product, that has to be emphasized in the negotiation with the customers. The technical-sales person is able to perceive whether the sale was successful because the customer understood and appreciated the innovation embedded in the product. Therefore this allows us to determine what is the quota of sales (and also of the value added) that is attributed to the innovativeness of the new product.

In the following table the Value Added Income Statement of the firm is shown (year 2015).

Tab 4 – Value Added Income Statement year 2015

VALUE ADDED INCOME STATEMENT 2015	€	%
PRODUCTION	€ 350,958	100%
External Costs	€ 173,465	49%
VALUE ADDED (VA)	€ 177,493	51%
Cost of Employees (Human Capital)	€ 163,170	46%
EBITDA	€ 14,323	4%

The detailed Cost of employees for 2015 is included in the following table.

Tab 5 - Cost of employees

Cost of employees (overall)	No. units	Average Cost	Total Cost
Computer Engineer	2	€ 23.210	€ 46.419
Management Engineer	2	€ 34.805	€ 69.610
Project Manager	1	€ 26.854	€ 26.854
Graphic and web designer	1	€ 20.287	€ 20.287
Total cost of employees	6		€ 163.170

The components of the project team were not engaged full time in the development of the new product. In general they are assigned to different projects and teams during the year. From the analysis of workloads, the percentage of the engagement in the team was calculated for each component. In the following table the percentage of time and the total cost of the project team is shown.

Tab 6 – Cost of the project team

Cost of the project team	Cost	% engagement in the team	Cost of unit in the team
Business Analyst (a management engineer)	€ 34.805	30%	€ 10.442
Software Developer (a computer engineer)	€ 23.210	70%	€ 16.247
Graphic	€ 20.287	50%	€ 10.143
Technical-Sales person (a management engineer)	€ 34.805	50%	€ 17.403
Total cost of the project team			€ 54.234

Now it is necessary to calculate the quota of the overall Value Added attributed to the new product. This estimation was possible thanks to the technical-sales person who, as already explained, has a direct perception of the impact of the innovativeness of the new product on the customer. Therefore, the Value Added attributed to the new product was 42% of the overall value added, and then € 74.547.

Tab 7 – Value Added attributed to the new product

VA attributed to the new product	42% of the total VA	€	74.547
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Now it is possible to calculate the productivity of the new product development project team for 2015. It is given by the ratio between the Value added attributed to the new product and the cost of the project team.

Tab 8 – Productivity of the project team

PRODUCTIVITY OF THE PROJECT TEAM =	VA new product	€	74.547	1,37
	Cost of the project team	€	54.234	

The calculation of the productivity can be useful for the policy of rewarding of the firm. Let us suppose that the top management fixes a threshold for the productivity above which the team will receive a bonus. These kinds of firm mainly work basing on projects and then teams; therefore, at the starting of the year, it can be stated that the teams that will obtain a productivity above the threshold will receive a bonus, the others will not. The threshold can be chosen following subjective criteria or can be for example the average productivity of the firm. In this case study the average productivity is calculated as the overall ratio Value added / Cost of employees. In the following table the calculation is shown.

Tab 9 – Average productivity of the firm

AVERAGE PRODUCTIVITY OF THE FIRM =	VA (overall)	€	177.493	1,09
	Cost of employees (overall)	€	163.170	

Therefore, as the productivity of the project team for the new product development is greater than the average ($1,37 > 1,09$), the team will receive a bonus (to be decided) and to be equally distributed within the team.

5. Conclusion

Although nearly 20 years have passed since Drucker pointed to the obligation of raising KW productivity there is not much literature or concrete solutions. One of the most interesting attempts that has been published is the article “Productivity in Knowledge Worker Teams” (Moreno et al., 2013). This article suggests that the team should become the unit for analysis, as the team can be seen as the link between the individual and organizational frameworks, which is logical and acceptable. However, the problem is, that this productivity is expressed in a classical way: the realized profit or spent hours. Although the article provided some insight into the state of the process, it does not mention a way to improve it.

Another, a far more ambitious, attempt was made by Cintron (2013). His analysis rests on processes and their value created. The Knowledge Value Added (KVA) plus Matrix of Change (MOC) plus System Dynamics (SD) are a framework that has been presented with its utilization of knowledge as a determinant of value from execution of processes. The analysis was conducted on two specific examples, namely the UAV (Unmanned Aerial Vehicles) Case Study and the Case Study of a Shipyard. Both examples showed that measurement by VA in sub-processes provides realistic data on the success of the whole process and provides a basis for the possibility of its improvement.

The main problem is the way of calculating VA. It uses a methodology, the Knowledge Value-Added (KWA), which is relatively unknown. However, its biggest problem is the complexity of data that it calculates. It is not easier to get the other two parameters: MOC and SD. That is why the authors of this paper do not believe anyone in the business world would be interested to apply it. On the other hand, the greatest value comes from the fact, that it has been shown on realistic examples, that without measurement in processes, the efficiency of knowledge work cannot radically be increased.

The indicators VA, PE and KWP presented in this article, are an objective and useful measure for knowledge economy. VA, PE and KWP translate the knowledge applied in processes into numbers. Using these objective measurements, managers have the possibility to make scenarios for comparing the processes and technologies used to create their outputs. All this opens a way for continuous improvement of the efficiency of knowledge work.

Furthermore, there are two key reasons in favour of continuously improving the value creation efficiency of processes:

- First, because the current state of the process is never perfect. This means there is always space for improvement, that is, to increase its efficiency.
- Second, the business environment is constantly changing. This ranges from small process' improvements to disruptive technological and organizational innovations.

In the end, KW can be understood and described as something abstract but also as something very concrete. It depends on our perspective. For example, we can ask abstract questions such as "Am I right that we don't know much about knowledge work?" (Efimova, 2003). But we can also ask ourselves how much our individual, as well as our collective knowledge, has contributed to creating value for our company and our community each day. I suppose that all knowledge workers, who create value successfully, would probably be happy to get proof of their work productivity and support measurement, especially if it could result in a monthly bonus.

References

- Aarons, J., Linger, H., Burstein, F. (2006), *Supporting organisational knowledge work: integrating thinking and doing in task-based support*. International Conference on Organisational Learning, Knowledge and Capabilities, University of Warwick, March
- Cintron J. (2013), "A Framework For Measuring The Value-added Of Knowledge Processes With Analysis Of Process Interactions And Dynamics", *Electronic Theses and Dissertations*, University of Central Florida, 2739

- Donaldson, T. and Preston, L. (1995), "The stakeholder theory of corporation: concepts, evidence and implications", *Academy of Management Review*, Vol. 20, Issue 1, pp. 65-91.
- Drucker, P.F. (1968), *The age of discontinuity: Guidelines to our changing society*. London: Transaction Publishers.
- Drucker P. (1991), "The New Productivity Challenge", *Harvard Business Review*, 69, 69-79
- Drucker, P.F. (1993), *Post- capitalist society*, Harper Collins, N. Y.
- Drucker, P.F. (1999a), *Management Challenges for the 21st Century*. Harper Collins.
- Drucker, P.F. (1999b), "Knowledge-worker productivity: The biggest challenge", *California Management Review*, Vol. 41, No. 2, pp. 79-92.
- Efimova L. (2003), "Knowledge worker paradox", Published on-line at the KnowledgeBoard, <http://www.knowledgeboard.com/item/119378>, October 30
- Gleeson F., Hargaden V. (2014), "A task based framework to improve knowledge work efficiency", POMS 25th Annual Conference Atlanta, Georgia, U.S.A. May 9 to May 12
- Guthrie, J., Ricceri, F. and Dumay, J. (2012), "Reflections and projections: A decade of Intellectual Capital Accounting Research", *The British Accounting Review*, Vol. 44, N. 2, pp. 68-82.
- Huges J. (2013), "What Value Creation Will Look Like in the Future", *Harvard Business Review*, May 17
- Iazzolino, G. and Laise, D. (2013), "Value added intellectual coefficient (VAIC): A methodological and critical review", *Journal of Intellectual Capital*, Vol. 14, No. 4, pp. 547-563.
- Iazzolino, G., Laise, D. and Gabriele, R. (2017), "Knowledge-based strategies and sustainability: a framework and a case study application", *Measuring Business Excellence*, Vol. 21, N. 2, pp. 152-174.
- Jensen, M. C. (2002), Value Maximization, Stakeholder Theory, and the Corporate Objective Function, *Business Ethics Quarterly*, Vol. 12, No. 2 , pp. 235-256.
- Kaplan, R.S and Norton, D.P. (1996), *The Balanced Scorecard: Translating Strategy into Action*, Harvard Business Press, Boston, MA, USA.
- Moreno A, Varanki H, Mahou A. (2013), Book of Proceedings of the 7th International Conference on Industrial Engineering and Industrial Management
- Pulic (1996), Der Informationskoeffizient als Wertschöpfungsmaß wissensintensiver Unternehmung, *Frankfurter Allgemeine Zeitung*, pp. 147-179
- Pulic A. (1993), *Elemente der Informationswirtschaft*, Bohlau Verlag, Vienna
- Pulic A. (1994), Information und Wertmessung, in Rauch W./Strohmeier F./Hiller H.: Mehrwert von Information - Professionalisierung der Informationsarbeit, Proceedings des 4. Internationalen Symposiums für Informationswissenschaft (ISI '94) Graz, November 2.-4, pp. 261-271
- Pulic, A. (2000), "VAICTM- an accounting tool for IC management", *International Journal of Technology Management*, Vol. 20, No. 5-8, pp. 702-714.
- Pulic, A. (2004), "Intellectual capital – Does it create or destroy value?", *Measuring Business Excellence*, Vol. 8, No. 1, pp. 62-68.
- Pulic, A. (2008), *The Principles of Intellectual Capital Efficiency. A brief Description*, Croatian Intellectual Capital Center, Zagabria.

A Knowledge-Based Organisational Solution to Create Value and Facilitate IT Innovation

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Abstract

An Italian company, which some years ago activated an Information Technology (IT) innovation process, has had to manage several requests pertaining to the founding of new IT projects or of introducing procedure improvements. After some years, the office in charge of this work activated an in-depth study of the procedure and its results to maximise the value of the IT implementations. Some weak points were identified and some different procedures were simulated to analyse the impact of the data and of the data treatment on the results.

A new approach, which methodologically improved the data acquisition procedure as well as the request evaluation and selection, was then defined. At the same time, the office decided to activate the knowledge resources of the organisation, in order to actually improve the whole IT innovation process and reduce or control the complaints that are inevitable after any selection activity that has to reject some proposals and fund and activate others. Some actions were implemented to involve other offices in the IT innovation process, for their competences in relation to some aspects of the innovation requests, and to facilitate cooperation and improve communication with the company sectors that were and are still used to proposing projects or procedure improvements.

After one year, the new approach produced interesting results, in relation to the IT request quality and to the reactions to the first steps of an organisational change process that was oriented towards improving knowledge sharing, cooperation and effective and transparent communication. Some procedural improvements have not yet been implemented, because such a drastic change could produce a negative reaction, and the possible consequences still need to be studied not only in relation to the quality of the request evaluation and selection, but also considering any possible organisational effects. A synthesis is here proposed of the analytical tools, which were used to methodologically and operationally analyse the past experience and to identify some weak points, and the organisational tools, which were then used to activate and share knowledge, starting from a new relationship between the involved actors, and to attempt to activate an

organisational change, that is, from a centralised activity to a shared communication space, and finally to put it to the test.

Keywords – Managerial challenge, Strategic resource, Knowledge sharing, Organizational knowledge dynamics

Paper type – Practical Paper

1 Introduction

Some years ago, an Italian company with 3200 employees arranged to stimulate requests, from the organization, of Information Technology (IT) new projects or of specific application improvements. It charged the office of IT demand management (which is shortly called DEMAND) with requirement acquisition and analysis, to map the whole company requirements and to plan the implementation of the most “interesting” and/or urgent requests.

DEMAND gathered approximately one thousand requests every year from the 15-20 sectors of the company, analysed the characteristics the proposers have indicated and the costs of each IT intervention, in order to plan and implement the most urgent requests and the others with the highest priority. Around 10 million euros were every year allocated for IT interventions.

After some years, while the request number was growing and the budget reducing, some doubts arose about the reliability of the acquired data, on costs and benefits of each IT possible intervention, and therefore about the decision. The main question was: “How can DEMAND maximize IT implementations value”. For this reason, an in-depth study of the procedure and its results was developed and some simulations were made, to analyse the impact of the data and the data treatment on the results. This study stimulated some changes that produced interesting results and the activation of an organisational change process.

The next section describes the nature of the problem and the tools, which were used to analyse the past use of the data and to identify and communicate weak points of the procedure.

The third section analyses the new approach, which was adopted to activate the knowledge resources of the organisation, in order to actually improve the whole process of IT innovation and to reduce or control the complaint that is inevitable after any selection activity that has to reject some proposals and found and activate some others.

The last section discusses the practical implications of the new approach, together with the dynamics and the risks that a new knowledge sharing vision can generate.

2 The problem and the methodological approach

Any company that stimulates IT innovation receives a growing number of proposals, year after year, and at a certain moment it has to reject some projects and application

improvement requests and to plan and implement others. This action requires a formal decision process, which is called “project selection”, in the areas of Project Management and Multicriteria Analysis. Several procedures that use economic approaches to evaluate and prioritise projects (Net Present Value, Internal Rate of Return, Benefit/Cost Ratio, Opportunity Cost, Payback Period, Economic Value Added, Initial Risk Assessment) are suggested in literature in the area of Project Management, but the values they estimate often cannot be applied to IT projects and require at least a certain minimum formalisation of the projects that have to be evaluated. Many of the costs and benefits are hidden, the lead times and pay-offs tend to be long-term and the risks are difficult to assess, all of which makes it problematic to select a proper rate of return (Milis and Mercken, 2002).

Multicriteria Analysis deals with the “project selection” problem starting from the identification of the preference system of the company. Multicriteria models and methods are used to select and exclude projects that do not present consistency with this system. This methodology can also be used in the early stages of the project definition. Relevant criteria and their weights are identified and formally defined, but the synthesis of the evaluations is not the weighted sum of the values and it depends on the specific class of multicriteria methods (Figueira et al., 2005).

The nature of a project selection problem changes in relation to the decision system (i.e. decision makers, rules and formal relationships between them and the other actors in the decision process) and to the state of knowledge that is present in the organisation or which can be activated (Norese, 2016). Several studies have analysed this kind of problem, and some methods have been proposed and used to facilitate the selection of projects, but also of offers, possible investments or programmes and, with the same logic, the management of suppliers or human resources (see, for instance, Costa et al, 2003; Norese and Viale, 2002; Norese, 2009; Viezental et al, 2010; Zopounidis and Doumpos, 2002).

DEMAND, the office that is in charge of this project selection procedure, set up good relationships with the different sectors of the company that could propose new IT projects or improvements of some IT applications and which have to document the different benefits that are associated with each project/improvement. A set of indicators has been created over the last seven years to allow all the possible benefits of these IT interventions to be appreciated. The actors of this decision process (IT intervention proponents, IT Area, DEMAND, PMO and General management) have in fact suggested these indicators year after year.

In 2017, the problem was completely reformulated, and an evaluation procedure was created to synthesize the evaluations, in relation to the set of indicators, and to rank the requests in relation to their characteristics. This new approach was adopted as a result of the need for more transparency and effectiveness of the IT implementation process.

An in-depth study of the new procedure and its results, in relation to the past and new data, was simultaneously developed. DEMAND was open to criticism, because it was evident that some requests, which were essential for the company, sometimes resulted in positions that were not so high in the ranking. Some weak points of both the indicators

and the new procedure were identified, from a methodological point of view, and some variants of the new procedure were identified and tested, in relation to certain new data treatment proposals. DEMAND considered the new proposal useful, and it stimulated some improvements of the procedure in 2018 as well as the activation and sharing of knowledge resources, in order to discuss, plan and implement a new IT demand management process.

This section describes the methodological approach that was used to analyse the evaluation procedure and to identify and communicate some possible new improvements and a multicriteria model proposal.

2.1 Methodological analysis

The first step was an analysis of the approximately one thousand requests made in the year 2017, which underlined their great dissimilarity and therefore their difficult comparison and ranking (Roy, 1996). Several different sectors in the company presented requests. Some sectors, working on the internal processes of the company (e.g. administrative planning and control, finance, compliance), proposed IT interventions to improve internal procedures (controlling operational risks, adapting procedures to new regulations, ...). The requests of other sectors (e.g. strategic marketing, claims, life insurance, ...) were of a different nature and were in general oriented towards improving communication with the present or future clients. The analysis of the requests made in the year 2017 distinguished the need for some evidently urgent interventions from the need for expensive and long procedural and technical changes, associated to some innovative projects. Some requests resulted to be clear, simple and not expensive, but their economic benefits for the company were not easily quantifiable.

The data and the implicit model the proponents had used to describe their requests were analysed, and it was evident that several possible benefits had been included by means of an often very limited and sometimes wholly absent valorisation of the benefits.

An indicator of IT intervention cost was used to analyse the complexity of the requests, to distinguish the different levels of complexity and to identify some evident outliers, which needed to be dealt with separately. Contemporarily, it was evident that the cost indicator was not often present (absent in more than 25% of the requests) because the IT Area had not been able to quickly evaluate the costs of more than one thousand requests.

As a variant of the new procedure, four different categories were proposed to distinguish the requests oriented towards:

- including new regulations in IT previous applications,
- improving internal processes,
- meeting the needs of the agencies, and
- improving the relationships with the clients.

A fifth category of transversal requests was considered. A different multicriteria model was created to rank the requests of each category. Each model included three or four specific and consistent benefits, which were extracted from the seventeen components of the original indicator set. Several simulations were implemented, and the results were

proposed to DEMAND for analysis. A cutting level was proposed for each category, in order to distinguish acceptable from unacceptable requests.

A comparison between these results and the original ranking underlined the consequences of some weak points of both the indicators and the evaluation procedure, and suggested some new models (one for each category) and some variants in the numerical or logical combinations of the data, and therefore new simulations and result analyses. As a consequence of this analysis, a new IT demand management process was outlined and proposed, to be discussed and implemented with the involvement of other company offices.

3 Knowledge resources to improve the IT innovation process

Several innovations were introduced in 2018 and communicated during some meetings in spring and summer, with the involvement of the proponents of the improvements and IT projects, in order to explain the motivations and nature of each innovation, to create new relationships between sectors and DEMAND, and therefore to facilitate the implementation of procedural and organisational changes in the following autumn.

The data acquisition procedure was changed for the first time in seven years, and other offices, with competences in relation to some data analysis and use procedures (Risk management, Compliance, Customer experience, Big Data, Lead Time, Profitability and so on), were involved in the demand management procedure. Cooperation between these offices and DEMAND improved the quality of the evaluation procedure and model. Their involvement in the meetings facilitated the communication of each change. Furthermore, their knowledge was made available to the different sectors, to facilitate them in valorising the benefits of their requests.

The new evaluation procedure reduced the workload of the IT Area, which was still involved in the cost estimation, albeit with less urgency and for a reduced number of proposals.

DEMAND also reorganised its work in order to create an institutional and operational exchange with the different sectors, along the whole IT innovation management process, and to increase reliability and effectiveness of the new data acquisition procedure. The request evaluation and priority definition procedures were changed, and several of the proposals that had been discussed during the analysis of the previous procedure were adopted.

3.1 The new procedures

The proposal of a cutting level, in order to distinguish acceptable requests from unacceptable ones, was partially accepted and this level was proposed to the proponents of the request as something that could easily be verified before the presentation of a request. This new message was combined with another indication: the need to monitor the effects of each IT innovation implied that each IT intervention proponent was required to propose a future monitoring (when, in what way, by means of what procedure). These

messages produced some interesting results, in relation to the IT demand: a 55% reduction in requests, an increase in the high-value requests from 36% to 43% and a reduction in the low-value requests from 64% to 27%.

Another new procedural element was introduced, that is, the requests were divided into seven categories, each with a different priority, and different procedures were defined to evaluate the requests and rank them, but only if needed.

The last change was a two-step evaluation procedure for the category with the maximum number of requests (371 out of the 562 requests). It allowed the benefits to be evaluated and compared with an acceptability value (the cutting level). The cost estimation was thus postponed, in order to reduce the work of the IT Area. Only the costs of the requests with benefits at least equal to the cutting level were estimated, and the combined cost/benefit indicator was used to rank the requests.

Communication of the procedure results became more transparent than in the past, in relation to both the proponent sectors and the IT Area that will implement the new projects and application improvements. The temporary and final results were communicated to the request proponents in December 2018, by means of a report (the Master Plan) on the company's intranet. This report has to be updated at least six times a year.

The Master Plan became an important communication space because it included notes and requests to some proponents (for a necessary clarification of their proposals or some new data acquisition), the category in which each proposal had been assigned, its position in the ranking and the state of the process evolution for each request ("to be evaluated", "evaluated and classified", "in the implementation plan", "implementation postponed", with the motivation for the postponement, "implementation activated" or "completed").

4 Conclusion

The improved relationship between internal offices, and a new valorisation of their knowledge, in a process in which they had not been involved in the past, were greatly appreciated by the company. DEMAND improved the quality and the results of its work, but the internal dynamics of the company also improved. This new use of organisational knowledge, together with new interactions and co-creation of value (Kohtamäki and Raiala, 2016; Ramaswamy and Ozcan, 2018), may have activated an organisational change process, from a centralised activity to a shared communication space. However, this organizational change has still to be put to the test.

This new knowledge sharing vision can generate risks. The Master Plan guarantees transparency, but can also reduce the "bargaining" space to some exceptions to be sent to an authorised management level, and can generate criticism to anything in the report or an automisation proposal of a process that now, for the first time, involves several sectors of the company. However, procedures of sharing *knowledge embedded in the interactions of people, tools and tasks provide a basis for competitive advantage in firms* (Argote and Ingram, 2000).

Some suggestions, from the analysis of the original procedure of data acquisition and request evaluation, have not yet been implemented, because a too drastic change could have produced a negative reaction. Some new model and procedure improvements will be tested this year, but the possible consequences of any new change needs to be studied, not only in relation to the quality of the request evaluation and selection, but also considering any possible organisational effects.

References

- Argote, L. and Ingram, P., (2000) "Knowledge transfer: a basis for competitive advantage in firms", *Organizational Behavior and Human Decision Processes*, Vol. 82, No. 1, pp. 150-69.
- Costa, A. P. C. S., de Almeida, A. T. and de Miranda, C. M. G., (2003) "Multicriteria Support to Sort Information Systems Portfolio", *Journal of the Academy of Business and Economics*, Vol.2, No.1, pp. 237-247.
- Figueira, J., Greco, S. and Ehrgott, M., (Eds.) (2005) *Multiple Criteria Decision Analysis: State of the Art Surveys*, Springer Verlag, London.
- Kohtamäki, M. and Raiala, R., (2016) "Theory and practice in value co-creation in B2B systems", *Industrial Marketing Management*, Vol. 56, pp. 4-13.
- Milis, K. and Mercken, R., (2002) "Success factors regarding the implementation of ICT investment projects", *Int. J. Production Economics*, Vol. 80, pp105–117.
- Norese, M. F. and Viale, S., (2002) "A multi-profile sorting procedure in the public administration", *European Journal of Operational Research*, Vol.138, No.2, pp. 365-379.
- Norese, M. F., (2009) "A Multi-Criteria Decision Aiding System to Support Monitoring in a Public Administration", *International Journal of Natural Computing Research*, Vol.1, No. 4, pp. 59-71.
- Norese, M. F., (2016) Decision aid in public administration: from evidence-based decision making to organizational learning, in *Multiple Criteria Decision Making: Applications in Management and Engineering*, eds. C. Zopounidis and M. Doumpos, Springer, Heidelberg, 1-29.
- Ramaswamy, V. and Ozcan, K., (2018) "What is co-creation? An interactional creation framework and its implications for value creation", *Journal of Business Research*, Vol. 84, pp. 196–205.
- Roy, B., (1996) *Multicriteria methodology for decision aiding*, Kluwer Academic, Dordrecht.
- Viezental, M., Szentesi, S. G. and Mot, G., (2010) "Electre method in multicriterial projects evaluation from economic and ecologic point of view", *Journal of Economics and Business Research*, Vol. 16, No. 2, pp.112-142.
- Zopounidis, C. and Doumpos, M., (2002) "Multicriteria classification and sorting methods: A literature review", *European Journal of Operational Research*, Vol.138, No. 2, pp. 229-246.

Knowledge Representation in the Specialty Coffee Agribusiness System: a Conceptual Framework Proposal

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Abstract

The aim of this paper is to present ways to make explicit the existing knowledge of the specialty coffee agribusiness system. The recognition of agriculture as a rapidly expanding segment involving primary, secondary and tertiary sectors of the economy necessitates solutions from various areas of knowledge. Specialty coffee, among the products of the agribusiness system, will be addressed in this paper as an example due to the complexity of maintaining quality during the various stages of transformation from coffee beans into the finished product. This research is based on field visits, interactions and a systematic search of the literature. Perspectives from the agribusiness sector present managerial focuses and address critical factors for its success. It is in the novelty of generating value through knowledge as a fundamental element that the originality of this paper stands out. Explicit knowledge of the specialty coffee agribusiness system will

contribute to the evolution of the market in all links of the agribusiness system, resulting in a collaborative, knowledge-intensive agribusiness system. The results show the domains, elements and value of knowledge in the Specialty Coffee Agribusiness System (SCAS), which will serve as the basis for the elaboration of the Specialty Coffee Domain Ontology and a Conceptual Framework of SCAS.

Keywords – knowledge representation, agribusiness system, value creation, specialty coffee, conceptual framework

Paper type – Academic Research Paper

1 Introduction

The global food and beverage market was estimated at more than \$ 5.650 billion in 2017. This segment encompasses alcoholic beverages, non-alcoholic drinks, pet food, grain products, meat, poultry, seafood, canned fruit and vegetables, frozen foods and dairy products (Food and Beverages Global Market Report, 2018)¹. This amount reflects the economic and social importance of meeting the food needs of a growing world population.

Food derives from complex productive chains composed of numerous agents within their business unit links. The demands that the current market has generated in agriculture have entailed rapid transformations and changes in the last decades (Boehlje, Doebling, & Sonka, 2005; Margherita, Secundo, & Taurino, 2009; Sánchez & Betancur, 2016) These authors emphasize that the changes have come about not only through technology, techniques and good production practices, but also through resource management, business models, supplier linkage, and planting operations. These changes impact consumers as well as government, science, and education involved in agriculture (Margherita et al., 2009).

Agribusiness is a unique form of economic activity (Wilk & Fensterseifer, 2003), where the companies involved tend to share basic resources, technologies and similar processes, but with different objectives. “*Agribusiness analysis thus requires, in addition to an interdisciplinary approach, a dynamic and systemic, rather than a static and local, view of investments in order to achieve a long-term dynamic optimization of the system as a whole*” (Wilk & Fensterseifer, 2003, p. 100).

The concept of agribusiness recognizes that the integration of the knowledge from different areas is what determines the success of the system as a whole. This paper presents a possibility of integrating, representing and explaining the knowledge involved in the processes of the Specialty Coffee Agribusiness System (SCAS) aiming at a better quality of the final product of this system through the proposal of the Conceptual Framework of the SCAS. In fact, coffee is not born bad, it can get bad (Kasai, 2016).

¹ <https://www.reportlinker.com/p05312926/Food-And-Beverages-Global-Market-Report.html>

2 Bibliographic Review

2.1 Agribusiness System

Food production chains have distinct denominations according to their particularities. Agroecology and organic producers can be seen as opposed to intensive agriculture, emphasize Soullignac et al. (2017). Agribusiness requires a high degree of interdependence among agricultural producers (Harling, 1995 apud Margherita et al., 2009) where the divergence between the two is in the size and use of agrochemicals in production.

The basilar concept of agribusiness was first publicized by Davis and Goldberg (1957, p. 2) as *“the sum of all operations in the manufacture and distribution of farm supplies; production operations on the farm; and the storage, processing, and distribution of farm commodities and items made from them”*.

Davis and Goldberg (1957) argue that agribusiness encompasses all the functions that the term agriculture included 210 years ago. Grynszpan (2012) treats the Agribusiness System (AGS) as a business of interdependent links that begins with the production of inputs and financing, through farms, product transportation, warehousing, processing and distribution.

Perspectives on this issue present managerial focuses and address critical factors for the success of the sector, such as the frameworks of Wilk and Fensterseifer (2003) and de Almeida and Zylbersztajn (2017), However, knowledge as a value is not explicit in these frameworks. Knowledge management is important for the generation of value in the agribusiness systems (Jatib, Vilella, Ordoñez, Napolitano, & Palau, 2003; Margherita et al., 2009; López, Hernández, & Marulanda, 2014; Ma & Huang, 2014; Bernardo, Binotto, & Farinha, 2017; Gessi et al., 2017; Horáková, Rydval, & Houška, 2017; Trauer, Valdati, Todesco, & Costa, 2018).

Problems surrounding agriculture require solutions that goes beyond biology, chemistry, and engineering (Grynszpan, 2012). Thus, the concept of agribusiness recognizes that the integration of the knowledge in the different areas is what determines the success of the system as a whole. *“Modern agriculture depends heavily on agronomy, engineering, technology, and the physical and biological sciences”* (Encarnação & Lima, 2003, p. 14, our translation).

The agribusiness system is composed of interrelated subsystems that aim to provide products and services to consumers worldwide (Biotto, De Toni, & Nonino, 2012; Gunderson, Boehlje, Neves, & Sonka, 2014; Satolo, Hiraga, Goes, & Lourenzani, 2017). These subsystems are underpinned by support services that provide logistics, coordination, financing, labour, technology, information, policies, programmes, incentives and others.

2.1.1 Specialty Coffees

Among the products of AGS is coffee, discussed in this paper as an example due to the complexity of maintaining quality during the stages of its transformation into a finished product.

Coffee is one of the most consumed beverages in the world, surpassing 3 billion cups daily (Illy, Alessandre, McDowell, & Codice, 2015). It is ingested primarily for the stimulating effects of caffeine as well as for social bonding and for its aromatic properties but is rarely drunk because of its beneficial properties to human health (Shaposhnikov et al., 2018). World coffee production forecast for 2018/2019 is 174.5 million bags of 60kg, 15.6 million more than in the last year (Trade, 2018) which is equivalent to an approximate sum of US\$ 57.9 billion only in the marketing of green coffee (not yet roasted and processed) and represents a commodity of extreme economic importance.

Before it is consumed, coffee undergoes several transformations within the Coffee Agribusiness System (CAS). In this type of system, all the producers and processors of commodities in semi-finished/finished products are linked to the suppliers of inputs and technology until reaching final consumers (Wilk & Fensterseifer, 2003; Kalaki & Neves, 2017). Non-controllable factors that encompass both the environment and policy decisions are linked to consumer decision-making regarding product choice and brand choice (Wilk & Fensterseifer, 2003).

Samoggia and Riedel (2019) after analyzing the publications of Casal et al. (2000); Gloess et al. (2013) and Parras (2007) point out that “The biochemical composition of a cup of coffee depends on the degree of roasting, the type of bean (Arabica versus Robusta), and the coffee brewing method, including grind type” (Samoggia & Riedel, 2019, p. 2). Depending on the quality of the grains used and the type of processing, coffee as the final product may have a quality disparity ranging from a product derived from blends (coffee, cereals, peels and spoiled coffee beans) to pure, well processed coffee where the preservation of its best properties is sought. It is the latter that will be called Specialty Coffee.

Although coffee seems to be a simple product, seed-to-cup transformations involve knowledge-intensive processes (Trauer, Valdati, da Costa, Trzeciak, & Varvakis, 2017) and numerous complex tasks (Hatzold, 2012). At the end of the processing, the coffee could be one of several quality standards – from coffees of a very dark roast – known as Italian or French roasted coffee (Melo, 2004; Lokker, 2016), to coffees composed of defective, green, burnt, mouldy and old harvest beans to gourmet and specialty coffees.

The final quality of this product can influence the health of its consumers, as well as scientific research that may be biased by the use of food derived from transformations that have damaged part of its substances (Mioto, 2015).

In studies involving coffee, the market, agronomy, chemistry and medicine, tend to show disciplinary interests about characteristics present in the production process that are sometimes not perceived, shared and used beyond these areas (disciplinary approach) and end up remaining implicit in the agents and activities of each sector and explicit in their areas of knowledge. It is necessary not only to explain knowledge, but also to obtain

consensus and integration on the present knowledge through agents/activities involved in the SCAS and, perhaps, to promote a transdisciplinary approach among the sectors.

2.2 Knowledge Representation

Nonaka and Takeuchi (1995) presented two types of knowledge: explicit knowledge, contained in manuals and procedures and tacit knowledge, learned only by experience and indirectly shared through metaphors and analogies. For these authors, systemic knowledge emerges from the aggregation of explicit knowledge. In the tacit dimension, Polanyi (2013, p. 4) highlights the fact that “*we can learn more than we can tell*”. This dimension of knowledge is fundamental to the development of scientific knowledge. Sharif (2004) corroborates the recognition of the tacit dimension as an indispensable part of human knowledge that is not always present at a conscious level.

In this paper, knowledge is defined through the lens of the Graduate Programme in Knowledge and Management Engineering, UFSC, Brazil: “it is content or process effected by human or artificial agents in the generation of scientific, economic, social or cultural activities” (Pacheco, 2016, p. 20, our translation).

Knowledge management makes it possible for organizations to work out strategies among the agents involved in a collaborative manner more efficiently and effectively (Hinton, 2003; Gessi et al., 2017), where knowledge is a critical factor for business survival.

SCAS can be considered as a set of several interdependent businesses throughout its chain. Thus, innumerable agents – human and non-human – make up the knowledge base of the sector. To this set it is possible to add knowledge of related scientific research. It is noteworthy that most knowledge of the organizations – in this case – of SCAS may be in the minds of the people who comprise them (Gessi et al., 2017).

The agribusiness sector demands knowledge management practices to meet knowledge gaps in the market (Nagaoka, Ensslin, Ensslin, & Nagaoka, 2011; Bernini, Nääs, Garcia, & Garcia, 2014; Bernardo et al., 2017). In this context, the importance of knowledge representation emerges to provide value generation throughout the SCAS. However, to represent knowledge only as informative content is insufficient; it is necessary to provide the understanding of this knowledge too (Sharif, 2004). Sharif stresses that the combination of context and reasoning of information content is fundamental to represent knowledge in an information system. It is understood that the combination of context and reasoning of information content is also valid for other forms of knowledge representations such as mind maps, ontologies and frameworks. The representation of knowledge contributes to the generation of value as explained by the assertion of Pacheco, Freire, and Tosta (2011) who conceive of knowledge as a generator of value.

2.2.1 Ontologies

An ontology is composed, in general terms, of concepts and relationships that can result in a knowledge base of a particular field that is modelled and explained, and can have as one of the objectives the constitution of a framework for modelling problems

(Zanni-Merk, Cavallucci, & Rousselot, 2011), as well as contributing to the collection of insights about the uniqueness of certain situations (Fernandes, Grosse, Krishnamurty, Witherell, & Wileden, 2011).

The use of ontologies is very broad in the areas of Knowledge Engineering, Artificial Intelligence, E-commerce, Computer Science, Natural Language Processing, Information Retrieval, Database Design and Integration, Bioinformatics, and Education (Simperl, 2009; Gómez-Pérez, Fernández-López, & Corcho, 2010), as well as in the context of Knowledge Management, in which "the characteristics of the development of an ontology are aligned with knowledge sharing, one of the basic processes of Knowledge Management" (Rautenberg, Todesco, & Steil, 2010, p. 171, our translation).

This paper uses the classic definition of ontology presented by Studer, Benjamins, and Fensel (1998):

An ontology is a formal, explicit specification of a shared conceptualization. Conceptualization refers to an abstract model of some phenomenon in the world by having identified the relevant concepts of that phenomenon. Explicit means that the type of concepts used, and the constraints on their use are explicitly defined. Formal refers to the fact that the ontology should be machine-readable. Shared reflects the notion that an ontology captures consensual knowledge, that is, it is not private of some individual, but accepted by a group (p. 184).

It is necessary to emphasize that the ontologies aim to represent the consensus knowledge of a given domain in a generic and formal way so that it can be reused and shared between applications and groups of people (Gómez-Pérez et al., 2010). The authors state that there is not only one ontology for each domain, but there can be several ontologies which – in different ways – model the same type of knowledge or domain.

2.2.2 Conceptual Framework

Crossan, Lane, and White (1999) based on concepts of Bacharach (1989); Whetten (1989); Sutton and Staw (1995); Weick (1995) define framework as a structure that fulfils the following fundamental requirements:

1. Identify the phenomenon of interest;
2. State the main premises or the premises underlying its structure and,
3. Describe the relationship between the elements of the structure analyzed.

The development and use of frameworks represents the most general form of theoretical analysis in which structures identify elements and general relations between them that need to be considered for institutional analysis, thus organizing diagnostic and prescriptive investigations (Ostrom, 2011).

Although they are now widely used, there is no standard definition of a framework. This paper employs the lens of the authors mentioned above, complemented by Miles and Huberman (1994) who define the Conceptual Framework as

The conceptual framework explains, either graphically or in narrative form, the main things to be studied – the key factors, constructs or variables – and the presumed relationships among them. Frameworks can be rudimentary or elaborate, theory-driven or commonsensical, descriptive or causal (p. 18).

To these definitions Shehabuddeen, Probert, Phaal, and Platts (1999) add that a Framework should:

1. Represent an issue for a defined purpose;
2. Link various elements to show a relationship;
3. Enable a holistic view of a situation to be captured;
4. Demonstrate a situation or provide a basis for solving a problem, and
5. Provide a structured approach to dealing with a particular issue (p. 9).

The Conceptual Framework represents a possibility for representation of SCAS knowledge based on the development of a Specialty Coffee Domain Ontology.

3 Research Design

The design of this research was based on stages and interactions, starting with systematic literature searches in the Scopus, Web of Science and Scielo databases supplemented by the SnowBall search technique in Google Academics, chapters of published and indexed books and technical reports in the area (Grey Literature). Key words were determined, searches of the databases were conducted, and relevant articles were selected and classified using EndNote@X9 software. Following the classification and reading of selected texts, a table containing the guiding concepts of the research and its references was developed, thus fulfilling the first step for integrating SCAS knowledge. Subsequently, guidelines for the development of the conceptual framework were presented. This knowledge representation will use knowledge engineering tools for identification of knowledge.

4 Development

With the aim of acquiring, organizing and representing knowledge of the process in SCAS to enable its sharing in this domain, the development of a Conceptual Framework will be proposed. The knowledge needed and available for this purpose is present both in SCAS agents and in related databases.

4.1 Representation of the Knowledge Context in SCAS

The various components that constitute SCAS need to be connected through relationships. Among these Wilk and Fensterseifer (2003) present in the SCAS Framework the following macro factors (here called knowledge domains): Competitive Situation; Economic Factors; Technology; Nature and Society. These macro factors can be complemented by the critical success factors defined in the Conceptual Framework of the Brazil's Coffee Industry presented by de Almeida and Zylbersztajn (2017). Figure 1 derives from this integration and in it, elements of knowledge originate from the domains,

flow smoothly and are fed by values that contribute to the understanding of the knowledge of the system. Such an understanding will enable SCAS agents to seek better results in the preparation of specialty coffee. Four components are integrated as a contribution to the above-mentioned frameworks: Knowledge Elements, Scientific Publications related to the sectors and their final products, Practical Contributions of SCAS Agents and Perceived Value for each of the components.

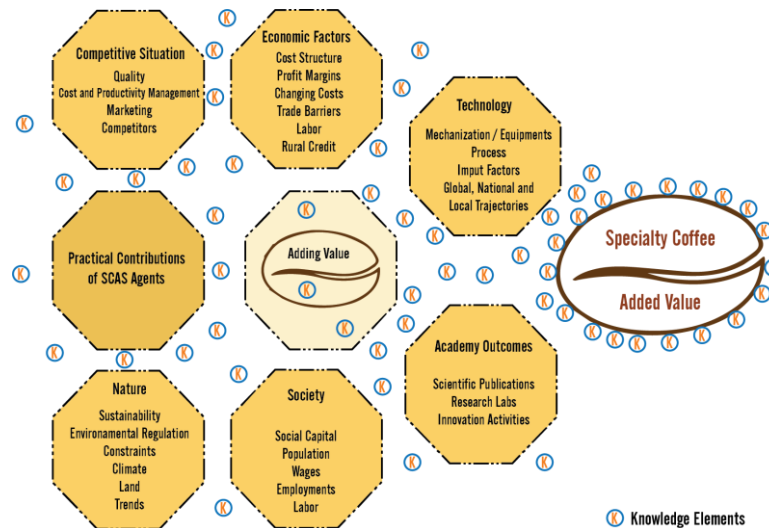


Figure 1: Domains, Elements and Value of Knowledge in SCAS. Source: Authors

Knowledge emerges in this graphic representation as a value generating factor to SCAS, encompassing scientific, economic, social and cultural aspects, according to the definition of knowledge presented by Pacheco et al. (2011), as a critical success factor in organizations (Toffler, 1991; Drucker, 1999; Porter, 2004; Stewart, 2010) and in the context of the Agribusiness Sector (Hinton, 2003; Nagaoka et al., 2011; Bernini et al., 2014; Bernardo et al., 2017; Gessi et al., 2017).

Explicit knowledge from scientific publications in the area was included because of its relevance to the sector, and because it is assumed that many SCAS agents do not have opportunities to access scientific knowledge bases, as verified in empirical interviews with specialists in the SCAS domain.

Through scientific databases it is possible to have access to knowledge such as that discussed by Hatzold (2012, p. 6): “The processing methods also influence the presence of bioactive compounds, both qualitatively and quantitatively, and therefore may influence coffee’s physiologic effects in the human body”. This author highlights the beginning of new discoveries regarding the effects of coffee on human health:

Science is only beginning to understand the relationship between coffee drinking and health and well-being. Previously, most scientific research focused on caffeine, for which there is now significant evidence describing its mild

stimulating effect. However, there are many compounds in coffee that appear to exert bioactive actions (p. 16).

The international scientific community is contributing to demystifying the notion that coffee can be harmful to human health. This product is classified as a nutraceutical beverage (nutritional and pharmaceutical), has a great variety of minerals, amino acids, lipids such as triglycerides and free fatty acids, sugars and polysaccharides, has a vitamin B complex (niacin, vitamin PP) that, when obtained from appropriate roasting processes, form chlorogenic acids – natural antioxidants – which might act to prevent depression and its consequences (Encarnação & Lima, 2003; Mito, 2015; Fischer, Victor, Robinson, Farah, & Martin, 2019).

It is important to note that of the coffee components, "only caffeine is thermostable, that is, it is not destroyed by excessive roasting. Other substances such as amino acids, sugars, lipids, niacin and chlorogenic acids can be modified, formed or even destroyed during the roasting process" (Mito, 2015, p. 4, our translation). Highly roasted coffee is essentially caffeine and ash. The aforementioned elements of knowledge are relevant to provide knowledge to SCAS agents and contribute to the generation of value of specialty coffee as final product.

Publications on the properties of coffee and their relation with human health have been presenting contradictory information over time. Fischer et al. (2019) present a historical approach to changes of conceptions about coffee consumption and its health impacts, thus reinforcing the importance of knowledge representation, having scientific bases as one of the input factors.

Many of the historical problems and controversies that were associated with the use of coffee are now linked to methodological gaps, inter- and intra-individual differences, interrelationships among food substances, form of roasting and brew preparation, and differences in coffee composition related to various aspects of growth and production (p. 14).

The form of knowledge representation that will give rise to the SCAS Conceptual Framework will be instanced by a Specialty Coffee Domain Ontology.

5 Conclusions

Ontologies and frameworks can be used to represent the integration of knowledge in formal and explicit SCAS, in which their interpretations contribute to the elaboration of referential and simplified guides available to the various SCAS agents. These representations of knowledge - among other results - present two common factors as highlighted by Pacheco (2016): "knowledge-actor relationship and its role in social co-production" (p. 11, our translation).

5.1 Theoretical Implications

This study presents four theoretical implications, the first one being in the integration of scientific academia to the proposal of the SCAS Conceptual Framework through its publications, the second in the representation of the Elements of Knowledge as actors in the integration of SCAS knowledge, the fourth with the Practical Contributions of SCAS Agents and lastly, Value Perceived in the interaction between the components of SCAS.

These implications complement the frameworks of Wilk and Fensterseifer (2003); de Almeida and Zylbersztajn (2017).

5.2 Managerial Implications

The agents and organizations that constitute the SCAS may benefit from the Conceptual Framework of SCAS as a guide for the production of products with greater added value. The framework will present motivations for transdisciplinarity in the areas that exert influence on the SCAS. Consumers of specialty coffees will benefit from shared knowledge in the market through the organizations participating in SCAS and from the possibilities of choosing coffees beneficial to human health and with particular flavours. An increase in consumption of specialty coffees could contribute to the reduction of human health expenditures¹, which in Brazil – for example – represented US\$ 140 billion² from 2010 to 2015. All these results generate wealth for society.

This paper presented ways to explain knowledge in the SCAS domain. From the evolution of this research, the proposition of the Domain Ontology of Specialty Coffee, and of the Conceptual Framework of SCAS and its respective checks with specialists will emerge.

References

- Bacharach, S. B. (1989). Organizational theories: Some criteria for evaluation. *Academy of Management Review*, 14(4), 496-515.
- Bernardo, L. V. M., Binotto, E., & Farinha, M. J. U. S. (2017). Practices of identifying knowledge management in agricultural cooperative. *Espacios*, 38(11). Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85014449263&partnerID=40&md5=e7576693d71666e116ecce17cd834f62>.
- Bernini, D. S. D., Nääs, I. d. A., Garcia, S., & Garcia, R. G. (2014). Cenário da Formação Profissional em Agronegócio no Brasil. *ENCICLOPÉDIA BIOSFERA, Centro Científico Conhecer-Goiânia*, 10(18), 2014. Retrieved from <http://conhecer.org.br/enciclop/2014a/AGRARIAS/cenario.pdf>.
- Biotto, M., De Toni, A. F., & Nonino, F. (2012). Knowledge and cultural diffusion along the supply chain as drivers of product quality improvement: The illycaffè case study. *International Journal of Logistics Management*, 23(2), 212-237. Retrieved from

¹ Cunha, Rodrigo A. (2019, April). *Coffee and Human Health: What we know and what we would like to know*. In R. D. Prediger; C. Tasca. *Coffee and Health Symposium. Lecture conducted from Graduate Program in Pharmacology, UFSC, Brazil*.

² IBGE (2010-2015). *Synoptic tables [Microsoft Excel spreadsheet]*. Brasília, DF: IBGE. Available from: <https://www.ibge.gov.br/estatisticas/economicas/contas-nacionais/9056-conta-satelite-de-saude.html?=&t=downloads> [accessed 14 April, 2019]

- <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84872116645&doi=10.1108%2f09574091211265369&partnerID=40&md5=f2bb22935512780abdb925d077b0141f>. doi:10.1108/09574091211265369
- Boehlje, M., Doehring, T., & Sonka, S. (2005). Farmers of the future: Market segmentation and buying behavior. *International Food and Agribusiness Management Review*, 8(3), 52-68. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-27544447999&partnerID=40&md5=58d8998d60bed2207557c9b77e7c1772>.
- Crossan, M. M., Lane, H. W., & White, R. E. (1999). An organizational learning framework: From intuition to institution. *Academy of Management Review*, 24(3), 522-537. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-0033247585&doi=10.5465%2fAMR.1999.2202135&partnerID=40&md5=6532d037e77087a2798f6a2bd2b6e1f0>. doi:10.5465/AMR.1999.2202135
- Davis, J. H., & Goldberg, R. A. (1957). *A concept of agribusiness*. Boston (MA): Harvard University, Division of Research, Graduate School of Business Administration.
- de Almeida, L. F., & Zylbersztajn, D. (2017). Key success factors in the Brazilian coffee agrichain: Present and future challenges. *International Journal on Food System Dynamics*, 8(1), 45-53. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85013632183&doi=10.18461%2fijfsd.v8i1.814&partnerID=40&md5=a7ce558a479d4807655108f6f1ceb7e0>. doi:10.18461/ijfsd.v8i1.814
- Drucker, P. F. (1999). Beyond the information revolution. *Atlantic Monthly*, 284, 47-57.
- Encarnação, R. d. O., & Lima, D. R. (2003). *Café & Saúde Humana* (C. B. d. P. e. D. d. Café, Trans. E. Café Ed.). Brasília, DF: Ministério da Agricultura, Pecuária e Abastecimento.
- Fernandes, R. P., Grosse, I. R., Krishnamurty, S., Witherell, P., & Wileden, J. C. (2011). Semantic methods supporting engineering design innovation. *Advanced Engineering Informatics*, 25(2), 185-192. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-79954416879&doi=10.1016%2fj.aei.2010.08.001&partnerID=40&md5=88b010af649d83bca5a144bebd3bbe4f>. doi:10.1016/j.aei.2010.08.001
- Fischer, E. F., Victor, B., Robinson, D., Farah, A., & Martin, P. R. (2019). CHAPTER 1 Coffee Consumption and Health Impacts: A Brief History of Changing Conceptions. In *Coffee: Consumption and Health Implications* (pp. 1-19): The Royal Society of Chemistry.
- Gessi, N. L., Allebrandt, S. L., Bussler, N. R. C., Baggio, D. K., Sausen, J. D. F. C. L., Froemming, L. M. S., & Da Silva, N. M. (2017). Knowledge management as a strategy for maintenance of talents in a company the business of agribusiness. *Espacios*, 38(13). Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85015161704&partnerID=40&md5=007228fb3d2b81339a9cc44ca3044795>.
- Gómez-Pérez, A., Fernández-López, M., & Corcho, O. (2010). *Ontological engineering : with examples from the areas of knowledge management, e-commerce and the semantic Web*. London; Berlin; Heidelberg: Springer.
- Grynszpan, M. (2012). Origens e conexões norte-americanas do agribusiness no Brasil. *Revista Pós Ciências Sociais*, 9(17).
- Gunderson, M. A., Boehlje, M. D., Neves, M. F., & Sonka, S. T. (2014). Agribusiness Organization and Management. In *Encyclopedia of Agriculture and Food Systems* (pp. 51-70): Elsevier.
- Hatzold, T. (2012). Introduction. In Wiley-Blackwell (Ed.), *Coffee : emerging health effects and disease prevention* (pp. 1-20). New Delhi, India.
- Hinton, B. (2003). Knowledge management and communities of practice: An experience from Rabobank Australia and New Zealand. *International Food and Agribusiness Management Review*, 5(3). Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-27544465847&partnerID=40&md5=451e8e514fe359ea84ad2f6055d0e875>.
- Horáková, T., Rydval, J., & Houška, M. (2017). Creating the knowledge-structured texts in agriculture companies: A cost modeling approach. *Agris On-line Papers in Economics and Informatics*, 9(2), 67-77. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2->

- s2.0-85021301160&doi=10.7160%2faol.2017.090206&partnerID=40&md5=78a9528e48d457a813da8d627acb4bbd. doi:10.7160/aol.2017.090206
- Illy, A., Alessandre, V., McDowell, G., & Codice, E. (2015). *A Coffee Dream*. Torino: Codice Edizioni.
- Jatib, M. I., Vilella, F., Ordoñez, H., Napolitano, G., & Palau, H. (2003). Agribusiness executive education and knowledge exchange: New mechanisms of knowledge management involving the university, private firm stakeholders and public sector. *International Food and Agribusiness Management Review*, 5(3). Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-27544504298&partnerID=40&md5=8f54b696cfbd0bfed67c9cf2633fb1e6>.
- Kalaki, R. B., & Neves, M. F. (2017). Plano estratégico para o sistema agroindustrial citrícola brasileiro. 24(2), 338-354.
- Kasai, J. L. (2016). O café não nasce ruim, ele fica ruim. Retrieved from <http://revistacafeicultura.com.br/index.php?tipo=ler&mat=61042>
- Lokker, B. (2016). Coffee Roasts from light to dark. Retrieved from <https://www.coffeecrossroads.com/coffee-101/coffee-roasts-from-light-to-dark>
- López, M., Hernández, A., & Marulanda, C. E. (2014). Processes and knowledge management practices in production chains of Colombia. *Informacion Tecnologica*, 25(3), 125-134. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84905232558&doi=10.4067%2fS0718-07642014000300015&partnerID=40&md5=782cc957ee9b59578c1eddd30c9e6a47>. doi:10.4067/S0718-07642014000300015
- Ma, Y. N., & Huang, S. (2014). The collaboration pattern, trust relationship, and transferring and learning willingness: Evidence of China's agribusiness and farmers. *International Journal of Services, Technology and Management*, 20(1-3), 31-46. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84904873747&doi=10.1504%2fIJSTM.2014.063587&partnerID=40&md5=41682ff5e38fe3247127e0b29e9d93e5>. doi:10.1504/IJSTM.2014.063587
- Margherita, A., Secundo, G., & Taurino, C. (2009). New challenges for agribusiness management. Designing a curriculum for competencies building. *International Journal of Continuing Engineering Education and Life-Long Learning*, 19(1), 19-33. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-59849122732&doi=10.1504%2fIJCEELL.2009.023056&partnerID=40&md5=4482f6a088a977427f163c7238c717ba>. doi:10.1504/IJCEELL.2009.023056
- Melo, W. L. d. B. (2004). A Importância da Informação Sobre do Grau de Torra do Café e sua Influência nas Características Organolépticas da Bebida. Retrieved from http://savassicafe.com.br/assets/documentos/ct58_20041_1_copia_em_alta_resolucao1.pdf
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis : an expanded sourcebook*.
- Mioto, B. M. (2015). *Influências do consumo de café em diferentes torras em variáveis cardiológicas de voluntários com doença coronariana crônica*. (Tese de Doutorado), Universidade de São Paulo, São Paulo.
- Nagaoka, M. d. P. T., Ensslin, S. R., Ensslin, L., & Nagaoka, A. (2011). Gestão de uma fazenda experimental utilizando o Balanced Scorecard. *Latin American Journal of Business Management*, 2(2).
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company : how Japanese companies create the dynamics of innovation*. New York [etc.]: Oxford University Press.
- Ostrom, E. (2011). Background on the Institutional Analysis and Development Framework. *Policy Studies Journal*, 39(1), 7-27. doi:10.1111/j.1541-0072.2010.00394.x

- Pacheco, R. C. S. (2016). Coprodução em Ciência, Tecnologia e Inovação: Fundamentos e Visões. In E. CRV (Ed.), *INTERDISCIPLINARIDADE: universidade e inovação social e tecnológica* (pp. 21-62).
- Pacheco, R. C. S., Freire, P. P., & Tosta, K. C. B. T. (2011). Experiência multi e interdisciplinar do Programa de Pós-Graduação em Engenharia e Gestão do Conhecimento da UFSC. In *Interdisciplinaridade em ciência, tecnologia e inovação* (Vol. 1, pp. 869-996). Barueri, SP: Manole.
- Polanyi, M. (2013). *The tacit dimension*. Chicago, Ill: The University of Chicago Press.
- Porter, M. E. (2004). *Competitive advantage*. New York; London: Free.
- Rautenberg, S., Todesco, J. L., & Steil, A. V. (2010). Domain Ontologies for mapping knowledge management instruments and knowledge engineering computational agents: The state-of-the-art. *Perspectivas em Ciencia da Informacao*, 15(2), 163-182. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-78649461325&partnerID=40&md5=471ad59d6915f1e412238e2b23d5325f>.
- Samoggia, A., & Riedel, B. (2019). Consumers' Perceptions of Coffee Health Benefits and Motives for Coffee Consumption and Purchasing. *Nutrients*, 11(3). doi:10.3390/nu11030653
- Sánchez, D. L. V., & Betancur, H. E. N. (2016). Systematic review of the literature associated with agribusiness. *Espacios*, 37(18), 1-19. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85044096897&partnerID=40&md5=772af006063016e4e52b8d8f680bbe0b>.
- Satolo, E. G., Hiraga, L. E. S., Goes, G. A., & Lourenzani, W. L. (2017). Lean production in agribusiness organizations: multiple case studies in a developing country. *International Journal of Lean Six Sigma*, 8(3), 335-358. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85025806127&doi=10.1108%2fIJLSS-03-2016-0012&partnerID=40&md5=cdbc72c61229633047a08cc5d5ad74d0>. doi:10.1108/IJLSS-03-2016-0012
- Shaposhnikov, S., Hatzold, T., Yamani, N. E., Stavro, P. M., Lorenzo, Y., Dusinska, M., . . . Collins, A. (2018). Coffee and oxidative stress: a human intervention study. *European Journal of Nutrition*, 57(2), 533-544. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84995747109&doi=10.1007%2fs00394-016-1336-4&partnerID=40&md5=59dfbf8f13fca6fea81f8c99226bba1a>. doi:10.1007/s00394-016-1336-4
- Sharif, A. M. (2004). *Knowledge representation within information systems in manufacturing environments*. (Doctor of Philosophy), Brunel University, London. Retrieved from <http://bura.brunel.ac.uk/handle/2438/2455>
- Shehabuddeen, N., Probert, D., Phaal, R., & Platts, K. (1999). Representing and approaching complex management issues: Part 1-Role and definition. *Centre for Technology Management Working Paper*(2000/03). doi:<http://dx.doi.org/10.2139/ssrn.1923155>
- Simperl, E. (2009). Reusing ontologies on the Semantic Web: A feasibility study. *Data and Knowledge Engineering*, 68(10), 905-925. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-69249216568&doi=10.1016%2fj.datak.2009.02.002&partnerID=40&md5=dd7b37c9d58691f35b24873107a312fc>. doi:10.1016/j.datak.2009.02.002
- Soulignac, V., Pinet, F., Lambert, E., Guichard, L., Trouche, L., & Aubin, S. (2017). GECO, the French Web-based application for knowledge management in agroecology. *Computers and Electronics in Agriculture*. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85034094484&doi=10.1016%2fj.compag.2017.10.028&partnerID=40&md5=c3c99c89664e5f2df4e674f061256a2>. doi:10.1016/j.compag.2017.10.028

- Stewart, T. A. (2010). *Intellectual capital : the new wealth of organizations*. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=722402>
- Studer, R., Benjamins, V. R., & Fensel, D. (1998). Knowledge Engineering: Principles and methods. *Data and Knowledge Engineering*, 25(1-2), 161-197. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-0032026995&doi=10.1016%2fS0169-023X%2897%2900056-6&partnerID=40&md5=fbd5875fdb4864dbd419630a3770cb9f>. doi:10.1016/S0169-023X(97)00056-6
- Sutton, R. I., & Staw, B. M. (1995). What theory is not. *Administrative science quarterly*, 371-384.
- Toffler, A. (1991). *The Third Wave*. New York, N.Y.: Bantam Books.
- Trade, C. W. M. a. (2018). *Coffee: World Market and Trade*. Retrieved from <https://apps.fas.usda.gov/psdonline/circulars/coffee.pdf>
- Trauer, E., Valdati, A. d. B., da Costa, E. M., Trzeciak, D. S., & Varvakis, G. (2017). *O conhecimento e a cadeia produtiva do café*.
- Trauer, E., Valdati, A. d. B., Todesco, J. L., & Costa, E. M. d. (2018, 4-6 July 2018). *Knowledge Representation of the Specialty Coffee Agribusiness System*. Paper presented at the 13th International Forum on Knowledge Asset Dynamics - IFKAD, Delft University of Technology.
- Weick, K. E. (1995). What theory is not, theorizing is. *Administrative science quarterly*, 40(3), 385-390.
- Whetten, D. A. (1989). What constitutes a theoretical contribution? *cademy of management review*, 14(4), 490-495.
- Wilk, E. d. O., & Fensterseifer, J. E. (2003). Towards a national agribusiness system: A conceptual framework. *International Food and Agribusiness Management Review*, 6(2), 99-110. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-27544438579&partnerID=40&md5=4746ef1960ddbc328a1899cc3adda149>.
- Zanni-Merk, C., Cavallucci, D., & Rousselot, F. (2011). Use of formal ontologies as a foundation for inventive design studies. *Computers in Industry*, 62(3), 323-336. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-79952445055&doi=10.1016%2fj.compind.2010.09.007&partnerID=40&md5=0180be7f9ebbeab142cdf2ce9c01f5cc>. doi:10.1016/j.compind.2010.09.007

Citizen Participation: a Buzz Word to Evaluate the European Capital of Culture?

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Abstract

As citizen participation and participatory governance have become central concepts in the cultural policies at EU level, we are interested in understanding what this entails in practice. While, generally speaking, participation has been deeply scrutinized in political science and public administration literature, how citizens become participants in a process of co-creation of culture, who benefits from this participation and why is rarely discussed. By focusing on the European Capital of Culture initiative, which has become widely recognized as one of the most prominent EU cultural initiatives, we offer a thorough analysis of the participatory practices and of the challenges to participation that unfolds over the development of the ECoC projects. Adopting a Systematic Literature Review, we discuss the variety of participatory practices in real cases of ECoC, many of which, however, cannot be labelled as practices of “participatory governance”. We contribute to the stream of research on citizen participation, highlighting the selective practices that are hidden under the veil of inclusivity. These results are valuable both from a theoretical and a practical perspective.

Keywords – European Capital of Culture, citizen participation, citizen engagement, societal impact, EU policies

Paper: Academic Research Paper

1. Introduction

EU cultural programmes and policies have included the issue of citizen participation, as it is witnessed by numerous cultural policy briefs related to the European Agenda for Culture, the EU Council decisions, and documents related to cultural work programmes. More specifically, the EU has introduced the issue of participation in the WPC 2011-2014, referring to topic of “better access to and wider participation in culture, especially for socio-economically disadvantaged groups”. In the WPC 2015-2018 the EU introduced the issue of participatory governance (WPC 2015-2018). According to Fischer (2012), “participatory governance is a variant or subset of governance theory that puts emphasis on democratic engagement, in particular through deliberative practices, a form of democratic engagement to deepen citizen participation in the governmental process” (Fischer 2012: 457).

Shifting from the policies levels to the practices, the OMC report (2018) shows that there are a variety of participatory practices in cultural heritage, many of which, however, cannot be labelled as practices of “participatory governance”. In fact, although there might be a high level of involvement of citizens or communities, such practices do not necessarily foresee a system of “shared decision-making and responsibility” for the cultural sector at stake.

Numerous methods and programs in the cultural field have defined a common European approach to cultural heritage. Among these programs, the designation of selected cities as European Capital of Culture (ECoC) has received greater attention and emphasis over the last decade. The ECoC initiative has been more and more centered on participation as well. In fact, since 2000 participation has become one of the criteria to select the city to become the ECoC of the year. Nevertheless, according to Nagy (2018), the participatory governance approach is not detectable in the ECoC program. In fact, decisions and guidelines do not foresee citizen participation in public decision-making processes. Furthermore, Nagy highlights that the framing of participation in fact unveils selective practices under the “veil of inclusivity” (Nagy, 2018, p. 244).

Responding to the call for further research on this topic, we shift the level of analysis from the EU policy level to the implementation of ECoC at “the local level of city leadership” (Nagy, 2018, p. 254). The purpose of this paper is thus to scrutinize the concept of citizen participation in ECoC local initiatives and to compare it against the participatory governance approach. While generally speaking citizen participation has been deeply scrutinized in political science and public administration literature, how citizens become participants in a process of co-creation of culture, who benefits from this participation and why, is barely discussed (Cooke & Kothari, 2001; Holdgaard & Klastrup, 2014). Hence, in this paper, focusing on ECoCs, we address the following research questions: *i*) How is participation translated in ECoC initiatives?; and *ii*) Does it lead to citizen involvement in decision-making processes?

In order to answer to these questions, we adapt Nagy’s framework based on Turnhout, Van Bommel and Aarts (2010) in order to analyse three selected cases of ECoC (Aarhus, Umeå, and Matera).

By providing one of the very few studies on ECoC citizen participation we contribute to the stream of research aimed at investigating the challenges, problems and difficulties associated with the processes of evaluating, fostering and monitoring citizen participation.

Our analysis shows that: a) the various actors who take part in the ECoC initiatives perceive and interpret the concept of participation in a wide array of different modes; b) not only the framing of participation unveils selectivity, further selective practices are embedded in the mechanisms that are used to pursue community engagement and participation; c) the actual participation never translate into the decision-making processes in the development of the whole cultural project.

2. Background

Europe is facing a controversial phenomenon, as on side fewer Europeans are ‘engaging in cultural activities’ (European Commission, 2013) whereas on the other side, a greater emphasis on “audience engagement”, “audience development”, “citizen engagement”, and in general “participation” can be detected in various policy statements at EU, national, and regional levels (Jancovich & Bianchini, 2013; Bianchini & Borchini, 2018).

On the verge of the “participatory turn in EU policy” (Saurugger, 2010), cultural policies have been embracing the issue of democratic decision-making processes that can concern creation processes and/or programming choices. Indeed, cultural policies have been dealing with access and participation in culture for a long time (Tomka, 2013). Recent trends, such as the budget cuts, the digitalization, and the globalization, have emphasized the focus on participation in culture. In fact, the general understanding of cultural audience has shifted from passive to active, and to super-engaged (Tomka, 2013). Participatory Cultural Initiatives - PCIs - (Biondi et al., 2018) include a participation also of non-professionals in cultural programs and policies.

Several EU policy briefs, documents, and reports claim such emphasis on participation, by recalling various levels of participation (e.g. OMC, 2012). The concept of participation entails highly diverse cultural, psychological and social actions; thus, very different forms of promoting ways of participation can be envisioned. Within the European Agenda for Culture, the Work Plan for Culture 2015-2018 introduces the concept of participatory governance of cultural heritage as one of the topics in the priority area concerning cultural heritage. In this document, participatory governance is intended as the “multilevel governance of tangible, intangible and digital heritage”, involving the “public sector, private stakeholders and the civil society” (Council of the EU, 2014, p. 11). This concept is further explained in the Work Plan for Culture 2019-2022, where participatory governance is recalled regarding both the priority of sustainability of cultural heritage and in that of cohesion and well-being. More in details, participatory governance is envisioned as an “innovative, people-centred and forward-looking approach, introducing a real change in how cultural heritage is managed and valued” (Council of the EU, 2018, p. 9). It must be said though that none of these documents

specify in details what participatory governance entails in practice, thus leaving room for very different interpretation and implementation.

If we look more in details to a specific cultural programme, such as the ECoC initiative, we still find a background that remains vague and undefined with respect to participation. In her original scrutiny of the main policy documents related to ECoC, Nagy (2018) points out that from 1999 to 2014 an apparent shift in the official ECoC program documents took place regarding the scope of participation from the supranational level (“state level regulation”) to the regional and local levels (“multilevel governance”). In particular, in 445/2014 Decision local participation is introduced in a way that seems to overlap with Fischer’s definition: “...a form of democratic engagement to deepen citizen participation in the governmental process” (Fischer, 2012, p. 457). However, since this large scope of participatory frame is more an option rather than a requirement, the ECoC initiative contains “selectivities under the veil of inclusivity” (Nagy, 2018, p.254). In other words, in the face of an apparent openness to citizen participation addressed to the entire local community, these policies define and structure groups/segments of local population (“specific roles”) for the satisfaction of specific functions. Among these groups, in particular two groups should have a central role according to the ECoC framing: the public decision makers, and the group of local artists and cultural activists (“the experts”). The latter serve as intermediaries between the local community in which they are rooted and the ECoC board, hence they are able to represent the needs and the interest of the civil society. Furthermore, as regards more specifically the participatory governance in the different stages of the ECoC program (planning, decision making and implementation stages), the participation frame never reached the level of partnership but aimed to promote “open advice” or “consultation”. Therefore, the participatory governance framing contained in the ECoC policies only fulfills the scope of “representative democracy”.

3. Methodology

The aim of this paper is to understand how participation is addressed in the ECoC program, and to discuss the framework of citizen participation stemming from the EU policy statements against its implementation as it emerges in various experiences of ECoCs. In order to collect evidence on specific ECoC cases, we applied a Systematic Literature Review (SLR), intended as a comprehensive search for relevant studies on a specific theme and a subsequent analysis of those studies according to a predefined explicit framework (Klassen et al., 1998).

We identified the publications through searches of electronic databases, such as Google Scholar and Scopus. As regards inclusion and exclusion criteria, we included studies that: (a) use the keywords “European capital of culture” and “citizen participation”; (b) were published either in a peer-reviewed journal or in official documents, report, forum and press releases; and (c) were written in the English language. No restriction was placed on year of publication. Then, a second screening allowed to select and retrieve the full text of the eligible studies against inclusion criteria, such as: (a)

be an empirical study on a real ECoC case; (b) discuss citizen participation as the main topical theme.

4. Results

As a result of the SLR, we identified about 20 papers, among which we selected those that specifically dealt with the participatory processes in real ECoCs, and that could be analysed in terms of our proposed questions adapted from Nagy's sensitising questions for the analysis of participation (2018):

- 1) Who participated in the specific ECoC under study?
- 2) In what did they participate?
- 3) Why did they participate?

We provide an overview of the findings in the following paragraphs, per each ECoC (Umeå 2014; Aahrus 2017; Matera 2019).

4.1 Umeå 2014

For the analysis of Umeå2014 case we selected three papers: Näsholm and Blomquist (2014); Wählin (2015); Hudson, Sandberg, and Schmauch (2017).

Hudson et al. (2017) focus on the concept of co-creation and the way it was operationalized by cultural officials and the participants during the Umeå Capital of Culture development process.

The city has been designated ECoC2014 thanks to its focus on citizen participation and the "co-creation" of culture. In Umeå the first shape of participatory process is evident since the beginning of the bidding process (Autumn 2007). The municipality addressed intensive calls to local inhabitants, local cultural actors/practitioners, larger established organization and smaller organizations (*who?*) to promote their involvement in putting together the ECoC Bid, titled "Curiosity and Passion –the Art of co-creation" and in compiling the programme for the year (*in what?*). In the city official narrative, the extensive process of participation was promoted as a means to give legitimacy to the project (*why?*). There was another "partly complementary and partly divergent" narrative that saw co-creation as a "well timed marketing strategy" for selling the city (Hudson et al, 2017, p. 1544). This narrative sees "culture" as an engine of the city's growth and "voluntary participation" as the idea that everyone can contribute to creating cultural growth (*why?*). To encourage the voluntary participation of cultural actors/practitioners in producing the Bid and its programme, the city officials implemented numerous measures without providing any compensation for their participation in the belief to give participants the opportunity to maintain their independence. However, different visions emerged during the application phase between the municipality and the participants about the way to conceive the co-creation practices, and specifically about: a) whether it was appropriate or not to reward the participants for their involvement in the production of ideas; b) how to take into account the unequal power relationships between the municipality and the small independent participants; c) what possibilities existed for a small independent participant to affect a process managed and controlled by the

municipality; d) the difficulties in understanding if and in what the co-creation processes differ from the collaboration. This criticism became part of a public narrative about Umeå2014 process and illustrates dissatisfaction with how co-creation was staged.

All the three papers that are included in our sample analyse the co-creation process that took place after the designation of Umeå2014. As described in Näsholm and Blomquist (2014), the municipality actively invites the entire Umeå Community - individual artists, volunteers, small organizations and large institutions (*who?*) - to produce the content of the project and the events to be realized during the ECoC year (*what?*).

The main idea of the city officials was that most of the cultural production and events should be done by the local actors in the city in order “to investigate the most creative ideas and to get many people to be responsible in the realization of the program” (*why?*), as stated by an Official in the municipality of Umeå2014 (p. 18). To encourage the development of small projects and cultural initiatives, the Umeå2014 project team used a simplified procedure named “Cultural Boost” through which cultural actors could apply for co-funding (or funding if the request did not exceed €2.200). Over 200 applications were received and less than half were funded by Umeå2014.

This phase of the development of the program of Umeå2014 has given rise to tensions and flaws in the real participatory process. First, different interpretations emerged of the concept and practices of co-creation. As an example, a politician claimed that “Now the audience should not just be a part of it, they should be a part in creating it. They are allowed to be part of the decision-making” (Näsholm and Blomquist, 2014, p. 17), whereas a program producer reported “What’s open source? [...] What does it mean, really? It’s easy to talk about open source, loosely” (p. 19). Hence, the meaning of co-creation communicated officially was mainly a broad ideal and a value that the politicians were trying to promote, but it was understood mainly as a general invitation to participate.

Second, different actors were able to respond to the application procedure leveraging a very diverse set of resources and competencies. In fact, large cultural institutions were accustomed to these application procedures and possessed all the required resources and knowledge, whereas smaller organizations and free-lance artists were not familiar with those procedures (Näsholm and Blomquist, 2014).

Third, a grey area in participation is related to the selection process that resulted in the list of the projects that were actually funded and included in the program. The selection process, that was managed by Umeå2014 project team, was not inclusive as the applicants did not have any stake in the final decision (Wählin, 2014).

4.2 Aarhus2017

The analysis of Aarhus2017 is based on Eriksson and Stephensen (2015). In detail, this paper focuses on a micro project under the main umbrella program of the ECoC event, called “The playful society”. The ECoC organisers (the Aarhus2017 Secretariat) asked for participation in the phase of planning cultural events (*in what?*) oriented to outreach and engage young audiences (*who?*). This decision stemmed from the goal to engage young people in “culture and society” against a widespread conception that

youngsters are a “somewhat problematic segment of the population” (Eriksson and Stephensen, 2015, p. 55) to be involved in civic participation in social organizations or in cultural institutions. Hence, a call was launched directed to young cultural entrepreneurs, who, as Nagy (20018) underlines, are included in a specific cluster of citizens (local artists and cultural organisers). Indeed, young cultural entrepreneurs were supposed to be a link with the local youngsters.

What emerges from the above-mentioned study is that there were different conceptions of participations among the ECoC organisers and the young cultural entrepreneurs correlated with different rationales and expectations (*why?*). In fact, the young project initiators perceived their inclusion in the program and the funding by Aarhus2017 as an official recognition that could be added to their CVs (p. 57). However, it was also a means to change or create something new, a way “to influence the living conditions and social communities not only of themselves, but of the cities in which they live” (p.61). On the other side, the organisers had the interest of legitimization in launching a call responding to the main goal of inclusion in the ECoC motto “a project and an opportunity for everyone” (p. 53).

However, it should be said that the goal of a wide participation of young cultural entrepreneurs failed, because only 32 proposals were submitted, out of which 24 were funded. The poor interest in the call might be related to a bad communication. Moreover, in realising the cultural projects, the young participants complained the lack of supervision and follow-up by the Aarhus2017 artistic administrators, which was primarily experienced not as a liberating lack of control, but as a confusing and somewhat demotivating lack of interest and interaction. Another criticism was related to the lack of coordinating direction to foster networking across diverse youth groups.

4.3 Matera2019

Regarding the Matera2019 case, Demartini, Marchiori & Marchegiani (2018) analyse what dynamics of participation unfolds from the initial idea to the formal designation as Capital of Culture.

The authors deem that a participatory process in public decision-making emerged only in the initial phases of the initiative, when citizens and civil society were involved to gather ideas and build collective knowledge. Hence, in those phases, cultural professionals and entrepreneurs, citizens represented by their not-profit or cultural associations (*who?*) were engaged by public officials in the decision-making process. In this phase, citizens and their associations play the role of co-designer of the first cultural program (*in what?*). Participation, in fact, was one of the fundamental elements that qualified the candidacy of Matera in the competition for ECoC2019. “Together” was chosen as the brand of the Matera2019 candidacy program and it was also the title of the first Bid book prepared for the application. In this vein, citizens were considered by the organisers (public officials) as valuable partners in order to enrich the content of the first Dossier and increment the likelihood to obtain the inclusion in the short list (*why?*).

Consequently, in this phase public officials have also been interested in implementing mechanisms that facilitate their active participation such as the launch of the online

Community, through which they collected 171 projects from civil society and the encouragement of “digital” volunteers to spread the Matera2019 candidacy around the world.

On the other side, the cultural project built on the feelings of identity of the citizens to enhance their history, strengthen their values, and focus on the peculiarities of their territory (*why?*). Indeed, in the first dossier, an idea of culture prevails as a resource on which to leverage a new social project and the enhancement of the city and its inhabitants.

Once the designation in the short list of the five candidate cities to obtain ECoC title was gained, a progressive decrease in the participatory process happened. The Matera 2019 project team established the Foundation Matera Basilicata 2019 that was founded by public and private actors with the fundamental mission to compile the cultural program outlined into the second Bid book. The phase of the production of the cultural program was characterised by considerable centralisation of decision-making processes led by the public administration and by a consequent weakening of the participatory process (Demartini et al., 2018, p.531).

5. Discussion and Conclusions

The present paper aims to provide a contribution to unlock the concept of citizen participation, as it unfolds in empirical contexts against how it is envisioned at the political EU level, in the specific context of ECoC.

We focus on real case studies of ECoC in order to understand how participation is actually enacted and put into real practices. In fact, as participation in public cultural policies is by nature situated and dependent from the context, any study of the participatory practices must consider the social contexts in which they are embedded. Our analysis of the selected ECoCs confirm that co-creation emerges as something “messy, raw and context dependent” (Walmsley, 2013, p.117).

Analysing how participation is translated in ECoC, all the cases show controversial elements about how citizens participation results in co-creation of culture, who really benefits from this participation, and why. First, in terms of who is involved in the participatory practices, we show that a substantial difference exists in all the cases between the formal narrative of the participation approach and the actual practices. In some cases, whereas a broad and inclusive approach is declared, the practices indeed unveil selectivity.

Moreover, when we analyse the rationale for participation (*why?*), some elements of selectivity still persist. In fact, the intentions of the public officials/municipality/project team seem to converge into the ideals of representing many types of people and their variety and diversity. At odds, the reality shows a very different picture, where this ample representation remains at an ideal level. Minorities and sub-cultures are very unlikely to reach visibility in the actual ECoC program.

Finally, our analysis discusses in what participation is sought. First of all, a difference must be made between the very initial phases of the ECoC initiatives and their subsequent development. In fact, the Matera2019 as well as the Umeå2014 cases confirm that it is

very likely that a high level of citizen participation is reached in the initial phases of the candidacy process, when it is necessary to gather many ideas and a high level of enthusiasm is shared among all the actors to produce the first Bid . Umeå2014 and Aarhus2017 also show that the participation is high in the phase of compiling the ECoC program. In fact, a very open call for cultural ideas and cultural projects was launched in both cases. Nevertheless, we claim that the actual mechanisms that are put into practice to promote citizen participation can instil selectivity. In some cases, the application procedures bear selectivity, because they set application criteria that required a level of competencies and knowledge that was not common to all the potential applicants. In the intentions of the organizers, using the application procedures was meant as a coordinating mechanism to boost actions, it in fact lead to excluding some actors, especially volunteers and individual artists.

In other cases, the selective practices are constituted by the selection processes of the ideas that converged into the Bid (initial phase) and of the projects to be included in the program (later phase). The project team of each ECoC was in charge of the selection process, which resulted in preferring large and mainstream projects over the smaller and more original ones.

Moreover, our analysis of the cases of ECoC highlights a further critical element to enable real participation in the development of the cultural projects. In fact, some participants refer to the lack of ad “hoc mechanisms”, intended as coordinating mechanisms to help and lead young artists to perform and to establish long lasting connections among each other.

The decreasing level of participation associated with the different phases of the projects suggests that the public actors may make an instrumental use of participation, aiming to obtain legitimacy and consent that are useful solely for the purposes of candidacy.

All considered, we discuss our findings in light of the concept of participatory governance, which seems to be more and more central in the EU cultural policies. We refer to participatory governance as participation in the decision-making processes in cultural events. Against this, our discussion of the ECoCs shows that participants are involved in the decision-making process only in marginal ways. In some cases, they participate in some phases (ideas collection) but they are not involved in the whole process of developing a cultural project as part of the Capital of Culture year (including planning, sourcing, equipment, facilities, exchange of competences etc.). More importantly, citizens are never involved in the most important decisions, such as the selection processes of ideas, events, and projects.

Our study contributes to the debate on participatory governance in cultural heritage as an opportunity for economic and social development and renewal of local communities. It can offer suggestions and insights for the EU Legislator to design new rules to make citizen participation in the ECoC events more effective and for the regional public administration to define new cultural policies able to engage the local communities.

References

- Aarhus 2017 (2014): "Aarhus 2017 supporting young entrepreneurs" Retrieved by Eriksson & Løhmann Stephensen (2015) from [http:// www.aarhus2017.dk](http://www.aarhus2017.dk)
- Bianchini, F., Borch, A. (2018) "Participation in arts activities in the context of European urban cultural policies" in Bonet, L., & Négrier, E. (Eds) *Breaking the Fourth Wall: Proactive Audiences in the Performing Arts. Oslo, Kunnskapsverket*, available online at http://www.bespectactive.eu/new/wp-content/uploads/2018/07/Breaking-the-Fourth-Wall_publication.compressed.pdf
- Biondi, L., Demartini, P., Marchegiani, L., Marchiori, M., & Piber, M. (2018). The Outreach of Participatory Cultural Initiatives: the Importance of Creating and Exchanging Knowledge. In Proceedings of the IFKAD2018, Delft, the Netherlands 4-6 July 2018.
- Cooke, B., and Kothari U. (2001). "Participation: The new tyranny?". Zed books, 2001.
- Council of the EU (2011). Work Plan for Culture 2011-2014- Conclusions of the Council and of the representatives of the governments of the member states, meeting within the Council – available at https://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/educ/117795.pdf (retrieved April 2019).
- Council of the EU (2014). Work Plan for Culture 2015-2018 - Conclusions of the Council and of the Representatives of the Governments of the Member States, meeting within the Council, on a Work Plan for Culture (2015 - 2018) – available at <http://data.consilium.europa.eu/doc/document/ST-16094-2014-INIT/en/pdf> (last retrieved April 2019).
- Council of the EU (2018). Work Plan for Culture 2019-2022 - Draft Council conclusions on the Work Plan for Culture 2019-2022 - available at <http://data.consilium.europa.eu/doc/document/ST-13948-2018-INIT/en/pdf#http://data.consilium.europa.eu/doc/document/ST-13948-2018-INIT/en/pdf> (last retrieved April 2019).
- Demartini, P., Marchiori, M. and Marchegiani, L., (2018). Citizen Engagement as a Criterion to Select the European Capital of Culture: a Critical Appraisal. In 13th international forum on knowledge asset dynamics (IFKAD) Proceedings 2018, Delft, Netherlands.
- Eriksson, B., & Stephensen, J. L. (2015). Rethinking participation and re-enacting its dilemmas? Aarhus 2017 and "the Playful Society". *Conjunctions. Transdisciplinary Journal of Cultural Participation*, 2(2), 48-66.
- European Commission (2013). *Press release: survey shows fall in cultural participation in Europe* [online]. Available from: http://europa.eu/rapid/press-release_IP-13-1023_en.htm [Google Scholar]).
- European Union (2018). *Participatory Governance of Cultural Heritage*. Publications Office of the European Union, Luxembourg, 2018. ISBN 978-92-79-67396-2.
- Fischer, F. (2012) 'Participatory Governance: from Theory to Practice'. In: Levi-Faur, David (eds.) *The Oxford Handbook of Governance*. Oxford, United Kingdom: Oxford University Press. 498-511.
- Holdgaard, N., & Klastrup, L. (2014). Between control and creativity: challenging co-creation and social media use in a museum context. *Digital Creativity* 25(3): 190-202.
- Hudson, C., Sandberg, L. & Schmauch, U. (2017). The co-creation (of) culture? The case of Umeå, European Capital of Culture 2014, *European Planning Studies*, 25:9, 1538-1555.
- Jancovich, L. & Bianchini, F. (2013). Problematising participation, *Cultural Trends*, 22:2, 63-66.
- Klassen, T. P., Jahad, A. R., & Moher, D. (1998). Guides for reading and interpreting systematic reviews. *Archives of Pediatric & Adolescent Medicine*, 157(7), 700–704.

- Nagy, S. (2018). Framing Culture: Participatory Governance in the European Capital of Culture programme. *Participations*, 15(2), 243-262
- Näsholm, M.H., & Blomquist, T. (2014). The Meanings of Cocreation of Culture in Lundgren B., Ovidiu M. "Culture and Growth: Magical Companions or Mutually Exclusive Counterparts?. Proceedings UNEECC Forum vol, 7 Umea 2014, pp.10-28, http://uneecc.org/wp-content/uploads/2014/12/UNeECC_Proceedings_2014_B5.pdf
- OMC. 2012. EUROPEAN AGENDA FOR CULTURE
- Saurugger, S. (2010). The social construction of the participatory turn: The emergence of a norm in the European Union. *European journal of political research*, 49(4), 471-495.
- Tomka, G. (2013) Reconceptualizing cultural participation in Europe: Grey literature review. *Cultural trends* 22 (3-4), 259-264.
- Wählin, N. (2015). "Projective cities: Organizing large cultural development initiatives". In Lundgren, B., and Ovidiu, M. *Culture and Growth: Magical Companions or Mutually Exclusive Counterparts?*, Proceedings Umeå, Sweden, 23/24 October 2014 UNEECC Forum Volume 7, Lucian Blaga University of Sibiu Press.
- Walmsley, B. (2013). Co-creating theatre: Authentic engagement or inter-legitimation? *Cultural Trends*, 22(2), 108–118. doi:10.1080/09548963.2013.783176

The Impact of Performance Measurement: New Approaches and Key Implications for Culture Management

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Abstract

Over recent years, in the International scenarios, very few routes have been entered to face the lack of the management dimension within Culture Sector. The contribution of economic disciplines to culture has mainly concerned political economy, rather than corporate disciplines, very often depriving the Cultural landscape of the needed profitable complementarities coming from the interaction between public and private entities. However, the very complexity of cultural heritage - for the territorial extension, to the landscape dimension, for the multiplicity of institutional levels called into question, for the intertwining of protection and valorization policies – should invoke the definition of interdisciplinary corporate operative solutions in order to respond to practical challenges and create value for all the stakeholders involved.

In this framework, the paper aims to define a theoretical and practical performance and measurement model ready to make cultural assets productive, thus demonstrate the impact of managerial private and public tools through to Cultural networks.

Without regard to any other production, authors will grade different combinations of managerial models and analysis with the view to ultimately define an innovative model in order to determine, under qualitative and quantitative terms, the consistent enhancement of artistic and cultural assets within a public-private company perspective.

The work is articulated in four steps: first, a proper analysis of existing task and general environment strategic models is in-depth; then, the assessment of a selection among those as the ideal base for Cultural Sector is shown; moreover, the definition of a new model is analyzed and its economic-financial political feasibility analysis based on a ROI outcomes quantification and Key Performance Indicators (KPIs) is tackled.

The approach undertaken appears to be totally innovative for the original definition of a new forge for the fulfillment of both companies and institutions needs and objectives, in order to fulfill the gap between theory and praxis managerial model applied to Culture. The potential of the research seems evident in consideration of the high feasibility in worldwide contextual realism and companies range, and consequent profitability of the application of the model, since the research represents a full strategic portfolio service package in order to follow the integrated Cultural investment cycle, transcending conventional indicators for the achievement of a medium and long-term economic, social and political value creation.

The attractiveness of the model is going to be crucial for the differentiation of business culture and decision makers in order to contribute to the re-launch of different territorial policies and to contribute to the development of the transparent competitive cultural performances of capital-intensive market. From this point of view, the incentives resulting from the model's application will eventually draw all different stakeholders to differently combined competences and endowments in order to undertake more collaborative and profitable action plan as to acquire a proactive role in the political decision-making, anticipating economic and occupational circumstances and needs.

Keywords – Cultural Organizational Structure, Public-private Relations, Evaluation and Assessment, Business Models, Knowledge Ecosystem.

Nature of the proposed paper: Practical Paper

1. Introduction

“The arts already stand naked and without defence in a world where what cannot be measured is not valued; where what cannot be predicted will not be risked; where what cannot be controlled will not be permitted; where what cannot deliver a forecast outcome is not undertaken; where what does not belong to all will be allowed to no one”
(John Tusa)

“Not everything that can be counted counts and not everything that counts can be counted”
(Albert Einstein)

Over recent years performance measurement systems have received increased attention. Those systems have been traditionally focused on financial measures such as sales, profit margin, economic value added, stock price performance or return on investment. It was since the 1990s that both practitioners and academics began to question the relevance of using solely financial performance measurement indicators, arguing that non-financial indicators, if correctly balanced with the former, would have been more deemed to indicate the real managerial efforts within the development of a medium and long-term strategy (Atkinson, Waterhouse and Wells, 1997; Kaplan and Norton, 1992, 1997; Banker, Potter and Srinivasan, 2000). Among those, Kaplan and Norton (2001) were the first to examine the application of multiple dimensions measures to not-for-profit organizations (NPOs), stressing the importance of the consideration of a multiple set of indicators for a more effective and complete evaluation of such realities.

Since then, the consistency and application of multidimensional indicators to score business performances have become increasingly relevant mainly for managers across a wide range of industries contexts characterized by the combination of knowledge and creativity in order to generate and sustain competitive advantage. This is exactly the case of the culture sector where, among others, the quality of customer satisfaction and cultural performances expressions represent the main preconditions for financial metrics. Within this scenario, culture management has to deal with the dilemma to combine ambiguity and dynamism, both of which are intrinsic to cultural goods that serve an aesthetic or expressive purpose rather than an utilitarian one (Bjorkergren 1996, Hirsch 1972, Holbrook and Hirschman 1982). Such characteristics conduct the managers involved with the creation, production, marketing and distribution of cultural goods to manage five different polarities, which shape organizational practices in cultural industries. First, managers must reconcile expression of artistic values with the economics of mass entertainment. Second, they must seek novelty that differentiates their products without making them fundamentally different in nature from others in the same category. Third, they must analyze and address existing demand while at the same time using their imagination to extend and transform the market. Fourth, they must balance the advantages of vertically integrating diverse activities under one roof against the need to maintain creative vitality through flexible specialization. And finally, they must build creative systems to support and market cultural products but not allow the system to suppress individual inspiration, which is ultimately at the root of creating value in cultural industries (Lampel, Joseph, Theresa Lant, and Jamal Shamsie, 2000).

Other academics, such as Cavalluzzo and Ittner (2004) argues as the difficulty and unpredictability of measuring qualitative emotional and expressive outcomes, the lack of clear technological capability, the weakness of the management commitment and the lack of employee training within the culture sector represent the main limit in the development of cultural performance measurement for the definition of clear standards of quality (Bjorkergren 1996, Holbrook and Hirschman 1982, Lewis 1990, Turow 1984).

The matter is therefore what can help the culture management to detect the right multidimensional indicators in order to make them more accountable for metrics purposes? Is there the possibility of finding, developing and maintaining control over resources such as talent, creativity and innovation, which are crucial for the success of a strategy of cultural industries (Jones and DeFillipi 1996, Miller and Shamsie 1996)?

Probably the best way to attempt an answer to such questions, is to focus and rely on the expertise of those sectors that are used to manage, on a daily basis, amorphous resources which cannot be clearly defined, that emerge from unexpected sources and that can lose their value for reasons that are not entirely understood similar to culture ones. One of those sectors is surely the Public Affairs one, that is, unfortunately, rarely incorporated by Culture and Arts organization. At the basis of the selection is the belief that the exploitation and mergers of the relationship between public and private interests still represents an underdeveloped ground for Culture sector, due to contextual and cultural resistances. But while Cultural business' as others, need to be answerable to society/audience for the way they conduct their activities, industries need favorable

political environments, and politicians, in return, need to rely on the expertise of cultural industry leaders to help shape policy with the aim to preserve cultural heritage, rendering the complementary exchange of views progressively mandatory. Unfortunately, despite those interdependent interactions, it happens, very often, that Cultural organizations and politics do not speak a common language. For Cultural business, as underlined, profit maximization and cost efficiency are consequences of their performances expression and are needed in order to survive and in politics, power, consensus and governance are, instead, the central concepts (Christian, 2015). The lack of a high profitable profile of culture sector therefore results in a lower reciprocal knowledge and understanding, usually implying the lost of opportunities, the slowdown of the decision-making process and a public and private waste of resources.

It is precisely to respond to such a climate of mutual incomprehension that Public Affairs and Communication specialized firms should operate, as intermediaries between societies needs, private interests and public recognition. Even because of their supporting role, over the last decades, on the public side, evaluation of advocacy and public affairs has become a new and emerging field capturing the increased attention of professional and less skeptical politicians. Their business is mainly based on the creation of common basis of communication with the attempt to overcome system boundaries that within the Culture sector could aim to render much more predictable the demand patterns, to better monitor and control production processes, to prevent the constant shifting in managerial practices and organizational forms and in shaping consumer preferences based on new methods of distribution, marketing, and promotion, striking a balance between the imperatives of creative freedom and commercial ones. The paper will therefore aim to define a theoretical and practical performance and measurement matrix model able to show the profitable impact of public affairs activities to culture organization structure.

2. Theoretical Framework

Historically literature addressed the issue of performance measurement mainly from the perspective of profit-oriented firms. As anticipated, it was only with the definition of the balanced scorecard by Johnson and Kaplan (1987) that took place the general overcoming of unidimensional approach to performance measurement, adding – for its determination - indicators as customers orientation, growth and innovation. While some saw the balanced scorecard as an innovation in performance measurement, others view it as incomplete. Sawhill and Williamson (2001), for example, argued that even with a multidimensional system very few organizations (both no-profit and profit) had linked their renewed metrics to their mission, introducing the necessity of major coherence between indicators and mission/organization identity. Successively, Atkinson, Waterhouse and Wells (1997) argued as the balanced scorecard was taking into account a limited number of stakeholders, instead fundamental for the definition of an organization, introducing the relevance of stakeholders detection for both internal and external organization expression and success. Moreover, in terms of the implementation of performance measurement systems, Ittner and Larcker (2001) argued that even if a multi-

dimensional approach provided a richer understanding of performance measurement, the practical implications of implementing such an approach limit its applicability, preventing managers from attempting to implement it mainly because of the lack of clear organization. Although criticism it seems that generally the most accepted conclusion is that organizations need to combine financial e non financial indicators selecting and linking performance measurement systems to their respective mission, as well as to their strategy for fulfilling those mission (Atkinson, Waterhouse and Wells, 1997; Sawhill and Williamson, 2001), within the detection of key stakeholders.

The literature on performance measurement within the culture sector is certainly not as extensive than as for others much more profitable sectors. Academics mainly focused their attention on how culture manager should measure performance rather than on how they actually do so. As Forbes (1998) assessed the performance measurement for culture sector remain an area to be explored. Morrison and Salipante (2007) argued as culture management is often very blinded in encompassing the forms of accountability that respond to explicit and objective standards of assessment without understanding that in the culture sector performance measurement implies a multidimensional concept that cannot be captured using one universal model. Also Schuster (1997), pointing out the risk of encouraging undesirable behavior, associated with using a limited number of indicators in order to monitor culture performance. The most basic guidelines concerning what principles should inspire performance measurement in the culture sector is provided by Voss and Voss (2000) who indicated as performance has to be linked to organization's values and strategic orientation to promote a clear mission statement. This principle is, however, not easily implemented by arts sector as one of the main difficulties is balancing the amount of resources needed to achieve artistic excellence with the dire need for funding (Lampel, Lant & Shamsie, 2000). Kushner and Poole (1996) suggested that effectiveness in culture performance measurement sector has four components: satisfying audiences, donors and volunteers; identifying and obtaining financial and human resources; efficiently organizing resources into technologies to present arts performances; and achieving performing arts program objectives. Gilhespy (1999, 2001) also proposed a performance measurement system for cultural institutions, arguing that external evaluation of a cultural institution's performance, including evaluation by the central government, does not take into account the distinctive objectives inherent in the arts sector, therefore suggesting a better needed relationship among public and private stakeholders to reach artistic excellence, innovation, social cohesion, public attendance and financial objectives. Generally it is recognized that weak governance typically results in a casual approach to culture performance assessment, while tighter governance mechanisms will induce performance measurement approaches that are closely tied to the organization's mission (Turbide and Laurin, 2009). When boards had no general consensus about how to measure culture organizational effectiveness, board members tended to monitor in ways that reflected their personal or professional competencies, rather than paying attention to measures needed to identify potential strengths, weaknesses and market opportunities. This result may be related to the fact that organizations do not see themselves as competing with others in terms of artistic

achievement. Activities that should, instead, be very important to the organization's survival. But in order to survive Cultural organization must be deemed legitimate by society (Ackerman, 1975). Since the public affairs function is responsible for managing the interface between the organization and its political and social stakeholders (Post, Murray, Dickie & Mahon, 1982), the way the public affairs function is conducted may be directly related to culture long-term industries survival (Meznar & Nigh, 1993). Since the 1990s the function of public affairs has been increasingly shifting from that of "improving the image" of business to that of "developing relations to consolidate reputation" (Invernizzi, 2005). Successively doctrine has been further developed and expanded, till to recognize those interpretation as restrictive and nearly overcome, considering lobbying and public affairs as one of the most important channel of sector success (Ansolabehere et al. 2003; Bennedsen and Feldman 2002; de Figueiredo and Cameron 2008; Gregor, 2011).

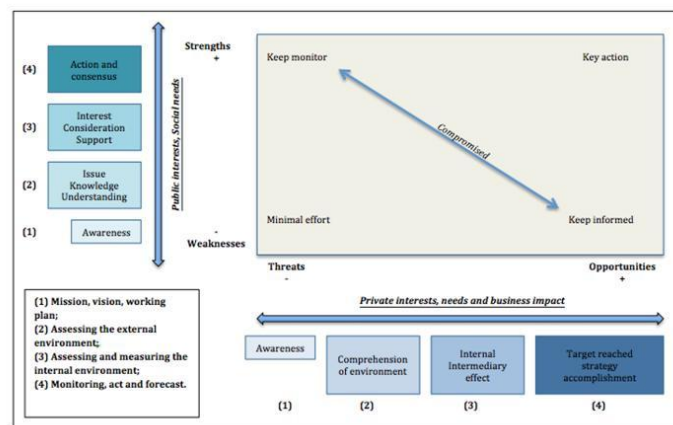
In consideration of the high levels of ambiguity and dynamism of the culture sector, which force managers to seek new models for managing their operations (Hirsch, 1972), authors will grade different combinations of managerial models and analysis with the view to ultimately define an innovative model in order to determine the consistent enhancement of artistic and cultural assets deriving from the application of Public Affairs activities in terms of freedom to operate, cost avoidance, market opportunity or advantage and reputation increasing.

3. A Public Affairs Matrix Proposal as a Culture Strategic Business Model

The role of public affairs establishment and functions is, indeed, to investigate the political groundwork structure with the attempt to recognize the opportunities for culture business coming from the legislative or regulatory interventions and stimulate the exchange of expertise and mutual recognitions. In details, the ultimate goals are: to raise public awareness on potential cultural private and public interests common grounds with the support of communication content and campaign; the identification of relevant stakeholders; the comprehension of the decision making process and the *scenario analysis*; to build a regulatory environment favorable for social, political and economic national and supranational targets; to strength the relational network and culture business external visibility; to stand private interlocutor as qualified partners as key decision makers/influencers in cultural sector policies. As evident those objectives can present themselves as a possible solution to previous theoretical observations and verified gaps and come to be essential both on a proactive and defensive way, in order to define and stimulate culture attractive economic conditions. These are just few reasons why all cultural organizations, with the initial support of a specialized firm, should dedicate, and if existing reinforced, a strategic management function to Public affairs with the task to analyze, interpret and help shaping the internal and external environment, through monitoring the political *arena*, analyzing political and social developments and, basically, representing the culture organization's interests within the political field.

On a strategic point of view, the precise knowledge of the ‘how, when and why’ of the entire decision-making processes and the identification of major decision-makers, almost inevitably gives to culture organization the possibility of easily overcoming obstacles and to anticipate the main changes of the market. Because of its peculiarities, public affairs result in being the main function able to change the fundamental course of a cultural political process already underway and headed in a certain direction. Therefore, as it aimed at detecting opportunities or preventing obstacles, it has to be part of the highest level of management in the cultural organization structure, able to exploit its value creation potential.

To this aim, authors decided to apply the following own production multi-dimensional matrix showing the importance of Public Affairs functions for business, here specifically applied to the culture sector.



The matrix results as interweave of the existing strategic business model and matrix, able to internalize almost the all mentioned variables. Initially, the matrix takes inspiration from the *SWAA matrix*, bringing together public and private needs and interests on the two dimensional axis then, inspired by the *SWOT analysis*, emphasizes actions of engagement between public and private context and cultural business, showing on the vertical axis the strengths and weakness of public intervention while on the horizontal axis the threats and opportunities coming from a private decision of a culture organization to employ public affairs actions. From the interaction of such dimensions private and public sector are immediately able to figurative realize when the collaboration and consequent actions are profitable and needed or when it's time to keep informed on the occurring progress, when it is needed to monitor and control changes and when there is the possibility to operate on a defensive or on a proactive way.

As detectable, the variables on the two axes have been putted into correlation with different action and decision consequential steps numerically and substantially corresponding to *the phases of the Allison and Kaye strategic making process (1997)*, transposable in cultural organization. In details, authors realized as in each numbered

step public affairs is able to understand which action undertake (part inside the matrix), based on the output and outcomes deliverable by the function through the different strategic phases (part outside the matrix), as follows:

(1) *Getting ready, defining mission and vision.* Private and public reconnaissance and awareness of the cultural matters. In this context, public affairs can support the portfolio analysis, to assist in the comprehension of the gaps between portfolio of services managed by the cultural organization and the expectation of its audience and stakeholders, such as donors, public funders, business sponsors, and the general public (CAIRS et al. 2004). *Measurable Output:* i.e. presentation material and strategic working and business plan definition;

(2) *Assessing the external environment.* Comprehension of environment from the private side corresponds to increased political issue, knowledge and understanding. It is evident as public affairs functions, at this level come to be climatic in mapping the operating environment through which, for instance, a stakeholder analysis model in conjunction with the Porter Five Forces model. Public affairs can identify relevant stakeholders in order to assist interests evaluating supporters and opponent and can contribute to understand the level of intensity of rivalry, understanding the threats coming from barriers and new entrants in the culture market. Moreover, within phase two it is important to *agree on priorities and actions, applying the SWOT analysis:* public affairs, being able to discern strengths and weakness and to intercept, opportunities and threats of the environment, provides the information needed to properly assess the culture organizational critical success factor, setting future agreement on priorities and goals. *Measurable Output:* i.e. list of critical issues and factors, map of competitive environment, stakeholder analysis and position papers;

(3) *Assessing and measuring the internal environment and strategic plan:* Internal intermediary effect in the private corresponds to the interest, consideration and support of the public. As shown, Public affairs also constitutes a relevant variable for the profitability analysis (i.e. ROI), the analysis of costs structures, the analysis of financing structures and for the identification of unconventional Key Performance indicator, KPI or Success critical factors (FCS). To this phase, the exiguity of outcomes concern comes to be even less substantial taking into consideration the existing *outcomes strategic-making process defined by Bryson (2004)*. Public affairs, in fact, stands on an equilibrate position between the deliberation of tangible and intangible content and process needed to succeed in the strategic change cycle. Public affairs function perfectly fits the scheme being able to deliver tangible process oriented outcomes (work, programs, stakeholders involvement and analysis, procedural requirements and expectation), intangible process such as crisis management and public relations. It provides intangible content in terms of individuation of key stakeholders and future goals, and, finally, tangible content in terms of action plans and budget saving cost. Moreover, in order to link strategy formulation to internal public affairs operating plans and budget, a *Balanced Scorecard (BSC)* can be putted in place. It permits the transformation of public affairs goals into a strategic map composed by integrated collection of objectives and performed indicators, grouped, as introduced, into four perspectives: *financial* (public affairs makes possible for culture sector to deliver

services at a lower cost and ensure trust, loyalty and affiliation), *customer* (identify targets and value propositions, ensure information, fair access and quality, satisfaction), *internal business process* (improve data-driven decision, coordination, external and internal cooperation and communication, improving public customer input process efficiency) and *learning and growing* (organizational capacity, learning and growing, improve skills, competences and resources, culture, enhancing commitment). *Measurable Output*: calculation of public affairs return on investment (ROI), impact on costs and financing structures and Key Performance indicator, KPI or Success critical factors (FCS). Identification of tangible process (i.e. work, program, stakeholders involvement, procedural requirements and expectation), intangible process (i.e. spread of appreciation, crisis management and public relations), intangible content (i.e. key relationships, future goals), tangible content (i.e. action plans and budget saving cost), definition of a *Balanced Scorecard (BSC)* for financial (cost saving), customer (trust, loyalty, affiliation, fair access and quality), internal business process (data-driven decision, coordination, cooperation, input process) and learning and growing (skills, competences, resources, culture, and commitment) indicators;

(4) *Monitoring, evaluating, act, control and forecasting future scenarios*. Target reached and strategies accomplished correspond to political collaborative action and consensus. In this phase public affairs perfectly contributes to the application of models such as the *Pest and Trend analysis*, that classified impact forces in: *political, economic, social and technological* with the support of *trend data analysis* in order to speculative combine data with evidence, probability and impact of different scenarios. Moreover, since no organization exists in a vacuum, public affairs, as anticipated, contributes to shift away from market towards service also within the *SWAA analysis of Montanari and Bracker (1986)* which is based on a two dimensional matrix: “public need support of services” and “unit capabilities needed for the service”. Public affairs function exactly fits in the forth dell of the matrix labelled “Back drawer issue” which corresponds to a function with low unit capabilities and low perceived public need - services that are not considered priorities; even though they might be very important services and they fail to be recognized as such. The matrix can therefore shows the importance of lobby/public affairs in individuate the actions involving the decisions about which cultural product or services have to be advocated, maintained, redesigned, reduced or closed down (Lega, & Cristofoli, 2009). *Measurable Output*: calculation of *Pest, Trend data and Scenario analysis* to determine whether efforts produced the desired results and decide how to alter future activities to better reach targets.

4. Results and Conclusion

Our survey thus contributes to the literature by exploring the practices in a sector that is often neglected, containing significant lessons also for similar industries. The matrix is able to focus both on political, social and technical aspects, adapting itself toward the definition of profitable public affairs actions and compromise of engagements between culture private and public context. Indeed, the research validate the possibility:

- *to establish a clearer measurable matrix capable of adapting public affairs activities to culture performance-management systems*: the matrix can be inserted on a annual time-line business planning in order to assure the budgetary framing of the function. As anticipated, authors suggest the externalization of the function to a specialized company firm, with the role to assist in the design and facilitation of the process providing expertise and external perspectives;
- *to create a link to real business outcomes – accountability*: the externalization permit do not excessively burden the budgetary adaptation of the cultural organization business.
- *to clarifying organizational support and orchestrate activities across the cultural organization business*: the support can be combined on complementary basis with both external affairs, regulatory and communication function. Moreover, the ability to convene and collaborate across functions on regulatory and communicative issues is a vital element for organizational and performance success;
- *to identify Key Performance Indicators – KPIs*, as public affairs appears fundamental in order to select the variables on which culture management can open with its decisions and which can significantly affect the competitive position of the organization, such as: *audience/stakeholders indicators* (satisfaction, awareness ratios, knowledge level, trust level, media opinion leaders contacts, number of information and relationship); *benchmark comparison indicators* (media share, share of audience, media scope, strategy success plans); *financial Indicators* (price performance, cost per program/service, return per program, cost growth); *human resources indicators* (hours per employee, growing of competences); *operational/process indicators* (program, product, service development, position papers and draft, completed project, quality performance level, volume of media released, deadlines met etc.); *quality of relationship indicator* (with investor, institutions, universities, general stakeholder, third parties; brand image and reputation; support in crisis communications and issues management; event and sponsorship);
- *to calculate public affairs return on investment (ROI)*, in order to demonstrate that business can recover investment costs and achieve measurable benefits for the function on a monetary basis. The equation for calculating Public Affairs return on investment is deceptively simple and is as follows: ROI percent= [Value of benefits generated by PA-Cost of PA] /Cost of PA x 100 percent (value received/ efforts and cost of activities).

It is therefore evident as public affairs, by preventing future levies, anticipating threats and by increasing opportunities of interaction and collaboration permits saving, cost avoidance and increased productivity within the culture sector. Such calculation is possible since outcomes became related to Public affairs activities; data are gathered during implementation thanks to the establishment of measures for each phase, able to turn data into information. In conclusion, the public affairs matrix applied to Culture can help: to anticipate and therefore shape consumer tastes; to understand if in a certain

period of time the culture organization need to drive decision making through artistic values or mass entertainment; to orient the cultural business strategy through product differentiation or market innovation; to detect problems and understand if belong to demand or market changes; to individualized a different structure of business mainly focused on vertical integration or on flexible specialization; to enchant individual inspiration or the creative system. Thanks to Public affairs culture management can be therefore able to analyze the market in order to understand what their consumers are likely to respond to, also influencing consumers by encouraging interest in attributes in which their products enjoy an advantage. From this point of view, the incentives resulting from the model's application will eventually draw all different stakeholders to differently combined competences and endowments in order to undertake more collaborative and profitable action plan as to acquire a proactive role in the political decision-making, anticipating economic and occupational circumstances and needs, representing a *benchmark* for the promotion of worldwide public affairs best practices for culture sector development.

References

- Christian., *Objectives and functions of lobbying for business*, Association of Accredited Public Policy Advocates to the European Union, online sources, 2015;
- Meznar, M. B., & Nigh, D. *Managing corporate legitimacy: Public affairs activities, strategies and effectiveness*. Business & Society, 32(1), 30-43, 1993;
- Gregor, M., Corporate lobbying: A review of the recent literature, Institute of Economic Studies, Faculty of Social Sciences Charles University in Prague, IES Working Paper: 32/2011;
- Yungwook, K., Measuring the bottom-line impact of public relations at the organizational level, Submitted to Institute for public relations for the 1998 Smart Grant, pp 1-5, 1999;
- Reisman, J., Gienapp, A., Stachowiak, S., *A guide to measuring advocacy and policy*, prepared for the Annie E. Casey Foundation by Organizational Research Services, pp 8-13, 2007;
- Musters, R., Ramkumar, S., Parekh, EJ., *Organizing the government-affairs function for impact*, McKinsey Quarterly, 2013;
- Lega, F., & Cristofoli, D., *Strategic public management*. Milano: EGEA, 2009;
- AMEC US Agency Research Leaders Group, *Valid Metrics for PR Measurement Putting The Principles Into Action*, Based on the Barcelona Declaration of Measurement Principles, 2011.
- Lampel, J., Lant, T., & Shamsie, J. *Balancing act: Learning from organizing practices in cultural industries*. Organization science, 11(3), 263-269, 2000;
- Turbide, J., & Laurin, C., *Performance measurement in the arts sector: The case of the performing arts*. International journal of arts management, 11(2), 56-70, 2009;
- Labaronne, L., *Performance measurement and evaluation in arts management*. Zeitschrift für Kulturmanagement, 3(1), 37-70, 2017;
- Hammar, J., & Lagerborg, E., *Performance measurement and evaluation for cultural non-profit organisations: A model developed for Swedish museums*, 2017;
- Hadida A.L., *Performance in the Creative Industries*, Oxford Handbook of the Creative Industries, 2015;
- Craik1, J., *Dilemmas in policy support for the arts and cultural sector*. Australian journal of public administration, 64(4), 6-19, 2005.

Digital Maturity and Growth of SMEs: a Survey of Firms in the Basque Country (Spain)

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Abstract

Sustainable competitiveness and growth of SMEs are increasingly determined by their capability to make use of digital technologies which are generating opportunities for developing new growth routes based on digitization. This paper reports the findings of a study how SMEs in the Basque region of Spain assess their digital maturity. The main purpose of this research is to gain insights into the development of digital capabilities of SMEs that support their digital based growth.

The DIGROW-Framework of digital maturity (North et al. 2018) was used to assess the digitization capabilities of SMEs in the Basque region in northern Spain. In cooperation with the regional business associations, a self-assessment questionnaire was sent to members and resulted in a return of 550 questionnaires by November 2018.

The study provides rich information on the digitization approaches of SMEs in the Basque region. It sheds light on the learning paths of digital transformation of SMEs. In particular, its originality and value resides in the application of a maturity framework based on dynamic capability theory to a wide range of SMEs. The model is easily applicable also to SMEs of other countries or regions.

Study results allow regional business associations as well as local and regional government to develop strategies and support measures to foster digital growth of SMEs. The survey also demonstrated that the applied maturity model provides guidance to SMEs to raise awareness of owners, managers and employees towards required capabilities as well as opportunities/threats, to create a shared understanding on what “digitally

enabled growth” means for the firm, to anchor pilot initiatives in an overall “picture” of digitalization and to define learning objectives.

Keywords: growth; dynamic capabilities; digital maturity; SMEs, Basque Country.

Paper type: Academic Research Paper.

1. Introduction

Sustainable competitiveness and growth of SMEs are increasingly determined by their capability to make use of digital technologies (EU 2017) which are generating opportunities for developing new growth routes based on digitization (Taruta and Gatautis, 2014). To understand how SMEs are approaching digitization we have to be aware that they are part of a heterogeneous universe of extremely diverse economic agents, whose characteristics vary depending on the business sector they operate in, the markets they serve, the products they produce and how involved and connected they are to the macroeconomic context and support institutions (Latameconomy, 2013). What SMEs have in common, however, is the need to integrate, build and reconfigure internal and external resources to adapt to rapidly changing environments (North and Varvakis 2016). These dynamic capabilities reside in skills, processes, procedures, organizational structures, decision rules and distinct disciplines that motivate and promote the detection (sensing) and capture (seizing) opportunities in order to reconfigure (transforming) their capabilities (Teece, 2007). Along these lines, several studies demonstrate that the development of dynamic capabilities contribute to SME performance and growth (He and Wong, 2004; Lubatkin et al., 2006; Macpherson and Holt; 2007; Protogerou et al., 2008).

Yeow et al. (2018) found that as an organization shifts towards a digital strategy, misalignments between the emergent strategy and resources give rise to tension and requires alignment actions, which iteratively reconfigure organizational resources and refine strategy in order to respond to both changes in the environment and internal tensions. Studies on digitization of SMEs (for an overview see North et al. 2018) suggest that in this first wave of digitisation (EU, 2017) SMEs adopt quick impact measures, experiment with new solutions, observe their peers and cautiously move forward mostly without a comprehensive vision on what digitisation means for the firm. However, we still lack consolidated evidence on the learning path of developing digitization capabilities in general and regarding SMEs in particular.

Along these lines, the main purpose of this research is to gain insights into the development of digital capabilities of SMEs that support their digital based growth. For this we apply a maturity approach based on dynamic capability theory.

Maturity models allow the assessment of the current situation of a company as well as the identification of reasonable improvement measures (Becker et al. 2009) and serve as a guide through the transformation journey (Valdez de Leon, 2016). Maturity can be defined as a measure to evaluate the capabilities of an organisation regarding a certain discipline (Paulk et al. 1993). Digital maturity means that a company has the necessary organizational capabilities to succeed in the digital transformation (Berghaus et al. 2017).

2. Methodology

2.1 The DIGROW-Framework of digital maturity

To assess the digitization capabilities of SMEs in the Basque region The DIGROW-Framework of digital maturity (North et al. 2018) was used. The theoretical foundation of the framework is Teece's (2007) model of dynamic capability development: "For analytical purposes, dynamic capabilities can be disaggregated into the capacity (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness through enhancing, combining, protecting and, when necessary, reconfiguring the business enterprise's intangible and tangible assets" (Teece, 2007: 1319). For the development of a practice oriented self-assessment framework a capacity of strategy development and communication was inserted between Teece's "sensing" and "seizing". This is based on findings that a particular shortcoming in SMEs is that owners and managers are aware of growth potentials but often lack an explicit strategy and if they have a strategy do not communicate that strategy to employees (North et al. 2016). It also pays tribute to Pavlou and El Sawy's (2011) argument on the importance of learning and integration in developing dynamic capabilities.

Therefore, the "DIGROW" framework contains the following four elements, which can be seen as challenges (e.g. what are our challenges to sense digitally enabled growth potentials?) or capabilities (e.g. do we have the capability to sense digitally enabled growth potentials?). Both views are useful in a self-assessment. Along the lines of Teece's (2007) microfoundations of enterprise performance, North et al. (2018) have defined four capacities for each of the four challenges or capabilities. The assessment is visualised as a "Wheel of digitally enabled growth" (Figure 1). Each of these capacities can be evaluated at five levels described by an anchor statement. In a pre-test with firms, we found that these five levels would allow a sufficient degree of differentiation. Therefore, the "DIGROW" framework is structured as follows:

1. *Sensing digitally enabled growth potentials*: Searching for digitally enabled growth opportunities, understanding and developing digital customer needs, sensing technology driven opportunities, use of external sources for digital innovation.

2. *Developing a digitally enabled growth strategy and mindset*: Digitally enabled growth strategy, digital leadership, digital mindset (attitudes & behaviors), empowered employees.

3. *Seizing digitally enabled growth potentials*: Digitally enabled business models, digital market presence, digital customer experience, agile implementation/deployment of digitalization initiatives.

4. *Managing resources for digital transformation*: Digital skills & learning, digital processes, digital technology & security, digital investments.

Table 1. provides an example how these capacities are assessed. The full framework can be downloaded from Researchgate.¹

https://www.researchgate.net/publication/326294602_Promoting_digitally_enabled_growth_in_SMEs_a_framework_proposal_-_Part_Ii_The_DIGROW-Framework_evaluation_grid

The wheel of digitally enabled growth

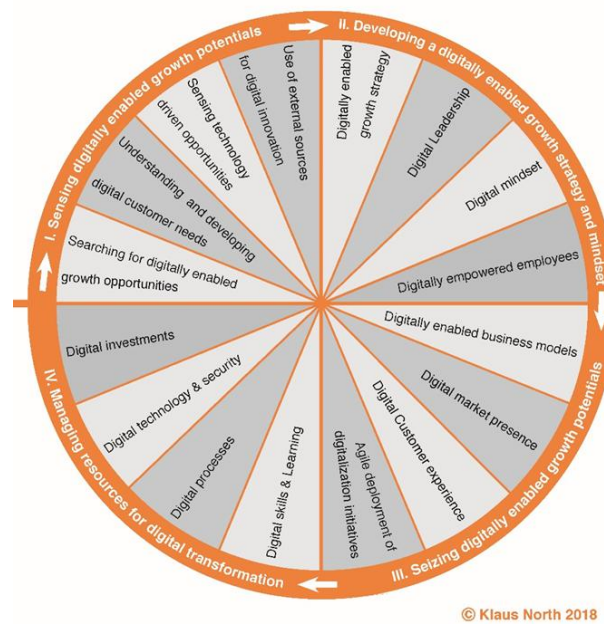


Figure 1 The wheel of digitally enabled growth (source: North et al. 2018))

Table 1: Example of the self-assessment questionnaire for the dimension “Digitally enabled business models”

Dimension	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
Digitally enabled business models	No digitally enabled business models	We have a reactive approach. First we see what competitors are doing or changing.	We are looking for new improved, innovative business models	We have started to change some components of our business model (e.g. sales channels, value proposition)	Our new business models already contribute to increased revenues	We systematically adapt our business models or create new ones for digital enabled growth, including customer segments, channels, activities/resources and the value proposition.

2.2 The survey and sample

The companies under study are small and medium-sized enterprises (SMEs) of the manufacturing and commerce sectors of the Basque Autonomous Community (CAV), characterized by having between 10 and 500 employees. According to the Basque statistics office EUSTAT the number of companies in this size range amounts to 2,599 SMEs and the number of SMEs in the commerce sector is 10170 companies. The self-assessment questionnaire was sent to 7040 firms in cooperation with the regional business associations between July and November 2018.

The number of SMEs that responded to the survey amounts to 540 (response rate 7,67%). After eliminating only partially completed or invalid questionnaires the final sample consists of 427 companies. Regarding the size of the companies, 47 firms have between 10 and 49 employees, 220 companies have between 50 and 249 employees, and 160 have between 250 and 500 employees. On the other hand, 138 firms belong to manufacturing industry, 29 to commerce sector, and the rest of the 234 companies are distributed among different types of services (i.e. education, health services, insurance, information services, transport, professional services, etc.) and building (26 firms).

3. Findings

In the following we will present the survey results, first regarding each integral dimension of the DIGROW-framework and, second, we will explore some relationships between the different dimensions and examine also other firms' characteristics (i.e. size).

1 - Sensing potential opportunities for digital growth

More than three quarters of companies (77%) search for digital growth opportunities, with more than a quarter of them (28.2%) actively working on their identification, but only 24% identify these opportunities systematically. Commerce firms identify opportunities more systematically than the manufacturing industry. In addition, a considerable percentage of them have a clear idea of the expectations and needs of their clients, although there is still a high percentage of companies that are unaware of them. Around 38% confirm that "we analyse how technology driven opportunities can create value for specific customer segments and we address them properly" and another 38% say that they appropriated some new digital technology.

However, there is still little collaboration with external agents such as potential customers, universities, research centres, "the crowd" or partners in the "eco-system" for the search of opportunities for growth and digital innovation. This sheds light on a rather closed learning path towards digitization.

2 - Developing a digital growth strategy and mindset

While many companies are sensitive to digitalisation, this does not translate into the development of strategies how to take advantage of the growth opportunities offered by digital technologies and the incorporation and application of them in the organization. Only 18% of firms claim that they have a consistent digitally enabled innovation &

growth strategy in alignment with their resources. Another 15% have updated their strategy regarding some aspects of digitally enabled growth. Commerce is more advanced than manufacturing in this respect.

The contrast between extreme positions is more accentuated in relation to digital leadership. Compared to a 14% of SMEs that count on leaders that initiate, coordinate and supervise digital initiatives, to which they assign a high priority, 30% acknowledge not having leaders that promote digital growth. The manufacturing sector is the one that concentrates the majority of companies that lack this leadership (42%).

Regarding a “digital mindset” a quarter of companies affirms that “people in our firm start thinking about digitalization and managers are developing new digital behaviours” An about 30% of SMEs situates them even higher in stating “There is a generally positive attitude towards digitalization and broad development of new behaviours”.

This emerging digital mindset has, however, a limited effect on empowering employees. While 30% of commerce firms say that employees are encouraged to experiment with digital initiatives, 40% of manufacturing deny that. This leaves still ample room for improvement and has to be seen with in connection with the very low level of agile implementation and deployment of digitalization initiatives discussed below.

3 – Seizing digitally enabled growth potentials

Although Basque SMEs, in a large percentage, are seeking opportunities for digital growth; their ability to take advantage of such opportunities and exploit them is quite limited. In this sense, although many companies are thinking of improving their business model or developing new business models based on digital technologies, few companies have taken comprehensive action. While 43% of commerce firms state that they have started to change some components of our business model (e.g. sales channels, value proposition) a similar number of manufacturing firms have done nothing so far.

Consequently, the percentage of companies actively present in the digital market is small and the interaction with customers through digital channels is limited. Also in these aspects differences are pronounced between commerce and manufacturing. Around two thirds of commerce SMEs confirm that they count with a customer-oriented website and presence in several social media or –even more advanced - continuously develop different activities to keep themselves at the top of mind (e.g. digital marketing campaigns, blogs, videos, digital communities, etc.). 44% of manufacturing have a website, which is not actively managed and some presence in social networks (e.g. Facebook or twitter). The level of a digital customer experience is quite low. Around 20% of firms say that they mainly interact with customers digitally. Some of them deliver customer service across multiple digital channels.

With their limited resources SMEs could benefit from an agile deployment of digitization initiatives. This includes methodologies such as design thinking for the development of new solutions or SCRUM for project management, small projects that lead to short-term results and that have an incremental and iterative approach to continuous improvement. Most of the companies of both sectors, however, claim not to

have projects or methodologies to implement digital initiatives. And there are few companies that systematize the use of agile technologies to implement digital initiatives.

4 - Managing resources for digital transformation

Companies still invest little in the development of digital skills and competencies as well as in digital technologies and cybersecurity. However, with regard to the digitalization of business processes, the situation is somewhat better, since almost half of the companies have begun to digitize some processes.

Digital skills include the habitual use of technology by collaborators to carry out their tasks and for the improvement and innovation of processes and / or business models. It also includes curiosity and experimentation to make improvements and the ability to be agile in order to rapidly advance at the pace of technological changes and new business models. Finally, digital skills include the capacity for continuous learning and development of teams and people to close the digital gaps. In relation to digital skills, 26% of companies say that investment to develop digital skills is low. For an additional 23% of firms the level is adequate in relation to relevant business areas. Companies that claim that their employees possess all the necessary digital skills and have formal learning and development programs are a minority, 6.7%, and represent almost the same proportion as companies that claim not to have digital skills or perform training for their development.

The implantation of technologies and the level of security of the companies is remarkably unequal. Thus, 23% of companies have incorporated digital technology in a few processes and have planned security measures, but at the same time 20 % have only minimal technology and very limited security measures. At the higher levels of maturity associated with the implementation of technologies and security measures in critical processes and / or throughout the business, the trade sector appears better positioned with 25% of companies compared to 16% of the manufacturing sector. This result may be associated with the B2C business model of the commerce sector that requires greater contact and security with the final consumer, compared to B2B relationships manufacturing.

Regarding investments in digital transformation initiatives, most companies (24%) claim to have a medium level. 15% of manufacturing firms say that they have not invested in digitization, whereas one third of commerce SMEs report a significant level of investment on digital initiatives in specific business areas.

5 Relationship between DIGROW dimensions and size effects

In order to know if there is any relationship between the different dimensions of the framework and between the different capacities making up each dimension as well, a correlation analysis has been performed. As a result of this analysis, a middle intense relationship between seizing digitally enabled growth potentials and managing resources for digital transformation dimensions is found. Regarding the relationship between the different capacities integrating both dimensions, the correlations between digital skills and learning and both digital customer experience and agile deployment for digital

initiatives are especially relevant, among others. Moreover, there are correlations between some capacities of the digitally enabled growth strategy dimension and capacities of other dimensions. In particular, the digital leadership capacity is correlated with digital business models as well as with digital skills and learning, and with digital investments.

On the other hand, and as far as the capacities of managing resources for digital transformation dimension is concerned, digital processes, digital skills & learning, digital technology & security and digital investments are quite correlated between each other (the relationship is slightly more intense between digital investment and digital processes and digital technology & security). With regard to the seizing dimension there are just two significant relationships, which are between presence in digital market and digital customer experience, and between digital enabled business model and digital market presence. In the case of developing a digitally enabled growth strategy and mindset, just one relationship is significant (the highest of all) between digital leadership and digital strategy for growth. Finally, no highly significant relationship exists between capacities related to sensing digitally enabled growth potentials dimension.

Moreover, further analysis has been carried out with the aim of testing if firm's characteristics affect digital maturity. In particular, size effect is examined. In this line, the sample has been divided into two sub-samples according to firms' size. One sub-sample is made up by firms having between 50 and 249 employees (i.e. group 1), and the other one includes companies having between 250 and 500 employees (i.e. group 2), with the purpose of comparing both sub-samples and verify if there is significant difference between them regarding the digital maturity level of companies. A mean comparative analysis has been carried out in order to test if the mean digital maturity level of firms for each capacity is significantly different or not according to size. The results of such analysis are shown in table 2 in Annex.

According to the results obtained, there is a significant difference according to the size of the firm in the case of eight capacities included in the framework over a total of sixteen (i.e. in the half of the capacities). In particular, in the case of the following capacities (the ones highlighted in red colour in the table 2): use of external sources for digital innovation, digital leadership, empowered employees, digitally enabled business models, digital market presence, digital customer experience, agile implementation/deployment of digitalization initiatives, and digital skills & learning. Therefore, it can be concluded that size is a relevant variable regarding digital maturity, since the mean digital maturity level of companies regarding each capacity is significantly different in each group of companies in the 50% of capacities the framework encompasses. Moreover, it is verified that the mean level of digital maturity is higher in the case of bigger companies in all the capacities (i.e. higher mean in the group of companies with more than 250 employees than in the group of firms having between 50 and 249 employees). This is very clearly appreciated in the table 3 in Annex which describes the mean level of digital maturity regarding each capacity in the two groups of firms distinguished.

Considering the aforementioned, it can be concluded that size is a relevant characteristic of the firm in terms of digital maturity and that, in general terms, smaller companies are less mature regarding digitalization which is probably explained by the

fact that they possess more limited capacities for enabling digitalization and digitally enabled growth than bigger ones.

4. Discussion

Our findings shed light on an experimental and less systematic learning path of digitization. Most companies surveyed do not have a digital strategy and are cautious with regard to investments. Development of digitization skills is also quite limited.

Although we currently lack consolidated evidence in this emerging field of research and practice, there is an increasing number of surveys and case studies which support our findings. The study "Impuls" (VDMA 2015) of 289 companies in the mechanical engineering sector in Germany notes that only 5.6 percent of the relatively small companies are already in the group of leaders when it comes to implementing Industry 4.0. Another 17.9 percent are beginners who work with the concepts of Industry 4.0 and are taking the first steps to make this happen. The overwhelming majority of 76.5 percent have not yet taken any systematic steps to implement Industry 4.0 and it is classified as new. In case studies of 68 German manufacturing SMEs, Müller et al (2018) illustrate that these companies generally approach Industry 4.0 with caution and still try to understand how to take advantage of the innovation of the business model in the creation of value, the offer of value and value capture. This cautious or reactive view is reflected in a survey of 300 SMEs in the US (IDC, 2017) that still consider that IT is a necessary cost (45%) instead of a driver (20%) of competitive advantage. The IDC-SAP study (2017) of 3900 SMEs in 14 countries also states that companies prefer to continue investing cautiously in small projects with a rapid impact, which lays the foundations for more ambitious and demanding projects. Observing and learning from other SMEs is a widely used approach in this gradual step towards digitization (Baker et al., 2015).

In our sample, particularly in the manufacturing sector, we witness a rather reactive approach to digitization. Employees are rarely empowered to experiment with digitization initiatives and there is a limited cooperation with outside partners. Proactive companies show strong leadership, develop a digital mindset, have well-developed sensors in terms of technology and market developments, learn from many sources, integrate into business ecosystems and actively promote their presence in the digital market (Conference Board of Canada, 2014; IDC-SAP, 2017; Sinkkilä, 2017; Müller et al., 2018).

Regarding the development of digital skills in our sample, only 23% of firms claimed that the level of training is adequate in relation to relevant business areas. This lack can be explained by the way of operating of SMEs (North and Varvakis 2016). The Interim Report of the European Pilot Project on digital skills (Bluespecs, 2018) states that the main barrier for SMEs is a lack of a long-term vision and strategy. It was argued that SMEs are not upskilling their people because by the very nature of being an SME, they are focused on delivery and the short-term. The report further argues that SMEs often are unaware of what skills they are lacking. In addition, given the scarcity of human resources, SMEs seem reluctant to have training occur during the working hours. Training is also not offered to all workers. Warnhoff and Krzywdzinski (2019) found that workers

with lower qualifications have less access to training for industry 4.0. On the other hand, successful cases demonstrate that SMEs active in non-native digital sectors acquire digital knowledge through their interaction with other SMEs specialised in offering IT services and solution, and who are able to bring skills and digitization to other SMEs in traditional sectors (Grand Coalition for Digital Jobs, no year).

On the other hand, a study of Swiss SMEs (PwC et al 2016) reveals that digital maturity correlates positively with the size of the organization and negatively with the age of its administration. This is also corroborated in the present study where it is found that also size correlates with digital maturity level, in the sense that bigger companies attain higher digital maturity levels than smaller ones.

Summing up the previous findings: in this first wave of digitalization (EU, 2017) SMEs adopt rapid impact measures, experiment with new solutions, observe their peers and move cautiously, mostly without a comprehensive vision of what the digitization for the company means.

References

- Baker, G., Lomax, S., Braidford, P., Allinson G., and Houston M. (2015) Digital Capabilities in SMEs: Evidence Review and Re-survey of 2014 Small Business Survey respondents, BIS Research Paper No 247, BMG Research and Durham University.
- BCG (Boston Consulting Group) (2013) Ahead of the Curve: Lessons on Technology and Growth from Small Business Leaders, October, http://www.bcg.com.cn/en/files/publications/reports_pdf/BCG_Ahead_of_the_C
- Berghaus, S.; Back, A., Kaltenrieder, B. (2017) Digital Maturity & Transformation Report 2017. Institut für Wirtschaftsinformatik, Universität St.Gallen
- Bluespecs (2018) Digital Skills: New Professions, New Educational Methods, New Jobs (SMART/2016/1006) Public Interim Report, 29th May 2018, <https://ec.europa.eu/digital-single-market/en/news/upskilling-europes-small-businesses-digital-age>
- Chen, Y.Y.K., Jaw Y.L., and Wu, B.L. (2016) "Effect of digital transformation on organisational performance of SMEs: Evidence from the Taiwanese textile industry's web portal", Internet Research, Vol.26, No.1, pp.186-212.
- Conference Board of Canada (2014) Adopting Digital Technologies - The path for SMEs. Briefing paper, https://www.nrc-cnrc.gc.ca/obj/doc/irap-pari/dtapp-ppatn/resources-ressources/REPORT_6029_adoptingdigitaltechnologies_en.pdf
- EU (2017) Digital Transformation Scoreboard 2017: Evidence of positive outcomes and current opportunities for EU businesses, <https://ec.europa.eu/growth/tools-databases/dem/monitor/scoreboard>
- Grand Coalition for Digital Jobs (no year) Digital Skills for SMEs, <https://digital.di.dk/SiteCollectionDocuments/Publikationer/DigitalskillsforSMEs.pdf>.
- Hamill, J. (2015) Digital Disruption and Small Business in Scotland, Federation of Small Businesses Scotland, Glasgow, <https://www.fsb.org.uk/LegacySitePath/policy/rpu/scotland/assets/fsb%20scotland%20-%20disruption%20report%20-%20final.pdf>
- He, Z.L. and Wong, P.K. (2004) "Exploration vs. Exploitation: An Empirical Test of the Ambidexterity Hypothesis", Organization Science, Vol.15, No.4, pp.481-494.

- IDC (2017) The Road to the Digital Future of SMEs, IDC White Paper, <https://www.virginmediabusiness.co.uk/pdf/Insights%20Guides/the-road-to-digital-future.pdf>
- IDC-SAP (2017) The Next Steps in Digital Transformation. How small and midsize companies are applying technology to meet key business goals, http://news.sap.com/wp-content/blogs.dir/1/files/SAP_IDC_infobrief_SMB_DX_102016.pdf
- Karltorp, L. (2017) Digital transformation strategies in small businesses - A case study in the Swedish manufacturing industry, Bachelor Thesis in Business Administration, Jönköping University <http://www.diva-portal.org/smash/get/diva2:1115635/FULLTEXT01.pdf>
- Latameconomy (2013) Latinamerican economic outlook, available in <http://www.latameconomy.org/en/outlook/2013/traits-and-policies-of-latin-american-smes/regional-overview-of-smes/>.
- Lubatkin, M. H., Simsek, Z., Ling, Y., and Veiga, J.F. (2006), "Ambidexterity and Performance in Small- to Medium-sized Firms: The Pivotal Role of Top Management Team Behavioral Integration", *Journal of Management*, Vol.32, No.5, pp.646-672.
- Macpherson, A and Holt, R. (2007) "Knowledge, learning, and small firm growth: A systematic review of the evidence", *Research Policy*, Vol.36, No.2, pp.172-192.
- Müller, J., Buliga, O., and Voigt, K.I. (2018) "Fortune favors the prepared: How SMEs approach business model innovations in Industry 4.0", *Technological Forecasting & Social Change* (in press).
- North, K. and Varvakis, G. (Eds.) (2016) *Competitive Strategies for Small and Medium Enterprises: Developing resilience, agility and innovation in turbulent times*, Springer, Heidelberg.
- North, K., Aramburu, N.; Lorenzo, O. (2018) "Promoting digitally enabled growth in SMEs: a framework proposal", *Proceedings, IFKAD Conference, Delft, 4th-6th July 2018*
- Protogeru, A., Caloghirou, Y., and Lioukas, S. (2008) "Dynamic Capabilities and their Impact on Firms Performance", DRUID working paper No. 08-11, Aalborg, Copenhagen.
- PwC Switzerland, Google Switzerland and digitalswitzerland (2016) Digital transformation: How mature are Swiss SMEs?, https://www.pwc.ch/en/publications/2016/digital_transformation_how_mature_are_swiss_smes_en_web.pdf
- Sinkkilä, H. (2017) Digitalisation Driven Strategic Renewal in Small and Medium Sized Enterprises in Finnish Manufacturing, Master Thesis, Aalto University School of Science Degree Programme in Industrial Engineering and Management.
- Tarutėa, A. and Gatautisa, R. (2014) "ICT impact on SMEs performance", *Procedia - Social and Behavioral Sciences*, Vol.110, pp.1218-1225.
- Teece, D.J. (2007) "Explicating Dynamic Capabilities: the Nature and Microfoundations of (sustainable) Enterprise Performance", *Strategic Management Journal*, Vol.28, No.4, pp.1319-1350.
- Teece, D.J. (2007) Explicating Dynamic Capabilities: the Nature and Microfoundations of (sustainable) Enterprise Performance, *Strategic Management Journal*, Vol.28, No.4, pp.1319-1350.
- VDMA (2015) Industrie 4.0 readiness. <http://www.impulsstiftung.de/documents/3581372/4875835/Industrie+4.0+Readiness+IMPULS+Studie+Oktober+2015.pdf/447a6187-9759-4f25-b186-b0f5eac69974>
- Warnhoff, K. and Krzywdzinski, M. (2018) Digitalisierung spaltet – Gering qualifizierte Beschäftigte haben weniger Zugang zu Weiterbildung. *WZB-Mitteilungen*, December 2018, pp. 58- 60
- Yeow, A., Soh, C., Hansen, C. (2018) "Aligning with new digital strategy: A dynamic capabilities approach", *Journal of Strategic Information Systems*, Vol 27, pp. 43–58

ANNEX

Table 2: Comparison between groups of firms by size

		Levene Test		T-test for mean comparison				
		F	Sig.	T	Gl	Bilateral significance	Mean difference	Standard error difference
Searching for digitally enabled growth opportunities	Equal variances	6,890	,009	,636	337	,525	,099	,156
	Variances not the same			,632	318,734	,528	,099	,157
Understanding and developing digital customer needs	Equal variances	,058	,810	-1,379	337	,169	-,273	,198
	Variances not the same			-1,378	331,723	,169	-,273	,198
Sensing technology driven opportunities	Equal variances	13,425	,000	-1,270	337	,205	-,207	,163
	Variances not the same			-1,257	309,158	,210	-,207	,165
Use of external sources for digital innovation	Equal variances	,009	,923	-2,663	337	,008 (*)	-,521	,196
	Variances not the same			-2,662	332,137	,008	-,521	,196
Digitally enabled growth strategy	Equal variances	,025	,875	-1,297	337	,195	-,250	,193
	Variances not the same			-1,298	333,244	,195	-,250	,193
Digital Leadership	Equal variances	2,524	,113	-2,399	337	,017 (*)	-,453	,189
	Variances not the same			-2,391	327,514	,017	-,453	,189
Digital mindset (attitudes & behaviors)	Equal variances	12,480	,000	-,871	337	,384	-,118	,136
	Variances not the same			-,861	305,553	,390	-,118	,138
Empowered employees	Equal variances	,175	,676	-2,630	337	,009 (*)	-,491	,186
	Variances not the same			-2,630	332,463	,009	-,491	,187
Digitally enabled business models	Equal variances	1,312	,253	-2,580	337	,010 (*)	-,489	,190
	Variances not the same			-2,571	327,354	,011	-,489	,190
Digital market presence	Equal variances	3,300	,070	-2,665	337	,008 (*)	-,439	,165

	Variances not the same			-2,659	329,171	,008	-,439	,165
Digital Customer experience	Equal variances	1,196	,275	-3,202	337	,001 (*)	-,506	,158
	Variances not the same			-3,197	330,729	,002	-,506	,158
Agile implementation/deployment of digitalization initiatives	Equal variances	7,643	,006	-3,423	337	,001	-,571	,167
Digital skills & Learning	Equal variances	6,457	,011	-3,058	337	,002	-,452	,148
	Variances not the same			-3,035	318,059	,003 (*)	-,452	,149
Digital processes	Equal variances	2,790	,096	-1,571	337	,117	-,252	,160
	Variances not the same			-1,561	320,385	,120	-,252	,161
Digital technology & security	Equal variances	7,553	,006	-,047	337	,962	-,010	,208
	Variances not the same			-,047	315,593	,963	-,010	,209
Digital investments	Equal variances	3,509	,062	-1,300	337	,194	-,206	,159
	Variances not the same			-1,291	319,427	,198	-,206	,160

Note: (*) (p<0,05) confidence interval of 95%

Table 3: Mean level of digital maturity per capacity in each group of firms

	Group (size)		
Searching for digitally enabled growth opportunities	1	N	220
		Mean	4,37
	2	N	160
		Mean	4,28
Understanding and developing digital customer needs	1	N	220
		Mean	3,56
	2	N	160
		Mean	3,83
Sensing technology driven opportunities	1	N	220
		Mean	3,96
	2	N	160
		Mean	4,16
Use of external sources for digital innovation	1	N	220
		Mean	2,92
	2	N	160
		Mean	3,44
Digitally enabled growth strategy	1	N	220
		Mean	3,42
	2	N	160
		Mean	

		Mean	3,68
Digital Leadership	1	N	220
		Mean	2,92
	2	N	160
		Mean	3,37
Digital mindset (attitudes & behaviors)	1	N	220
		Mean	3,58
	2	N	160
		Mean	3,69
Empowered employees	1	N	220
		Mean	3,08
	2	N	160
		Mean	3,57
Digitally enabled business models	1	N	220
		Mean	3,02
	2	N	160
		Mean	3,51
Digital market presence	1	N	220
		Mean	2,91
	2	N	160
		Mean	3,34
Digital Customer experience	1	N	220
		Mean	2,84
	2	N	160
		Mean	3,34
Agile implementation/deployment of digitalization initiatives	1	N	220
		Mean	2,55
	2	N	160
		Mean	3,12
Digital skills & Learning	1	N	220
		Mean	3,12
	2	N	160
		Mean	3,58
Digital processes	1	N	220
		Mean	3,59
	2	N	160
		Mean	3,84
Digital technology & security	1	N	220
		Mean	3,61
	2	N	160
		Mean	3,62
Digital investments	1	N	220
		Mean	3,47
	2	N	160
		Mean	3,68

Note: Group 1: number of employees between 50 and 249. Group 2: number of employees between 250 and 500.

The Benefits of Software-Supported Collaboration for Small and Medium sSized eEnterprises

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Abstract

Collaborative applications – also known as collaborative software – are increasingly being used by companies. The applications are meant to support intensive, effortless cooperation among team members, management and clients at any place and at any time. The uniqueness is their combination with social media and Web 2.0 functionalities (McAfee, 2009). The aim of this contribution is to identify the actual, in-field benefits of software-supported collaboration for small and medium-sized enterprises (SMEs) thus far reported in the literature.

We review and summarise the findings of former research on the use of collaborative software. The term collaborative software is used to describe Web-based applications (platforms) to support communication and collaboration in enterprises. For our research of the literature we used the ProQuest and EBSCO databases, which included highly ranked journals in the field of SMEs. Only peer reviewed empirical research papers dealing with the use of collaborative software were included in the review. Our research questions were: 1. Which studies have focused on the use of collaborative software in SMEs? 2. What benefits of software-supported collaboration in SMEs have been found? 3. What were the other main findings of the studies? On the basis of the collected results we will discuss the intended vs. actual benefits software-supported collaboration have for SMEs.

To the best of our knowledge, there is no other review of the benefits of collaborative software potentially relevant for SMEs, making this review is an important addition to other contributions in the field.

The results provide valuable (albeit less comprehensive than we hoped) information to managers and practitioners in SMEs, helping them to decide their IT strategy and the importance of collaborative software therein. Knowledge about the benefits of software-supported collaboration as well as impacts on employee- and organisational-work design is useful for the effective implementation and use of collaborative software.

Keywords – collaborative software, collaboration, small and medium enterprises (SMEs), dynamic capabilities, growth

Paper Type – Academic Research Paper

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1 Introduction

Information technology is seen as a major driver of business success and as a key for enabling collaboration on spatial distance (Warner and Witzel, 2004). An innovation in enterprise software, collaborative software was made possible by the introduction of Web 2.0 applications. Collaborative applications differ fundamentally from both earlier groupware applications and from classical knowledge management applications (McAfee, 2009). “However, a distinctive feature of Web 2.0 era collaboration systems is the emphasis on end user content creation; improved tools for information organisation and retrieval and the combination of existing content to deliver new information services.” (Schubert and Williams, 2012, p. 213)

In the literature, various terms are used for this type of Internet-based enterprise software: Enterprise Social Networks (Rossmann *et al.*, 2016), Enterprise Social Media (Archer-Brown and Kietzmann, 2018), Enterprise 2.0 (McAfee, 2009; Alberghini *et al.*, 2013), Emergent Social Software Platforms (McAfee, 2009), Social Software (Raeth *et al.*, 2010), Collaborative Applications (Schubert and Williams, 2012; Klötzer *et al.*, 2017), Enterprise Collaboration Systems (Cardon and Marshall, 2015; Nitschke and Williams, 2018) or Unified Communication and Collaboration Technology (Silic and Back, 2016). This variety of terms reflects both the rapid development in the field and the different perspectives from which the subject is viewed. We use the term collaborative applications in this article for applications, which connect team members via the Internet, allowing them to work anyplace and anytime. They usually include a variety of tools for communication (e.g. email, chat, online communities, Web conferencing), task

coordination (e.g. calendar, project management) and a project's knowledge management (e.g. Wiki, blog, document collaboration, social media) on a single platform ("suite").

Collaborative applications have a fast growing distribution in bigger companies (Kane, 2015) and this also applies to smaller companies (Kim *et al.*, 2013). However, there are indications that their adoption rate by small and medium-sized enterprises (SMEs) in the USA "is still much lower than that of large firms" (Kim *et al.*, 2013, p. 169) and that some SMEs in Germany have experienced difficulties in their implementation and use (Hardwig *et al.*, 2018; Paul, 2018). Overall, a very strong market potential is seen (Mikogo, 2018; Schubert and Williams, 2015).

The implementation of collaborative applications is associated with high expectations for the improvement of internal communication and collaboration. "Collaboration software enables companies to streamline their business processes, better manage projects of all sizes, and boost productivity across the board." (Mikogo, 2018, p. 2) Collaborative software has been recognised as an important enabler of productivity in enterprises (Silic and Back, 2016, p. 21). However, many of the current reports are based on market studies by consulting firms or case studies by companies reporting on their successes (see the sources in the paper of Archer-Brown and Kietzmann, 2018).

What do we really know about the real benefits of collaborative applications for companies? The aim of this paper is to identify the actual benefits of software-supported collaboration, especially for small and medium-sized enterprises (SMEs).

For this purpose we have conducted a structured literature review to find relevant studies. In the next section we present the method of the review. Then we present the results and end with a discussion of the findings and a conclusion for further research.

2 Data and Methods

We used ProQuest and EBSCO as databases to conduct the structured literature search. Since three high ranking journals are viewed to be especially relevant sources in the field of SMEs research (Durst and Edvardsson, 2012, p. 883), we ensured that these were included in our search: The International Small Business Journal, Journal of Small Business Management and Entrepreneurship Theory and Practice. We focussed our search on English-language peer reviewed empirical research papers and limited the publication time from 2009 to 2019. Based on McAfee (2009) we can assume that Web 2.0 application started to become a relevant factor for cooperation in companies about 10 years ago.

We iteratively developed a suitable search strategy for our research questions by experimenting with several search terms and combinations of terms. Due to the substantial terminological variance in the field of collaborative software (see Introduction) we examined multiple terms with regard to the number of findings and their relevance. Furthermore, we excluded the terms "education" and "corporate social responsibility" from our search, as they are not relevant to our research questions. We tried to narrow the search to studies of SMEs, but this reduced the search results too much. We therefore reversed our decision and reopened the search to all company sizes.

In the ProQuest database we achieved the most convincing results if we only searched for the applications using the different terms in the title, abstract, keywords and omitted the full text in the search.

Search term for ProQuest database:

(noft("enterprise social network") OR noft("collaborative software") OR noft("collaboration software") OR noft("social software") OR noft("unified communication") OR noft("enterprise social systems") OR noft("enterprise social media") OR noft("enterprise 2.0") OR noft("collaboration platforms")) AND (pd(20090315-20190315) AND PEER(yes))

Since there are differences in the search processes in the databases, we had to adjust our approach for EBSCO. In EBSCO the full text in the search is included. Therefore, we added different aspects (outcomes) like benefits, advantages and positive effects as well as importance and growth to focus the search on our research questions.

Search term for EBSCO database:

(enterprise social network or collaborative software or collaboration software or social software or unified communication or enterprise social systems or enterprise social media or enterprise 2.0 or collaboration platforms or enterprise collaboration system) AND (benefits or advantages or positive effects or importance or impact)

As a result, a total of 818 articles was identified. To select the relevant literature from all of our findings, we proceeded in four steps. Firstly, all 818 titles of the articles were checked for their relevance to our research questions. Over 76% of the articles did not pass the first sorting assessment. In the second step we screened the abstracts of the 193 remaining articles for their relevance. An additional 127 articles (34%) were disqualified. Although 5 articles had to be excluded because their full texts could not be procured, the full texts of the remaining 61 were subsequently read and checked with regard to their empirical method and the reported benefits of the use of software-supported collaboration. Based on this full text screening, 46 articles were disqualified, leaving 15 articles with relevant characteristics (see Table 1 in appendix).

3 Findings

Clearly, the benefits of the use of collaborative applications have not yet been thoroughly researched, demonstrated by the small number of studies found in our literature search of two large databases. Only 15 suitable studies from the last ten years were found, and they were found only because we did not limit our search to studies of collaborative software use in SMEs. The search was made more difficult by the fact that the topic is discussed using a large spectrum of different terms (see Table 2 "Type of IT System" column). In the 15 studies we analyse, 10 different terms are used, all of which refer more or less to the same subject. The only exception is the term social enterprise software, which clearly describes an add-on to existing enterprise software; the presented study by Engelstätter and Sarbu (2013) deals with customer relationship management (CRM) systems. The focus terms of the other studies are Web 2.0 and enterprise social

media. However, the concrete functionalities or products are not specified in most cases (Table 2 “Product” column).

The challenging use of collaborative applications is a global issue. The majority of the studies we found stem from Europe (8 studies), but contributions were also made in India/China (3) and Arabia (1). Three contributions analyse the situation of internationally active companies.

Most studies make no differentiation according to company size. Usually these are surveys involving a mix of company types and sizes (6), often lacking a precise description. Quite a few of the studies do not disclose their basis at all (4). Two studies are representative of the basic population (Engelstätter and Sarbu, 2013; Sarbu, 2017). One case study deals with an SME (Forsgren and Byström, 2018), one SME is represented in a multi-case study (Makkonen and Virtanen, 2015) and one study predominantly describes the situation in SMEs (Anders, 2016). More often we find studies of very large companies (4).

Not surprising is that IT companies are over-represented among the industries reported using collaborative applications. Four studies relate to the IT sector alone, and in the samples of three studies they are very strongly represented. In three surveys different industries are represented, and – as mentioned above – two analyses refer to representative samples. Three case studies add individual sectors to the list: energy sector (Alberghini *et al.*, 2013), electrical industry (Wu and Wang, 2014) and there is a collaborative application comparison of profit and non-profit companies (Trimi and Galanxhi, 2014).

Table 1 gives an overview of the methods used. Case studies (6) and surveys (5) predominate. Methodologically innovative are a multi-case study (Makkonen and Virtanen, 2015) and the content analysis of blog posts with a mixed-method approach (Anders, 2016). Econometric analyses based on representative data are carried out less frequently (3). All three analyse a regular company survey conducted by the Centre for European Economic Research (ZEW) in Germany. We also evaluate the presentation and interpretation of findings from a survey conducted by Microsoft itself (Williams and LaBrie, 2015). This study does not include a description of its method and the underlying data set, shining a light on its qualification as empirical research. We have included it because of its practical relevance.

Qualitative methods – mostly interviews – are used in case studies (Forsgren and Byström, 2018; Makkonen and Virtanen, 2015); in one case an additional survey is carried out (Trimi and Galanxhi, 2014). In these case studies, the number of respondents is between 12 and 42. In other case studies, questionnaires are used and more people are included, the amount being between 138 (Wu and Wang, 2014) and 158 (Alberghini *et al.*, 2013).

The number of cases in which company representatives are interviewed is similarly large in many surveys (between 115 and 174). Only the Czech survey achieves a large sample of 842 respondents (Skoludova, 2017). The largest samples can be found in the secondary analyses of the representative surveys (505 to 4400 respondents). Two studies do not disclose their case numbers.

The methods that were used show a relatively large number of advanced statistical approaches. There is no room here to take a closer look at whether the statistical methods match the questions used in the surveys and the data available.

What can be said about the benefits of collaborative applications based on the literature (see Table 3)?

The most noticeable result first: Only one study comes to the result that the use of social media in companies could have negative consequences. Especially the use of blogs and social media (not the use of Wiki systems) negatively correlated with labour productivity (Sarbu, 2017). The fact that the use of collaborative applications does not promise advantages under all conditions can also be taken from other studies, which we discuss later.

For the presentation of our findings on the use of collaborative software, we divide the existing contributions into four groups according to their focus on the benefits of collaborative applications:

A) The first group of four studies pursue research questions that focus on the perspective of the users of collaborative applications. What do users like about using the new tool called Slack (Anders, 2016)? What differences can be found between functional areas in a company, which are interpreted as work activities with different work related needs (Forsgren and Byström, 2018)? To what extent is the potential of such applications to generate social closeness associated with individual performance (Kügler *et al.*, 2015)? In which different dimensions (structural, relational, cognitive) do the users experience a benefit (Makkonen and Virtanen, 2015)?

These studies reveal multi-faceted effects of collaborative applications. The benefits of using collaborative applications can be summarised in four dimensions on the basis of these studies: The first is knowledge sharing (Anders, 2016) and work related information (Forsgren and Byström, 2018); the second is social benefits, comprising engagement and cohesion (Anders, 2016), the feeling of social connectedness (Kügler *et al.*, 2015) socializing (Forsgren and Byström, 2018) and the possibility to express themselves as a member of a community (Makkonen and Virtanen, 2015). The third aspect is collaboration, which comprises for instance the aspects of context awareness, collaborative workflows and avoidance of redundant work, as well as more space for collaborative discussions (Anders, 2016). The fourth dimension concerns change in the perception of events and activities within and outside the company. This dimension also includes a changed control of user awareness by the fact that independent user groups can be formed or users themselves can control which contents they want to perceive. This is described by similar terms: attention allocation (Anders, 2016) ambient awareness (Forsgren and Byström, 2018) transparency and awareness (Makkonen and Virtanen, 2015).

B) A second group of four studies surveys the benefits of collaborative applications for an entire company in the context of one (or more) case studies. They usually worked with pre-defined categories from the literature and report on very large companies. The case study of Alberghini *et al.* (2013) explores the expectations and perceptions of the employees using an enterprise 2.0 system. Another study compares management's and

employees' assessments of the benefits of a collaborative application in two large organisations, one a for-profit and one a non-profit organisation (Trimi and Galanxhi, 2014). Wu and Wang (2014) orient their evaluation towards the Balanced Scorecard system, which they operationalize with their own criteria. Williams and LaBrie (2015) do not use a specific classification system. Trimi and Galanxhi (2014) and Alberghini et al (2013) reports rather weak forms of benefits, the latter big differences between the needs of the users and the experienced reality.

Based on the above studies, three of the four dimensions of the benefits of collaborative applications can be confirmed: knowledge sharing (Alberghini *et al.*, 2013; Trimi and Galanxhi, 2014); social benefits, which includes community building, and employee engagement (Trimi and Galanxhi, 2014) as well as employee satisfaction (Williams and LaBrie, 2015); and lastly, the confirmation of collaboration (Alberghini *et al.*, 2013; Trimi and Galanxhi, 2014; Williams and LaBrie, 2015; Wu and Wang, 2014). But there are no reports of attention allocation, probably because it is not part of their given survey classifications.

Some other aspects are mentioned as benefits: better communication (Trimi and Galanxhi, 2014), competence (Alberghini *et al.*, 2013), more intensive customer relationship because of better problem handling (Wu and Wang, 2014) and organisational activities and outcomes (Trimi and Galanxhi, 2014). And last-but-not-least financial measures: Direct effects of the use of collaborative software are reduced conferencing and travel cost (Williams and LaBrie, 2015) or reduced cost of communication and reduced work hours (Wu and Wang, 2014). Other economic advantages result from the different way of working, which includes the reorganization of the work places. Williams and LaBrie (2015) report relevant reduction for real estate and operating costs and better productivity.

C) Further studies pose very specific questions regarding the benefits or drawbacks of collaborative applications. Three studies conducted econometric analyses on the basis of representative data. One (Engelstätter and Sarbu, 2013) analysed the economic effects of extending e-commerce applications with Web 2.0 functions, called social enterprise software (SES). This study reported that companies using this extension have higher revenue and labour productivity. Sarbu (2017) found that companies with a higher use of blogs and social media experience a decrease in labour productivity – the only study that reported a clear negative result of using collaboration software. The third article using der ZEW database revealed a positive relationship between the use of social media and innovation, however cause and effect were unclear (Meyer, 2010). The study from Indian IT companies found that the use of Web 2.0 applications results in significant business benefits. These effects become stronger with more advanced Web 2.0 applications (Wahi *et al.*, 2016). Skoludova (2017) found that using collaborative applications has a positive impact on managerial decisions and on all managerial functions (control, leading, organising, financial reporting).

D) The last group, including only two studies, deals with advantages of using collaborative applications almost incidentally. One used the measure of individual productivity (self-assessed job performance) as part of a model to predict the impact of

utilitarian and hedonic motivations (Aboelmaged, 2018). But he found a positive impact of the use of enterprise social networks. The other study analysed the impact of service characteristics of collaborative applications on teamwork and project success (Ulhas *et al.*, 2016). The study finds a correlation between collaborative applications and the quality of teamwork as well as the project results, which depend on how well the service quality of the collaborative applications.

4 Discussion and Conclusions

The topic of software-supported collaboration is, to date, insufficiently researched. Even once reports on the topic are identified, their focus and/or data sources tend to be narrow or even incomplete and their objectivity at times questionable. Nevertheless, important and largely consistent results are available, predominantly indicating the benefits of using collaborative applications. In our own survey of SMEs in Germany, representatives of companies reported very positive experiences with the use of collaborative applications as well (Hardwig *et al.*, 2018; Paul, 2018). Companies who have implemented collaborative applications are characterized by a requirement for high intensity of internal collaboration and the necessity to bridge spatial distances (Hardwig, 2019). A study of early adopters of collaborative applications revealed that 25% of their sample could no longer imagine working without their collaboration systems (Schubert and Williams, 2015).

In this respect, the results of this literature study are in line with other reports and allow an initial systematisation of the state of research on the subject. At the highest aggregated level, we find indications of the economic benefits of the tools for companies. The studies revealed positive effects on revenue, labour productivity (with one above-reported exception in this category), cost reductions and innovation.

These effects are probably based on the direct effects of using the tools on collaboration: The studies provide clear evidence that four central benefit dimensions can be identified:

1. Knowledge sharing
2. Social engagement and cohesion
3. Collaboration
4. Attention allocation

The first three are shown in the literature by qualitative and quantitative survey methods. The fourth dimension is above all a result of qualitative analysis. In order to identify new effects of the use of collaborative applications such as attention allocation, it seems necessary to intensify qualitative analytical research in this field.

That our literature survey confirms collaborative applications serve to improve communication, the exchange of knowledge and to foster collaboration is not surprising. What is striking, however, is how important collaborative applications seem to be for (re)creating social cohesion in the organization. Collaborative applications have been identified as a possible counteraction against the process of virtualizing the organisation (Child, 2015).

The dimension attention allocation describes probably a relatively new effect of information technology applications. Modern enterprise work redefinitions that include employees searching and organising content independently in the network (self-organised networking) is certainly noteworthy. Here, the tools provided by collaboration software apparently provide an unprecedented benefit: users no longer have to orient themselves on given structures and classifications of knowledge management (McAfee, 2009). This confirms the assumption that collaborative applications differ fundamentally from classical knowledge management (Alberghini *et al.*, 2013). Previous results regarding the benefit of knowledge management of SMEs (Durst and Edvardsson, 2012) would benefit from being systematically examined. This theoretically could be accomplished in the same way as a comparable evaluation of knowledge management benefit dimensions was conducted by Choy *et al.* (2006). However, there is currently a lack of sufficient studies on SMEs. Another shortfall of the literature is that with the ever-evolving characteristics of software-supported collaboration as their rollouts continue and their features are tweaked, it can be assumed that previously identified aspects have diminished in importance and new, unstudied aspects have emerged.

The future of the various benefits of collaborative applications depends on very different prerequisites. The properties (need vs. fit) of the applications themselves are important: on the one hand the quality of service (Ulhas *et al.*, 2016) and on the other hand the development as a Web 2.0 tool, which supports a free and intensive exchange (Wahi *et al.*, 2016).

The quality of the introduction/implementation of collaborative applications is also brought into play. Important factors here are the level of management support and the role model of new forms of collaboration (Makkonen and Virtanen, 2015). The relevant dimensions to be considered during implementation have been described (Alberghini *et al.*, 2013). Key factors are the extent to which the use of the system creates reputation for the users and how soon the implementation reaches a critical mass of convinced users, motivating other potential users to use the systems (Kügler *et al.*, 2015). And not to be underestimated is the need to redesign the entire workplace and its environment in order to harness the potential of the new forms of work these implementations create (Williams and LaBrie, 2015).

Several contributions show very clearly that collaborative application implementation challenges are not limited to known technical and organisation issues. It must be treated as a holistic approach in which structural, relational and cognitive aspects are treated integratively (Makkonen and Virtanen, 2015). The work-related interests of the various employee groups play a critical role that should not be underestimated. For instance, it cannot be assumed that collaborative applications are used in the same way by all groups (Forsgren and Byström, 2018). There are not only differences in acceptance (Trimi and Galanxhi, 2014), but also in the way applications can support the different groups' respective work.

The studies reported here do not cover all the design dimensions that have to be considered in the successful deployment of collaborative applications. But they are essentially in line with the state of research on design challenges (Greeven and Williams,

2017). We have already presented a first draft of a design model for collaborative work systems in SMEs and will continue this work (Hardwig *et al.*, 2018). An orientation framework for operational work designers dealing with how they can successfully realize a socio-technical design of the complex requirements and conditions would be of high practical value. The fact that the use of collaborative applications can bring benefits is shown by these studies, although their implementation requires critical, holistic attention to the demanding changes of individual and organisational work content and style.

Two main limitations of the results presented here must be taken into account. Firstly, we have only considered two databases and the period of ten years to date. Because extending the time period would cause the findings to become less relevant to modern SMEs than they already are, we will continue to try to identify additional, SME-relevant studies through a targeted evaluation of relevant bibliographies. The second limitation concerns the blurriness in the terminology of the tools we call collaborative applications. The various attempts to define the subject more precisely (via functionalities, possible uses, affordances, product names) have not yet been convincing. But it should be stressed that the validity of the studies would be enhanced if the subject could be better defined.

Which questions have remained unanswered? We have learned almost nothing about the specific conditions of SMEs regarding the effects of the use of collaborative applications. There are some indications that in smaller companies it might be easier to realize a successful use of collaborative applications. But whether really the specific conditions of SMEs are the cause or perhaps the context of the IT industry or other factors (i.e. implementation), cannot be decided conclusively. This is where research efforts need to be made. At present we cannot say whether and to what extent the benefits of collaborative applications in small and medium-sized enterprises differ substantially from large-scale enterprises. The studies currently available in the literature make no relevant statements on this, meaning the benefits of collaborative applications for SMEs remain a research desideratum. Another research task ahead of us is a systematic evaluation of the importance of collaborative applications for the development of dynamic capabilities and the growth of SMEs.

References

- Aboelmaged, M.G. (2018), "Knowledge sharing through enterprise social network (ESN) systems: motivational drivers and their impact on employees' productivity", *Journal of Knowledge Management*, Vol. 22 No. 2, pp. 362–383.
- Alberghini, E., Cricelli, L. and Grimaldi, M. (2013), "KM versus enterprise 2.0: a framework to tame the clash", *International Journal of Information Technology & Management*, Vol. 12 No. 3/4, pp. 320–336.
- Anders, A. (2016), "Team Communication Platforms and Emergent Social Collaboration Practices", *International Journal of Business Communication*, Vol. 53 No. 2, pp. 224–261.
- Archer-Brown, C. and Kietzmann, J. (2018), "Strategic knowledge management and enterprise social media", *Journal of Knowledge Management*, Vol. 22 No. 6, pp. 1288–1309.
- Cardon, P.W. and Marshall, B. (2015), "The Hype and Reality of Social Media Use for Work Collaboration and Team Communication", *International Journal of Business Communication*, Vol. 52 No. 3, pp. 273–293.

- Child, J. (2015), *Organization: Contemporary principles and practices*, 2nd Edition, Wiley, Hoboken.
- Choy, C.S., Yew, W.K. and Lin, B. (2006), "Criteria for measuring KM performance outcomes in organisations", *Industrial Management & Data Systems*, Vol. 106 No. 7, pp. 917–936.
- Durst, S. and Edvardsson, I.R. (2012), "Knowledge management in SMEs: a literature review", *Journal of Knowledge Management*, Vol. 16 No. 6, pp. 879–903.
- Edvardsson, I.R. and Durst, S. (2013), "Does Knowledge Management Deliver the Goods in SMEs?", *Business and Management Research*, Vol. 2 No. 2, pp. 52–60.
- Engelstätter, B. and Sarbu, M. (2013), "Why adopt social enterprise software? Impacts and benefits", *Information Economics and Policy*, Vol. 25 No. 3, pp. 204–213.
- Forsgren, E. and Byström, K. (2018), "Multiple social media in the workplace: Contradictions and congruencies", *Information Systems Journal*, Vol. 28 No. 3, pp. 442–464.
- Greeven, C.S. and Williams, S.P. (2017), "Enterprise collaboration systems: Addressing adoption challenges and the shaping of sociotechnical systems", *International Journal of Information Systems and Project Management*, Vol. 5 No. 1, pp. 5–23.
- Hardwig, T. (2019), "Das integrative Potenzial "kollaborativer Anwendungen". Drei Fallstudien aus mittelgroßen Unternehmen", *Arbeits- und Industrie soziologische Studien*, Vol. 12 No. 1, pp. 55–72.
- Hardwig, T., Klötzer, S. and Boos, M. (2018), "Software-Supported Collaboration: A New Way of Working in Small and Medium-Sized Enterprises", in 13th International Forum on Knowledge Asset Dynamics (Ed.), *Societal Impact of Knowledge and Design: Proceedings IFKAD 4-6 July 2018 in Delft(NL)*, Delft University of Technology, Delft, pp. 229–243.
- Kane, G.C. (2015), "Enterprise Social Media: Current Capabilities and Future Possibilities", *MIS Quarterly Executive*, Vol. 14 No. 1, pp. 1–16.
- Kim, H.D., Lee, I. and Lee, C.K. (2013), "Building Web 2.0 enterprises: A study of small and medium enterprises in the United States", *International Small Business Journal: Researching Entrepreneurship*, Vol. 31 No. 2, pp. 156–174.
- Klötzer, S., Hardwig, T. and Boos, M. (2017), "Gestaltung internetbasierter kollaborativer Team- und Projektarbeit", *Gruppe. Interaktion. Organisation. Zeitschrift für Angewandte Organisationspsychologie*, Vol. 31 No. 5, p. 133.
- Kügler, M., Dittes, S., Smolnik, S. and Richter, A. (2015), "Connect Me! Antecedents and Impact of Social Connectedness in Enterprise Social Software", *Business & Information Systems Engineering*, Vol. 57 No. 3, pp. 181–196.
- Makkonen, H. and Virtanen, K. (2015), "Social capital approach on Enterprise 2.0: a multiple case study", *Technology Analysis & Strategic Management*, Vol. 27 No. 10, p. 1212.
- McAfee, A. (2009), *Enterprise 2.0: New collaborative tools for your organization's toughest challenges*, Harvard Business Press, Boston, Mass.
- Meyer, J. (2010), "Does Social Software Support Service Innovation?", *International Journal of the Economics of Business*, Vol. 17 No. 3, p. 289.
- Mikogo (2018), "The Future of Collaboration Software – A Qualitative Study", available at: <https://www.mikogo.com/downloads/docs/future-collaboration-software-trends.pdf> (accessed 5 January 2019).
- Nitschke, C.S. and Williams, S.P. (2018), "Traces of design activity: the design of coordination mechanisms in the shaping of enterprise collaboration systems", *Procedia Computer Science*, Vol. 138, pp. 580–586.
- Paul, G. (2018), "Die Befragung von KMUs zur Kollaborativen Team- und Projektarbeit", available at: www.collaboteam.de.
- Raeth, P., Urbach, N., Smolnik, S., Butler, B.S. and Königs, P. (2010), *The Adoption of Web 2.0 in Corporations: A Process Perspective: Proceedings of the Sixteenth Americas Conference on Information Systems*, Lima.

- Rossmann, A., Stei, G. and Ebner, W. (2016), "Governancemodelle für Enterprise Social Networks", in Rossmann, A., Stei, G. and Besch, M. (Eds.), *Enterprise Social Networks: Erfolgsfaktoren für die Einführung und Nutzung - Grundlagen, Praxislösungen, Fallbeispiele*, Springer Gabler, Wiesbaden, pp. 61–82.
- Sarbu, M. (2017), "Does Social Media Increase Labour Productivity?", *Journal of Economics and Statistics*, Vol. 237 No. 2, pp. 81–113.
- Schubert, P. and Williams, S.P. (2012), "Implementation of Collaborative Software in Enterprises. A Thematic Analysis", *it - Information Technology*, Vol. 54 No. 5, pp. 212–219.
- Schubert, P. and Williams, S.P. (2015), *Social Business Readiness Studie 2014*, Koblenz.
- Silic, M. and Back, A. (2016), "Factors driving unified communications and collaboration adoption and use in organizations", *Measuring Business Excellence*, Vol. 20 No. 1, pp. 21–40.
- Skoludova, J. (2017), "The Impact of Enterprise Social Networks on Management process in the Czech Republic", in *Economic and Social Development: Book of Proceedings*, Varazdin Development and Entrepreneurship Agency (VADEA), Varazdin, pp. 523–530.
- Trimi, S. and Galanxhi, H. (2014), "The impact of Enterprise 2.0 in organizations", *Service Business*, Vol. 8 No. 3, pp. 405–424.
- Ulhas, K., Lai, J.-Y. and Wang, J. (2016), "Impacts of collaborative IS on software development project success in Indian software firms: a service perspective", *Information Systems and eBusiness Management*, Vol. 14 No. 2, pp. 315–336.
- Wahi, A.K., Misra, R.K. and Shakeel, M. (2016), "Why should Indian businesses transition to Enterprise 2.0?", *Info*, Vol. 18 No. 1, pp. 31–55.
- Warner, M. and Witzel, M. (2004), *Managing in Virtual Organizations*, Thomson Learning, London.
- Williams, J. and LaBrie, R.C. (2015), "Unified communications as an enabler of workplace redesign", *Measuring Business Excellence*, Vol. 19 No. 1, pp. 81–91.
- Wu, M.-Y. and Wang, Y.-C. (2014), "The benefits of using unified communication systems for SMEs", *International Journal of Electronic Business Management*, Vol. 12 No. 4, pp. 236–246.

Appendix

Table 1: Overview of the studies considered: Methods

Nr	Author(s)	Type of Research	Methods	Empirical Base	Respondents
1	Aboelmaged 2018	Survey	Inductive Statistics	Questionnaire	115
2	Alberghini, Cricelli and Grimaldi 2013	Case Study	Descriptive Statistics	Questionnaire	153
3	Anders 2016	Content Analysis	Mixed Methods	Blog Posts	100
4	Engelstätter and Sarbu 2013	Data Analysis	Inductive Statistics	Secondary Analysis	4400
5	Forsgren and Byström 2018	Case Study	Qualitative Methods	Interviews	21
6	Kügler, Dittes, Smolnik and Richter 2015	Survey	Inductive Statistics	Questionnaire	174
7	Makkonen and Virtanen 2015	3 Case Studies	Qualitative Methods	Interviews	12
8	Meyer 2010	Data Analysis	Inductive Statistics	Secondary Analysis	505
9	Sarbu 2017	Data Analysis	Inductive Statistics	Secondary Analysis	907
10	Skoludova 2017	Survey	Descriptive Statistics	Questionnaire	842
11	Trimi and Galanxhi 2014	2 Case Studies	Descriptive Statistics	Interviews and Questionnaire	42
12	Ulhas, Lai and Wang 2016	Survey	Inductive Statistics	Questionnaire	153
13	Wahi, Misra and Shakeel 2016	Survey	Inductive Statistics	Questionnaire	NA
14	Williams and LaBrie 2015	Case Study	Descriptive Statistics	Secondary Analysis	NA
15	Wu and Wang 2014	Case Study	Descriptive Statistics	Questionnaire	138

Table 2: Overview of the studies considered: Subjects

Nr	Region	Industries	Size (Employees)	Type of IT System	Product
1	United Arab Emirates	Various	Various	Enterprise Social Network	NA
2	Italy	Energy	80.000	Enterprise 2.0	NA
3	Global	~ 53% IT, Media 31 %	~ 77% SME	Team communication platform	Slack
4	Germany	Representative	Representative	Social Enterprise Software, Web 2.0	NA
5	Scandinavia	IT	100	Enterprise Social Media	Wiki, Yammer, et al
6	Germany	IT	NA	Enterprise Social System	NA
7	Finland, Italy	IT, Production, Service	200, 4000, 58000	Enterprise 2.0	IBM Connctions
8	Germany	IT, Knowledge Intensive Services	Various	Social Software	NA

9	Germany	Representative	Representative	Enterprise Social Media	NA
10	Czech Republic	Various	NA	Enterprise Social Network	NA
11	Global	Profit and Non-Profit	Very Large	Web 2.0	NA
12	India	IT	NA	Collaborative Information System (CIS)	NA
13	India	NA	NA	Web 2.0	Various
14	Global	IT	135000	Unified Communication	Microsoft
15	China	Electrical industry	1400	Unified Communication	Lync

Table 3: Overview of the studies considered: Research aim and Main findings

Nr	Author(s)	Research aim	Main findings: Benefits of the use of collaborative applications
1	Abouelmaged 2018	This study aims to predict the impact of utilitarian and hedonic motivations on using Enterprise Social Networks for sharing internal and external knowledge, as well as their effects on employee productivity. Identifying the benefits of the tools is a minor matter.	The use of Enterprise Social Networks has a positive impact on productivity of the company. Productivity was operationalized as a self-assessment of the users' job-performance.
2	Alberghini, Cricelli and Grimaldi 2013	The aim is to demonstrate the benefits of social technologies, the major component of enterprise 2.0. Based on a bottom up framework to highlight new technology potentialities the study tries to understand how to support current users' needs. In the end the paper provides guidelines to help the management to adopt enterprise 2.0.	The benefits are described in the dimensions of Rao 2005 (but unfortunately not reported). The difference between expectations and perceptions from the users' point of view is presented. Expectations: the aspects "sharing knowledge", "collaboration" and "competence" have the highest expression. Perceptions: the aspects "collaboration" and "connectivity" are the most important. A clear difference between the perception and the degree of fulfillment calls for design measures.
3	Anders 2016	The study aims to find out why early adopter use the team platform Slack. What possibilities (affordances) that the platform offers do they value the most and how does their behaviour change through the use of Slack. Blog posts from 100 users who have talked about their experiences were examined.	The study reports new forms of collaboration enabled by teamplatforms. Rationals for adoption of the platform: virtual collaboration (34%), openness and transparency (19%), need for interoperability with external sources; centralizing communication and information (13%). Benefits are knowledge sharing (proactive knowledge aggregation 17%; recombinant idea generation 15%, vicarious learning 12%), social benefits (social engagement 17%, social cohesion 26%, virtual collaboration 34%) and collaboration (context awareness 34%, flexible roles and collaborative workflows 34%, avoidance of redundant work 28%, more space for collaborative discussions 34%, generative role taking 18%, leadership awareness 17%, context awareness for boundary work 11%) and attention allocation (engagement and presence 29%, compartmentalization 38%, synchronizing 26%).
4	Engelstätter and Sarbu 2013	This paper explores the performance impacts and benefits of the adoption of Social Enterprise Software (SES). This type of social software links and combines established enterprise software with social software applications. Focus of the research are e-commerce applications.	Companies that use Social Enterprise Software (SES) and Business to business (B2B) applications together have higher revenue and labor productivity than companies that do not use social media applications. The results offer first evidence of positive performance impacts of SES, which seem to be particularly high for firms which adopt SES in addition to already established B2B e-commerce solutions.

5	Forsgren and Byström 2018	The authors report an investigation on the use of multiple Social Media in knowledge work and explore the contribution of activity theory for such a study. Because Social Media are increasingly adopted at work, it is important to understand how they are being incorporated. The study focuses on how Social Media may improve or reduce coherence in work activities.	Social Media in general helped maintaining coherence in terms of sharing work related information, improving ambient awareness and for socialising. However there are cases where negative effects emerge, such as inconsistent use or lack of adoption. New forms of benefits in this area are informal, self-directed forms of exchange. The results reveal important differences in use: Development adopted an active and constructive approach whereas both Sales and Production Management positioned themselves in a passive, opportunistic and strategic way. Development used Social Media to build a knowledge base and solve problems, whereas Sales and Production Management focused on expanding their horizons and gathering information beyond their own immediate context.
6	Kügler, Dittes, Smolnik and Richter 2015	The paper investigates the concept of social connectedness and its antecedents, as well as its potential impact on employees' work performance. The use of Enterprise Social Software enables users to build close social relationships. To feel close to other members of the organisation (referred as social connectedness) has been shown to improve employees' work performance.	The use of Enterprise Social Software is positively related with social connectedness. The study reveals that the social connectedness impact is positively associated with individual performance impact: "employees not only feel more connected to their colleagues when using ESS, but also complete their work tasks more quickly." Important antecedens of social connectedness are reputation (quality) and critical mass (quantity) of the use of the tools in the organisation.
7	Makkonen and Virtanen 2015	Using a social capital approach, the study aims at getting a deeper understanding of Enterprise 2.0 as a holistic socio-technical phenomenon.	Enterprise 2.0 has multidimensional benefits: It provides a solid and multifunctional platform for communication and information access (structural dimension). It provides possibilities for employees to express themselves, make their work more visible to others and build their social identity as members of a particular community (relational dimension). Transparency and awareness enables users to develop shared visions and norms through the use (cognitive dimension). Management processes can be converted into a more collaboratively oriented social activity.
8	Meyer 2010	Using data from German IT companies and knowledge-intensive service firms, this paper empirically analyses whether the use of Social Software Applications triggers innovation.	"The econometric results reveal that there is a positive relationship between the use of Social Software and service innovation, measured as broadening or differentiation of the range of services offered. Firms applying at least one Social Software Application are more likely to innovate compared to firms which do not use Social Software. There is an endogeneity problem: on the one hand, it is not clear whether firms that use Social Software are more innovative or whether innovative firms tend to use new and innovative applications such as Social Software."
9	Sarbu 2017	The study analyses the relationship between social media applications and labour productivity using firm-level data of 907 German manufacturing and service firms.	The use of blogs and social networks is negativley correlated with labour productivity."In summary, firms using social media experience a decrease in labour productivity. This result is robust across all model specifications. The decrease in labour productivity is mainly driven by the social media applications blog and social network. Both applications are especially prone to the shirking of employees."
10	Skoludova 2017	The study aims at the impact of Enterprise Social Networks on the management process and on different management functions.	The responding managers assessed that the use of ESN has a positive impact on managerial decisions and on all managerial functions (controll, decions, leading, controlling, etc.). Organizing and controlling were most effected by implementing ESN.

11	Trimi and Galanxhi 2014	The study examines the hypothesis that the level of congruence of management-employees perceived benefits would affect the level of adoption of Enterprise 2.0. The study analyzed the use of Enterprise 2.0 on the basis of a case study of two large global organizations.	The study revealed that managers were more sceptical towards Enterprise 2.0 than employees. In addition there were relevant differences between the two organisations. The benefits measured on six dimensions were rated "little" by respondents (5 point likert scale): Communication (2,9), collaboration (3,0), community building (3,1), employee engagement (3,0), Knowledge management (3,2) and organisational activities and outcomes (3,2).
12	Ulhas, Lai, and Wang 2016	The study investigates the role of the Collaborative Information System (CIS) service characteristics for teamwork and software development project success using DeLone and McLean's Information System Success Model.	The service quality (performance of service) and service convenience (expense of use) of Collaborative Systems has an high impact on teamwork quality and performance. The applications "aid team members by boosting task-related and social interactions among the team members, which in turn influences teamwork performance". "The CIS provide platforms for enhancing teamwork quality, which not only enables them to communicate and coordinate, but also develops them as a social unit."
13	Wahi, Misra and Shakeel 2016	This study aims at examining the factors governing business benefits of moving to Enterprise 2.0. The study wants to develop a framework that can be used to study the readiness of an organization to implement Enterprise 2.0.	The usage of both basic and advanced Web 2.0 tools can result in significant business benefits for the organization. The impact of advanced Web 2.0 tools is higher than the impact of basic tools. The business benefits are very significant when the organization has the maturity to use both the simple/common Web tools as well as the basic and advanced Web 2.0 tools.
14	Williams and LaBrie 2015	The authors examine how advances in Unified Communications (UC) technologies are enabling radical changes in workplace redesign. The advantages of UC were presented on the basis of a case study (Microsoft) using a secondary analysis of a study conducted by Microsoft and performance measures of the company.	Workplace redesign together with the use of Unified Communication leads to a significantly better productivity. Employee satisfaction in the new work environment arose (+ 10 %), collaboration intensified and the individual effectiveness (+ 10%) increased a little more than the team effectiveness (+ 7%). Important was the cost reduction in real estate and operating costs (- 8 %), reduced space per employee, conferencing costs and relevant travel savings.
15	Wu and Wang 2014	This study investigates the benefits of a Unified Communications (UC) system for a company which is located in the electrical industry in Taiwan. The UC system would be explored from interviews with staff in the information department of the case company, and using the Technology-Organization-Environment framework.	Relevant benefits were found in all four dimensions of the balanced scorecard. The dimension "learning and growth" (improved efficiency of information exchange between employees, improved handling of problems, improved work efficiency of employees) had the highest value expression followed by the dimension "internal processes" (improved interactions between departments; improved interactions between plants; improved efficiency of work processes), the dimension "customer" (improved employees' efficiency in solving problems that must be handled immediately) and the dimension "financial" (reduced work hours of employees; reduced cost of communications). The reported means were above 3,69 (5 point-scale). Nine of twenty items ranked high. Only three items were below 3,5 in the media (customer satisfaction, improve customer trust, and the financial dimension reduced cost of buying new software).

Knowledge Management Practices Related to Organizational Resilience Capabilities

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Abstract

Small and Medium Enterprises (SMEs) are highly vulnerable in times of crisis and are affected by various financial and human risks (Vargo & Servilha, 2011). One strategy for adapting and responding proactively is to develop the potential for organizational resilience. This can be understood by four capacities: to anticipate, to respond, to monitor and to learn (Hollnagel, 2010). These can be developed through the strategic management of the knowledge resource using the practices of Knowledge Management (KM). In turn, these, can be grouped according to the knowledge creation spiral of Nonaka, Takeuchi and Umemoto (1996), in actions aimed at externalization, socialization, combination and internalization. The literature addresses some KM practices related to resilience in a segmented way, such as the work of Chalfant and Comfort (2015) and Patil and Kant (2016). In this way, this study identified knowledge management practices to improve/boost resilience capabilities in the organizational environment.

The application of phase 4 of the framework developed by Fraga, Varvakis and Sell (2018) was used as a base in a small business in the information technology industry to identify practices related to resilience capabilities. Data were collected through semi-structured interviews, and knowledge management practices related to each resilience capacity were indicated.

The application of the framework allowed the connection of knowledge management practices identified through the processes of socialization, externalization, combination and internalization, making possible the understanding of the critical aspects of the resilience potential, reducing the risks of loss of knowledge and avoiding the reinvention of know-how of employees in SMEs.

It is worth noting that the use of knowledge spiral lenses to look at each resilience capacity facilitated the grouping of KM practices. It is suggested that KM techniques and tools be identified and instituted according to organizational strategies. Thus, in this study, the Nonaka and Takeuchi (1997) spiral presented an adherence to resilience capacities and their characteristics found in SMEs. This contribution is relevant, since many studies mention the importance of KM for resilience, and this research allowed the proposal of specific practices to improve the potential for resilience in this particular context.

Keywords – Organizational Resilience, Resilience Capacity, Knowledge Management, Knowledge Management Practices.

Paper type – Practical Paper

1 Introduction

Complex and turbulent environments are characterized by constant social and economic changes, disturbances, and changes in their functioning (Sahebjamnia, Torabi & Mansouri, 2015; Hosseini, Barker & Ramirez-Marquez, 2016). In view of this, with regard to constant changes in organizational environments, there are companies that do not resist or adapt to the new market realities and end up disappearing (Choo, 2006). Furthermore, complexity and turbulence also lead to uncertainties in the actions of individuals who do not know how to respond to certain situations, be they human, structural, technological or social.

Small and Medium Enterprises (SMEs) are highly vulnerable in times of crisis and are affected by various financial and human risks (Vargo & Servilha, 2011). However, to minimize and even dissolve uncertainties, organizations can develop their organizational resilience capabilities. SMEs seek to develop their resilience potential through strategic readiness, responsiveness, and knowledge creation (Pal, Torstensson & Mattila, 2014).

Resilience capabilities can be developed through strategic management of the knowledge resource, enabling organizations to be able to respond in a resilient manner to risks and changes in their environment (Rankin et al. 2014). These are understood as follows: to anticipate, to respond, to monitor and to learn (Hollnagel, Woods & Leveson, 2007).

Hollnagel and Woods (2004) add that it is not only the stocks of resources that determine resilience but also the efficient deployment of existing resources. Efficient management of available resources is required (Van Der Vorm et al., 2011). With the same line of thought, Wernke (2002) states that the differential of an organization is related not only to the quantity of equipment used in its productive processes, but also to the collective knowledge generated and acquired, to the creative abilities as well as the values, attitudes and motivation of the organization's people.

Given this context, Knowledge Management (KM) is highlighted as an essential resource for the promotion of resilience, that is, for the organization's ability to manage

the complexity and risks of its environment (Salgado, 2013). KM as a coordination mechanism through practices and tools allows the most efficient use of resources, promotes interaction, and contributes to an improvement in the organization's innovative capacity and performance (Darroch, 2005).

From the above, it can be seen that KM in organizations has a fundamental role in the context of competitiveness, complexity and changes, with the purpose of promoting organizational resilience. The literature addresses some KM practices related to resilience in a segmented way. Chalfant and Comfort (2015) discuss the importance of shared knowledge about risks to improve natural resource management. Along the same lines, the work of Patil and Kant (2016) addresses the importance of KM strategies to build a resilient supply chain. Therefore, this study aims to identify knowledge management practices to improve/boost resilience based on the analysis of their capacities in the organizational environment.

2 Theoretical Background

2.1 Knowledge as a resource

With the advancement of studies, the management of organizations has changed from the resource-based view (RBV) developed by Nelson and Winter (1982), to a knowledge-based view (KBV) studied by Grant (1996) and Sveiby (1997). The knowledge-based view considers organizational knowledge as an intangible asset as critical to respond adequately to changes in the business environment (Grant, 1996; Sveiby, 1997; Nieves, Quintana & Osorio, 2014).

In accordance with the knowledge-based view, Stewart (1998) explains that the knowledge age has the following decisive factors in its development: knowledge and relationships, both internal and external to the organization; and no longer the capital, natural resources or labor. For the author, the intangibles, present in the intellectual capital of the organization, deal with the competence and know-how in order to carry information, allowing faster reaction to the market than its competitors.

For Sabbag (2007), there are different perspectives of KM definitions as a structured process of identifying, describing and organizing the knowledge used in the organization with the objective of retaining them, multiplying them and improving them in order to leverage skills, making processes, optimizing processes, and developing the workforce. Another relevant point is cited by Fialho et al. (2010), which explains that it is through the creation and organization of his experiences that man acquires knowledge, and this can be understood as a result of his quest to contextualize and deal with the context in which he is inserted.

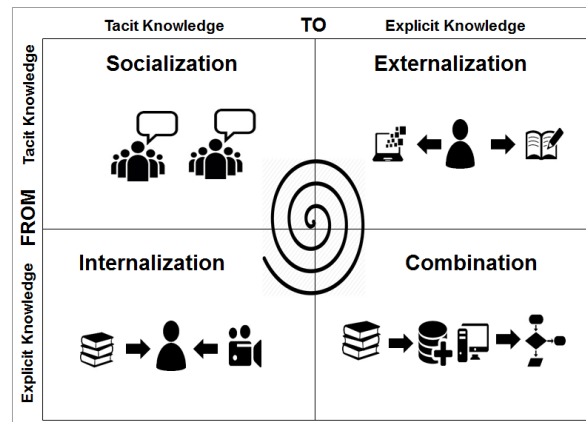
There are different levels of knowledge, ranging from individual to organizational. Individual knowledge is necessary to develop the basis of organizational knowledge, however, organizational knowledge is not simply the sum of individual knowledge (Bhatt, 2000; Bhatt, 2001). Organizational knowledge is formed through unique patterns of interactions between technologies, techniques and people, which can not easily be

imitated by other organizations. These interactions are shaped by the organization's history and its cultural aspects (Bhatt, 2001).

In addition, there is the distinction of knowledge of different natures: the tacit and the explicit. Authors Nonaka and Takeuchi (1997) argue that tacit knowledge is understood as the know-how of the individual that can not be verbalized and is related to the techniques and abilities that allow the individual to know how to do it. On the other hand, explicit knowledge is transmissible and allows the individual to know, in the sense of understanding and comprehension, about facts and events in their environment. Moreover, for the authors, tacit and explicit knowledge are complementary and interact with each other through a cycle of knowledge conversion, also called the knowledge spiral.

Nonaka and Takeuchi (1997) explain that an organization does not create knowledge by itself, given the fact that tacit knowledge present in the minds of individuals goes through several levels until it is expanded at organizational level. The authors argue that for the emergence of the knowledge spiral, there are four models of knowledge conversion. This conversion occurs from the interaction between tacit and explicit knowledge, known as processes of socialization, externalization, combination and internalization. These processes are represented in Figure 1 and are described by Nonaka and Takeuchi (1997) as follows:

- **Socialization:** the process of converting tacit knowledge into new tacit knowledge, that is, experiences and mental models are shared and tacit knowledge and technical skills are created. In organizational practice, socialization occurs through workplace training; informal sessions and brainstorming; interactions with customers, suppliers, etc.
- **Externalization:** the most important way of creating knowledge, by facilitating the transformation of tacit knowledge, which is personal, context-specific and difficult to formalize, into new and explicit knowledge. This process occurs through the use of metaphors, writing, analogies, concepts, hypotheses and models, which are used in dialogue and collective reflection.
- **Combination:** understood as the process of systematizing existing concepts into a new knowledge system. It is caused by the placement of newly created knowledge and existing knowledge, coming from other sections of the organization in a network, thus constituting a new product, service or management system. It means combining several sets of explicit knowledge, such as documents, meetings, telephone conversations, computerized communication networks, which can lead to new knowledge.
- **Internalization:** the existing explicit knowledge is reformulated by the individual and internalized as new tacit knowledge. Externalization becomes skills and knowledge in attitudes; internalization turns these attitudes into skills. For this, the verbalization and the diagramming of the knowledge in the form of documents; manuals or oral histories, and training programs that use simulations and experiments, which also facilitate internalization, are necessary.



Source: Adapted from Nonaka and Takeuchi (1997).

Figure 1 - Model of knowledge conversion

Therefore, socialization generates shared knowledge; explicitness generates conceptual knowledge; combination gives rise to the systemic knowledge and internalization produces the operational knowledge (Fialho et al., 2010). In addition, generating knowledge in an organization involves the creation of individual knowledge, initially, which is expanded through the interactions between individuals at different organizational levels.

These mechanisms are supported by KM practices, which are considered intentional, formal or informal activities or routines, oriented to adequately manage knowledge for efficient use and aligned with the objectives associated with a specific task (Dávila et al., 2014, Kianto & Andreeva, 2014). Examples of practices are: knowledge banks (Davenport & Prusak, 1998), coaching (Salim, 2002), practice communities (Ahmadijan, 2008), lessons learned manual (OECD, 2003), shared electronic space (Balestrin & Verschoore, 2008), prospecting scenarios (Chermack, 2004) and storytelling (Keyes, 2006). Additionally, practices can be grouped according to the knowledge creation spiral of Nonaka, Takeuchi and Umemoto (1996) in actions aimed at externalization, socialization, combination and internalization of knowledge.

2.2 Organizational resilience approach

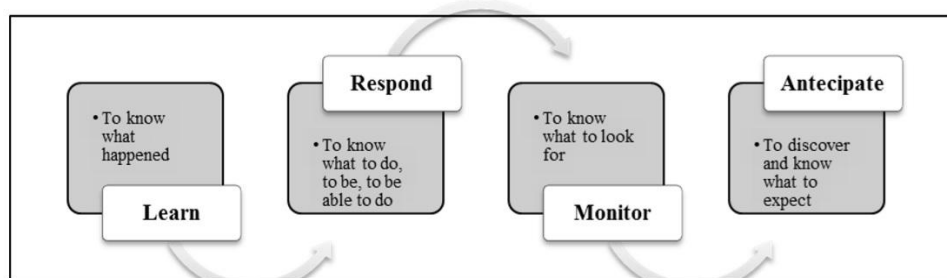
The concept of resilience is multidisciplinary and is present in several areas of knowledge, such as psychology (Coutu, 2002), ecological systems (Holling, 1973), engineering (Hollnagel & Woods, 2004) and organizational level (Hamel & Valikangas, 2003). For the purpose of this paper, we will use the concept of resilience addressed by Hollnagel (2010), in the organizational environment, with the following definition:

Resilience is the intrinsic ability of a system or an organisation to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions. (HOLLNAGEL, 2010, p. 1).

In addition, it should be pointed out that this work is based on the resilience engineering approach, analyzing the organizational context, as a way of complementing the visions and elements that characterize and compose the area of resilience in the organizational context. It is important to explain that resilience engineering is not only about addressing what should have been done and explaining what happened when a failure occurs (Hollnagel et al., 2006), but learning from organizational changes and limits, to predict and anticipate possible future failures (Vargas & Guimarães, 2006).

In his research, Hollnagel (2010, 2015) points out four interdependent capacities, which form the basis of this work. If analyzed together, they make it possible to analyze the performance of an organization's resilience potential and enable it for action. These action-oriented capacities are: to respond, to anticipate, to monitor and to learn. The four capacities are represented in Figure 2 and are described by the author:

- **Anticipate:** discovering and knowing what to expect, or being able to anticipate the future, such as potential interruptions, new requirements or limitations, new opportunities, or changing operating conditions.
- **Respond:** corresponds to knowing what to do, or being able to respond to regular and irregular changes, disruptions and opportunities by activating prepared actions or adjusting the current mode of operation.
- **Monitor:** indicates what to look for, or be able to monitor what is or could seriously affect the performance of the system in a positive or negative way. Monitoring should cover the system's own performance, as well as what happens in the environment.
- **Learning:** occurs from what happened, or being able to learn from experience, specifically to learn the correct lessons from experiences, as shown in the study by Argyris and Schön (1974).



Source: adapted from Hollnagel (2010)

Figure 2 - Organizational resilience capabilities

In the area of resilience engineering, resilience capabilities are addressed in order to adapt organizations to change and also anticipate and learn from what has been experienced at a given time. Organizations should proactively develop strategies that can prevent as well as prepare them to support other forms of business disruption (Umoh, Amah & Mnim, 2014) and recovery (Bhamra, Dani & Burnard, 2011).

The choice of the four elements proposed by Hollnagel (2010), arose from empirical evidences that used them. This choice is justified by the relevance that the four elements

possess to the capacity to generate solutions, since these make possible the action and reach of resilient organizational performance. Moreover, Hollnagel (2011, 2015) argues that it is necessary to understand the definition of resilience in a more precise and operational way, considering the resources that make the performance resilient, since it is not characterized by a single characteristic or specific domain.

From this point of view, it makes sense to consider the four capabilities that provide the basis for resilient performance. However, one might ask how well a system is able to respond, monitor, anticipate, and learn. While in some cases it may be useful to approach each capability as a simple and uniform quality, understanding the set brings a complementary view on the potential for resilience.

This understanding can be accomplished, for example, by using objective-goal analysis through functional decomposition to reveal which specific functions or sub-functions are necessary to enable an organization to respond, monitor, anticipate, and learn (Hollnagel, 2015). The answers to these detailed questions can be used to develop a profile of each capability and thus serve as a (composite) measure to measure the organization's resilience potential.

3 Research Methodology

This work is a continuation of the work of Fraga, Varvakis and Sell who in 2018 developed the study entitled "Framework for Analyzing Critical Knowledge Related to the Potential of Organizational Resilience". Therefore, how they performed the research will be briefly explained, to later approach the accomplishment of the present study.

Fraga, Varvakis and Sell (2018) proposed a framework to analyze critical knowledge related to organizational resilience capabilities, which was applied through a case study in a technology-based company. The framework is composed of four phases, as explained below:

- **Phase 1** - Characterization of the context, process identification and necessary knowledge;
- **Phase 2** - Characterization of process resilience and knowledge related to its capabilities;
- **Phase 3** - Analysis of the criticality of knowledge related to resilience capabilities; and
- **Phase 4** - Identification of Knowledge Management strategies to contribute to the potential of resilience.

Regarding the main results, the authors mentioned that the application of the framework made it possible to identify and analyze critical knowledge in its value creation process, reducing the risks of loss of essential skills and avoiding the reinvention of know-how of its collaborators. These critical knowledge mapping actions are strategic to the organization's development and are supported by the analysis of their resilience capabilities and the associated critical knowledge associated with them. The perspective of this base of analysis points to KM strategies for greater capacity for action and

adequate reaction to the risks related to knowledge in a turbulent environment, as can be observed in the organization focus of this study.

It is also worth explaining that the framework was applied in a small technology-based company that can be characterized by its complex socio-technical context. This context is characterized by interaction with the environment, capability of self-regulation, and the property of equifinality, that is, it can reach the same goal from different paths and using different resources (Biazzi, 1994). Organizations of this nature are composed of two categories: the technical part that involves technologies and tasks and the social part that involves structure and people (Strauss & Porto Bellini, 2008).

Following the previous elucidations, we continue with the purpose of this study, which through the extended exploration of phase 4, intends to identify KM practices to improve/boost resilience from the analysis of capacities in the organizational environment.

Phase 4 is subdivided into two steps, each with its method of application. They are:

Step	Purpose	Method of application
1	Relate the characterization of resilience capabilities and their knowledge to the processes of knowledge management (socialization, externalization, combination, internalization).	Data collection was performed through semi-structured interviews with six company employees. The processes of the knowledge management spiral of Nonaka and Takeuchi (1997) were related as a way of structuring the analysis and indicating management strategies of the knowledge resources mapped in each capacity. This analysis was performed based on transcripts of the interviews and the results of the previous phases. It is important to note that this lens of analysis from the knowledge conversion model of Nonaka and Takeuchi (1997) does not limit future analyses from other KM frameworks.
2	Identify KM practices for each organizational resilience capacity.	KM practices related to each capacity and suggested KM process were identified. This phase analyzes the results of the previous phases together.

Source: authors (2019).

Figure 3 – Method of application of phase 4

5 Results

The results obtained in this research were done so by applying the framework (Fraga, Varvakis & Sell, 2018) and enabled the identification and analysis of critical knowledge in its key process of value creation in the chosen SME. It should be noted that this knowledge audit phase serves as the basis for the analysis of their resilience capabilities—to anticipate, to respond, to monitor and to learn—and critical knowledge associated with each.

This section is subdivided into two parts. The first deals with knowledge-oriented actions that are transversal to resilience capabilities, and the second refers to the analysis for each of the capabilities.

Considering the first part, figure 4 below shows the transversal knowledge next to to resilience capacities, and with each, relates them to the processes of the knowledge spiral of Nonaka and Takeuchi (1997). From this, techniques and tools for the management of critical knowledge related to each capacity are suggested.

Critical knowledge across capabilities	Processes and practices of Knowledge Management
Knowledge of programming logic. Capacities involved: respond, anticipate, monitor	<i>Characteristics:</i> explicit knowledge, combination of different knowledge, more learning time. <i>Combination and internalization practices:</i> knowledge base shared with documents and manuals on the subject; meetings with presentation of learning about scheduling among employees (pitch* weekly). * Pitch: speech or brief and objective speech that an individual uses to dialogue about a product, service or an organization demonstrating its benefits and values, arousing the interest of the interlocutor.
Knowledge of domain logic in data usage. Capacities involved: anticipate, monitor	<i>Characteristics:</i> explicit and tacit knowledge, as it involves the technical part of the domain and also the applicability of the use of the data. <i>Combination and externalization practices:</i> registration and formalization of weekly activities to document use cases; sharing of the cases in the shared knowledge base among the collaborators.
Know how to identify and correct errors when systems are out of order (e.g, Lattes Platform). Capacities involved: anticipate, respond, monitor	<i>Characteristics:</i> tacit knowledge, based on the experience of employees, more vulnerable. <i>Socialization and externalization practices:</i> access to fast electronic resources such as chats, intranets and extranets to speed up the identification process; registration and sharing of the process of correction of the error in the knowledge base with access by all collaborators.

Source: authors, based on interviews (2019).

Figure 4 - Critical cross-disciplinary knowledge and practices of knowledge management

Figure 5 shows the results obtained with the application of the framework of Fraga, Varvakis and Sell (2018) through the application of the instruments of characterization of resilience capabilities, which allowed the identification of the issues to be solved (first column). Subsequently, each of these questions was related to a process of the spiral of knowledge in the second column; and in the third column, some KM practices associated with the KM process are mentioned to solve each question.

Ability to anticipate		
Issues to be solved	KM process	KM practices
Lack of formalization of anticipatory activities.	Externalization	Prospecting scenarios, knowledge bank.
Sporadic and informal knowledge sharing.	Socialization	Mentoring, storytelling.
There is a lack of knowledge retention actions of the most experienced members.	Externalization	Coaching, personnel exchange (shukko).
Ability to respond		
Issues to be solved	KM process	KM practices
Little documentation on what is done.	Externalization	Construction of best practice manuals, bank of lessons learned.
Lack of time to document.	Socialization	Prospecting scenarios, storytelling.
Sharing of informal response knowledge.	Combination	Knowledge bank, electronic spaces.
Ability to monitor		
Issues to be solved	KM process	KM practices
Systematization of the validation process is lacking.	Externalization	Construction of best practice manuals, knowledge bank.
Low frequency of validation activities.	Socialization	Pitch for sharing of daily validations, informal meetings.
Lack of specific validation roadmap for new demands.	Combination	Internal and external benchmarking, virtual practice community, electronic spaces.
Ability to learn		
Issues to be solved	KM process	KM practices
There is a lack of documentation and formalization of the lessons learned.	Externalization	Bank of lessons learned, periodic post-action review.
Outdated and underused database.	Combination	Electronic document management.
Lack of formalized process for learning new knowledge.	Internalization	Skills and training, personnel exchange (shukko).

Source: authors (2019).

Figure 5 - Matrix of critical knowledge management actions related to resilience capabilities

Given the analysis presented, the externalization process emerges as a perspective of analysis which improves the development of each capacity of resilience. This is considered by Nonaka and Takeuchi (1997) as the most important method of knowledge conversion for the creation of knowledge, since it aims to facilitate the formalization of tacit and individual knowledge specific to certain technical contexts in knowledge documented and shared with all.

The second mode of conversion seen as necessary to develop resilience capabilities, was socialization, that is, the transmission of tacit to tacit knowledge. Faced with an environment that involves the structuring of technical data for systems development, many mental models of problem solving and programming are developed, but they are little disseminated. The practices that involve socialization deal with the sharing of knowledge developed by the practice of new technical skills, through actions of personal interaction between employees.

In this way, according to the analysis represented in Figure 5, it is possible to verify a series of specifications that vary according to the critical question diagnosed in each resilience capacity and its outstanding critical knowledge. The KM processes associated

with each capability as well as the practices identified correspond to suggestions for enhancing the organization's resilience.

Regarding the ability to anticipate, we identified knowledge related to identification and knowing what to expect from risks and problems. For this, practices of socialization and internalization were indicated, such as the backing up of functions, master and apprenticeship, coaching, and banking of knowledge.

Considering the ability to respond, the knowledge corresponds to knowing what to do and being able to do, and the actions of KM correspond to practices of externalization and combination, as a bank of lessons learned and formalization of emergency manuals.

With relation to the ability to monitor, which seeks to know what to look for in times of uncertainty, actions were identified to combine and socialize knowledge as updated and accessible electronic spaces, as well as daily meetings to share errors and correctness.

Finally, the ability to learn detected knowledge related to the learning process, namely what happened, making use of existing knowledge and identifying new knowledge gaps. It addresses aspects of the externalization and internalization process and indicates practices such as lessons learned banks, post-action review, knowledge mapping, and practice communities.

6 Conclusions

In this study, the extended exploration of phase 4 of the framework proposed by Fraga, Varvakis and Sell (2018) revealed strategies of KM that contribute to the development of resilience potential in the complex socio-technical context.

Authors like Mafabi, Munene and Ntayi (2012), Ose, Ramstad and Steiro (2013), and Speranza, Wiesmann and Rist (2014) highlight the importance of KM to develop resilience actions. In this study, the priority actions identified for each resilience capacity were: anticipate (externalization and socialization), respond (externalization, socialization and combination), monitor (externalization, socialization, combination) and learn (externalization, combination, internalization).

The application of phase 4 of the framework of Fraga, Varvakis and Sell (2018) allowed this alignment of KM practices with resilience capabilities through the categorization of the Nonaka and Takeuchi (1997) knowledge conversion processes.

In this way, it is emphasized that the use of knowledge spiral lenses to look at each resilience capacity facilitated the grouping of KM practices. It is suggested that KM techniques and tools be identified and instituted according to organizational strategies. Thus, in this study, the spiral of Nonaka and Takeuchi (1997) presented an adherence to resilience capacities and their characteristics found. This contribution is relevant, since many studies mention the importance of KM for resilience and this research allowed the proposition of specific practices to improve the resilience potential.

Furthermore, KM strategies generate greater capacity for action and appropriate response to the risks related to knowledge of resilience capabilities in the dynamic environment of SMEs and can be expanded to other contexts.

Thus, for future work, it is suggested that the approach proposed here be applied in other organizations that are part of the complex socio-technical context. Also, it is suggested that other perspectives of KM analysis that contribute to the development of resilience potential are used.

References

- Ahmadjian, C. L. & Okumura, A. (2011). Corporate governance in Japan. *Handbook on international corporate governance: Country analyses*, 247.
- Argyris, C. & Schon, D. A. (1974). *Theory in practice: Increasing professional effectiveness*. Jossey-Bass.
- Bhamra, R., Dani, S. & Burnard, K. (2011). Resilience: the concept, a literature review and future directions. *International Journal of Production Research*, 49(18), pp. 5375-5393.
- Bhatt, G. D. (2000). Organizing knowledge in the knowledge development cycle. *Journal of knowledge management*, 4(1), 15-26.
- Bhatt, G. D. (2001). Knowledge management in organizations: examining the interaction between technologies, techniques, and people. *Journal of knowledge management*, 5(1), pp.68-75.
- Biazzi Junior, F. de. (1994). O trabalho e as organizações na perspectiva sócio-técnica. *Revista de administração de empresas*, 34(1), pp. 30-37.
- Chalfant, B. A. & Comfort, L. K. (2015). Dynamic decision support for managing regional resources: Mapping risk in Allegheny County, Pennsylvania. *Safety Science*.
- Chermack, T. J. (2004). Improving decision-making with scenario planning. *Futures*, 36(3), 295-309.
- Choo, C. W. A. (2006). *organização do conhecimento: como as organizações usam a informação para criar significado, construir conhecimento e tomar decisões*. São Paulo: SENAC.
- Coutu, D. L. (2002). How resilience works. *Harvard Business Review*, 80(5), pp. 46-56.
- Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of Knowledge Management*, 9(3), pp. 101-115.
- Davenport, T. H. & Prusak, L. (1998). *Working Knowledge: How Organizations Manage What They Know*. New York: Harvard Business Press.
- Dávila, G. A. et al. (2014). O ciclo de Gestão do Conhecimento na prática: um estudo nos núcleos empresariais catarinenses. *International Journal of Knowledge Engineering and Management (IJKEM)*, 3(7), pp. 43-64.
- Fialho, F. et al. (2010). *Gestão do conhecimento organizacional*. Florianópolis: Ed. da UFSC.
- Fraga, B. D., Varvakis, G., & Sell, D. (2018, july). Framework for analyzing critical knowledge related to the potential of organizational resilience. *Proceedings IFKAD 2018*, Delft, Netherlands, 13.
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(Special Issue), pp. 109-122.
- Hamel, G. & Valikangas, L. (2003). The quest for resilience. *Harvard business review*, 81(9), pp. 52-65.
- Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual review of ecology and systematics*, 4(1), 1-23.
- Hollnagel, E. (2010). How Resilient Is Your Organisation? An Introduction to the Resilience Analysis Grid (RAG). In: *Sustainable Transformation: Building a Resilient Organization*.
- Hollnagel, E. (2011). Epilogue: RAG – The Resilience Analysis Grid. In: Hollnagel, E., Pariès, J., Woods, D., Wreathall, J. (Eds.) *Resilience Engineering in Practice – A Guidebook*. London: Ashgate Publishing Limited.

- Hollnagel, E. (2015). Introduction to the Resilience Analysis Grid (RAG).
- Hollnagel, E., Woods, D. D. & Leveson, N. (2007) Resilience Engineering (Ebk) Concepts and Precepts.
- Hosseini, S., Barker, K. & Ramirez-Marquez, J. E. (2016). A review of definitions and measures of system resilience. *Reliability Engineering & System Safety*, 145, pp. 47-61.
- Keyes, R. (2003). *The courage to write: How writers transcend fear*. Revised. Henry Holt and Company, New York.
- Kianto, A. & Andreeva, T. (2014). Knowledge Management Practices and Results in Service Oriented versus Product Oriented Companies. *Knowledge and Process Management*, 21(4), pp. 221-230.
- Mafabi, S., Munene, J. & Ntayi, J. (2012). Knowledge management and organisational resilience: Organisational innovation as a mediator in Uganda parastatals. *Journal of Strategy and Management*, 5(1), pp. 57-80.
- Nelson, R. R. & Winter, S. G. (1982). The Schumpeterian tradeoff revisited. *The American Economic Review*, 72(1), 114-132.
- Nieves, J., Quintana, A. & Osorio, J. (2014). Knowledge-based resources and innovation in the hotel industry. *International Journal of Hospitality Management*, 38, pp. 65-73.
- Nonaka, I.; Takeuchi, H. (1997). *Criação do conhecimento na empresa: como as empresas japonesas geram a dinâmica da inovação*. 2nd Edition. Rio de Janeiro: Campus.
- Nonaka, L., Takeuchi, H. & Umemoto, K. (1996). A theory of organizational knowledge creation. *International Journal of Technology Management*, 11(7-8), pp. 833-845.
- OECD – Organisation for Economic Co-operation and Development. (2003). *Measuring knowledge management in the business sector*. Paris: OECD Publishing.
- Ose, G. O., Ramstad, L. S. & Steiro, T. J. (2013). Analysis of resilience in offshore logistics and emergency response using a theoretically based tool. In: *Proceedings of the fifth resilience engineering symposium*. Netherlands: Soesterberg.
- Pal, R., Torstensson, H. & Mattila, H. (2014). Antecedents of organizational resilience in economic crises—an empirical study of Swedish textile and clothing SMEs. *International Journal of Production Economics*, 147, pp. 410-428.
- Patil, S. K. & Kant, R. (2016). A fuzzy ANP-based approach for selection of knowledge management strategies to build resilient supply chain: an empirical case Study. *International Journal of Integrated Supply Management*, 10(2), pp. 173-205.
- Rankin, A. et al. (2014). Resilience in everyday operations: a framework for analyzing adaptations in high-risk work. *Journal of Cognitive Engineering and Decision Making*, 8(1), pp. 78-97.
- Sabbag, P. Y. (2007). *Espirais do conhecimento: ativando indivíduos, grupos e organizações*. Saraiva.
- Sahebjamnia, N., Torabi, S. A. & Mansouri, S. A. (2015). Integrated business continuity and disaster recovery planning: Towards organizational resilience. *European Journal of Operational Research*, 242(1), pp. 261-273.
- Salgado, C. O. M. (2003). *Componentes da resiliência organizacional*. Doctoral Dissertation, Universidade do Minho, Portugal.
- Speranza, C. I., Wiesmann, U. & Rist, S. (2014). An indicator framework for assessing livelihood resilience in the context of social–ecological dynamics. *Global Environmental Change*, 28, pp. 109-119.
- Stewart, T. A. (1998). *Capital Intelectual*. Rio de Janeiro: Campus.
- Strauss, L. M. & Bellini, C. G. P (2008). Momentos sócio técnicos da organização transformada por sistemas integrados de gestão: o caso das rotinas individuais de trabalho em universidade. *REAd-Revista Eletrônica de Administração*, 14(3), pp. 670-703.

- Sveiby, K. E. (1997). *The new organizational wealth: Managing & measuring knowledge-based assets*. Berrett-Koehler Publishers.
- Umoh, G. I, Amah, E. & Wokocha, H. I. (2014). Management Development and organizational resilience: a case study of some selected manufacturing firms in rivers state. *Journal of Business and Management*, 16 (2), pp. 7-16.
- Van der Vorm, J. et al. (2011). *Images of Resilience: The Resilience Analysis Grid Applicable at Several Organizational Levels?* Paris: Transvalor-Presses Des Mines.
- Vargas, C. V. de & Guimarães, L. B. de M. A (2006). Engenharia de Resiliência e o Sistema de Controle de Tráfego Aéreo. *Proceedings Encontro Nacional de Engenharia de Produção*, São Paulo, Brazil, 26.
- Vargo, J., & Seville, E. (2011). Crisis strategic planning for SMEs: finding the silver lining. *International Journal of Production Research*, 49(18), pp. 5619-5635.
- Verschoore, J. R. & Balestrin, A. (2008). Fatores relevantes para o estabelecimento de redes de cooperação entre empresas do Rio Grande do Sul. *Revista de Administração Contemporânea*, 12(4), 1043-1069.
- Wernke, R. (2002). Proposta para avaliação de ativos intangíveis. *Revista Brasileira de Contabilidade*, (134), 60-71.
- Woods, D. D. & Hollnagel, E. (2006). *Joint cognitive systems: Patterns in cognitive systems engineering*. CRC Press.

Knowledge Management Practices in Technology-Based SMEs

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Abstract

The objective of this article is to identify knowledge management practices in technology-based SMEs in the South of Brazil.

This is an empirical, qualitative, and descriptive study. Data were collected in interviews with directors of technology-based SMEs in the South of Brazil, following a semi-structured interview script, adapted from Kianto and Andreeva (2014) and validated by Dávila (2016). Data were analyzed using thematic and content analysis with triangulation of evidence: bibliographic review; content from primary data sources, and data obtained from secondary sources.

This paper contributes to advancing research into knowledge management practices, which are recognized as important organizational strategies, capable of driving better performance and strengthening organizations' competitiveness. Notwithstanding, this paper's stand-out contribution is made by its empirical results. The evidence collected in technology-based SMEs in the South of Brazil demonstrates that knowledge is recognized as a strategic resource. However, these SMEs do not have management strategies for

implementation of knowledge management programs, although their practices related to organizational structure and organizational culture are better explained. This finding is attributed to the fact that the organizations analyzed are located in a technological incubator, which encourages knowledge assimilation and sharing between employees and firms, and its application to promotion of an innovation culture.

The practical results of this paper provide a basis for executives and managers interested in the subject to decide which knowledge management practices they should adopt to achieve the best strategic and operational results in Brazilian technology-based SMEs. The main findings also highlight the most important knowledge management practices that can explain the capacity that the firms studied have to share their existing knowledge among their employees, seeking to promote an innovation culture.

Keywords – Knowledge Management, Knowledge Management Practices, Brazilian SMEs.

Paper type – Academic Research Paper.

1 Introduction

The knowledge-based view (KBV) theoretical approach proposed by Grant (1996) treats knowledge as a valuable organizational resource, considered one of the most important factors of production, of capital, and of work. For Edvinsson (2013), the knowledge economy, based on the value of intangible assets, highlights the importance of managing the organizational knowledge process, because it is capable of generating competitive value, driving innovations, improving performance, and influencing organizational learning (APO, 2009).

Knowledge management (KM) practices have been defined by Inkinen, Kianto, and Vanhala (2015) as intentional organizational and management strategies or activities that enable value to be delivered from knowledge as an organizational asset. The objective is to support organizational management processes, to capture, disseminate, and promote knowledge sharing.

It has been recognized that transforming knowledge into innovative management practices and strategies is a condition for organizations to establish themselves in dynamic and competitive markets. However, this is particularly challenging for small and medium enterprises (SMEs) (Yap & Lock, 2017) and even more so in the scenarios found in developing countries, such as Brazil (Cassol, Zanesco, Martins, & Marietto, 2019).

Brazilian SMEs generate employment and revenues and develop Brazil's economy. This segment is responsible for approximately 30% of the makeup of its Gross Domestic Product (GDP), according to data from the institute for applied economic research (IPEA - *Instituto de Pesquisa Economica Aplicada*, 2018). Therefore, understanding the organizational practices and strategies implemented by these firms to keep themselves competitive in dynamic, innovative, and technological industries is an important research agenda (Koerich & Cancellier, 2017).

Dávila, Durst, and Varvakis (2018) have observed that barriers related to the economic context, to the organizational culture, and also to the limited capacity of SMEs to access and share knowledge are indicative of a need for studies of the relationship between knowledge-related capabilities and innovation in SMEs based in developing countries.

A study by Cassol et al. (2019) has contributed to discussions on the role of KM in the organizational context of Brazilian SMEs, providing insights into the need to understand the factors that drive development of practices that provide support for knowledge management to become a dynamic organizational capacity. This paper therefore contributes to filling the research gap left by the lack of studies about knowledge management practices in Brazilian SMEs, attempting to answer the following research question: What knowledge management practices can be identified in technology-based SMEs?

The paucity of empirical studies on the subject and of evidence collected in technology-based SMEs in the South of Brazil highlights the relevance of this research, since its objective is to identify knowledge management practices in technology-based Brazilian SMEs. It should be noted that, in addition to this being a recent field of study (Kianto & Andreeva, 2014; Dávila, 2016), KM practices are organizational strategies that have the capacity to foster better performance and to strengthen firm competitiveness.

2 Knowledge Management Practices

According to Wiig (1997), the ultimate objective of knowledge management practices is to ensure that the organization's knowledge-related activities are as effective as possible and provide the maximum returns, while also constantly renewing them. Therefore, to manage knowledge is "to understand, focus on, and manage systematic, explicit, and deliberate knowledge building, renewal, and application - that is, manage effective knowledge processes" (Wiig, 1997, p.9).

Davenport and Prusak (2003) recognize that in order for an organization to manage knowledge, it must develop practices based on the diversity of its employees' knowledge and experience. This requires top-management buy-in, a KM-oriented culture, the appropriate infrastructure and techniques to promote knowledge, managers who are focused on the process, a knowledge creation incentive program, and efficient communication for dissemination of knowledge.

The current discussion in the KM literature has established a number of ways to conceptualize management processes and practices. Authors such as Mckeen, Zack, and Singh (2006), Heisig (2009), Andreeva, and Kianto (2012), Dorow (2013), Kianto and Andreeva (2014), Inkien et al. (2015), Inkien (2016), and Dávila (2016), have reached consensus on the concept, creating measurable categories and employing the term knowledge management practices.

Mckeen et al. (2006), define such practices as observable activities related to KM that are executed by an organization. They analyze them using 4 dimensions: the ability to locate and share existing knowledge; the ability to experiment and create new knowledge;

a culture that encourages knowledge creation and sharing; and a regard for the strategic value of knowledge and learning.

Heisig (2009) observes that the success of KM initiatives in organizations depends on the basic conditions of their implementation. In his study, he showed that the practices central to KM are based in 4 categories: human resources factors – with its subcategories culture and organization, people, and leadership; organizational aspects of the process and structure; information technology factors; and processes for strategic management of knowledge.

Kianto and Andreeva (2014) expanded the analytical categories and defined KM practices as the set of intentional organizational and managerial activities aimed at strengthening a firm's knowledge processes. They explain them using an extended set of 27 KM practices, grouped into 5 dimensions: strategic management of knowledge, organizational culture, human resource management, organizational structure, and information and communication technologies.

Dávila (2016) adopted the Kianto and Andreeva (2014) theoretical model that considers knowledge management practices to be intentional routines for efficient management of the knowledge involved in an organization's processes, human resources, and technologies. He conducted research with 127 SMEs in the South of Brazil, finding that the flow of creation of value for organizations improved their performance and starts with contributions by two groups of KM practices. Strategic knowledge management, organizational culture, and organizational structure influenced the process of acquisition and assimilation of external knowledge. In turn, strategic knowledge management practices and information and communication technologies influenced transformation and application of knowledge within the organizations.

Dávila et al. (2018) consider that Brazilian companies have the potential to develop competitive advantages if they improve management of information and knowledge. Furthermore, as the internal information flows improve, the knowledge assimilation processes also improve. They therefore support the idea that KM practices must be implemented within firms and must be managed to improve innovation and organizational performance.

According to Dorow (2013), KM practices are important for innovation to occur, in the same way that innovation is linked with new information that will be used to create new knowledge. Finally, it has been found that use of these practices is an important driver of innovation and has been associated with organizational performance, since efficient and effective management of knowledge resources generates organizational benefits (Inkinen, 2016).

Thus, the first objective of this study is as follows: **To identify which KM practices are utilized by technology-based SMEs.**

It is clear that KM promotes and drives many different aspects of organizations. Robinson, Anumba, Carrillo, and Al-Ghassani (2006) claim that, in addition to promoting continuous improvement, enhancing stakeholder relationship management, and putting people at the center of knowledge creation processes, KM also facilitates innovation in business processes and products.

However, certain challenges faced when implementing KM programs have also been highlighted. According to Dalkir (2005), KM processes are complex, because they do not merely involve decisions related to technology, but also people and cultural elements. In turn, the second of these can create barriers to KM. A systemic perspective is needed that encompasses the organizational context, business objectives and strategies, and people, processes, and technologies.

Horta and Barbosa (2017) conducted a study that assessed the main barriers to implementation of KM programs and identified factors of the organizational context that can interfere with KM practices. According to their findings, the main barriers are a lack of support from top management, low levels of trust, and a lack of technology to support knowledge sharing.

Along similar lines, an earlier study by Ghafourian (2014) had shown that cultural aspects, individual differences, lack of vision, infrastructure, and organizational structure were the main barriers to implementation of KM programs in the context studied.

In the context of Brazilian SMEs, implementing KM systems remains a challenge. However, when KM processes are set up, these firms reap benefits such as the possibility of improving quality, efficiency, productivity, and decision-making (Yap & Lock, 2017).

Research has also highlighted the limitations of using strategic tools capable of establishing formal management processes (Cassol et al, 2019) because firms have distinct characteristics in relation to their structure and configuration (Dávila, 2016). Additionally, for firms to improve their innovation performance, it is necessary to identify and recognize the factors that drive KM and those that create obstacles to KM, which may reflect the characteristics of SMEs.

In order to guarantee that the objectives underlying implementation of KM practices will be achieved, it is necessary to identify the barriers and potential and real critical factors in each firm that can reduce the likelihood of these systems' success (Horta & Barbosa, 2017). For these reasons, and motivated by this scenario, the second research objective is as follows: **To identify the difficulties and barriers facing KM in technology-based SMEs**

3 Methodology

This is an empirical study, employing qualitative and descriptive methodology. This approach is recommended by Creswell (2010), who states that it enables the researcher to understand the experience of a given group or organization from the point of view of its members.

The strategy used to select firms for the study sample was intentional, based on criteria defined by the researchers: a) firms characterized as SMEs; b) in technology-based sectors; and c) participants of a Technology Incubator scheme. A total of twelve firms were contacted at a Technology Incubator in the South of Brazil and seven of them agreed to take part in the study. Interviews were conducted with managers, directors, and/or partners from these firms. For the purposes of this paper, these firms will be labeled 1B, 2C, 3D, 4E, 5F, 6G, and 7H.

Data were collected during semi-structured, in-depth interviews and by documentary research and non-participatory observation. The interview script was constructed by Kianto and Andreeva (2014), based on their theoretical model of KM, and was adapted for studies of Brazilian SMEs by Dávila (2016). The script covers a set of 27 KM practices grouped into 5 dimensions: strategic management of knowledge, organizational culture, human resource management, organizational structure, and information and communication technologies.

To enable analysis of the data, all of the interviews were transcribed and subjected to content and thematic analysis. According to Bardin (2010), these are a set of techniques for analysis of communication designed to overcome uncertainty and enrich readings of the data collected. Triangulation of data was also employed in the analysis, using concepts from the literature review, content from the primary data sources (interviews), and data obtained from secondary sources.

4 Data Analysis

Statements by managers of the technology-based SMEs were used to attempt to achieve the first study objective. To do so, the results were first categorized according to the 5 dimensions proposed in the Kianto and Andreeva model (2014).

Although the managers expressed doubts about the meaning and concept of knowledge management and about how it is utilized, KM practices were detectable in their organizations' practices and were cited as important, from a management perspective. They were also aligned with the strategies of the firms analyzed.

The **strategic knowledge management** dimension deals with KM initiatives within organizations' strategic planning, analyzing forms of mapping and understanding knowledge, integration of KM initiatives and plans, implementation or promotion of KM routines, and development of strategies for organizations' knowledge (Kianto & Andreeva, 2014).

Four of the seven firms studied stated that they conduct strategic planning. However, they claimed not to have explicit knowledge management plans that were aligned with their planning. All have a clear understanding of the knowledge needed to do business in the technology sector and explained some of their strategies for knowledge development, such as training and activities for acquisition of knowledge.

Our firm encourages training and learning for everybody here. We have access to courses, to universities, and to training provided by the incubator, and we also take part in projects to win funding. We are constantly monitoring the market in search of new knowledge. (Interviewee 7H)

There is no doubt that training of personnel is the most important part. Since our firm was created by a merger between three firms, each owning 33% of the new company, we don't conform to the, I'd say, prevailing, preestablished,

company model - the owner-manager-worker style. So everyone works to improve their qualifications in the best way possible. (Interviewee 2C)

Kianto and Andreeva (2014) treat the **organizational culture** dimension as one that can encourage knowledge sharing and creation, fostering, valuing, and encouraging open relationships and learner-initiated learning, with flexibility and interdepartmental cooperation.

This was one of the dimensions most often mentioned by the interviewees. The firms cited and explained practices that are initiated both by individual employees and in response to company incentives. A practice that all firms stated they use is the knowledge formalization system, which functions as a means of monitoring lessons that have been learnt

There was strong evidence of interdepartmental cooperation in the interviews, founded on open relationships between the different organizational levels. The firms also state that they value self-initiated learning, which is one of the practices in this dimension.

We believe (...) that sharing knowledge is a necessity and is part of the game. Right from the start we share knowledge ... I share my knowledge with my employees, my employees share their knowledge with me, and with each other as well, and we do the same with our customers and suppliers too (...) we share it and multiply it. (Interviewee 5F)

Our team is multidisciplinary and everyone contributes to projects. In fact, our team includes a doctor, an automation engineer, a mechanical engineer, a lawyer, and a salesman, and we have to have that for the business to work. It's good because we can think outside of the box and our management is very open. (Interviewee 4E)

Considering that the era of the Knowledge-Based Economy (Edvinsson, 2013) is replete with change, the adaptability of an organization's culture becomes an essential factor in increasing a firm's competitiveness. The study data reveal that the culture of these organizations is characterized by a horizontal structure. Decision-making is shared, with the objective of achieving the best development of innovations and the greatest possibilities for improvements.

We always share decisions, we have no resistance to that. To the extent that now we're sharing the same room (...). This type of interaction happens very frequently, both informally and formally. Twice a week we have meetings to share information and take strategic decisions. (Interviewee 2C)

(...) but really, when you're in an incubator, knowledge exchange is what you do most. What do you need help with (...) I'm in management and I can help you with this, and this, and this, and someone in the engineering department will help you with that. (Interviewee 7H)

Practices related to the human resources management dimension are assessed in terms of monetary and non-monetary forms of compensation for knowledge creation and sharing, and inclusion of these activities in the firm's performance assessments (Kianto & Andreava, 2014). With regard to the last of these items, it was found that none of the firms had performance assessments that covered knowledge creation and sharing. However, it could be considered that the streamlined structural characteristics of these firms mean that this process is not employed in a formal manner.

Nevertheless, the firms did state that they compensate employees monetarily when, by sharing and applying innovative ideas, they enable firms to achieve better performance in their markets.

We even provide incentives for our interns, who are given a percentage of the firm and become partners. For example, our engineer is an employee, but he also has a minority percentage of the firm that he was paid for a product he created. (Interviewee 2C)

If the employee solves the problems with the machine, I'll give him a 5% share of the firm. He hasn't managed it yet (...) but I hope he is able to. Less than 3 weeks after he came to the firm, I told him, if you find the answer, we'll be partners, and ever since it's been tests and trial and error - that's how development of a new product works. (Interviewee 7H).

Based on the results, it can be stated that human resources management is fundamental to reaping the benefits of KM (Kianto & Andreava, 2014). According to Dávila (2016), research has found evidence that providing people with incentives to seek and bring in external information increases innovation performance, motivates employees, and achieves efficient management.

This type of interaction, as already shown in the "organizational culture" dimension, is also a part of the **organizational structure** dimension, which is concerned with cooperation between people working in different parts of the organization (Kianto & Andreava, 2014).

The main characteristics of these firms' organizational structures were as follows: the majority had been established four years and the average number of employees was four. Management was horizontal and in the majority of the firms the employees are also partners.

It is important to note that the Technology Incubator where the firms are established provides training, promotes opportunities for information sharing, and runs programs for development of leaders and innovations.

Considering the multidisciplinary nature of their teams, the firms state that their employees cooperate actively in decision-making and in information sharing. It was therefore found that there are no barriers to collaboration between employees, because these firms are so small. Indeed, in small firms, the majority of these activities are generally informal, since the strategies and plans that are explicit in KM are not present (Dávila, 2016).

Six of the firms stated that knowledge sharing is carried out in an informal manner. This creates difficulties with relation to employee performance assessment and for formal retention of knowledge within the firm.

Knowledge sharing is not at all formal; we haven't set up daily routines or practices in the firm yet, it's totally informal. However, we treat it as a target, everybody should be sharing. That is how our structure is, (interviewee 6G).

Finally, firm practices that fall into the **information and communication technologies** (ITCs) dimension were analyzed. According to Kianto and Andreava (2014), ITCs are important strategies for supporting KM, since they contribute to storage and recovery of knowledge and also to sharing and creation of knowledge, functioning as communication channels.

The firms declared that they employ technological resources to store routines and methods, but do not have any formal KM systems implemented, which would enable them to expand on existing knowledge and create new knowledge.

We don't have any kind of a management system and no specific software. But we use freeware and some paid software that helps us with management. None of them are specifically management software, but some programs that help are part of our everyday routine at the firm. Google drive is one example. Google drive is possibly one of the best methods of sharing knowledge and information here in the firm. (Interviewee 5F)

We use certain tools, such as Drive, which is adequate for our needs for the moment. Maybe in the future, as work progresses and the firm grows, we will have to find other options for better solutions. (Interviewee 1B)

The majority of the firms studied have technological information and communication tools. However, they have no formal systems or software platforms to record and track their KM practices.

Analyses of the dimensions made it possible to identify KM practices in these firms, thereby fulfilling the first objective. Practices cited with greatest frequency include

interdepartmental cooperation and multidisciplinary teams, which are part of the organizational culture and organizational structure dimensions. These findings coincide with Dávila (2016), who has stated that creation of culture that fosters open-mindedness and multidisciplinary teams increase a firm's capacity to transform knowledge.

Moving on to the second research objective, to identify **difficulties and barriers facing KM**, it is clear that the main problems are related to Strategic Knowledge Management. The firms state that they understand what knowledge exists within their organizations, but when they were asked about methods of assessing their employees' competencies and knowledge, none of them mentioned using these practices as a strategic resource to manage their knowledge.

Evidence from the study conducted by Dávila (2016) indicates that there is a lack of focus on aspects related to strategic knowledge management practices, which he considers are the most important and significant practices for transforming organizational knowledge into value creation. Therefore, SMEs clearly need to create strategies to develop and implement KM as part of their strategic planning.

It was also observed that, since these are SMEs, they have not implemented KM planning, knowledge mapping, or benchmarking of external knowledge. These gaps could make it difficult for the firms to utilize strategies for technological innovation and to keep up with market tendencies. These findings are compatible with Dalkir's position (2005) that KM must be approached from a systemic perspective. Therefore, for KM to be effective, it is necessary to combine actions that cover business strategies, people, processes, and technologies.

Difficulties with Human Resources Management were also identified, with no utilization of any type of management model for performance assessment to control human resources management. According to Horta and Barbosa (2017), employees could see this barrier as a lack of incentive, causing insecurity and leading to employee turnover.

Although the firms stated that they have open organizational structures and multidisciplinary teams, they do not use coaching, a feedback culture, or mentoring, which are all actions that foster open dialogue. This could create barriers to development of teams and of individual employees, since these are founded on retaining knowledge within the organization. According to Nkomo, Thwala, and Aigbavboa (2017), practices that support knowledge transfer between people are important to ensure that firms don't lose organizational knowledge.

Considering the dynamic environment in which technology-based SMEs are inserted, and also the scarcity of resources, one starting point is to implement the KM practices that offer the greatest benefit for management strategies, thereby identifying efforts that create value for the organization, whose objective is to remain competitive in the market (Dávila, 2016).

5 Conclusions

The empirical results of this study indicate that KM practices do exist at the firms studied and, in the main, are conducted in a shared manner. However, it is also clear that these firms do not have structured and planned KM initiatives. In other words, although they have knowledge management practices, their effective implementation within the organizations remains a challenge.

Also of relevance in the findings is the observation that the practices most evident in the firms' routines were those associated with organizational structure and organizational culture. This is attributed to the fact that these organizations are located in a Technology Incubator, which is a factor that stimulates knowledge assimilation and sharing between employees and firms, applied to promotion of an innovation culture.

This paper's theoretical contribution is to extend research into KM practices in technology-based SMEs in the Brazilian setting. It also helps to fill the research gap already identified that is created by a need for more studies that deal with a pragmatic perspective on knowledge management in the organizational context of SMEs. This illustrates the importance of identifying which practices actually enable knowledge to be managed effectively.

In terms of its practical contributions, this study offers executives and managers interested in the subject a foundation for determining which KM practices could be adopted in the context studied to achieve better strategic and operational results. It also highlights the main KM practices that explain the capabilities of the firms investigated, sharing the knowledge they possess among their employees and attempting to improve their innovation culture.

With regard to the study's limitations, although much evidence of KM practices in these technology firms was observed, it was also perceived that there is a need to extend the study by conducting an analysis of KM maturity, in order to diagnose its stage of evolution and identify the next steps that these firms should take to best develop their knowledge management, in search of competitive advantages.

Finally, it is suggested that future studies could identify KM practices in organizations with a similar profile, conducting a comparative case study or even a quantitative research project. Additionally, research is needed that relates KM maturity to the practices utilized by firms.

References

- Andreeva, T. & Kianto, A. (2012). Does knowledge management really matter? Linking knowledge management practices, competitiveness and economic performance. *Journal of knowledge management*, 16(4), 617-636.
- Apo. Asian Productivity Organization. (2009). *Knowledge Management: Facilitators Guide*. Tokyo.
- Bardin, L (2010). *Análise de conteúdo*. Portugal: Edições 70, LDA.
- Cassol, A. ZanESCO, D. Martins, C. B. & Marietto, M. L., (2019). Capacidade absorptiva como moderadora da relação entre inovatividade organizacional e desempenho inovador de pequenas e médias empresas brasileiras. *Interciencia*, 44(1), 15-22.

- Creswell, J. W., (2010). Projeto de pesquisa: Métodos qualitativo, quantitativo e misto. 3. ed. Porto Alegre: Artmed
- Dalkir, K., (2005) Knowledge management in theory and practice. Boston: Elsevier, p. 303-326.
- Dávila, G. A., (2016). Relações entre práticas de gestão do conhecimento, capacidade absorptiva e desempenho: evidências do sul do Brasil. Florianópolis, SC. Tese de Doutorado. Universidade Federal de Santa Catarina. Florianópolis, Brasil.
- Dávila, G. A. Durst, S. & Varvakis, G., (2018). Knowledge absorptive capacity, innovation, and firm's performance: insights from the South of Brazil. *International Journal of Innovation Management*, 22(02),
- Davenport, T. H. & Prusak, L. (2003) Conhecimento Empresarial: como as organizações gerenciam o seu capital intelectual. 8. Ed. Rio de Janeiro: Campus.
- Dorow, P. F., (2013). O processo de geração de ideais para inovação: estudo de caso em uma empresa náutica. Dissertação (Mestrado) - Curso de Engenharia e Gestão de Conhecimento, Universidade Federal de Santa Catarina, Florianópolis, 2013.
- Edvinsson, L., (2013). IC 21: reflections from 21 years of IC practice and theory. *Journal of Intellectual Capital*, 14(1), 163-172.
- Ghafourian, J., (2014). An exploration study to detect important barriers for knowledge management. *Management Science Letters*, 4(1), 25-30.
- Grant, R. M., (1996). Toward a knowledge-based theory of the firm. *Strategic management journal*, 17(S2), 109-122.
- Heisig, P., (2009). Harmonisation of knowledge management-comparing 160 KM frameworks around the globe. *Journal of knowledge management*, 13(4), 4-31.
- Horta, V. & Barbosa, R. R. (2017). Desafios e barreiras à implantação da gestão do conhecimento em organizações. *Biblionline*, 13(2), 3-17.
- Inkinen, H. T. Kianto, A. & Vanhala, M., (2015). Knowledge management practices and innovation performance in Finland. *Baltic Journal of Management*, 10(4), 432-455.
- Inkinen, H., (2016) Review of empirical research on knowledge management practices and firm performance. *Journal of knowledge management*, 20(2), 230-257.
- Kianto, A. & Andreeva, T., (2014). Knowledge management practices and results in service-oriented versus product-oriented companies. *Knowledge and Process Management*, 21(4), 221-230.
- Koerich, G. V. & Cancellier, E. L. P. de L., (2017). Capacidade de Absorção: levantamento e análise de pesquisas quantitativas e principais constructos relacionados. In *Seminários de Administração*, São Paulo, 20, 1-16.
- McKeen, J. D. Zack, M. H. & Singh, S., (2006). Knowledge management and organizational performance: an exploratory survey. In *Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS'06)*(Vol. 7, pp. 152b-152b). IEEE.
- Nkomo, M. W. Thwala, W. D. & Aigbavboa, C. O., (2017). Human Resource Management and Effects of Mentoring on Retention of Employees in the Construction Sector: A Literature Review. In *International Conference on Applied Human Factors and Ergonomics* (pp. 207-217). Springer, Cham.
- Robinson, H. S. Anumba, C. J. Carrillo, P. M. & Al-Ghassani, A. M., (2006). STEPS: a knowledge management maturity roadmap for corporate sustainability. *Business Process Management Journal*, 12(6), 793-808.
- Wiig, K. M., (1997). Knowledge management: an introduction and perspective. *Journal of knowledge Management*, 1(1), 6-14.
- Yap, J. B. H. & Lock, A., (2017). Analysing the benefits, techniques, tools and challenges of knowledge management practices in the Malaysian construction SMEs. *Journal of Engineering, Design and Technology*, 15(6), 803-825.

Innovativeness of Family SMEs: Knowledge Transfer during the Succession Process

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Abstract

Despite increasing scholarly interest in the topic of innovation in the family firms, our understanding is still incomplete and inconsistent and the question of innovativeness of successors and family SMEs remains relatively unexplored (Botero et al. 2015). Our empirical research explores the relationship between the knowledge transfer in family SMEs and innovativeness of successors and of family SMEs during the succession process.

Conducting a quantitative empirical research, our research results indicate that “early inclusion into family SME” and “learning by doing” are the most valued forms of the transfer of founder’s tacit and experiential knowledge and skills to the successor and are the most important for their and the family SMEs’ innovativeness. Regarding the external knowledge transfer, our research revealed that working experiences in other firms and external training are of high importance and positively correlated with innovativeness of successors and of family SMEs.

Keywords – Family SMEs, Innovativeness, Knowledge transfer, Succession process.

Paper type – Academic Research Paper

1 Introduction

The succession (in management and ownership) in a family firm is recognized as one of the most critical period in its life cycle (Daspit et al., 2016) and therefore has been attracting the scholars’ research interest for many years (e.g., Chirico, 2008). On one hand, research findings indicate that numerous family firms do not survive the transfer especially due to badly prepared succession process (Miller et al., 2003). On the other hand, there are some indications that new generation in charge can bring new ideas and perspectives in a firm thus keeping the entrepreneurial, creative and innovative

orientation across generations (e.g., Bettinelli et al., 2017; Cabrera-Suárez et al., 2018). Due to importance of developing and selecting the most competent future family firm leader, several research studies address the education and training of successors (Le Breton-Miller et al., 2004) and the process of transferring knowledge between generations (e.g., Cabrera-Suárez et al., 2018). However, there is a lack of research addressing the succession process not only as a process of transferring knowledge between predecessors and successors but also as the process with “potentials” for enhancing successors’ and family firms’ innovativeness. If family firms want to survive across generations, there is a strong need for the ability to renew through innovations (Hauck and Prügl, 2015). Research studies deal with the entrepreneurial orientation of family firms (e.g., Barroso Martinez et al., 2016; Bettinelli et al., 2017) and their innovativeness (e.g., Brinkerink, 2018). However, research attempts have not addressed the relationship between the process of transferring and creating new knowledge during the succession and innovativeness of successors and family firms. Therefore, we address the following research question: “Is the transfer of knowledge (internal and external) into family SMEs positively related to the innovativeness of successors and family SMEs?”.

In order to bridge the identified research gap, we build our investigation on the knowledge-based view (Grant, 1996) and the organizational knowledge creating theory (Nonaka, 1994) as innovativeness of individuals and firms is influenced by their ability to acquire, assimilate, transform and exploit existent knowledge (Quintaine et al., 2011). Additionally we draw from previous studies on knowledge as a source of innovations of individuals and firms (e.g., Delgado-Verde et al., 2011) and studies on succession as we still do not dispose with succession theory (Sharma et al., 2012). We limit our research on the intrafamily succession from the first to the second generation, which can be understood as a family commitment to entrepreneurship and innovativeness by seeking for new business opportunities also when the next family generation takes over the firm (Nordquist et al., 2013). Members of the new family generation can be due to their commitment the driver of innovations in the family firm (Bettinelli et al., 2017).

The paper is divided into several sections. Following the introduction section, we review the literature and develop hypothesis in the second section. In the next sections the research method, sampling, data collection and findings are presented with a discussion of the research results. We conclude our paper with the most important conclusions and limitations of the research, and identify the future research directions.

THEORETICAL BACKGROUND AND DEVELOPMENT OF HYPOTHESES

2 Succession in family firms

We still lack a cohesive theoretical structure on the complex phenomenon of succession that affect many groups of family firms’ stakeholders (De Massis and Foss, 2018). Several research findings suggest that family firm succession still in many cases is

not solved adequately and consequently many family firms do not survive beyond the first generation (Daspit et al., 2016).

Several research works acknowledge that family business succession is rather a process than an event of transferring control to a successor (Sharma et al., 2001). It is described as a multistage process that occurs over time, starting before heirs even enter the business (Cabrera-Suárez, 2005). Since we can observe growing involvement of a (potential) successor in a family firm during the succession process (Cabrera-Suárez et al., 2001), several authors proposed multiphase models of the succession (e.g., Le Breton-Miller et al., 2004).

Most of the family firms' literature acknowledges (e.g., Cabrera-Suárez, 2005) differentiation between succession in management and in ownership. Especially the process of the leadership transfer has been viewed as the process of transferring knowledge (Duh, 2014). Since the most valuable resources and capabilities in family firms are based on information and especially tacit knowledge of the family firm leaders, the transfer of knowledge from a predecessor to a successor is of crucial importance for the family firm's success during and after the succession process (Sharma, 2004). Dynamic global environment requires successors that are able to add new knowledge and new perspectives (Barroso Martínez et al., 2016) and to seek new opportunities and foster entrepreneurship (García-Álvarez et al., 2002) thereby enhancing competitiveness and sustainability of a family firm across generations. Internal sources and transfer of knowledge should be combined with the external ones due to the importance of new knowledge for innovativeness of individuals and firms (Delgado-Verde et al., 2011).

3 Innovativeness and knowledge transfer

3.1 Innovativeness of a firm

Innovativeness is "the ability of the firm to introduce new processes, products, or ideas into a firm" (Marcati et al., 2008). Lynch et al. (2010) defined the firm's innovativeness as an expanded mindset and the attitude to innovation that all firms have to a certain extent which enables quick incorporation of changes in business practices through (early) creation and/or accepting new ideas.

The innovation ability of the firm is a prerequisite of innovativeness (Lynch et al., 2010), and is reflected in innovation. It is the ability to mobilize the knowledge that employees have in the firm (Kogut and Zander, 1992) and combine it with new knowledge that results in product and/or process innovation (Cakar and Ertuerk, 2010). Innovation abilities as a source of competitive advantage are deeply rooted in the context of an organization, and it is difficult to accurately define and imitate them (Nonaka, 1994). A firm with a high level of innovation ability is usually using a knowledge transfer method "learning by doing", which prevents competitors from accessing this knowledge in the market and imitation of knowledge is more difficult (Calantone and Zhao, 2003).

3.2 Innovativeness of individual

Hurt et al. (1977) defined individuals' innovativeness as a level to which an individual, in comparison with others in the social system, adopts relatively early something new.

Lin (2007), Liao et al. (2007) (summarized by Aulawi et al., 2009) emphasize the importance of sharing knowledge for the development of an individual's innovation ability.

The emphasis in our survey is on the innovativeness of individuals in family SMEs, the result of which is innovativeness of family SMEs. We assume that by measuring innovativeness of the family SME, we can indirectly measure innovativeness of the individual. In this assumption, we follow the definition of Tajeddini and Trueman (2005) and Verhees and Meulenbergh (2004), who claim that innovativeness is a feature of a firm or of the owner (and therefore also of the successor, note by the author).

3.3 Knowledge transfer during succession process

Knowledge and processes of knowledge creation are of crucial importance in any firm due to their direct effect on creativity and innovation (e.g., Nonaka and Von Krogh, 2009) and success of a firm (Chirico and Salvato, 2008). In family firms, knowledge “has strong tacit elements embedded in certain individuals, generally the entrepreneur/family firm founder and the successor” (Cabrera-Suárez et al., 2018, p. 181). However, there is the whole network of knowledge transfers and exchanges between successors and numerous stakeholders within and outside a family firm that should take place during the succession process (Cabrera-Suárez et al., 2018) and is of crucial importance for successors' and family firms' innovativeness.

The transfer of (tacit) knowledge can start by early inclusion of a successor into a family firm through summer and lower category jobs that present valuable experiences for successors (e.g., Cabrera-Suárez et al., 2001; Letonja and Duh, 2016). This way an important process of socialization (Nonaka et al., 2000) starts during which successors acquire founders' tacit knowledge (e.g., Cabrera-Suárez et al., 2001) and become aware of the predecessor's mental processes, ideas, and experiences (Mazzola et al., 2008). This socialization process (Nonaka et al., 2000) is an important starting point for enhancing the successor's knowledge and enabling assimilation of knowledge during succession. Creative and learning family environment importantly affects this process of early socialization and contributes to the successor's absorptive capacity that is important for future knowledge transfer processes and builds potentials for creativity and innovativeness (Cabrera-Suárez et al., 2018). The quality of the relationship between incumbent and successor is fundamental for effective succession (Daspit et al., 2016). Especially open relationship built on trust are required for optimal transfer of knowledge during the development and training of a successor (Daspit et al., 2016). Creative family environments in childhood and a family culture that stimulates innovation from the early childhood (Litz and Kleysen, 2001) influence this process of early socialization and

builds potentials for creativity and innovativeness of a successor and a family business (e.g., Cabrera-Suárez et al., 2018; Maček and Pšeničný, 2012)). Therefore, the following hypothesis is developed:

H1: Innovativeness of successors and of family SMEs are positively correlated with transfer of tacit and experiential knowledge in the form of early involvement of a successor in a company.

In order to become a qualified leader, both soft skills (e.g., personality traits, motivation and commitment) and hard skills (e.g., technical expertise, knowledge required for a job) are needed (Cabrera-Suárez et al., 2018). When successors enter the business, they should become familiar with the culture, values, mission and philosophy of a firm (Mazzola et al., 2008), acquire knowledge about different aspects of the business, and management skills (e.g., Mazzola et al., 2008). Mentoring and supervising relationships with predecessors present an important form of enhancing successors knowledge (Chirico, 2008). Mentoring by the predecessors has been recognized in the literature as suitable for development of successors (Cabrera-Suárez et al., 2018) as this way critical technical and managerial skills, knowledge on managerial systems, norms, values can be transferred (Swap et al., 2001) thus preventing the lost of predecessors' valuable knowledge (e.g., Desouza and Awazu, 2006). In the opinion of some authors (Gersick et al., 1997), family mentors are not adequate mentors as they are not able to give honest feedback to their children. Non-family mentors are proposed as very valuable in the process of successors' training and development (Daspit et al., 2016). Successors can also learn from predecessors in a learning-by-doing process that helps them to understand the technical field of family firms' operations (Chirico, 2008). Research findings indicate that a great part of learning experiences occur on the job (Cabrera-Suárez, 2005). Through socialization both mentoring and learning-by-doing (Nonaka et al, 2000) contribute significantly to successors' knowledge. Therefore, the following hypotheses were developed:

H2: Innovativeness of successors and of family SMEs are positively correlated with transfer of tacit and experiential knowledge in the form of mentoring.

H3: Innovativeness of successors and of family SMEs are positively correlated with transfer of tacit and experiential knowledge in the form of learning by doing.

Since successors' capacity to absorb knowledge, to understand and use it, is largely a function of the pre-existing stock of knowledge (Szulanski, 1996), formal academic and professional education is also of great importance (Cabrera-Suárez et al., 2018). It provides concepts and generic skills, which can be applied to most business contexts, enables development of analytical skills and abilities required for effective decision-making, and help successors to learn about new ideas and trends in management and technology (Sardeshmukh and Corbett, 2011). Barbera et al. (2015) suggest a "whole-person learning" approach in the family firm education that can foster development of a successor through development of cognitive, emotional and social skills. Therefore, we developed the following hypothesis:

H4: Innovativeness of successors and of family SMEs are positively correlated with formal education enabling knowledge in areas of critical thinking, creativity, communication, customer focus and teamwork.

Being up-to-date with recent technological, product and market developments is of crucial importance for innovativeness, competitiveness and performance of any firms. Working outside the family firm for a particular period helps successors to acquire a broader perspective of the firm's environment (Chirico, 2008) and to develop a detached view on how to manage and develop a family firm (Sardeshmukh and Corbett, 2011). Taking part in academic courses and practical training in schools and universities is of crucial importance for those successors whose family firms are active in dynamic, fast changing markets (Chirico, 2008). Training and working experiences gained outside the family firm are therefore of crucial importance for successors' and family firms' innovativeness since they expose to new ideas and situations (Sardeshmukh and Corbett, 2011) and give them access to new bodies of knowledge thus avoiding conservatism and closeness. The following hypotheses were developed:

H5: Innovativeness of successors and of family SMEs are positively correlated with work experience in another company that develops specific skills and abilities, opens different views on business operations, relevant for development of innovation skills.

H6: Innovativeness of successors and of family SMEs are positively correlated with academic and practical courses outside the family SME that allow transfer of knowledge from others to the successor, which is combined with the tacit knowledge in the family SME into new knowledge and fosters innovativeness of successors.

RESEARCH

4 Method

3.1 Approach

In order to explore how the transfer of knowledge (internal and external) relates to the innovativeness of successors (the second generation) and of family SMEs, we have carried out a quantitative research. We developed two questionnaires for the target group, one for the founders, one for the successors in family SMEs, as we have not found relevant already tested standardized measurement instruments to verify hypotheses. The final survey design was trialed from the aspect of length and validity of the content on several members of the target group. Minor adaptations had to be made. Data was analysed with help of IBM SPSS 22 and excel 2013. As we had two independent samples with (mostly) ordinal data, we used univariate (analysis of averages, variance, Cronbach alpha index, t-test) and multivariate (simultaneous analysis of several variables, correlation) statistical methods.

3.2 Data collection and sample

The questionnaires were sent to e-mail addresses of 408 family SMEs in Slovenia. The survey was conducted by the online survey tool (1KA.si).

We selected the "top management team" (TMT) approach, involving more interviewees from the company – the founder and the (or one of) successor. The first question to the founder was: "Do you consider your firm a family SME?" With this approach, used by e.g., Llach and Nordquist (2010), we avoid the danger that the answers would not be representative.

We ended up with a sample of 103 complete answers of successors and 103 answers of the founders from the same family SME (response rate 25,2%). There are 82 first generation family SMEs and 21 second generation family SMEs in our sample.

3.3 Measures

Dependent variables

Dependent variables in our research are innovativeness of successors and innovativeness of family SMEs.

Innovativeness of successors was measured with the help of Douglas N. Jackson's personality inventory (JPI) (Jackson, 1994) adapted by Mueller and Thomas (2001). JPI is a measure of the propensity to innovativeness and conceptually it is synonymous for creativity. The reliability and validity of JPI to measure the generalized risk-taking have been confirmed by different studies (e.g., Jackson, 1994).

Innovativeness of successors was measured in total by 11 variables. By the coefficient of reliability (Cronbach alpha) being 0.764, the reliability of the construct of innovativeness of successors is good (coefficient between 0.70 and 0.90).

Innovativeness of family SMEs was measured with the help of the scale, developed by Hurt and Teigen (1997), Hollenstein (1996), and it consists of 6 variables; it has been confirmed by different studies.

The coefficient of reliability (Cronbach alpha) of the construct of innovativeness of family SMEs is by 0.761 good.

Independent variables

In our research we defined four constructs (independent variables): transfer of tacit and experiential knowledge and skills of the founder as a form of internal knowledge transfer; working experiences of the successor in another company, formal education of the successor, academic and practical courses outside the family SME as external forms of knowledge transfer. Successors assessed the importance of different forms of knowledge transfer and actual experiences with them. Of total 28 variables 13 were relevant for testing our hypotheses. The reliability of the constructs is by the Cronbach alpha value of 0.891 very good.

3.4 Findings and discussion

Results of correlation between dependent variables and the importance of transferring the founder's tacit and experiential knowledge and skills to a successor, show the medium strong positive correlations between successors' and firms' innovativeness measured by "I often surprise by novel ideas/Our family SME is regularly testing new ideas" and "early involvement in family SME as a form of knowledge transfer" and "learning by doing as a form of knowledge transfer"; as well they exist between "I am a very creative person/Our family SME is creative in business methods" and "early involvement in family SME as a form of knowledge transfer".

The study of correlations between the dependent variables and actual experiences of successors with different forms of internal knowledge transfer show that successors' and firms' innovativeness measured by "In the recent 5 years I developed/started to market 0, 1, 2, 3-5, more than 5 new lines of products and services/Introduction of new products on the market has increased in our family SME in the last 5 years" "is medium strong correlated with "in my childhood I often watched parents how they run their business" and "we worked together with a parent on various activities". There are medium strong correlations between innovativeness measured by "In the recent 5 years I developed/started to market 0, 1, 2, 3-5, more than 5 new processes" and "In the recent 5 years the changes in production/services/ process lines .../Our family SME is often on the market with new products and services and "we worked together with a parent on various activities".

Therefore, our hypotheses H1 and H3, that innovativeness of successors and of family SMEs positively correlate with variables "early involvement in the company" and "learning by doing", are partly confirmed. Hypothesis H2 was not confirmed as mentoring does not correlate positively with dependent variables.

Our research revealed that early inclusion of a successor into a family SME through summer and lower category jobs is valued by successors as a factor which has the most important impact on their innovativeness and consequently innovativeness of a family SME within the process of tacit and experiential knowledge transfer. This finding is in agreement with e.g. Cabrera-Suarez et al. (2001), Letonja and Duh (2016) that early inclusion of successors in the family SMEs environment presents a valuable experience through which according to Nonaka et al. (2000) the process of socialization starts and enables absorption of the founder's tacit knowledge, ideas, experiences and builds potentials for creativity and innovativeness (Cabrera-Suarez et al., 2018). "Learning by doing" is according to the results of our research the most important actually performed form of knowledge transfer in family SMEs, which is in accordance with findings of e.g. Chirico (2008) that "learning by doing" helps successors understand the technical field of family SME operations and of Calantone and Zhao (2003) that it prevents competitors from accessing tacit knowledge in the market and imitation of knowledge is more difficult. This is positively influencing the successor's innovativeness, as well consequently innovativeness of the family SME.

The survey revealed that between the dependent variables and successor's formal education there is no positive correlation. We are surprised by the result due to relatively high educational level of successors. Therefore, the hypothesis H4 was not confirmed.

Thus our results contradict the results of previous studies by e.g. Cabrera-Suarez et al. (2001; 2018) that educational level affects the performance level of the next generation.

Research results indicate that successors' and firms' innovativeness measured by "I often surprise with novel ideas/Our family SME is testing new ideas" and by "In the recent 5 years I developed/ started to market 0, 1,2 3-5, more than 5 new processes" is correlated medium strong to working experience of successors in another company "which gives the successor a special view to the introduction and implementation of changes and innovation in the family SME" and to "working experience in another company can develop specific skills and abilities, opening different views on business operations, relevant for the development of innovation skills".

Therefore, we can partially confirm the hypothesis H5.

Our research revealed that *working experience in another company that develops specific skills and abilities, opens different views on business operations, relevant for development of innovation skills* is from the aspect of successors a very important factor for their innovativeness and consequently innovativeness of the family SMEs. This finding is in agreement with Chirico (2008).

The medium strong correlations exist between innovativeness measured by "I often surprise with novel ideas/Our family SME is regularly testing new ideas" and "I am a very creative person/Our family SME is creative in business methods" and the variable *"academic and practical courses outside the family SME that allow transfer of knowledge from others to the successor, which is combined with the tacit knowledge in the family SME into new knowledge and fosters innovativeness of successors."*

Therefore, we partially confirm the hypothesis H6.

Our research revealed that academic and practical courses of successors outside the family SMEs that allow *"transfer of knowledge from others to the successor, which is combined with the tacit knowledge in the family SME into new knowledge and fosters innovativeness of successors"* positively correlate with their innovativeness and consequently innovativeness of family SME. Our findings are in agreement with Sardesmhukh and Corbett (2011).

4 Conclusions

Our research findings filled the literature gap in the relation of internal and external knowledge transfer in family SMEs and innovativeness of successors and of family SMEs.

Our study contributes to definition of factors, which are within transfer of knowledge affecting the innovativeness of successors and of family SMEs, e.g. early inclusion in the family SME, learning by doing, working experiences in other firms and external training programs. We proved which of the variables within the construct of knowledge transfer are positively correlated to innovativeness of successors and of family SMEs.

Practical implications of our research findings are useful for founders and successors of family SMEs by demonstrating the most effective forms of transferring the existing knowledge and creating new knowledge thus fostering innovations.

Our research was limited to the smaller family firms with prevailing first generation family firms. Thus, a survey on a sample with more equal representation of family SMEs of both generations shall be considered.

Future research should address some other forms of transfer of knowledge not explored in our research, e.g. transfer of knowledge from customers, suppliers and other participants outside the family SME; exchange of knowledge through participation at meetings, in processes of strategic decision-making, which are as well important (e.g. Cabrera-Suárez et al., 2018). The challenges of future research are as well to include other variables e.g., leadership styles and psychological capital of founders and their impact on innovativeness of successors and of family SMEs; as well as the process of the leadership transfer has been viewed as the process of transferring knowledge (Duh, 2014), another interesting research direction would be how does ownership succession affect innovativeness.

References

- Aulawi, H., Sudirman, I., Suryadi, K. and Govindaraju, R. (2009) »Knowledge sharing behavior, antecedent and their impact on the individual innovation capability«, *Journal of Applied Sciences Research* 5 (12), 2238-2246.
- Barbera, F., Bernhard, F., Nacht, J., and McCann, G., (2015) "The Relevance of a Whole-Person Learning Approach to Family Business Education: Concepts, Evidence, and Implications", *Academy of Management Learning & Education*, Vol. 14, No. 3, pp. 322-346.
- Barroso Martínez, A., Sanguino-Galván, R. and Bañegil Palacios, T. M., (2016) "An empirical study about knowledge transfer, entrepreneurial orientation and performance in family firms", *European Journal of International Management*, Vol. 10, No. 4, pp. 534-557.
- Bettinelli, C., Sciascia, S., Randerson, K., and Fayolle, A., (2017) "Researching Entrepreneurship in Family Firms", *Journal of Small Business Management*, Vol. 55, No. 4, pp. 506-529.
- Botero, I. C., Cruz, C., De Massis, A., and Nordquist, M., (2015) "Family Business Research in the European Context", *European Journal of International Management*, Vol. 9, No. 2, pp. 139-159.
- Brinkerink, J., (2018) "Broad Search, Deep Search, and the Absorptive Capacity Performance of Family and Nonfamily Firm R&D", *Family Business Review*, Vol. 31, No. 3, pp. 295-317.
- Cabrera-Suárez, K., (2005) "Leadership transfer and the successor's development in the family firm", *Leadership Quarterly*, Vol. 16, No. 1, pp. 71-96.
- Cabrera-Suárez, K., De Saa-Pérez, P., and García-Almeida, D., (2001) "The Succession Process from a Resource and Knowledge-based View of the Family Firm", *Family Business Review*, Vol. 14, No. 1, pp. 37-46.
- Cabrera-Suárez, M. K., García-Almeida, D. J., and De Saa-Pérez, P., (2018) "A Dynamic Network Model of the Successor's Knowledge Construction from the Resource- and Knowledge-Based View of the Family Firm", *Family Business Review*, Vol. 31, No. 2, pp. 178-197.
- Cakar, N. D., and Ertuerk, A. (2010). "Comparing innovation capability of small and medium-sized enterprises: examining the effects of organizational culture and empowerment", *Journal of Small Business Management*, 48 (3), 325-359.

- Chirico, F., (2008) "Knowledge Accumulation in Family Firms: Evidence from Four Case Studies", *International Small Business Journal*, Vol. 26, No. 4, pp. 433–462.
- Chirico, F. and Salvato, C., (2008) "Knowledge Integration and Dynamic Organizational Adaptation in Family Firms", *Family Business Review*, Vol. 21 no. 2, pp. 169–181.
- Daspit, J. J., Holt, D. T., Chrisman, J. J., and Long, R. G., (2016) "Examining Family Firm Succession From a Social Exchange Perspective: A Multiphase, Multistakeholder Review", *Family Business Review*, Vol. 29, No. 1, pp. 44-64.
- Delgado-Verde, M., Martín-de Castro, G., and Navas-López, J. E., (2011) "Organizational knowledge assets and innovation capability: Evidence form Spanish manufacturing firms", *Journal of Intellectual Capital*, Vol. 12 No. 1, pp. 5–19.
- De Massis, A. and Foss, N. J., (2018) "Advancing Family Business Research: The Promise of Microfoundations", *Family Business Review*, Vol. 31, No. 4, pp. 386-396.
- Desouza, K. C. and Awazu, Y., (2006) "Knowledge management in SMEs: five peculiarities", *Journal of Knowledge Management*, Vol. 10, No. 1, pp. 32-43.
- Duh, M. (2014), "Family business succession as knowledge creation process", *Kybernetes*, Vol. 43, No. 5, pp. 699 – 714.
- García-Álvarez, E., López-Sintas, J., and Gonzalvo, P.S., (2002) "Socialization Patterns of Successors in First- to Second-Generation Family Businesses", *Family Business Review*, Vol. 15, No. 3, pp. 189–203.
- Gersick, K.E., Davis, J.A., McCollom Hampton, M., and Lansberg, I., (1997) "Generation to Generation. Life Cycles of the Family Business", Harvard Business School Press, Boston.
- Grant, R. M., (1996) "Toward a Knowledge-based Theory of the Firm", *Strategic Management Journal*, Vol. 17(Winter Special Issue), pp. 109–122.
- Hauck, J., and Prügl, R., (2015) "Innovation activities during intra-family leadership succession in family firms: An empirical study from a socioemotional wealth perspective", *Journal of Family Business Strategy*, Vol. 6, No. 2, pp. 104-118.
- Hollenstein, H. (1996). "A composite indicator of firm's innovativeness: An empirical analysis based on survey data for Swiss manufacturing". *Research Policy*, 25 (4), 633-645.
- Hurt, T.H. and Teigen C.W., (1977) "The development of a measure of perceived organizational innovativeness", *Communication Yearbook*, 1 (1), pp. 377-385.
- Jackson, D.N. (1994). "Jackson Personality Inventory—Revised Manual". Port Heron, MI: Sigma Assessment Systems, Inc.
- Kogut, B. and Zander, U. (1992) "Knowledge of the firm, combinative capabilities and the replication of technology", *Organization Science* 3 (3), 383-397.
- Letonja, M. and Duh, M., (2016) "Knowledge transfer in family businesses and its effects on the innovativeness of the next family generation", *Knowledge management research and practice*, Vol. 14, No. 2, pp. 213-224.
- Litz, R. A. and Kleysen, R. F., (2001) "Your old Men Shall Dream Dreams, Your Young Men Shall See Visions: Toward a Theory of Family Firm Innovation with Help from the Brubeck Family", *Family Business Review*, Vol. 14 No. 4, pp. 335–352.
- Llach, L., and Nordquist, M. (2010) "Innovation in Family and non-family businesses: A resource perspective", *International Journal of Entrepreneurial Venturing*, 2, 381-399.
- Lynch, P., Walsh, M. M., and Harrington, D. (2010) "Defining and dimensionalizing organizational innovativeness". Presenting at International CHRIE Conference, Massachusetts.
- Maček, A., and Pšenčny, V., (2012) "Internationalization as a growth factor of employment in dynamic companies in Slovenia". *Mednarodno inovativno poslovanje: strokovno znanstvena revija za področje poslovanja in poslovnega izobraževanja*, ISSN 1855-6175, 2012, letn.4, št.2.

- Marcati, A., Guido, G. and Peluso, A.M., (2008) "The role of SME entrepreneurs' innovativeness and personality in the adaption of innovations", *Research policy*, 37 (9), pp. 1579-1990, doi:10.1016/j.respol.2008.06.004.
- Mazzola, P., Marchision, G., and Astrachan, J., (2008) "Strategic Planning in Family Business: A Powerful Developmental Tool for the Next Generation", *Family Business Review*, Vol. 21 No. 3, pp. 239–258.
- Miller, D., Steier, L. and Le Breton-Miller, I., (2003) "Lost in time: intergenerational succession, change, and failure in family business", *Journal of Business Venturing*, Vol. 18 No. 4, pp. 513–531.
- Mueller, S. L., and Thomas, A. S., (2001) "Culture and entrepreneurial potential: A nine country study of locus of control and innovativeness", *Journal of business venturing*, Vol. 16, No. 1, pp. 51-75.
- Nonaka, I., (1994) "A Dynamic Theory of Organizational Knowledge Creation", *Organization Science*, Vol. 5 No. 1, pp. 14–37.
- Nonaka, I., Toyama, R. and Konno, N., (2000) "SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation", *Long Range Planning*, Vol. 33 No. 1, pp. 5–34.
- Nonaka, I. and von Krogh, G., (2009) "Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory", *Organization Science*, Vol. 20 No. 3, pp. 635–652.
- Nordquist, M., Wennberg, K., Bau, M., and Hellerstedt, K., (2013) "An entrepreneurial process perspective on succession in family firms", *Small Business Economics*, Vol. 40, No. 4, pp. 1087-1122.
- Quintaine, E., Casselman, R. M., Reiche, S., and Nylund, P. A., (2011) "Innovation as a knowledge based outcome", *Journal of Knowledge Management*, Vol. 15, No. 6, pp. 928-947.
- Sardeshmukh, S. R. and Corbett, A. C., (2011) "The Duality of Internal and External Development of Successors: Opportunity Recognition in Family Firms", *Family Business Review*, Vol. 24, No. 2, pp. 111–125.
- Sharma, P., Chrisman, J.J., Pablo, A.L., and Chua, J.H., (2001) "Determinants of Initial Satisfaction with the Succession Process in Family Firms: A Conceptual Model", *Entrepreneurship Theory and Practice*, Vol. 25, No. 3, (Spring 2001), pp. 17-35.
- Sharma, P., (2004) "An Overview of the Field of Family Business Studies: Current Status and Directions for the Future", *Family Business Review*, Vol. 17, No. 1, pp. 1–36.
- Sharma, P., Chrisman, J.J., and Gersick, K.E., (2012) "25 Years of Family Business Review: Reflections on the Past and Perspectives for the Future", *Family Business Review*, Vol. 25, No. 1, pp. 5-15.
- Szulanski, G., (1996) "Exploring internal stickiness. Impediments to the transfer of best practice within the firm", *Strategic Management Journal*, Vol. 17(Special Winter Issue), pp. 27–43.
- Swap, W., Leonard, D., Shields, M., & Abrams, L., (2001) "Using Mentoring and Storytelling to Transfer Knowledge in the Workplace", *Journal of Management Information Systems*, Vol. 18, No. 1, pp. 95–114.
- Verhees, Fr. J. H. M., and Meulenberg, M. T. G., (2004) "Market orientation, innovativeness, product innovation and performance in small firms". *Journal of Small Business Management*, 42 (2), 134-154.

Social Media use in Communities of Practice: insights from an Engineering Service Company

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Abstract

The use of Communities of Practice (CoPs) to support knowledge sharing and collaboration within organisations has been increasing over the years. Today, many different companies from various sectors are deliberately resorting to CoPs to better managing cognitive assets and improving business performance. In particular, the availability of the new web-based technologies, like for example Enterprise Social Media platforms, are promoting the widespread utilisation of virtual CoPs, i.e. CoPs that make use of ICTs to enable distant and asynchronous communications among members. Even though the “marriage” of Social Media with CoPs seems to be perfect, studies that investigate the use of the new social applications in the context of CoPs are still scarce. To contribute to fill this gap, the present paper analyses the factors that influence the frequency of CoP access by means of a Social Media platform. Specifically, the paper illustrates and discusses the results of a survey which involved 262 employees of an international engineering project-based service company that eight years ago established

several global CoPs in order to improve internal knowledge exchange and collaboration processes. At present, inside the company there are 20 active communities, involving about 1,400 project execution employees, whose functioning is supported by a Social Media platform dubbed Connect. The survey, that included 22 questions, was administered online between September and October 2018.

The findings of the survey have allowed to identify some factors that result to be strictly correlated with the frequency of use of the Social Media platform to interact with the others community members. Among others these are: position in the company, role inside the community, individual motivation, kind of use, perceived technical and organizational obstacles. The paper contributes to advance the research about the adoption of Social Media technologies as knowledge management tools by identifying some factors that influence their use inside a CoP. It also provides useful suggestions to managers who intend to promote the development of Social Media enabled virtual Communities of Practices. The main limitation of the study is that it bases on the experience of only one company working in a specific industry with specific knowledge needs and capabilities. In spite of this, the findings provide interesting insights that can be a basis for future investigations as well as suggestions to managers willing to create and sustain virtual CoPs.

Keywords – Knowledge Management, Social Media, Community of Practice, Survey

Paper type: Academic Research Paper

1 Introduction

The use of Communities of Practice (CoPs) to support knowledge sharing and collaboration within organisations has been spreading over the years (Aljuwaiber, 2016; Nithithanatchinnapat et al., 2016). Nowadays many different companies from various sectors are deliberately resorting to CoPs to better managing their cognitive assets and in this way improving their business performance. As underlined by the literature, technology is one of the key pillars of CoPs (Scarso et al., 2009; Wenger et al., 2009), since it can streamline their internal knowledge sharing processes (Hislop et al., 2018). This is particularly true in the case of virtual CoPs, i.e. communities that make use of ICTs to enable distant and asynchronous communications among members, whose rapid diffusion (Frank et al., 2017) has been favoured by the availability of new web-based tools, like for example Enterprise Social Media platforms (Leonardi et al., 2013). Such tools, in fact, enable better communication and collaboration as well as enhanced knowledge location and transfer (Mäntymäki and Riemer, 2016). However, even though the “marriage” of Social Media with CoPs seems to be perfect (Annabi and McGann, 2013), there is little research that investigates the use of the new social applications in the context of CoPs.

Considering the above, this study aims to better understand how Social Media are employed as a communication and knowledge sharing tool inside a CoP. More

specifically, the paper intends to identify and discuss the factors connected with a more or less frequent use of an Enterprise Social Media platform to access a CoP and collaborate.

The paper is articulated as follow. In the next section, the conceptual background and the rationale of the study are illustrated. Section three focuses on the research goals and method, while section four is devoted to presenting the research findings. In section five the findings are more deeply discussed; the last section offers some conclusive remarks also regarding potential and limitations of the study.

2 Background

The notion of Community of Practice was introduced almost thirty years ago by Lave and Wenger (1991) as a part of a broader conceptual framework for reflecting on learning in its social dimension. From then on, it has gained increasing popularity and found extensive practical use in so many contexts (business, government, education health, etc.) that it is difficult to list all its applications (Wenger, 2010). But it is especially in the field of Knowledge Management (KM) that CoPs have been employed as a key tool to promote collaboration and knowledge sharing among “people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis”, to recall the probably most cited definition of Wenger et al. (2002). The recent years have seen a rapid diffusion of virtual (ICT-enabled) CoPs favoured by the fact that Web 2.0 applications and especially Enterprise Social Media (ESM) platforms have increased the ease with which they can be established and sustained.

In fact, it is a widely shared opinion that ESMs can bring substantial benefits to knowledge-related processes (Bechina et al., 2012; Calero Valdez et al., 2018; Helms et al., 2017; Sankaran et al., 2018). Specifically, they are deemed to promote new ways of exchanging knowledge by employees of an organization (Razmerita et al., 2017), they can transform knowledge sharing from an intermittent and occasional process into a systematic conversation (Majchrzak et al., 2013), and they are generally less complex and more affordable than the technologies of earlier generations used to store and facilitate knowledge sharing (like, for example, big centralized databases and automated search engines). Hence not surprisingly, there are those who affirm that KM and ESM are a perfect “couple” (Helm et al., 2017), and that a perfect “marriage” exists between CoPs and ESMs (Annabi and McGann, 2013). Conversely, it is rather surprisingly that studies that investigate the use of ESMs within professional CoPs are still scarce.

The present paper intends to contribute filling this gap by identifying and analysing the factors that influence the frequency of use of an ESM platform to access a CoP and interact with its members. The assumption under this study is that understanding how to promote the sharing of knowledge within a CoP through the effective and efficient use of new social tools is not only vital for the proper functioning of the community but also for the successful adoption of the new media.

In order to perform our analysis, we mainly referred to the studies that have investigated the factors influencing knowledge sharing through ESMs. Scholars who, in

the recent literature, examined this topic tend to consider factors deriving from different conceptual perspectives (Stei et al, 2016) as follows. Nielsen and Razmerita (2014) – who recall a classification proposed by Lin (2007) – distinguish between three different classes of factors: individual factors, organizational factors, and technological factors. In a later paper (Razmerita et al., 2016), the authors provide additional specifications by distinguishing between drivers and barriers. Other scholars (Chin et al., 2015a; Lal, 2016, Harker et al., 2018), willing to underline the social nature of these technologies, add the class of social factors. Further scholars take into consideration additional factors such as: process/operational (Bolisani and Scarso, 2016; Chin et al., 2015b), economic, and cultural factors (Bolisani and Scarso, 2016). Together with the previous factors, we took into account few specific cognitive aspects that can affect how an individual use an ESM to access the knowledge resources (human and documentary, as e.g. written texts, figures, presentations, templates) made available by a CoP.

3 Research goals and methods

According to what is said above, our research aimed to examine the factors that influence the frequency of use of an ESM platform to access a CoP. More specifically it intends to identify and analyse which elements differentiate frequent users from less frequent ones. At this aim we investigated the employees of a company that have adopted an ESM platform to support their CoPs (that the company calls CoI, i.e. Community of Interest). It is an international engineering project-based service company (whose name is not indicated for reasons of confidentiality) specialized in pharmacy whose offices are in 8 different countries (Denmark, France, Belgium, Germany, Switzerland, India, Japan, and United States). At present 20 active communities involve about 1,400 employees. Their functioning is supported by ICT tools, and especially by a Social Media platform named Connect. For collecting data, we conducted a survey that included 22 questions aimed to understand how the ESM enabled CoPs of the company are supporting its knowledge management processes. The survey was administered online between September and October 2018. The present study makes use of the survey data to investigate the aspects characterizing employees who access the communities by means of the Social Media platform. For reasons of space, in the next section only a limited part of the most interesting results is illustrated and discussed.

4 Findings

4.1 The case company

The investigated enterprise is a global engineering company that specializes in the pharmaceutical industry, with around 2,000 employees in 15 offices dispersed in Europe, China, India, and USA. The company employees who are involved in the execution of the projects are expected to consult written engineering guideline when developing solutions to customers, provide feedback or suggest improvements to the guideline owner, and

participate in knowledge development discussions. Employees are also expected to leverage the globally dispersed workforce to resolve problems and find solutions by posting questions online or directly to expert colleagues. CoIs are a central part of the its strategy to become a world leading pharma engineering company that has a local presence and use the knowledge of experts around the world.

The company has organized 20 global CoIs (the first ones were established in 2008) with 1,400 project execution employees who are members of at least one CoI. Participants are voluntary practitioners that interact continuously, and the CoIs define their own task, are responsible for stewarding knowledge within the enterprise, and have a long-term focus. Each CoI represents a competence that has been identified by at least four countries as being a core competence. CoIs are responsible for writing the global engineering standards and implementing best engineering practice derived from projects throughout the world. CoIs are supported by several ICT tools including the ESM platform Connect. Each CoI has a Chairman who is overall responsible for the community and key members engagement. He/she is also responsible for the mainly administrative tasks of inviting to meetings, reporting on CoI performance, maintaining the dialogue with the CoI board, and following up on budget. A CoI has several Key members that are voluntarily appointed to the position because they are recognized experts within their field, and these are central to developing knowledge, sharing knowledge and answering questions. The CoI size ranges from 67 to 373 members. CoIs are governed by a board made up by management representatives from the countries and the board is responsible for the budget and strategy.

4.1 Characteristics of high and low frequent users

We received 262 valid answers from employees from eight countries that correspond to about 19% of CoIs members; the most frequent were Denmark (47.7%), India (13.1%) and Switzerland (12.2%).

We define a high-frequent user as a person that uses Connect for accessing his/her COI at least on a weekly basis. A low frequent user is only active on a monthly basis or even more seldom. In our dataset, we have 147 (56.1%) of high-frequent users and 115 (43.9%) low-frequent users. More specifically, only 17.6% of respondents access CoIs by means of Connect less than once a month.

Table 1: Demographic information

		All participants	High-frequent users	Low frequent users
Position	Manager	6.9%	55.6%	44.4%
	Project/Engineering Manager	19.5%	37.3%	62.7%
	Engineer/Specialist	73.6%	60.9%	39.1%
Seniority in the company	0-2 years	21.8%	64.9%	35.1%
	2-5 years	29.8%	56.4%	43.6%
	5-10 years	22.5%	54.2%	45.8%
	10-15 years	11.8%	51.6%	48.4%
	More than 15 years	13.4%	45.7%	54.3%
	Missing	0.8%		

Membership in primary CoI	0-6 months	9.5%	60.0%	40.0%
	6 month – 1 year	7.6%	85.0%	15.0%
	1-2 years	14.1%	48.6%	51.4%
	2-4 years	31.7%	50.6%	49.4%
	More than 4 years	36.6%	56.3%	43.4%
	Missing	0.4%		
Role in primary CoI	Chairman	7.3%	89.5%	10.5%
	Key member	20.2%	79.2%	20.8%
	Member	72.1%	46.6%	53.4%
	Missing	0.4%		

Table 1 shows that engineers and specialists, i.e. operative people, are more regular users than project/engineering managers. This could be ascribed to the fact that CoIs are seen as a tool to find information related to the daily work more than a coordinating tool. In any case it must be recalled that, according to some information collected by the company, project/engineering managers prefer to use other tools to coordinate their teams, as well as they are less willing to share their PM-related knowledge with other PMs. The frequency of use decreases with the seniority in the company, which indicates that more recently hired employees are also those who need it most to acquire information and knowledge about the company and their work. Instead, there is no clear relation between the frequency of use and the level of seniority, which is an aspect that would deserve further investigation. Lastly, as expected given with their role, the large majority of Chairmen and Key members are high-frequent users.

Before proceeding with analysing the results, it is needed recalling that the next figures show the percentage distribution of responses given by the two groups, where 100% corresponds to the total of valid responses of each group (between parentheses in each caption it is indicated the maximum number of possible answers).

One of the questions asked how a user interacts with his/her primary CoP. The three main ways of interacting with the primary CoI are to use content like wiki articles, to browse through content and, to a lesser extent, to contribute to conversations (Figure 1). The two groups show rather different behaviours. Specifically, high-frequent users contribute to conversations, upload articles or comment articles more than low-frequent users: in substance they show a more knowledge sharing oriented behaviour. Conversely, low-frequent users more like to browse through the content of the CoI, use relevant information and ask other users for help. To sum up, high-frequent users give a more active contribution, while low-frequent ones seem having a sort of need-driven behaviour.

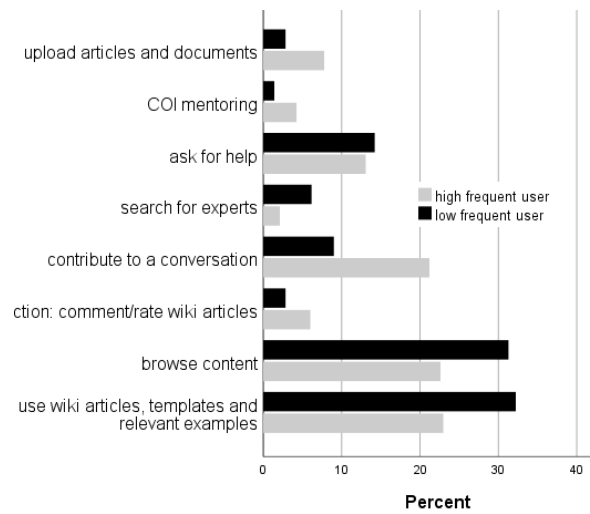


Figure 1: Interaction with primary CoI (max 3 answers)

Survey participants were asked to state why their colleagues should participate in a CoI (Figure 2); this was an indirect way to ask them why they do so. While high-frequent and low-frequent users both agree that to be informed and share information are good reasons to participate in the CoIs, more high-frequent users than low-frequent users think that easier communication is a reason to use the CoIs. Both groups do not think that a CoI can replace meetings. Data confirm that CoIs are considered a tool that should be useful for the daily work, but also that at present they are not so useful for low-frequent users.

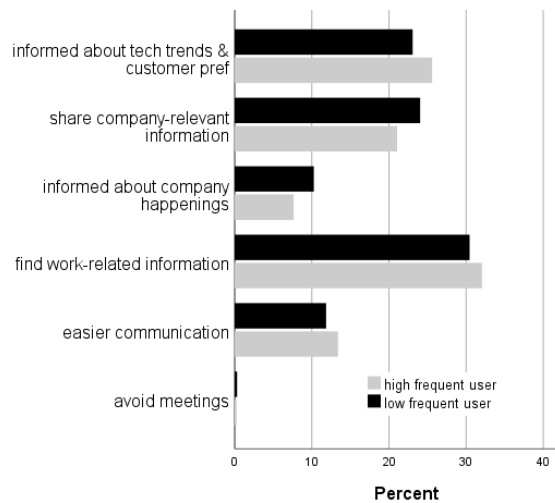


Figure 2: Participation reasons in CoIs for other colleagues (max 3 answers)

4.3 Perceived Challenges using CoIs

Both low-frequent and high-frequent users face technical challenges by using Connect as software for the CoIs. The three most named challenges independently of the user group were the difficulties to find the information in the system, the perceived usability of the system compared to other systems as well as the lack of features (Figure 3). A higher percentage of high-frequent users than low-frequent users perceived challenges, and this could be explained with their more intensive use. Especially high-frequent users complained about the insufficient technical support, while system security is not an issue at all. Interesting to note that low-frequent users more believe that other tools or solutions are quicker and /or easier to use, which could be a further reason for their sporadic use.

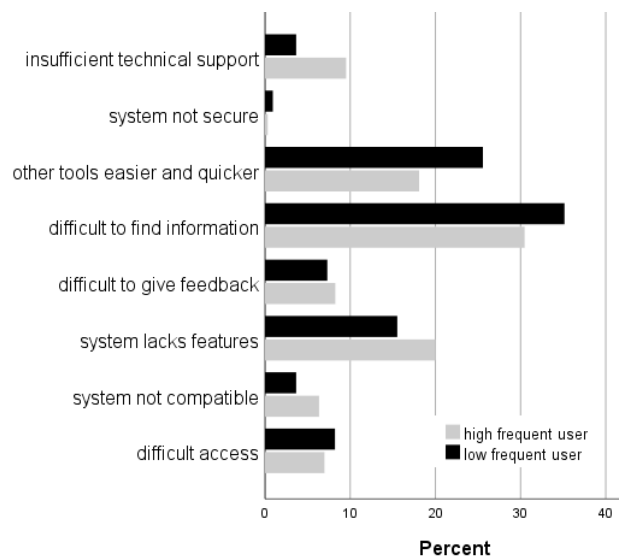


Figure 3: Perceived technical obstacles with Connect

Besides of technical obstacles, Connect users also face organizational ones (Figure 4). The fact that respondents indicated on average more organizational obstacles than technical ones (2.46 vs. 2.04) underline how the organizational ones are perceived as more relevant than the technical ones.

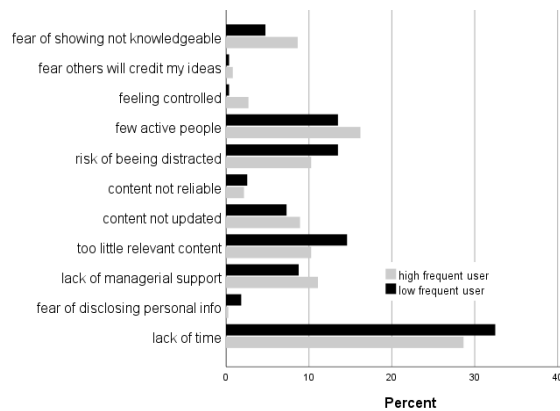


Figure 4: Perceived organizational obstacles by using Connect

The biggest organizational challenges are lack of time, too few active people and the risk of feeling distracted from the daily work. High-frequent users have a higher fear of showing that they are not knowledgeable than low-frequent users, as well as they complain a not full managerial support. More low-frequent than high-frequent users have the impression that the provided content is not relevant for them.

In line with the identified obstacles, Connect users provided ideas about how to improve knowledge sharing in the company (Figure 5). In general, employees require the allocation of time to contribute to the CoIs, knowledge sharing services and search functionality should be improved. Low frequent users are more interested in usage guidelines, better explanation of the purpose of CoIs and better integration of the Connect system with other systems than high-frequent users. High-frequent users are more interested to get a reward for their contributions, more features and better information classification than low-frequent users. Quite surprising is the fact that more high-frequency users suggest the giving of rewards than low-frequency users. It would be interesting to understand if they believe that their intense participation deserves to be rewarded, or if they think that rewards can be an effective way to motivate current sporadic users.

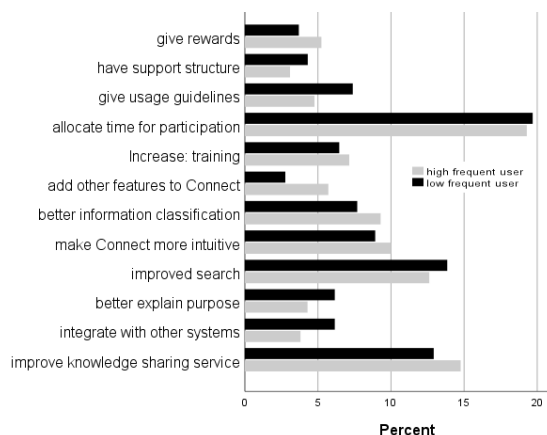


Figure 5: Ideas for increasing knowledge sharing in the company (max 3 answers)

5 Discussion

What emerged from the study first shows that Social Media can not only be used to support knowledge sharing processes that occur inside a community, but especially that the peculiar organizational context of a CoP appears to be particularly suitable for the successful introduction and use of these new tools. This is confirmed by the positive experience of the investigated company where more than half of the employees that answered the questionnaire access Connect frequently in order to participate to CoIs' life.

Furthermore, the findings of the survey have provided some interesting indications of general character concerning the use of an ESM platform as a tool to support a CoP, as follows:

- Communities are mainly used as virtual places where to find relevant knowledge under the form of web content, wiki articles, templates and examples.
- The most important reason to participate to a community (and hence to use Connect) is to access information and knowledge useful to the daily work.
- Technical obstacles are perceived being less important than organisational ones. Among the first ones, the difficult finding of information and the availability of easier and quicker to use alternative tools are the most named. Regarding the second ones, lack of time clearly prevails over the others.
- In accordance to the previous points, suggestions to promote a more frequent use underline the need to allocate time as well as to make the access to relevant information/knowledge easier. An element that deserves to be recalled here is the very little relevance attributed to rewards as a mean to promote knowledge sharing.

Coming to the specific issue investigated by the paper, that is which elements differentiate frequent from not frequent ESM users, the survey underlines that regular users differ from sporadic users for several aspects as e.g.: position and seniority inside the company, role within CoI, kind of use of the ESM platform, reasons to participate to a CoI, nature of perceived technical and organisational barriers. Specifically, compared to the sporadic users, frequent users seem to pay more attention to the nature of a community as a "knowledge management environment", and are particularly aware of the relevant support that Social Media can give to knowledge sharing. Conversely, sporadic users seem to show a more "opportunistic" use of the community, denoted by a very low level of personal involvement in the community.

6 Conclusion

The paper contributes to a better understanding of how Social Media-supported CoPs can promote knowledge management activities of a global company. More specifically, it investigates the factors that lead to a more frequent access to the CoP by means of Social Media. In doing this, the study reiterates the importance and usefulness of adopting a KM lens to analyse Social Media and that a very good "marriage" exists between CoP and ESM.

From the academic point of view, the study confirms the results of previous research about the existence of different classes of ESM users and the need to improve our understanding of their characteristics. It also confirms the crucial role played by some factors (as e.g. time availability, usefulness for daily work, advantages offered by alternative tools) in influencing the intensity of use of the new social platforms.

The study also offers some practical indications to managers willing to promote a more frequent use of an ESM platform in order to improve the knowledge sharing processes inside their company's CoPs. In particular, it suggests that together with some actions of general validity (as e.g. allocating time to the use of the platform) some other specific actions must be implemented that take into account the specific situations of sporadic users. In this regard, as most of the literature about ESM and CoP underlines, it is worth recalling that less frequent users are however important to keep the CoP (and the ESM platform) alive, and that therefore the first goal is to prevent their abandoning the platform.

The study is not without limitations. A first one is that it applied only descriptive analytics. Hence the next step will be to do a more sophisticated statistical elaboration of the collected data. Another limitation is that results cannot be generalised, since only one company was analysed that belongs to an industry with specific knowledge needs and capabilities. Therefore, future research should extend this analysis in other companies of different sectors. In any case, the findings of the study provide interesting insights that can be a basis for further studies.

References

- Aljuwaiber, A. (2016) "Communities of practice as an initiative for knowledge sharing in business organisations: a literature review", *Journal of Knowledge Management*, Vol. 20, No. 4, pp. 731–758.
- Annabi, H. and McGann, S.T. (2013) "Social media as the missing link connecting communities of practices to business strategy", *Journal of Organizational Computing and Electronic Commerce*, Vol. 23, pp. 56-83.
- Bechina, A., Arntzen, A. and Ribiere, V. (2012) "Is the emergence of social software a source of knowledge management revival?", in Gurteen, D. (Ed.), *Leading Issues in Social Knowledge Management*, Academic Publishing International, Reading, pp. 1-21.
- Bolisani, E. and Scarso, E. (2016) "Factors affecting the use of wiki to manage knowledge in a small company", *Journal of Knowledge Management*, Vol. 30, No. 3, pp. 423-443.
- Calero Valdez, A., Brell, J., Schaar, A.K. and Ziefle, M. (2018) "The diversity of why: a meta-analytical study of usage motivation in enterprise social networks", *Universal Access in the Information Society*, Vol. 17, No. 3, pp. 549-566.
- Chin, C.P.Y., Evans, N. and Choo, K.K.R. (2015a) "Exploring Factors Influencing the Use of Enterprise Social Networks in Multinational Professional Service Firms", *Journal of Organizational Computing and Electronic Commerce*, Vol. 25 No. 3, pp. 289-315.
- Chin C.P.Y., Choo K.K.R., Evans N. (2015b) "Enterprise Social Networks: A Successful Implementation within a Telecommunication Company", *Twenty-first Americas Conference on Information Systems*, Puerto Rico,
- Frank, A. G., Sander, N., Gastaldi, L., Madini, E. and Corso, M. (2017) "An assessment model for virtual communities of practice: a study in the oil and gas industry", *Knowledge*

Management Research & Practice, Vol. 15, No. 4, pp. 507–522.

- Hacker, J. (2017) “Enterprise Social Networks: Platforms for Enabling and Understanding Knowledge Work?” in Helms, R., Cranefield, J. and van Reijssen, J. (Eds), *Social Knowledge Management in Action*, Springer International Publishing, Switzerland, pp. 17-37.
- Helms, R., Cranefield, J. and van Reijssen, J. (2017) “Social Media and Knowledge Management: A Perfect Couple”, in Helms, R., Cranefield, J. and van Reijssen, J. (Eds), *Social Knowledge Management in Action*, Springer International Publishing, Switzerland, pp. 1-13.
- Hislop, D., Bosua, R. and Helms, R. (2018) *Knowledge Management in Organizations: A Critical Introduction*, Oxford University Press, Oxford, 4th ed.
- Lave, J. and Wenger, E. (1991) “Situated learning: legitimate peripheral participation”, *Cambridge University Press*, Cambridge, UK.
- Leonardi, P.M., Huysman, M. and Steinfield, C. (2013) “Enterprise social media: Definition, history, and prospects for the study of social technologies in organizations”, *Journal of Computer-Mediated Communication*, Vol. 19, No. 1, pp. 1-19.
- Lal, P. (2017) “Analyzing the Factors Driving the Usage of Enterprise Social Network”, *International Journal of Social and Organizational Dynamics in IT*, Vol. 5, No. 2, pp. 15-30.
- Lin, J. (2007) “Effects of extrinsic and intrinsic motivation on employee knowledge sharing intentions”, *Journal of information science*, Vol. 33, No. 2, pp. 135-149.
- Mäntymäki, M. and Riemer, K. (2016) “Enterprise social networking: A Knowledge management perspective”, *International Journal of Information Management*, Vol. 36, pp. 1042-1052.
- Majchrzak, A., Faraj, S., Kane, G.C. and Azad, B. (2013) “The Contradictory Influence of Social Media Affordances on Online Communal Knowledge Sharing”, *Journal of Computer-Mediated Communication*, Vol. 19, No. 1, pp. 38-55.
- Nielsen, P. and Razmerita, L. (2014) “Motivation and Knowledge Sharing through Social Media within Danish Organizations”, in Bergvall-Kärebörn, B. and Nielsen, P.A. (Eds.), *Creating Value for All Through IT*, Springer, Berlin, pp. 197-213.
- Nithithanatchinnapat, B., Taylor, J., Joshi, K.D., and Weiss M.L. (2016) “Organizational communities of practice: Review, analysis, and role of information and communications technologies”, *Journal of Organizational Computing and Electronic Commerce*, Vol. 26, No. 4, pp. 307-322.
- Razmerita, L., Kirchner, K. and Nielsen, P. (2016) “What factors influence knowledge sharing in organizations? A social dilemma perspective of social media communication”, *Journal of Knowledge Management*, Vol. 20, No. 6, pp. 1225-1246.
- Razmerita, L., Kirchner, K. and Nielsen, P. (2017), “The Perceived Business Value of Social Media at Work”, *International Journal of multidisciplinary in business and science*, Vol. 3, No. 4, pp. 52-59.
- Sankaran, P., Bheeman, S., Priya, K.H., Zhou, X. and Gururajan, R. (2017) “Factors impacting employee engagement on enterprise social media”, *Proceedings of the International Conference on Web Intelligence*, pp. 1114-1121.
- Scarso, E., Bolisani, E. and Salvador L. (2009) “A systematic framework for analysing the critical success factors of communities of practice”, *Journal of Knowledge Management*, Vol. 13, No. 6, pp. 431-447.
- Stei, G. and Rossmann, A. (2017) “Implementation Strategies for Enterprise Social Networks”, in Rossmann, A. and Zimmermann, A. (Eds.), *Digital Enterprise Computing (DEC 2017)*, Gesellschaft für Informatik, Bonn, pp. 67-78.
- Wenger, E. (2010) “Communities of practice and social learning systems: the career of a concept”, in Blackmore, C. (Ed.), *Social Learning Systems and Communities of Practice*, The Open University, Springer, London, pp. 179-198.

- Wenger, E., McDermott, R. and Snyder, W. (2002) *Cultivating Communities of Practices*, Harvard Business School Press, Boston, MA.
- Wenger, E., White, N. and Smith, J. D. (2009) *Digital habitats: Stewarding technology for communities*, CPsquare, Portland, OR.

Managing Projects and Related Knowledge at Strategic Level – a Case Study of a Hungarian IT Company

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Abstract

The paper aims to fill in the gap of investigating the role of strategic project portfolio management and to introduce a case study that focuses on a new strategic project portfolio management model and its application at a Hungarian IT service provider company. The model integrates strategic management, project management and knowledge management in order to set up the strategic project portfolio and to support the successful planning and realization of strategic projects.

There are several approaches to create an organizational strategy (Hunger and Wheelen, 2011). However, they all share a common feature that the foundation of a successful strategy is the analysis of internal conditions and external environment. The way, how the mission and vision statements, as well as the strategic goals are formulated, the strategy for business units are defined, and the operational plans are derived, varies from organizations to organizations. Even more different is, how strategic projects are identified. The main challenge is to create a project portfolio that is aligned with the organizational strategy and provides the balance between exploration and exploitation (Kaiser et al., 2015, Kerzner, 2017, Kopmann et al., 2017, Pemsel and Wiewiora, 2013, Pinto, 2019).

The theoretical part of the paper introduces a new model of developing an organizational strategy and the strategic project portfolio. It is based on the traditional approach of strategic planning, and it is combined with the project planning processes. Scorecard systems provide the interface of these planning systems. Projects are directly linked to strategic goals and the project portfolio is managed at the strategic level.

The practical part demonstrates how this model can be applied in an organization. A Hungarian IT service provider company was selected where the model had been introduced and project management office (PMO) had been created in order to conduct the strategic project portfolio. The new model introduction, the strategic project proposal selection process as well as the project-related knowledge management practice is investigated.

Keywords – Strategy, project, portfolio, knowledge, success

Paper type – Academic Research Paper

1 Introduction

The paper aims to fill in the gap of investigating the role of strategic project portfolio management and to introduce a case study that focuses on a new strategic project portfolio management model and its application at a Hungarian IT service provider company. The model integrates strategic management, project management and knowledge management in order to set up the strategic project portfolio and to support the successful planning and realization of strategic projects.

The article begins with an overview of the evolution of strategic management. This is followed by the introduction of a new approach of developing an organizational strategy, starting from the analysis of the internal and external conditions, through the formulation of the vision and the mission, as well as the organizational goals till the definition of series of projects. The model integrates project management into strategic management.

In the practical part the paper reveals how this model has been applied to a Hungarian IT service provider. Interviews with key internal stakeholders provide a detailed analysis of the new system and lead to identify the need for further actions.

2 Evolution of strategic management

There are several theories of strategic management. The early stages of strategic management evolution concentrated on the process of strategy formulation (Chandler, 1962; Ansoff ;1965; Learned et al. 1965). Later it was investigated, what is the source of competitive advantage: the industry position that forms the space for competition (industry structure based view) or those fundamental resources and capabilities, which create the base of strategy by differentiating itself from others (resource based view). Both approaches can be considered a paradigm of strategic management, and is subject to theory and practice until today, including the Porterian industry sector analysis model's modifications, as well as the trend of emphasis shift in resource-based theory into the direction of knowledge-based dynamic capabilities (Deutsch et al, 2017; Porter, 1980, 1986; Hamel and Prahalad, 1990; Grant, 1991, 2008; Teece and Pisano, 1994; Teece et al, 1997).

Project management is one of the most dynamic fields of management science and practice. Projects are part of the organizational strategy and project management plays an increasing role in strategic management. The main challenge of project management is not limited to the successful project completion, but much more about how these projects contribute to the successful realization of organizational strategic goals (Martens et al., 2018; Pinto, 2016; Blaskovics, 2016; Cserhádi and Szabó 2014; Artto et al., 2008.).

Ambidextrous organizations try to get the balance between exploration and exploitation. Meanwhile exploitation focuses on how effectiveness of existing processes and procedures can be increased, exploration is oriented towards innovation (O'Reilly and Tushman, 2008; Birkinshaw and Gibson, 2004). Theory of ambidexterity links project management to strategic management.

3 Integration of project management into strategic management

Despite all of scientific articles and research results, there is still a lack in investigations on how project management can be integrated into the strategic management. To fill this gap, based on the model of Kessler and Winkelhofer, an integrated model was developed by the author of this article. The model relies on the traditional strategic planning process providing long term strategic and short term operational plans. This process is directly linked to the exploitation perspective of ambidexterity. Projects are platforms for exploration and the strategic project portfolio is the interface between strategic management and project management.

As it is introduced in the previous chapter, there are several approaches to create an organizational strategy (Hunger and Wheelen, 2011). However, they all share a common feature that the foundation of a successful strategy is the analysis of internal conditions and external environment. During the analysis of internal conditions, the strengths are collected and the weaknesses are faced, then an attempt is made to adjust these to market opportunities and threats. The best solution in analyzing the external environment is to have an integrated approach to examine the different environmental segments (legal, economic, political, cultural, and geographical). As the result of these analyses, a decision can be made on those business areas that the operation needs to focus on in the future (Luthans and Doh, 2012).

The next step is the formulation of the vision and the mission. The vision describes the desired future state of the organization. It does not contain numerical values to be obtained, it rather outlines those conditions the organization will endeavor to achieve in the future. The mission is the formulation of the guidelines of the core of the organizational strategy and values which is the guiding principle for managers and employees. The vision and mission are essential because during the development of strategic goals, the determination of the operational and action plans, the development of the control system, the achievement of the goals and objectives defined in the vision and mission need to be taken into consideration.

The organizational goals compared to the mission are more specifically defined. They are the core elements of the organizational management system (Luthans and Doh, 2012). During their formation their quantitative determination should be kept in mind.

The organizational strategy and thus the strategic goals are related to different areas: customers (products and services, markets or market segments), financial (profit, income, cost), internal processes (effectiveness, productivity) and learning and growth (courses, trainings) (Kaplan and Norton, 2007; Kaplan and Norton, 1996). These key areas are of high importance not only for for-profit, but also for non-profit organizations.

The strategic goals defined in the above mentioned target areas, can also be converted into specific, short-term operational plans. However, the market introduction of new products and services or the organization of an international event as projects also have a significant impact on the organization's success. Therefore, it is necessary to deal with these target areas from a strategic point of view. In these areas, the strategic goals can be accomplished as a series of projects, the purposes of which are aligned to the strategic

goals. The organizational strategic goals can be successfully achieved by the successful accomplishment of the projects conducted in the same target areas (Szabó and Csepregi, 2016).

The main challenge is to derive project goals from the organizational strategic goals (top-down approach) as well as to select project proposals which directly contribute to the realization of strategic goals (bottom-up approach). All these projects form the strategic project portfolio.

Figure 1 summarizes this integrated model for strategic project portfolio management. The model integrates project management into strategic management, therefore provides opportunity to get the balance between exploration and exploitation to ambidextrous organizations.

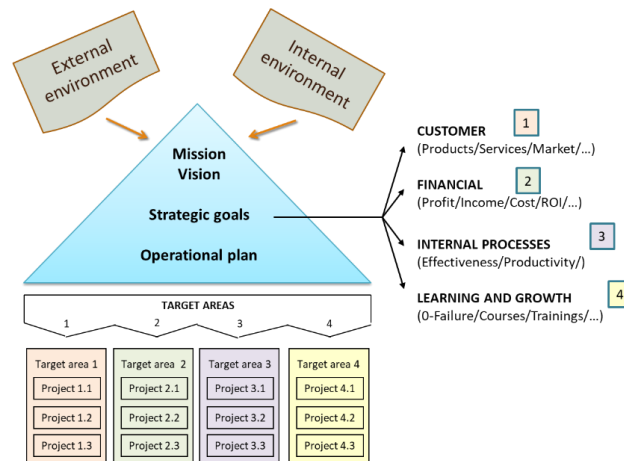


Figure 1: Integrated model for strategic project portfolio management (based on the model of Kessler and Winkelhofer, 1997)

4 Case study

The case study aims at introducing the practical application of the integrated model for strategic project portfolio management. A Hungarian IT service provider was selected in order to show how strategic project portfolio management was introduced by using the integrated model described in chapter 2.

4.1 The case: A Hungarian IT service provider

The selected company is a middle sized Hungarian IT service provider. It was founded in the middle of 90s when the first global IT companies arrived to Hungary. Over the past more than 20 years it became one of the most important local service provider of global IT companies' affiliated firms. During the past two decades, the companies' operation as well as the organizational structure went through some major changes, strategic planning system was set up and project management processes were developed. Because of the acceleration of technological development and the increased complexity of

new product and service development, increased number of project failure was realized. A consulting company was invited to identify the situation, to detect the reason of high level project failure rate and to provide solutions and recommendations for successful operation.

4.2 Applied research methodology

From methodological point of view this paper is a particular one. As an external research consultant the author was invited as subcontractor of the consulting company to take part of the screening process and support the development of the solution. After having completed the consulting process, the author carried out in-depth interviews as part of this research project. Chief Executive Officer, Head of the PMO, and 3 senior project managers were interviewed.

4.3 Result of the screening process

The organizational screening concluded with the following result. In order to increase the profitability, the company applied for many tenders and accepted lots of assignments. Many projects were launched without effective and efficient project management at the organizational level.

The most important symptoms calling for an effective strategic project portfolio management were as follows:

- Single project and process management system is operated but no organizational unit was created to provide coordination among projects.
- No project-related knowledge management system was developed. No systematic knowledge collection and knowledge sharing processes were introduced.
- Many projects were initiated without adding „strategic value” to the organization.
- Several project opportunities were taken without focusing on the strategy.
- No prioritization process was developed for business requests.
- Too many small projects were underway.
- Short term problem-solving instead of long term strategic orientation.
- Frequent change of status of projects (active – on-hold – priority – on-hold).
- Excessive project delays due to lack of resources.
- Intense competition internally with regard to financing / staffing projects.

4.3 Solution: the integrated model for strategic project management

After realizing the problems listed above, necessary conditions for strategic project portfolio management were formulated.

The solution has to fulfil requirements as follows:

- Links project selection to strategic metrics.
- Prioritizes project proposals across a common set of criteria, rather than on politics or emotion.

- Allocates resources to projects that align with strategic direction.
- Justifies killing projects that do not support organization strategy.
- Improves communication and supports agreement on project goals.
- Builds discipline into project selection process.
- Provides executive oversight of the firm.
- Provides the structure / process for project portfolio governance.
- Avoids duplication or waste.
- Supports collecting, compiling and sharing project-related knowledge.

The solution is based on three main pillars:

A/ Introduction of the integrated model for strategic project portfolio management

The integrated model for strategic project portfolio management was recommended to be introduced. Strategic project portfolio is defined as selection of projects where all projects are directly linked to the strategic goals. Strategic alignment, fitness - projects are doable with the available resources – as well as innovation are the three main features of projects of the strategic project portfolio.

B/ Converting the theoretical model into a process-based view of strategic redefinition

After deciding to introduce the new model, the next question had been raised. Although the model introduction links projects to strategic goals, the project selection process had to be developed and selection criteria had to be defined. This led to the development of process-based view of the integrated model. The new process starts with rethinking and reviewing the organizational strategy. If the review gives grounds for redefinition of the organizational strategy, strategic decision makers have to reconsider both the main pillars of the organizational strategy and the strategic project portfolio. Figure 2 shows the process-based view of strategic redefinition. The model includes the planning processes of strategic management as well as of portfolio-, program- and project management.

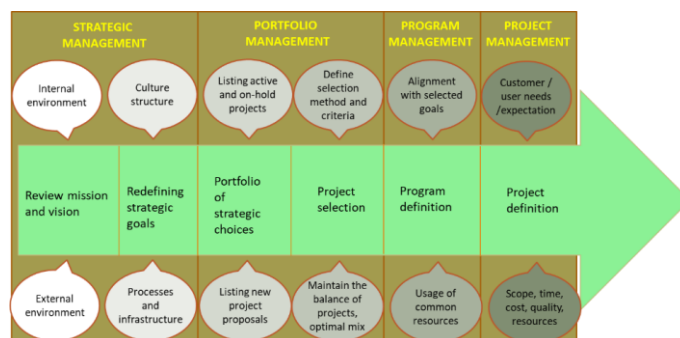


Figure 2: The process-based view of strategic redefinition

The model allows decision makers to take into consideration not only the new project proposals, but to re-evaluate on-hold and active projects when refreshing the strategic project portfolio. Listing already existing projects (active and on-hold) aims at identifying

those projects organization needs for realizing new strategic objectives, meanwhile gathering and listing new project proposals demonstrates the innovation potential of the organization. Screening models help managers pick winners from this pool of projects.

Figure 3 summarizes the most important selection criteria the company applies when selecting projects for its strategic project portfolio.

FINANCIAL	MARKET	BUSINESS BENEFIT	ORGANIZATION	CUSTOMER	FUNCTIONAL
NPV	Increasing market share	Short-term benefit	Relevance	Added value	Internal processes
Payback period	Retaining existing customers	Long-term benefit	Impact	Cost-added value ratio	Knowledge and competence
IRR	Getting new clients	Cost-benefit ratio	Sustainability	Client satisfaction	Cost management
PI			Efficiency		
			Effectiveness		

Figure 3: Criteria for strategic project selection

Financial and functional criteria represent the traditional approach of project selection and business benefit criteria indicate the new interpretation of project success. Economic, social and environmental perspectives of sustainability point out the importance of long-term orientation of project-, and portfolio management.

C/ Setting up a PMO (Project Management Office) as project-related knowledge management center

PMO as a new organizational unit was set up and head of the PMO was appointed to manage the portfolio and to direct the PMO. The new PMO has to serve as a project repository by operating as knowledge management center in terms of collecting, compiling and providing project-related information. The PMO has to provide a consultative role to projects by supplying templates, best practices, training, access to information, and lessons learned from other projects. It has to organize trainings on project management processes and tools, project management software, and project management skill development.

4.4 Assessing the result of the new model introduction

Based on the five interviews the result of the new model introduction was assessed. The assessment was divided into three main parts. The model introduction process itself as a project was evaluated. This was followed by the evaluation of the new system's operation. Finally, the project-related knowledge management conducted by the PMO was analyzed. Based on different assessment criteria, interview partners were asked to evaluate the introduction, the new system as well as the knowledge management system by using a five-grade scale with 5 being the highest and 1 being the lowest grade.

4.4.1 Assessing the new model introduction from project success perspective

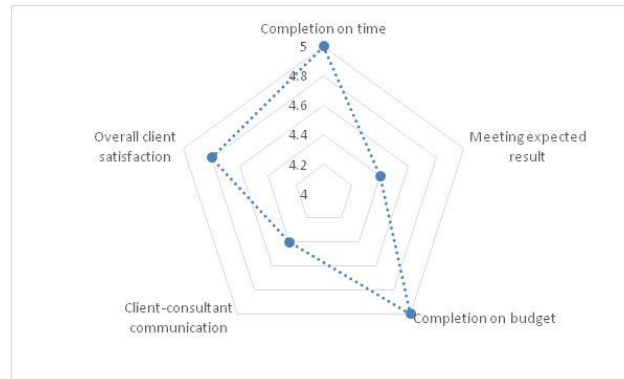


Figure 4: New model introduction from project success perspective

The new model introduction was evaluated by using project success criteria as project triangle (time, budget and result), client satisfaction and client-consultant communication. Figure 4 illustrates that the introduction project was completed on time and on budget. The client representatives expressed a relatively high level of overall satisfaction. The client-consultant communication was assessed as good with an average score of 4.4. In case of communication, interview partners reported on a good partnership with the consulting company, but beside the presentations at the project milestones they expected written executive summaries as well. Executive summary and detailed written report were prepared only at the end of the introduction project. Similar score was given to the final result judgement. Components of the final result were assessed one by one in the next chapter of the interviews.

4.4.2 Assessing the new system's operation

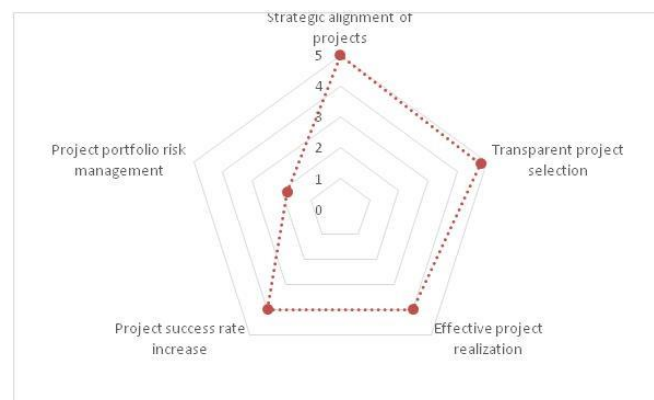


Figure 5: Evaluation of the new system

Components of the new system which integrates projects into the organizational strategy reveal that project proposals are selected in a standardized and transparent manner, and realized based on the standards of designing, executing, closing and

evaluating projects. The introduction and application of the new system concluded with this content.

According to the interviews, the need for project portfolio risk management was identified. However, this was not incorporated into the consultant-client contract, the client realized the lack of project portfolio revision and risk evaluation. This led to a new contract and to the second phase of client-consultant cooperation which is still continuing.

4.4.3 Assessing project-related knowledge management

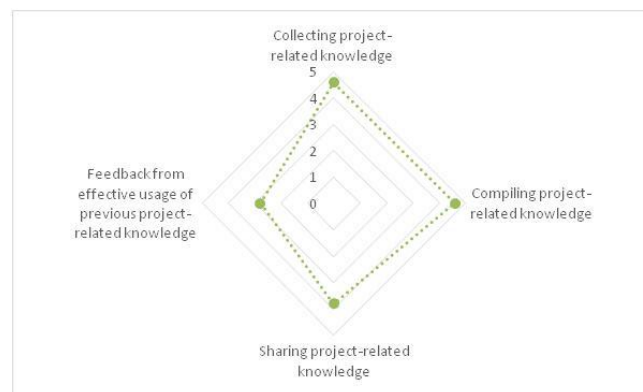


Figure 6: Analysis of the project-related knowledge management system

As an important structural development, a new organizational unit in form of project management office (PMO) was introduced. Figure 6 reveals how effectively project-related knowledge management system is operated by the PMO. Gathering, compiling and sharing functions of knowledge management are operating as expected. On the contrary, feedbacks about how knowledge of previous projects are used when initiating and realizing new projects are not collected and evaluated. Therefore, the new client-consultant contract contains assignment to work out and introduce new feedback-processes.

5 Conclusions

Strategic management and project management are often considered by scientist and practitioners as two separated disciplines and functional areas. Based on a case-study, this paper highlighted how project management can be integrated into strategic management. Through the introduction of the integrated model projects are aligned with the organizational strategy, strategic project portfolio is effectively managed and selection of project proposals goes on a transparent and standardized way. Interviews with key internal stakeholders revealed how successfully the new model was implemented and what kind of needs for further development evolved.

References

- Ansoff, I. (1965) Corporate Strategy, Mc Graw Hill, New York
- Artto, K. – Kujala, J. – Dietrich, P. – Martinsuo, M. (2008) What is project strategy? *International Journal of Project Management*, Vol 26, No. 1, pp. 4-12.
- Birkinshaw, J., - Gibson, C. B. (2004) Building an ambidextrous organisation. *Advanced Institute of Management Research Paper*, (003).
- Blaskovics B. (2016) The impact of project manager on project success — The case of ICT sector. *Society and Economy in Central and Eastern Europe*. Vol. 38. Iss. 2. p. 261-281.
- Chandler, A. (1962) *Strategy and Structure: Chapters in History of the American Industrial Enterprise* M.I.T. Press, Cambridge, MA.
- Cserháti, G. and Szabó, L. (2014) The relationship between success criteria and success factors in organisational event projects. *International Journal of Project Management*, Vol. 32, No. 4, pp. 613-624.
- Deutsch N. - Mészáros T. - Szabó L. (2017) Modelling the development of strategic management. In: Zoltayné, Paprika Zita; Horák, Péter; Váradi, Kata; Zwierczyk, Péter Tamás; Vidovics, Dancs Ágnes; Rádics, Péter János (ed.) *ECMS 2017. 31st European Conference on Modelling and Simulation*. pp. 67-73.
- Grant, R. M. (1991) The Resourced-Based Theory of Competitive Advantage; Implications for Strategy Formulation. *California Management Review* Vol. 33. pp. 114-135
- Hunger, J.D. and Wheelen, T.L., (2011) *Essentials of Strategic Management*. Prentice Hall. New Jersey.
- Kaplan, R.S. and Norton, D.P., (2007) Using the Balanced Scorecard as a Strategic Management System. *Harvard Business Review*, July-August, pp.1-14.
- Kaplan, R.S. and Norton, D.P., (1996) *The balanced scorecard: translating strategy into action*. Harvard College.
- Kessler, H. – Winkelhofer, G.A. (1997) *Projektmanagement*, Springer Verlag, Heidelberg.
- Learned, E. P. – Christensen, C. R. – Andrews, K. R. – Guth, W. D. (1965) *Business Policy: Text and Cases*. Home wood, IL: Irwin.
- Luthans, F. and Doh, J.P. (2012) *International Management*. McGraw-Hill, New York.
- Martens, C. D. P. - Machado, F. J. - Martens, M. L. - de Oliveira e Silva, F. O. P. - de Freitas, H. M. R. (2018) Linking entrepreneurial orientation to project success. *International Journal of Project Management*, Vol 36, No. 2, pp. 255-266.
- O'Reilly, C. A., - Tushman, M. L. (2008) Ambidexterity as a dynamic capability: Resolving the innovator's dilemma. *Research in organizational behavior*, 28, pp. 185-206.
- Pinto, J. K. (2016) *Project Management: Achieving Competitive Advantage*, Pearson Publishing.
- Porter, M. (1980) *Competitive Strategy: Techniques for Analysing Industries and Competitors*. New York Free Press
- Porter, M. (1986) *Competition in Global Industries*. Harvard Business School Press, Boston
- Szabó L. and Csepregi A. (2016): Strategic Management Tools and Techniques: the Cultural Influence. In: JC, Spender; Giovanni, Schiuma; Jörg, Rainer Noennig (ed.) *Towards a New Architecture of Knowledge : Big Data, Culture and Creativity*. Institute of Knowledge Asset Management, pp. 178-193.
- Teece, D. J. and Pisano, G. (1994) The dynamic capabilities of firms: an Introduction. *Industrial and Corporate Change* vol. 3. No. 3.
- Teece, D. J. – Pisano, G. – Shuen, A. (1997) Dynamic capabilities and Strategic Management, *Strategic Management Journal*, Vol. 18, pp. 509-513.

Limits and Alternatives to Traditional Strategy Formation: a Review

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Abstract

The main assumption of our conference paper is that in the contemporary, ever-changing, precarious economic environment that can be described by the concept of digital transformation, it is particularly worthwhile to reintroduce the evergreen question whether traditional strategic planning and long-term strategic goal-setting, and strategic implementation based on them, are still valid concepts. We investigate this question by a brief literature review that intends to underpin the problems related to the classical models of strategic planning as well as its alternatives. Our main conclusion is that, based on the latest research results, strategy formation (and planning within it) are not outdated concepts. This is the case since 1. the implementation of a pre-defined strategy can be interpreted as a rational organizational act; 2. the failure rate of the implementation of pre-defined strategies does not disprove the validity of this traditional approach. In the discussion part of our paper we also briefly touch upon the situations in which traditional planning, to our view, can be effective, as well as on potential areas for future research related to digital transformation.

Keywords – strategy, strategy formation, strategic planning, alternative approaches, review

Paper type – Academic Research Paper

1 Introduction

The world around us is in the process of constant change at an ever-growing pace regarding nearly all aspects of life, which makes the continuous development of knowledge, skills and competences as well as the continuous adaptation to the changing environment indispensable. This is true, in particular, in the dynamic, uncertain present-

day economic environment that can be described by the notion of digital transformation. Such an environment legitimately raises concerns with regards to the effectiveness of traditional strategic planning and long-term strategic goal-setting. Can such traditional methods be effective in this modern milieu or will long-term goal setting and rigid insistence to the pre-defined plan during strategy implementation make organizational operations inflexible, thus hindering adaptation to challenges, and, ultimately, threatening the functioning and competitiveness of the organization.

In business practice we are witnessing the emergence of new management ideas both in the fields of strategy and ‘operations’. Such examples are data-driven strategy, project portfolio management, and agility, just to mention a few. In such context, exploring this fundamental question has become, once again, of central importance. Our paper intends to provide a brief overview of the conclusions that can be drawn from the related literature, putting its emphasis on the problems and alternatives to traditional strategy formation.

The theoretical approaches to strategy formation will not be covered in this paper. We only touch upon them in this paragraph, as a contextual question from the perspective of our paper, to the extent to which the basic categories need to be clarified. Thus, we need to refer to *Henry Mintzberg*, the well-known author of strategy formation, and his colleagues (Mintzberg et al., 1998), who distinguished ten schools of strategy formation. The traditional approaches, the three so-called ‘prescriptive’ schools according to Mintzbergian terminology, mainly focused on the question how strategies *should* be formed, and not so much on how they are actually formed. Contrastingly, the six other approaches, categorized as ‘descriptive’ schools, do not focus on the definition of ideal strategic behaviour, but instead focus on the ways strategies are *actually* made. Finally, the last one, the ‘Configuration School’ tries to integrate the approaches of the other nine ‘schools’ (Mintzberg et al., 1998: 6-7). Naturally, other authors have used different taxonomies. For instance, Ellen Earle Chaffe distinguished *linear*, *adaptive* and *interpretive* strategies (Chaffe, 1985). From the diversity of potential approaches, we will apply Mintzberg and colleagues’ taxonomy as a starting point.

2 Problems of classical strategy formation

The pitfalls of the traditional, ‘prescriptive’ theories of strategic planning (the design school, the planning school, and the positioning school) are related to the rigid division of planning and implementation, the formalization of the planning process, and the prior fixation and inflexibility of the strategy. For instance, just to mention a few such pitfalls, the lack of organizational commitment to the strategy (Friis et al., 2016: 1), or the fact that strategic plans in fact serve ‘symbolic goals’ and focus on the present instead of the future (Akhter, 2003: 2). In his paper about the obstacles in the way of effective strategy implementation, Hrebieniak identifies a variety of well-identifiable, cardinal problems. Among others, the disregard towards the interdependence between planning and implementation, or the fact that implementation lasts much longer than planning are worth mentioning (Hrebieniak, 2006: 12-15). A related and important problem is the fact that ‘implementers’ are often unaware of the strategy, and even in cases when they are, to

some extent, familiar with it, they tend to lack the necessary knowledge and skills required for successful implementation (Heide et al., 2002: 218).

Another important group of problems is related to the preliminary fixation of the strategy, which usually leads to the inflexibility of both the plans and the planning process, as well as to the difficulties in the adaptation to the internal and external changes (Mintzberg, 1990: 172-176). First, inaccurate identification of the internal and external factors can lead to problems even at the starting point (Hansen – Smith, 2003, cited by Arvand – Baroto, 2016: 302). Second, even for the manager who creates the strategy it is virtually impossible to collect and harmonize all the relevant factors (internal, corporate decisions, events of the external environment, actions of competitors, etc.) at the same time, ‘so that they come together at any precise moment’ (Quinn, 1978: 17). Third, and this may be the most important aspect with regards to adaptation to changes, the more clearly a strategy is articulated and the more deeply it is embedded in organizational culture, the more it will hinder necessary strategy changes in the future as well as increase resistance to such attempts (Mintzberg et al., 1998: 36).

Similar problems related to classical strategy formation (‘prescriptive’ schools) have been long and widely discussed in the literature. With regards to the *planning school*, known for its high level of formalization, Ian Wilson in his paper titled *Strategic Planning Isn’t Dead – It Changed* describes the development of strategic planning from the early 1970s. Wilson emphasizes that following the initial failures (‘seven deadly sins’) strategic planning transformed into a viable system, strategic management (Wilson, 1994: 13). Some notable debates related to this topic are well-known, such as the debate between Mintzberg and Ansoff about the design school, on the columns of the *Strategic Management Journal* (Mintzberg, 1990; Ansoff, 1991). Similarly, it is worth mentioning authors who stood out in defence of SWOT-analysis, for instance Geoffrey Bell and Linda Rochford (Bell – Rochford, 2016). However, instead of describing debates and pitfalls in more detail, in the following section we will briefly present some alternative approaches that go beyond the ‘prescriptive’ school.

3 Alternatives to traditional planning

It is important to stress that even though many authors believe that all organizations have a strategy (either explicitly or implicitly), there are some who disagree. In their paper *The seeking of strategy where it is not: towards a theory of strategy absence*, Andrew Inkpen and Nandan Choudhury concentrate on the possible reasons behind the absence of a strategy, as well as on the characteristics of such organizations. The authors emphasize that while strategic theories are becoming more and more elaborated, strategic research is presence-oriented. However, the systematic study of the *absence* of strategies could also contribute to the better understanding of how strategies work (Inkpen and Choudhury, 1995: 313-314). Inkpen and Choudhury emphasize three different approaches to this topic: 1- the absence of strategy as a negative concept: the proof of managerial *failure*; 2. the absence of strategy as a temporary, *transitional phase* in the firm’s life cycle; 3. the absence of strategy as a positive concept: the result of a *conscious, deliberate*

decision (Inkpen and Choudhury, 1995: 316-319). For the last one, the authors give two examples. In the first example, the absence of a strategy is related to the unpredictability of the environment and the intensification of competition: the lack of strategy and the conscious ambiguity integrated into the objectives may contribute to the preservation of *corporate flexibility*, to proactive and innovative decision making (Inkpen and Choudhury, 1995: 318). In the second example, the absence of a strategy is interpreted as a *symbolic message*: the organization sends a clear message to stakeholders that it does not intend to take part in 'resource-consuming ceremonies' (Inkpen and Choudhury, 1995: 319).

As has been described above, in some cases the absence of a strategy can be interpreted as a *transitional phase*. In these cases, strategy is evolving gradually, simultaneously with the increase in the firm's resources and knowledge (Inkpen and Choudhury, 1995: 317). In their paper *Of Strategies, Deliberate and Emergent*, Henry Mintzberg and James A. Waters distinguishes between deliberate and emergent strategies, which they do not consider as dichotomous categories but the *two ends of a scale*, emphasizing that observable real life strategies fall somewhere between these two ends (Mintzberg and Waters, 1985: 258-259). In relation to gradually emerging strategies, *James Brian Quinn's* name and the concept of *logical incrementalism* need to be mentioned. Quinn argues that in real life effective strategies are typically the blending of strategic subsystems focusing on specific strategic issues, however, the management and integration of these subsystems happen *incrementally*, due to the cognitive and process limits (Quinn, 1978: 8). According to his view, managers 'consciously and proactively move forward incrementally' in order to achieve such goals as the improvement of the quality of information utilized in strategic decision making, overcoming resistance against strategic change, the building of organizational awareness and commitment needed for the implementation of the strategy, and the improvement of the quality of strategic decisions themselves (Quinn, 1980: 20-21).

These concepts, emergent strategies and logical incrementalism, could be considered as the forerunners of the Mintzbergian *learning school* (one of the descriptive approaches). In addition to this school, another approach deemed desirable from many aspects by Mintzberg and his colleagues has been labelled as the *configuration school*. The main ideas of this school are organized around two central concepts: configuration and transformation. *Configuration* describes the organization and its surrounding context, while *transformation* is the strategy making process itself, the process of 'leaping from one state to another' (Mintzberg et al., 1998: 302).

From the other mainstream theories of strategic thinking C.K. Prahalad and Gary Hamel's *core competence* theory (Prahalad and Hamel, 1990) and Robert Grant's *resource-based theory* (Grant, 1991, 1996) may also be highlighted. With regards to the latter, Grant considered corporate resources and capabilities as the foundation for strategies, and, similarly to the followers of the learning school, considers organizational learning as one of the central themes. He emphasizes that *knowledge* is the most strategically-significant resource of the firm (Grant 1996: 375).

Finally, let us have a look at another possible categorization of different strategic approaches. In his paper *Strategy as practice*, Richard Whittington distinguishes four strategic perspectives based on their central issues ('dominant concerns') and the organizational level they focus on: the *planning*, the *policy*, the *process*, and the *practice* approaches (Whittington, 1996). The process-oriented approach emphasizes that the formation and implementation of a strategy is a *process*, putting great emphasis on renewal and growth, and not a static state of corporate position, resource pool, and environmental nestedness (Pettigrew, 1992, 1997). The *strategy as practice* approach focuses on the practitioner and, instead of corporate core competences, puts the emphasis on the practical competences of the manager as a strategist (Whittington, 1996: 732). The central question to this approach is how managers and consultants can act and what type of interactions they have, in other words, how strategy is actually created and operated ('doing strategy') during the process of strategy formation (Whittington, 1996: 732). Whittington emphasizes that, besides the fact that an effective strategist needs to know the analytical techniques of planning, the appropriate policy options and the organizational processes related to decision making and implementation, the strategist also draws to a great extent on the *practical knowledge and skills* obtained during the process of strategy-making. According to him, research and training should put greater emphasis on this latter area.

4 Concluding discussion

Based on the concepts and approaches described so far, the question arises whether it is worth formulating and implementing strategic goals at all. When answering this question, it is important to distinguish between the *perfect* implementation of a strategy and the *successful* performance of a firm (as a result of the strategy followed) (Lee and Puranam, 2015). Another widely discussed phenomenon in the literature related to the successfulness of strategies is the observation that a significant proportion of strategies fail or never even gets implemented (e.g. Neluheni et al., 2014; Arvand and Baroto, 2016; Hrebieniak, 2006). However, estimations and the findings of empirical research remarkably differ with regards to the size of this 'significant proportion'. Carlos Cándido and Sérgio Santos in their paper *Strategy implementation: What is the failure rate?* discuss this problem in details (Cándido and Santos, 2015). Their research findings do not support the argument that it is not worth formulating a strategy as it is not going to be implemented successfully.

However, the way and extent of strategy implementation still remains a question. Is it necessary to insist upon the pre-defined strategy planned by the management, or is it better if strategy is formed gradually with the involvement of lower levels of the organizational hierarchy? As described in this paper, the literature of strategy formation has produced basically two different answers to this cardinal question. In order to help answer this 'ultimate question', we would like to draw on the findings of an interesting computer simulation here. Eucman Lee and Phanish Puraman in their paper *The implementation imperative: Why one should implement even imperfect strategies perfectly*

emphasize that the ‘implementation imperative’ in managerial discourses is surprising for several reasons. The authors describe this phenomenon as the view according to which the improvement in the precision of strategy implementation is always desirable. In case the correct strategy were known ex ante, this would doubtlessly be the case. However, in a world of bounded rationality strategies that can be objectively called correct are rarely known (Lee and Puranam, 2015). In their paper the authors test the ‘implementation imperative’ with the help of a computational model in an environment where the optimal strategy is unknown. In this model the strategy adapts based on feedback. The two scholars found that even in such an insecure environment the ‘implementation imperative’, i.e. the precise implementation of a pre-defined strategy, is rational in cases when strategy formation and implementation are clearly separated across organizational actors.

Based on the ideas described so far, we believe that for new businesses, or businesses that intend to enter a new market, the classical strategy formation models can be useful frames. They can also be effective for small or medium-sized enterprises that work on relatively stable and predictable markets, in case their leaders are able to assess properly all the internal, firm-related and external, market-related factors and are able to collect all the relevant information related to them. (Mintzberg et al., 1998: 52-53) Naturally, in both cases employees’ understanding of the centrally-set strategy is necessary, as well as their willingness to implement it. However, in situations different from the ones described above, the risk of the appearance of problems related to classical planning increases significantly. In these cases some of the alternative approaches to strategy formation can be helpful, the main ideas of which might be worth considering for integration into the strategy formation process regardless of the situation.

The main goal of our paper was to briefly outline the most important questions related to the ‘classical’ literature of strategy formation, predominantly focusing on the problems and alternatives. We did so with the aim to review the most important findings in the field, thus enabling our forthcoming analysis of planning in a world of digital transformation. We firmly believe that in order to understand the importance of strategy formation in the world today, further research is needed. This could be extended to several aspects of planning, involving the practice of successful firms exploiting the network effect (e.g. Airbnb, Uber, eBay), or the practice of the agile small and large-sized enterprises.

References

- Akhter, S.H. (2003): Strategic planning, hypercompetition, and knowledge management. *Business Horizons*. Vol. 46, No.1, pp. 19-24.
- Ansoff, H.I. (1991): Critique of Henry Mintzberg’s ‘The Design School: Reconsidering the Basic Premises of Strategic Management’. *Strategic Management Journal*. Vol. 12, No. 6, pp. 449-461.
- Arvand, N. – Baroto, M.B. (2016): How to implement strategy more effectively. *International Journal of Business Performance Management*. Vol. 17, No. 3, pp- 301-320.

- Bell, G.G. – Rochford, L. (2016): Rediscovering SWOT's integrative nature: A new understanding of an old framework. *The International Journal of Management Education*. Vol. 14, No. 3, pp. 310-326.
- Cándido, C.J.F. – Santos, S.P. (2015): Strategy implementation: What is the failure rate? *Journal of Management & Organization*. Vol. 21, No. 2, pp. 237-262.
- Chaffee, E.E. (1985): Three Models of Strategy. *The Academy of Management Review*. Vol. 10, No. 1, pp. 89-98.
- Friis, O. – Holmgren, J. – Eskilden, J.K. (2016): A strategy model – better performance through improved strategy work. *Journal of Modelling in Management*. Vol. 11, No. 3, pp. 742-762
- Grant, R.M. (1991): The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. *California Management Review*. Vol. 33, No. 3, pp. 114-135.
- Grant, R.M. (1996): Prospering in Dynamically-Competitive Environments: Organizational Capability as Knowledge Integration. *Organization Science*. Vol. 7, No. 4, pp. 375-387.
- Hansen, F. – Smith, N. (2003): Crisis in corporate America: the role of strategy. *Business Horizons*. Vol. 13, No. 7, pp. 7-18.
- Heide, M. – Grønhaug, K. – Johannessen, S. (2002): Exploring barriers to the successful implementation of a formulated strategy. *Scandinavian Journal of Management*. Vol. 18, No. 2, pp. 217-231.
- Hrebiniak, L. (2006): Obstacles to Effective Strategy Implementation. *Organizational Dynamics*. Vol. 35, No. 1, pp. 12-31.
- Inkpen, A. – Choudhury, N. (1995): The seeking of strategy where it is not: towards a theory of strategy absence. *Strategic Management Journal*. Vol. 16, No. 4, pp. 313-323.
- Lee, E. – Puranam, P. (2015): The Implementation Imperative: Why One Should Implement Even Imperfect Strategies Perfectly. *Strategic Management Journal*. Vol. 37, No. 8, pp. 1529-1546.
- Mintzberg, H. – Waters, J.A. (1985): Of Strategies, Deliberate and Emergent. *Strategic Management Journal*. Vol. 6, No. 3, pp. 257-272.
- Mintzberg, H. (1990): The Design School: Reconsidering the Basic Premises of Strategic Management. *Strategic Management Journal*. Vol. 11, No. 3, pp. 171-195.
- Mintzberg, H. – Ahlstrand, B. – Lampel, J. (1998): *Strategy Safari: A Guided Tour through the Wilds of Strategic Management*. Free Press, New York.
- Neluheni, G.N. – Pretorius, W. – Ukpere, W. (2014): The role of Quality Strategic Planning on Organisational Success. *Mediterranean Journal of Social Sciences*. Vol. 5, No. 1, pp. 697-708.
- Pettigrew, A.M. (1992): The Character and Significance of Strategy Process Research. *Strategic Management Journal*. 1992. Winter, pp. 5-16.
- Pettigrew, A.M. (1997): What is a Processual Analysis? *Scandinavian Journal of Management*. Vol. 13, No. 4, pp. 337-248.
- Prahalad, C.K. – Hamel, G. (1990): The Core Competence of the Corporation. *Harvard Business Review*. 1990. May-June, pp. 79-90.
- Quinn, J.B. (1978): Strategic Change: „Logical Incrementalism”. *Sloan Management Review*. 1978. Autumn, pp. 7-21.
- Quinn, J.B. (1980): Managing Strategic Change. In: Asch, D. – Bowman, C. (eds.) *Readings in Strategic Management*. Macmillan, London, 1989.
- Whittington, R. (1996): Strategy as Practice. *Long Range Planning*. 29. Vol.5. No., pp. 731-735.
- Wilson, I. (1994): Strategic Planning Isn't Dead – It Changed. *Long Range Planning*. Vol. 27, No. 4, pp. 12-24.

Investigating the Interplay between Performance Standards, Organizational Variables and Contextual Factors: the Case of Public Service Providers in Italian Water and Electricity Sectors

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Abstract

The topic of public service improvement has received great attention all over the world in recent decades, in both private and public sectors. While there is a huge literature investigating components which are critical in formulating an organization strategy for achieving service quality improvement, in both public and private organizations, namely organizational variables affecting service quality (such as resources, organizational structure, performance management system), and contextual (internal and external) factors conditioning the achievement of higher performance, there are no studies analysing how the public sectors organizations reacts to the regulation imposing performance standards and how contextual factors may affect such organization response to new performance standards. In particular, many questions posed about regulation are concerned with the extent to which it assists with or damages attempts to maintain and raise the standards of public service performance.

The aim of this paper is to contribute to the stream of public service performance (PSP) improvement by addressing the following research questions: How the organizations of public sector providers react to higher performance standards fixed by the regulators? How contextual factors affect such organization response?

With this objective, after reviewing the literature dealing with the organizational variables that are believed to be linked to quality service and performance, the areas of service quality as well as the link contextual (internal and external) factors and performance, a reference framework is developed, which is used as a guide model for the empirical analysis which was carried out on 15 public service providers in Italian water and electricity sectors.

The results of the empirical investigation indicate organizational variables mainly affected by higher performance standards imposed by the regulation are resources and performance management systems. They also reveal the existence of clusters of firms.

This will provide an interesting practical implication, by making the regulator aware that the achievement of high performances in the public service in order to be compliant with the new standards entails a change in the organizations of service providers, not so much in terms of organizational structure as in terms of the required resources and the design of the PMS. On the other hand, the study gives a number of examples about how a sample of firms has responded to the introduction of the new standards and how such response is affected by contextual factors.

Keywords – Strategic management, Performance standards, Organizational variables, Public sector.

Paper type – Academic Research Paper

1 Introduction

The topic of public service improvement has received great attention all over the world in recent decades (Boyne, 2003), in both private and public sectors. While in the private sector the use of a variety of measures of service quality as critical indicators of both organizational performance and general customer satisfaction is widely accepted (David Mc, 2013), organizations operating within the public sector have come to realize that customer service and quality are critical strategic issues only in the late 1990s (Wisniewski, 2001).

The performance of public organizations is influenced by many variables (Boyne 2003). Some of these are largely outside the control of public managers, at least in the medium term. These include the resources allocated by higher levels of government, the size and characteristics of client populations, the political ideology of national and subnational governments, and the level of support provided by political principals.

In this framework, the strategic management (SM) assumes a key role for the organizations of public sector.

SM is defined as “the conscious selection of policies, development of capacity, and interpretation of the environment by managers to focus organizational efforts toward the achievement of present objectives” (Poister, 2010).

The strategic management is important because it varies across public organizations, and it is not simply a trivial or redundant category once the impact of environmental and organizational variables is taken into account. Indeed, strategy shapes the impact of

external and internal constraints on performance, and is, in theory, both directly and indirectly linked to performance.

There is a small but growing research field (see, e.g., Andrews and Van de Walle 2012; Elbanna, Rhys, and Pollanen 2016; Ferliem and Ongaro 2015; George and Desmidt 2016; Hansen Rosenberg and Ferlie 2014) that has highlighted the importance of studying strategy and strategic thinking in public organizations for the past decade, and how public organizations apply SM in practice and which tools are used to realize a strategic intent (Hoglund et al., 2018).

Moreover, while there is a huge literature investigating components which are critical in formulating an organization strategy for achieving service quality improvement (Andrews and Boyne, 2010; Andrews et al., 2009), namely organizational variables affecting service quality (such as resources, organizational structure, performance management system), and contextual(internal and external) factors conditioning the achievement of higher performance (Capaldo et al., 2018; Andrews et al., 2005), there are no studies analysing how the public sectors organizations reacts to the regulation imposing performance standards and how contextual factors may affect such organization response to new performance standards. In particular, many questions posed about regulation are concerned with the extent to which it assists with or damages attempts to maintain and raise the standards of public service performance.

Theory and empirical evidence indicate that when a regulator chooses to regulate prices using price or revenue caps, a company's incentives to deliver efficient levels of service quality tend to drop (Giannakis et al., 2005; Pellegrino et al., 2011; Ter-Martirosyan and Kwoka, 2010). As a consequence, price cap or revenue cap regulation must be supplemented by service quality regulation (Fumagalli et al., 2007). Regulator had therefore to intervene in order to secure desirable levels of performance on the multiple dimensions of service quality. One simple regulatory instrument employed to achieve this goal is the publication of data on company performance. The dissemination of information regarding a company's performance with respect to a set of quality indicators provides unambiguous incentives for increased investments in quality (Weisman, 2005). A second relatively simple instrument is the setting of minimum quality standards (MQS). The regulator specifies performance standards in the form of a minimum level of service quality that the company is expected deliver to its customers. Non-compliance with these minimum levels of quality might entail the payment of penalties, according a predefined reward and penalty scheme for exceeding or failing to achieve these standards (Fumagalli et al., 2007).

This means that once such performance standards have been fixed by the regulators, service providers have to operate in such a way to meet them and to avoid huge penalties if they fail to do so.

Spurred by the discussed research gap and enhancing the seminal work of Capaldo et al. (2017), the aim of this paper is to contribute to the stream of public service performance (PSP) improvement by addressing the following research questions:

- How the organizations of public sector providers react to higher performance standards fixed by the regulators?

- How contextual factors affect such organization response?

The paper is organized as follows. Next section reviews the literature dealing with the organizational variables that are believed to be linked to quality service and performance, the areas of service quality as well as the link contextual (internal and external) factors and performance, and Section 3 develops the reference framework used as a guide model for the empirical analysis. Section 4 illustrates the research methodology adopted for the empirical investigation, and Section 5 discussed the result of the multiple case study. Finally, Section 6 concludes and outlines some avenues for future research.

2 Theoretical background

This section reviews the literature dealing with the organizational variables that are believed to be linked to quality service and performance, the areas of service quality as well as the link contextual (internal and external) factors and performance. The purpose is to develop a reference framework that can be used as a guide model for the subsequent empirical analysis aimed at investigating how the organizations of public sector providers react to higher performance standards fixed by the regulators and how contextual factors affect such organization response.

2.1 Organizational variables and public sector performances

The literature on PSP agrees that organizational variables, as resources, organizational structure, performance management systems, managerial capacity are critical components for achieving service delivery improvement.

Resources

The common idea that more resources will lead to better results is the basis for both the strong theory that higher public expenditure is a sufficient condition for improvement because this must result in a higher quantity and/or quality of public services, and the weak theory suggesting that greater spending is a necessary but not sufficient condition since the resources must be effectively managed in order to deliver the maximum potential benefits (Boyne 2003). On the other hand, the majority of the empirical results reveal no significant relationship between either financial resources or real resources and service performance (Bradley et al. 2001; O'Toole and Meier 2001; Meier et al. 2000). This is coherent with the theory that inefficient public managers fritter away extra money without any improvement in performance. Therefore, it is reasonable to suppose that the greater the real resources available for the organization, the higher the performance.

Organizational structure: Hierarchy of authority and degree of participation in decision-making

The literature on public service performance broadly focuses attention on the internal characteristics of public organizations that can affect service quality. In particular, it has been hypothesized by policy makers and scholars that the degree to which decision-

making is centralized or decentralized is a determinant of public service performance (Andrews et al. 2009).

For organizational theorists, the degree of centralization within an organization is indicated by the hierarchy of authority and the degree of participation in decision making, since these aspects reflect the distribution of power across the entire organization (Carter and Cullen 1984; Glisson and Martin 1980; Hage and Aiken 1967, 1969). Hierarchy of authority refers to the extent to which the power to make decisions is exercised at the upper levels of the organizational hierarchy, whereas participation in decision making pertains to the degree of staff involvement in the determination of organizational policy. There is still comparatively little research investigating the effects of the degree of centralization on public service performance (Andrews et al. 2009). Empirical studies in the private sector have failed to find a consistent or substantial relationship between centralization and performance (Wagner 1994).

Overall, theoretical arguments suggest that centralization is likely to have positive effects on performance, even though the evidence is weak or non-existent (Andrews et al. 2009).

The performance management system

Efforts to improve performance in public sector organizations have fostered the spread of performance management practices (Hood 1995) falling within the so-called New Public Management approach. Performance management practices include setting the goals to be achieved and measuring and evaluating performance (Heinrich 2002).

Despite the great attention devoted by governments to performance management practices for improving public service, a fundamental question posed by several researchers is whether performance management will actually improve public sector performance (Verbeeten, 2008). A rather limited number of empirical studies investigate the impact of PM-practices on public organizations (Van Helden, 2005) and they generally focus on the relation between one specific factor of the performance management system and performance. Some studies assert that clear goals and measurable results allow organizations to reduce ambiguity regarding objectives and to gain coherence and focus in pursuit of their mission (Rangan 2004; Kaplan 2001). Furthermore, the use of incentives may increase performance (Bonner and Sprinkle 2002). Some researchers have found that performance management may also result in unintended managerial side effects (e.g. Vakkuri and Meklin 2006; Hood and Peters 2004; De Bruijn 2002). In particular, a performance management system that does not account for difficult circumstances beyond the control of the management causing performance failure may discourage managers from performing well, thus decreasing rather than increasing the organizations' performance (Verbeeten 2008; Andrews et al. 2005; 2009). Therefore, it is reasonable to assume a positive relationship between a well-designed performance management system and performance.

2.2 Areas of service quality and performance standards

Service quality in the public service delivery covers a large number of aspects, either technical or non-technical (Fumagalli et al., 2007).

Non-technical aspects arise in the relationship between the customer and the service providers (mainly the distributor and the retailer), before the beginning of the service and during the validity of the contract.

Technical aspects of service quality are generally referred to as ‘power quality’ issues and include any variations of the characteristics of services around their ideal values.

2.3 Contextual (internal and external) factors and performances

One of the issues widely debated in the public policy literature is the relative importance of constraints and choices in the explanation of organizational processes and behaviour (Boyne 1996; Andrew et al., 2005; Capaldo et al., 2018).

Some studies stress the importance of various aspects of management for public services, such as HRM, leadership, organizational culture and strategy content (Meier and O’Toole 2002a; Brewer and Selden 2000; Zigarelli 1996). Other studies have also investigated the relationship between organizational size (e.g., number of staff, capacity, and number of service users) and performance (Boyne, 2003), revealing that the impact of size does not appear to be linked systematically to type of service or specific dimensions of performance.

Theories that emphasize the importance of external constraints imply that ‘force of circumstance’ leaves policy-makers with very limited room for manoeuvre (Andrew et al., 2005). Literature review shows that performances are significantly influenced by the characteristics of local populations and environment and that ‘poor’ performance is partly attributable to difficult circumstances rather than bad choices. Other two aspects of the local environment that have been considered as variables influencing performance are population size and population density (Boyne 1996b).

3 Reference framework

Based on the reviewed literature, we built the reference framework that served as a guide for our empirical analysis, as depicted in Figure 1. It hypothesizes that higher quality standards imposed by law impact on the organization of public service providers, specifically influencing the resources, the organizational structure and performance management system. Furthermore, it advances that the context in which the firm operates has a potential influence over the organization response to higher performance standards fixed by the regulator.

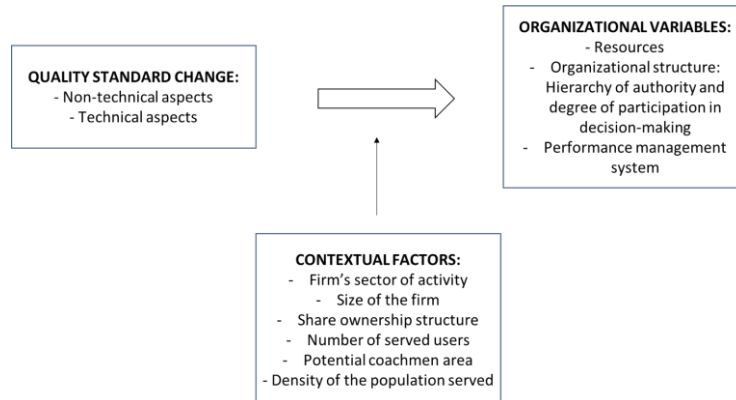


Figure 1. Reference framework

4 Research Methodology

This study uses a multiple case comparison methodology for the empirical investigation (Eisenhardt and Graebner, 2007, Yin, 2003).

The study involved 15 Italian firms, specifically 10 from the water sector and 5 from the electricity sector, that were studied during the last 2 years (see Table 1, where the identity of companies was concealed for confidentiality reasons).

Table 1. The studied firms

Firm	Sector of activity	Role of people interviewed	Firm size (No. of employees)	Share ownership structure	Number of served users	Potential coachment area (Kilometers of network)	Density of the population served*	Sold volumes	Revenues [M€]
Company A	Water	Manager of operating center	398	Public	266720	10267	25,98	39 [Mmc]	61
Company B	Water	Commercial Manager	648	Mixed (63% public share)	535234	2090	256,09	100 [Mmc]	176
Company C	Water	Administrative and customers manager	66	Mixed (52% public share)	40051	597	67,09	0,2 [Mmc]	13,5
Company D	Water	Finance and Administration manager	858	Public	594000	5368	110,66	59 [Mmc]	139,7
Company E	Water	Head of engineering and R & D department	498	Public	1650000	2500	660,00	180 [Mmc]	93
Company F	Water	Responsible for Planning and Coordination of Regulated Services	2940	mista (52% pubblica)	1450000	35096	41,32	300 [Mmc]	82,6
Company G	Water	Head of General Administrative Services	240	Public	41000	4865	8,43	71 [Mmc]	42
Company H	Water	Strategy and planning director	490	Public	2000000	2228	897,67	230 [Mmc]	72,6
Company I	Water	Responsible for Regulatory Affairs	1930	Public	1000000	21000	47,62	264 [Mmc]	550
Company L	Water	Planning and Control director	800	Public	347000	6460	53,72	250 [Mmc]	232
Company M	Water	Operative director	263	Public	450000	3370	133,53	37 [Mmc]	64
Company N	Electricity	Director	15783	Mixed (30% public share)	31500000	1.150.000	27,39	227,3 [Twh]	7591
Company O	Electricity	Technical manager	< 5	Mixed (30% public share)	970	50	19,40	0,005 [Twh]	1
Company P	Electricity	Commercial employee	<5	Mixed (25% public share)	310	14	22,14	0,013 [Twh]	<1,5
Company Q	Electricity	Responsible for Electricity Works	1.500	Mixed (52% public share)	1000000	20.000	50,00	13,23 [Twh]	600
Company R	Electricity	Responsible for the electricity grid operations	295	Mixed (85% public share)	310000	12000	25,83	2,5 [Twh]	53

* Density of the population served = Number of served users / Kilometers of network

To gather information the study followed these steps:

- We established a relationship with one of the senior managers from the selected firm.
- We used a semi-structured replicable guide to collect data, with a set of questions related to relevant constructs in our reference framework. The items investigated were measured on two Likert scales of 1-7 or 1-5,

depending on the question (with lower numbers representing “strong or totally disagree” and higher ones “strongly or totally agree”).

- Secondary information was company documentations and archival records, collected from different sources.

Data and information gathered through case studies were manipulated before their analysis.

5. Results and discussion

5.1. Service quality and performance standards change in Italian water and electricity sectors

Beginning from the year 2000 a number of EU countries, Italy too, adopted regulatory instruments that relates a company’s revenues to its performance in terms of quality: rewards and penalties scheme. Rewards/penalties schemes refer to the average level of quality, rather than to the quality level received by the individual consumer.

In the 2015, after long time compared by the electricity sector, the Authority for Electricity, Gas and the Water System approves the Integrated Text for the regulation of the contractual quality of the water system, which introduces specific quality standards, referred to the individual services provided to users, automatic compensation to be paid to users, while for general quality standards, referred to the whole of services, a penalty mechanism.

5.2. Performance standards change and organizational variables

Looking at the sample of the firms in the whole (i.e., averaging the answers of all the companies), as shown in Table 1, the response of the organizations to the new standards is mainly in terms of resources and the performance management systems, while it seems that the new higher standards have averagely less impact in terms of organizational structure.

In terms of resources, the findings indicate that to improve performance and to be compliant with the new standards, the companies invest in IT system/ informatic processes, new equipment for staff people and personnel training programs, while they less hire new employees or staff people and develop new investment plans.

In terms of PMS, the findings suggest that the companies involved in our study have registered an improvement and a diffusion of the PMS, with the adoption of incentive mechanisms that recognize premiums in case of achievement of the objectives and that consider any external factors (beyond the management control) that may undermine their achievement (Capaldo et al., 2018).

Table 1. Evidence of organizational variables affected by the new performance standards

Factors / Constructs	Item	Questionnaire Items	Mean	Std	Likert scale
Resources	New employees or staff people hired	With reference to the situation post-standard-adoption, new employees or staff people have been hired (or made available)	2,0625	0,854	5
	New personnel training programs developed	With reference to the situation post-standard-adoption, new training programs have been developed for personnel	3	1,265	5
	New equipment for staff people	With reference to the situation post standard adoption, new equipments have been provided to employees or staff people	3,3125	1,401	5
	Development of investment plans	With reference to the situation post-standard-adoption, new plans of investments have been developed	4,0625	1,482	7
	Implementation of IT system/informatic process	With reference to the situation post-standard-adoption, a new IT system or new informatic processes have been implemented	4,6875	1,957	7
Hierarchy of authority	Hierarchy levels between Top Management and lower level	With reference to the situation post-standard-adoption, the number of hierarchy levels between the top management and the lower level with power of budget / expenditure has increased	1,4375	1,031	5
	Managers reporting to the top management	With reference to the situation post-standard-adoption, the number of managers reporting to the top management has increased	1,625	1,628	5
	Strategic decisions made by the Chief Executive	Strategic decisions for our service are made by the Chief Executive more than before the new standard adoption	2,5625	1,861	5
	Strategic decisions made by the Corporate Management Team	Strategic decisions for our service are made by the Corporate Management team more than before the new standard adoption	1,125	0,342	5
Participation in decision-making	Maximum level of expenditure/investment on which the Corporate Management Team decides autonomously	With reference to the situation post-standard-adoption, the maximum level of expenditure/investment on which the Corporate Management Team decides autonomously has increased	1	0,000	5
	Level of involvement of lower levels in the strategy process of problem identification	With reference to the post-standard-adoption, lower levels are more involved in the strategy process of problem identification	2,4375	2,097	5
	Level of involvement of lower levels in the strategy process of problem solving	With reference to the post-standard-adoption, lower levels are more involved in the strategy process of problem solving	2,3125	2,120	5
	Level of involvement of lower levels in the strategy process of goals definition	With reference to the post-standard-adoption, lower levels are more involved in the strategy process of goals definition	2,375	1,893	5
	Level of involvement of lower levels in the strategy process of results analysis	With reference to the post-standard-adoption, lower levels are more involved in the strategy process of results analysis	2,3125	1,815	5
Performance management system	New standards affect the Management-by-objective	With reference to the situation post-standard-adoption, the new standards affect the Management-by-objective	4,5	1,549	7
	Adoption of performance management system	With reference to the situation post-standard-adoption, the adoption of performance management system has increased	4,5	1,751	7
	Incentives mechanisms based on goals achievement	With reference to the situation post-standard-adoption, incentives mechanisms are based on goals achievement have been introduced	4,6875	1,887	7
	External factors affecting the goal achievement	With reference to the situation post-standard-adoption, performance measurement systems take into account external factors that may affect the goal achievement	4	1,461	7

5.3. Performance standards change and organizational variables: the effect of contextual factors

In order to understand if and how contextual factors affect the response of the organizations to the new performance standards imposed by the regulators, we analyze the responses of the firms in relation to some contextual variables.

The empirical analysis reveals that the organization response to the new standards fixed by law is pursued in clusters by firms.

A first differentiation is between the cluster of firms operating in the water sector versus the one operating in the electricity sector.

The firms operating in the water sector register an organizational change in terms of resources investment and PMS improvement after the new standard adoption that is averagely higher than the one registered by the firms operating in the electricity sector, as shown in Table 2.

Table 2. The effect of firm's sector on organization response to the new standard adoption

Factors / Constructs	Item	Questionnaire Items	Water		Electricity	
			Mean	Std	Mean	Std
Resources	New employees or staff people hired	With reference to the situation post-standard-adoption, new employees or staff people have been hired (or made available)	2,273	0,7862	1,600	0,894
	New personnel training programs developed	With reference to the situation post-standard-adoption, new training programs have been developed for personnel	3,273	1,2721	2,400	1,140
	New equipment for staff people	With reference to the situation post standard adoption, new equipments have been provided to employees or staff people	3,636	1,2863	2,600	1,517
	Development of investment plans	With reference to the situation post-standard-adoption, new plans of investments have been developed	4,273	1,4894	3,600	1,517
	Implementation of IT system/informatic process	With reference to the situation post-standard-adoption, a new IT system or new informatic processes have been implemented	5,000	1,8974	4,000	2,121
Hierarchy of authority	Hierarchy levels between Top Management and lower level	With reference to the situation post-standard-adoption, the number of hierarchy levels between the top management and the lower level with power of budget / expenditure has increased	1,000	0,0000	2,400	1,517
	Managers reporting to the top management	With reference to the situation post-standard-adoption, the number of managers reporting to the top management has increased	1,000	0,0000	3,000	2,550
	Strategic decisions made by the Chief Executive	Strategic decisions for our service are made by the Chief Executive more than before the new standard adoption	1,636	1,4334	4,600	0,548
	Strategic decisions made by the Corporate Management Team	Strategic decisions for our service are made by the Corporate Management team more than before the new standard adoption	1,000	0,0000	1,400	0,548
Participation in decision-making	Maximum level of expenditure/investment on which the Corporate Management Team decides autonomously	With reference to the situation post-standard-adoption, the maximum level of expenditure/investment on which the Corporate Management Team decides autonomously has increased	1,000	0,0000	1,000	0,000
	Level of involvement of lower levels in the strategy process of problem identification	With reference to the post-standard-adoption, lower levels are more involved in the strategy process of problem identification	1,455	1,2136	4,600	2,074
	Level of involvement of lower levels in the strategy process of problem solving	With reference to the post-standard-adoption, lower levels are more involved in the strategy process of problem solving	1,273	0,9045	4,600	2,302
	Level of involvement of lower levels in the strategy process of goals definition	With reference to the post-standard-adoption, lower levels are more involved in the strategy process of goals definition	1,636	1,4334	4,000	1,871
	Level of involvement of lower levels in the strategy process of results analysis	With reference to the post-standard-adoption, lower levels are more involved in the strategy process of results analysis	1,545	1,2136	4,000	1,871
Performance management system	New standards affect the Management-by-objective	With reference to the situation post-standard-adoption, the new standards affect the Management-by-objective	5,000	1,3416	3,400	1,517
	Adoption of performance management system	With reference to the situation post-standard-adoption, the adoption of performance management system has increased	4,909	1,7003	3,600	1,673
	Incentives mechanisms based on goals achievement	With reference to the situation post-standard-adoption, incentives mechanisms are based on goals achievement have been introduced	5,545	1,2136	2,800	1,789
	External factors affecting the goal achievement	With reference to the situation post-standard-adoption, performance measurement systems take into account external factors that may affect the goal achievement	4,273	1,4206	3,400	1,517

Contrarily, the firms operating in the electricity sector show a significant response of the organization to the new standards adoption in terms of organizational structure (either participation in decision making or the hierarchy of authority). As shown in Figure 2, Companies N, O, Q, and R operating in the electricity sector register the higher impact in terms of organizational structure.

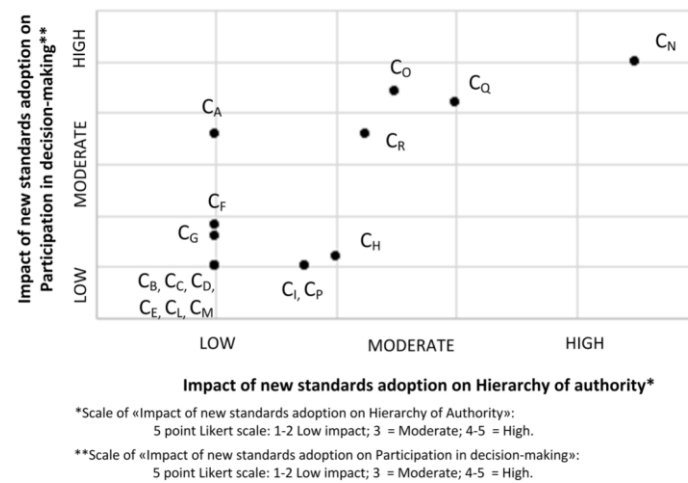


Figure 2. The impact of new standards adoption on the organizational structure

A second differentiation of the firm's reaction to the new standard adoption is between companies with a lower number of employees and those with a higher number of employees. The first cluster of firms has an heterogenous response in terms of resources and PMS (in some cases the impact is high, while in other is not significant). The second cluster of firms (with a higher number of employee) highlights a significant impact of the new standards on the organization, either in terms of resources or in terms of PMS.

The same comes out by grouping the firms based on potential coachmen area (measured by the kilometers of network served by the company).

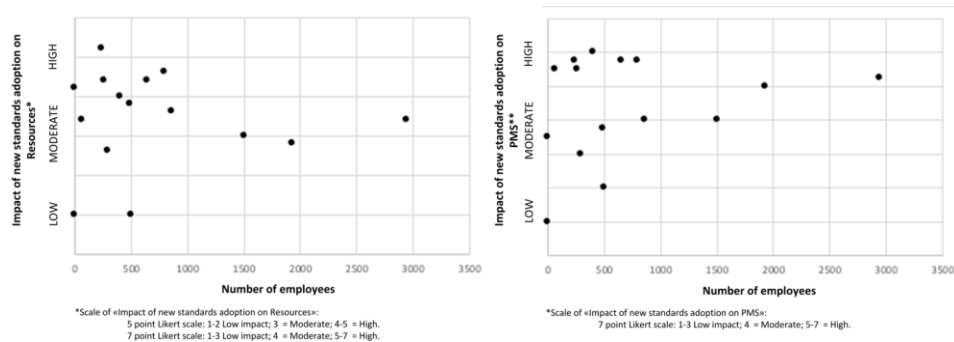


Figure 3. The effect of firm's size (number of employees) on organization response to the new standard adoption

Another difference that can be grasped in the response of companies to the new standards adoption is between fully public companies and mixed enterprises, with public-private participation. While the public companies show a heterogenous behavior in terms of resources and PMS, the companies characterized by a significant private share of

ownership (higher than 50%) register a higher change in their organizations, in terms of resources and PMS.

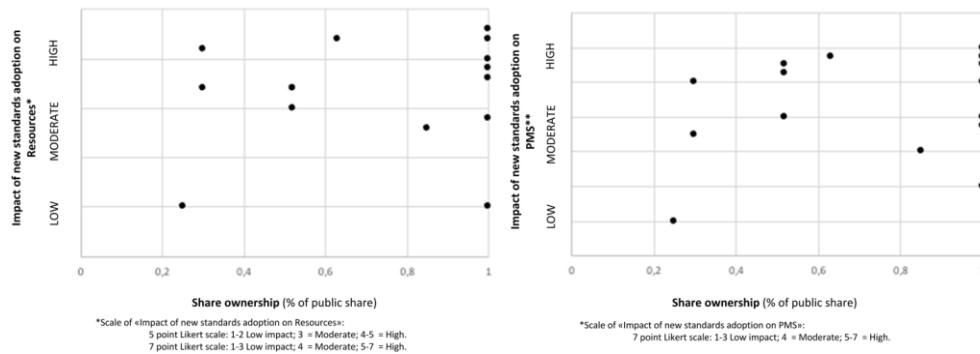


Figure 4. The effect of share ownership structure on the organization response to the new standards adoption

Finally, the analysis of the firms' responses show that it is not possible clustering firms based on the number of served users or kilometers of network; rather, it is possible to group firms on the basis of the density of the population served. In particular, the firms with lower density of the population served seem to record on average a higher impact of the new standards on the organization in terms of resources and PMS.

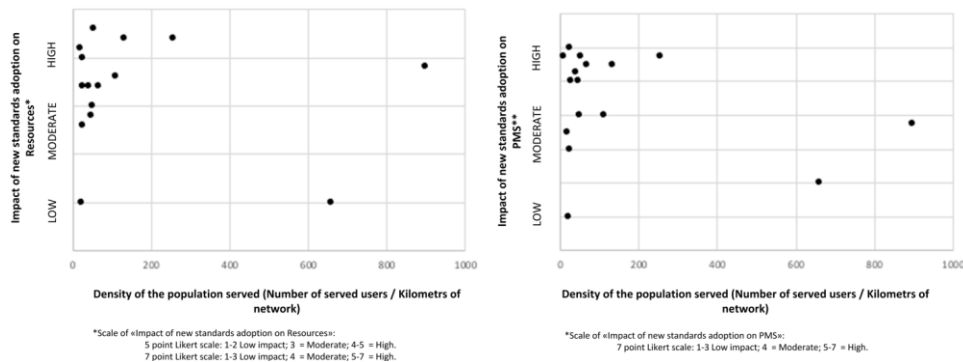


Figure 5. The effect of the density of the population served on the organization response to the new standards adoption

6. Conclusion

The theoretical and empirical evidence that the regulation of public service price often reduces a company's incentives to deliver efficient levels of service quality forced the regulator to intervene by setting minimum quality standards (MQS), namely, minimum level of service quality that the company is expected deliver to its customers.

This paper looks into the problem by exploring the interplay between performance standards, organizational variables and contextual factors through an empirical analysis carried out on 15 public service providers in Italian water and electricity sectors.

The results of the empirical investigation indicate organizational variables mainly affected by higher performance standards imposed by the regulation are resources and performance management systems.

The results also reveal the existence of clusters of firms: the firms operating in the water sector are affected by the new performance standards mainly in terms of resources and PMS, while the firms operating in the energy sector react to the new standard adoption mainly through a change in the hierarchy of authority and participation to the decision making, rather than in terms of resources and PMS.

Another cluster of firms that can be identified is the group of firms with a higher number of employees and the higher potential coachmen area (measured by the kilometers of network served by the company) which shows a significant impact of the new standards on the organization, either in terms of resources or in terms of PMS.

Companies with a significant private share of ownership (higher than 50%) register a uniform change in their organizations to respond to the new standards adoption, in terms of higher resources and improved PMS, while the public companies do not seem characterized by an homogeneous behaviour.

Finally, the firms with lower density of the population served seem to record on average a higher impact of the new standards on the organization in terms of resources and PMS.

Although the results of the study cannot be understood in the statistical sense and, consequently the results cannot yet be generalised to companies of every origin, we believe they hold valuable implications for both practitioners and academics.

The practical contribution of the paper is twofold. On the one hand, it makes the regulator aware that the achievement of high performances in the public service in order to be compliant with the new standards entails a change in the organizations of service providers, not so much in terms of organizational structure as in terms of the required resources and the design of the PMS. On the other hand, it gives a number of examples about how a sample of firms has responded to the introduction of the new standards and how such response is affected by contextual factors.

The paper contributes also to the research. It adds to our understanding of the effect of higher performances on the organization of firms because it is the first contribution, to our best knowledge, that analyses how the public sectors organizations reacts to the regulation imposing performance standards and how contextual factors may affect such organization response to new performance standards.

Despite the important contributions, the study has some methodological limitations. Because of the adopted research methodology, results cannot be statically generalized. Even though the validity and reliability of the results are ensured by the cross-case, explanation-building and patter-matching analyses, the study does not consider other contextual factors that might influence the response of the organization of public sector providers to higher performance standards imposed by the regulator for the public service

quality. Further research could be devoted to investigating the effect of other contextual factors on the reaction of organizations to higher standards.

References

- Andrews, R. and S. Van de Walle. 2012. "New Public Management and Citizens' Perceptions of Local Service Efficiency, Responsiveness, Equity and Effectiveness." *Public Management Review* 15(5):762–783.
- Andrews, R., & Boyne, G. A. (2010). Capacity, leadership, and organizational performance: Testing the black box model of public management. *Public Administration Review*, 443–454. doi:10.1111/j.1540-6210.2010.02158.x
- Andrews, R., Boyne, G. A., Law, J., & Walker, R. M. (2005). External constraints on local service standards: The case of comprehensive performance assessment in English local government. *Public Administration*, 83(3), 639–656. doi:10.1111/padm.2005.83.issue-3
- Andrews, R., Boyne, G. A., Law, J., & Walker, R. M. (2009). Centralization, organizational strategy, and public service performance. *Journal of Public Administration Research and Theory*, 19(1), 57–80. doi:10.1093/jopart/mum039.
- Bonner, S. E., & Sprinkle, G. B. (2002). The effects of monetary incentives on effort and task performance: Theories, evidence, and a framework for research. *Accounting, Organizations and Society*, 27, 303–345. doi: 10.1016/S0361-3682(01)00052-6
- Boyne, G. A. (1996a). Scale, performance and the new public management: An empirical analysis of local authority services. *Journal of Management Studies* 33:809–26.
- Boyne, G. A. (1996b). Constraints, choices and public policies. London: JAI Press.
- Boyne, G. A. (2003). Sources of public service improvement: A critical review and research agenda. *Journal of public administration research and theory*, 13(3), 367-394.
- Bradley, S., Jones, G., & Millington, J. (2001). The effect of competition on the efficiency of secondary schools in England. *European Journal of Operational Research*, 13 (5), 545–68.
- Brewer, G., and S. Selden. 2000. Why elephants gallop: Assessing and predicting organizational performance in federal agencies. *Journal of Public Administration Research and Theory* 10:685–711.
- Capaldo, G., Costantino, N., & Pellegrino, R. (2017). The Effect of More Demanding Public Services Quality Standards on the Organization of Service Providers. *International Journal of Public Administration*, 40(10), 847-859.
- Capaldo, G., Costantino, N., Pellegrino, R., & Rippa, P. (2018). The Role of Risk in Improving Goal Setting in Performance Management Practices within Public Sector: An Explorative Research in Courts Offices in Italy. *International Journal of Public Administration*, 41(12), 986-997.
- Carter, N. M., & Cullen, J. B. (1984). A comparison of centralization/decentralization of decision making concepts and measures. *Journal of Management*, 10, 259–268. doi:10.1177/014920638401000211
- David Mc A, B. (2013). Service quality and customer satisfaction in the airline industry: A comparison between legacy airlines and low-cost airlines. *American Journal of Tourism Research*, 2(1), 67-77.
- de Bruijn, H. (2002). Performance measurement in the public sector: Strategies to cope with the risks of performance measurement. *International Journal of Public Sector Management*, 15(6/7), 578–594. doi:10.1108/09513550210448607
- Ebdon, C. (2007). Underpinning government: Capital and infrastructure management in state and local government. In P. W. Ingraham (Ed.), *In pursuit of performance: Management systems in state and local government* (pp. 57–81). Baltimore, MD: Johns Hopkins University Press.

- Elbanna, S., A. Rhys, and R. Pollanen. 2016. "Strategic Planning and Implementation Success in Public Service Organizations: Evidence from Canada." *Public Management Review* 18(2):1017–1042.
- Eisenhardt, K.M. and Graebner, M.E. (2007) Theory building from cases: opportunities and challenges. *Academy of Management Journal*, 50, 25–32.
- Fumagalli, E., Schiavo, L., & Delestre, F. (2007). *Service quality regulation in electricity distribution and retail*. Springer Science & Business Media.
- George, B. and S. Desmidt. 2016. "Strategic-Decision Quality in Public Organizations: An Information Processing Perspective." *Administration & Society* 43:1–26.
- Giannakis, D., Jamasb, T., & Pollitt, M. (2005). Benchmarking and incentive regulation of quality of service: an application to the UK electricity distribution networks. *Energy policy*, 33(17), 2256–2271.
- Glisson, C. A., & Martin, P. Y. (1980). Productivity and efficiency in human service organizations as related to structure, size and age. *Academy of Management Journal*, 23, 21–37. doi:10.2307/255494
- Hage, J., & Aiken, M. (1967). Relationship of centralization to other structural properties. *Administrative Science Quarterly*, 12, 72–93. doi:10.2307/2391213
- Hage, J., & Aiken, M. (1969). Routine technology, social structure, and organizational goals. *Administrative Science Quarterly*, 14, 366–376. doi:10.2307/2391132
- Hansen Rosenberg, J. and E. Ferlie. 2016. "Applying Strategic Management Theories in Public Sector Organizations: Developing a Typology." *Public Management Review* 18(1):1–19.
- Heinrich, C. (2002). Outcomes-based performance management in the public sector: Implications for government accountability and effectiveness. *Public Administration Review*, 62(6), 712–725. doi:10.1111/puar.2002.62.issue-6.
- Höglund Linda, Mikael Holmgren Caicedo, Maria Mårtensson & Fredrik Svärdsten (2018) Strategic Management in the Public Sector: How Tools Enable and Constrain Strategy Making, *International Public Management Journal*, 21:5, 822–849, DOI: 10.1080/10967494.2018.1427161
- Hood, C. (1995). The new public management in the 1980s: Variations on a theme. *Accounting, Organizations and Society*, 20, 93–109. doi:10.1016/0361-3682(93)E0001-W
- Hood, C., & Peters, G. (2004). The middle aging of new public management: Into the age of paradox? *Journal of Public Administration Research and Theory*, 14(3), 267–282. doi:10.1093/jopart/muh019
- Kaplan, R. S. (2001). Strategic performance measurement and management in non-profit organizations. *Non-Profit Management and Leadership*, 11(3), 353–370.
- McKean, R. 1965. The unseen hand in government. *American Economic Review* 55:496–506.
- Meier, K., and L. O'Toole. 2002a. Public management and organizational performance: The impact of managerial quality. *Journal of Policy Analysis and Management* 21:629–43.
- Meier, K., Polinard, J., & Wrinkle, R. (2000). Bureaucracy and organizational performance: Causality arguments about public schools. *American Journal of Political Science*, 44, 590–602. doi:10.2307/2669266
- O'Toole, L.J., & Meier, K.J. (2001). Managerial strategies and behaviour in networks. *Journal of Public Administration*, 11, 27–93.
- Pellegrino, R., Ranieri, L., Costantino, N., & Mummolo, G. (2011). A real options-based model to supporting risk allocation in price cap regulation approach for public utilities. *Construction Management and Economics*, 29(12), 1197–1207.
- Selden, Sally C., and Willow Jacobson. 2007. Government's Largest Investment: Human Resource Management in States, Counties, and Cities. In *In Pursuit of Performance: Management Systems in State and Local Government*, edited by Patricia W. Ingraham, 82–116. Baltimore: Johns Hopkins University Press.

- Ter-Martirosyan, A., & Kwoka, J. (2010). Incentive regulation, service quality, and standards in US electricity distribution. *Journal of Regulatory Economics*, 38(3), 258-273.
- Vakkuri, J., & Meklin, P. (2006). Ambiguity in performance measurement: A theoretical approach to organizational uses of performance measurement. *Financial Accountability and Management*, 22(3), 235–250. doi:10.1111/j.0267-4424.2006.00401.x
- van Helden, G. J. (2005). Researching public sector transformation: The role of management accounting. *Financial Accountability and Management*, 21(1), 99–133. doi:10.1111/fam.2005.21.issue-1
- Verbeeten, F. H. M. (2008). Performance management practices in public sector organizations. *Accounting, Auditing & Accountability Journal*, 21(3), 427–454. doi:10.1108/09513570810863996
- Voss, C., Tsikriktsis, N. and Fröhlich, M. (2002), “Case research in operations management”, *International Journal of Operations & Production Management*, Vol. 22 No. 2, pp. 195-219.
- Wagner, J. A. (1994). Participation's effects on performance and satisfaction: A reconsideration of research evidence. *Academy of Management Review*, 19(3), 12–30.
- Weisman, D., 2005. Price regulation and quality. *Information Economics and Policy*, 17 (2), 165-174.
- Wisniewski, M. (2001). Assessing customer satisfaction with local authority services using SERVQUAL. *Total Quality Management*, 12(7-8), 995-1002.
- Yin RK (2003) *Case Study Research: Design and Methods*, 3rd edn. Sage Publications, Thousand Oaks, CA, USA.
- Zigarelli, M. 1996. An empirical test of conclusions from effective schools research. *The Journal of Educational Research* 90:103–111.

The Relationship between the Project Management Competences and the Project Success – the Case of a Central European Oil Company

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Abstract

Based on the biggest project management professional association, the Project Management Institute's report (2013), the oil and gas sector considered to be one out of the seven project intensive industries besides manufacturing, business services, finance and insurance, information services, construction and utilities. Out of the three segments of the oil industry (upstream, midstream and downstream), the upstream possess the biggest complexity level regarding the size and the novelty level of the projects.

The purpose of this academic research paper is to assess the project management competencies of the different participants being involved into the project-related processes (project managers, their line managers and the staff of the project management office (PMO) in the upstream segment and to analyse the relationship between these competences and the different criteria of the project success. Bearing in mind this aim, the paper focuses on the following research questions:

- *How does the project management competence contribute to the different criteria of the project success, i.e. (a) the project triangle, (b) client satisfaction, and (c) the stakeholder satisfaction?*
- *How could the organisational context influence the project management competencies' contribution to the project success?*

Görög's (2013) hierarchical project success criteria model and the main project management competency models (e.g. Crawford, 2005) provide the theoretical background of this paper. The 4th edition of the Individual Competence Baseline for Project, Programme & Portfolio Management issued by International Project Management Association (2015) also served as a basis to assess the project management competencies of the interviewees.

Previous academic papers were not focusing on the link between the different criteria of the project success and project management competencies. In this research organisational barriers were also highlighted, which contributed to the realization of the project management competencies. They have strong impact on the actual workplace performance, thus they could block the competencies contribution to the successful completion of the projects.

Understanding the relationship between the project management competencies and the different project success criteria could contribute to the further development of the professional workplace performance of the project managers.

Keywords – project management, project management competence, project success, hierarchical success criteria

Paper: Academic Research Paper

1 Introduction

Project management is considered to be one of the most complex professions nowadays, and project related jobs could be found in almost every sector of the global economy. Organisations operating in the so-called project intensive industries should focus on the improvement of their project management performance to stay competitive and relevant in this business environment. The purpose of this academic research paper is to assess the project management competencies of the different participants being involved into the project-related processes (project managers, their line managers and the staff of the project management office, PMO) in the upstream sector of the industry and analyse the relationship between these competences and the different criteria of the project success.

Bearing this aim in mind, the paper focuses on the following research questions:

- *How does the project management competence contribute to the different criteria of the project success, i.e. (a) the project triangle, (b) client satisfaction, and (c) the stakeholder satisfaction?*
- *How could the organisational context influence the project management competencies' contribution to the project success?*

2 Literature review

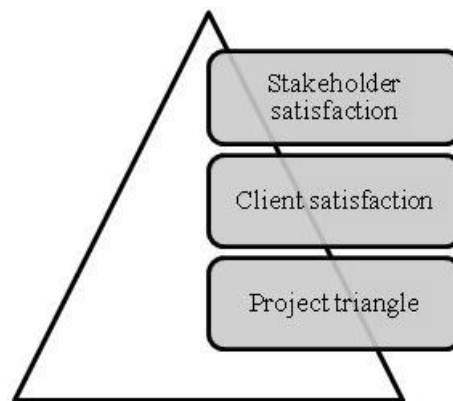
2.1. Evolution of the project success criteria models

The development of the project management profession came along with the evolution of the project success determinants. The classical triple constraint model measured project success against the classical project triangle; cost, time and quality (Pinto, 2016). Later models distinguished more criteria. Shenhar *et al.* (2001) identified four dimensions of project success; (1) the first dimension was “Project efficiency”, which measured the projects against the budget and the time constraints, (2) the second was the “Impact on the Customer”, which tested how the project result meets the customer needs. (3) “Business success” serves as the third criterion, which evaluated the commercial profitability of the project. The final dimension (4) “Preparing for the future” measured the project’s impacts on the future market development or the level of technical innovation. Atkinson (1999) also created a four criteria model, in which he not only measured the project success against the (1) the classical triangle, but also against (2) the maintainability, reliability and quality of the IT system and against (3) the organisational and (4) the stakeholder benefits. The organisational benefit criterion evaluates the project

based on the efficiency, effectiveness, profit rate of the company, and how much the strategic goals were achieved by the implementation of the project. Stakeholder benefit criterion considers the satisfaction of the internal (project team) and the external stakeholders (users, social and natural environment, suppliers, etc.).

Görög's (2008) project success approach integrates the most important elements of the previously mentioned theories into a hierarchical model. The three success criteria of his model are as follows:

- project triangle,
- client satisfaction (which is the level of alignment with the organisational strategy and how the project could reach the organisational goals),
- and the stakeholder satisfaction.



Source: Görög (2013)

Figure 1. Hierarchical criteria model of project success

One of the biggest advantages of this model is that it evaluates the project success against efficiency aspects (basically the first criterion level), as well against effectiveness aspects (basically the second and third level). There is a chance to prioritise the criteria, although Lindahl and Rehn (2007) say that the upper levels in hierarchical models can be achieved, even if the project is not completed on time and to budget, so this model is really flexible in success evaluation.

2.2. Project management competency

One of most well-known project management competency approach is Crawford's (2005) integrated project management competency model. In this model the author integrates two general competency approaches; the attribute base inference of competence and the performance based inference of competence. The project management competency can be broken down into three main components; (a) the input competencies - knowledge and skills – which are also called surface competencies (Spencer & Spencer, 1993), (b) the personal competencies – motives, traits, self-concept - (Spencer & Spencer, 1993) or attitudes, personality traits, behaviours (Heywood et al., 1992), and (c) output competencies, which are measuring the demonstrable performance of the project

managers. Görög (2013) distinguishes the project manager's competencies from the project management competencies. He consider the first term as broader which includes not only all elements of the project management competency, but also the personal features and the leadership style of the project managers.

This models are focusing mainly on the different levels of the competence. The other dimension in which project management competence could be interpreted is the content aspect. El-Sabaa (2001) distinguishes three different areas of project management competency; (1) the human skills, (2) the conceptual and organisational skills and (3) the technical skills. These three main competence areas can further broken down into competence elements. The human competency area involves those competency elements which are inevitable to manage the project team and the stakeholders, the technical competencies are focusing on the classical project management tools and techniques, while the conceptual and organisational competencies are focusing on the industrial, economical and organisational context of the project. This areas could be identified in case of the most important project management competency standards as well:

- *Project Manager Competency Development Framework (PMI, 2007)* – Performance and Personal competence areas
- *Individual Competence Baseline for Project, Programme & Portfolio Management (IPMA, 2015)* – Perspective, People and Practice competence areas
- *APM Competence Framework (APM, 2015)* – contextual, technical and behavioural.

3 Empirical research

3.1 Research methodology

Considering the research questions the use of explorative research and the mixed research methodology was selected (Creswell & Clark, 2006). The research was divided into four steps: (1) preparation phase, (2) data collection and triangulation and (3) analysis and (4) evaluation.

In the *preparatory phase* several *explorative interviews* were made with the head of the company group's upstream project management office. He was the *gatekeeper* and also main contact of the researcher during this research. These interviews and the documents which were available for the researcher about the company group's organisational structure, processes, KPI system, competency development program, helped a lot to understand the operation of this special business sector and streamline the research aims and the research questions. After these meetings a *workshop* was organised for the project managers working in the upstream sector of the selected company group. During this workshop, a section was devoted to the research, which had a multifaceted aim: (a) on one hand, it highlighted the importance of the research for company group's management and for those people who were planned to be involved into the research. The researcher and the research itself was officially introduced during this event. The whole

population (all project managers of the company group) were present here. In case of an explorative research focusing on an especially sensitive topic (like the competencies) creating trust can be crucial in a situation like that. (b) On the other hand, the workshop aimed to collect general information about the population and the organisation group. In the preparatory phase the *competency self-assessment questionnaire* was also tested. This questionnaire was based on the 4th edition of the Individual Competence Baseline. The International Project Management Association's newest project management competency standard was issued in 2015. It was selected as a source of the self-assessment because it was the newest and the most complex competency system including three competency areas (Perspective, People, Practice) and which could be broken down into 28 individual competency elements. The tests served as an input for determining the length of the assessment and finalizing the English text. The assessment was conducted in English and based on the feedbacks it was decided that the researcher will be present during the whole assessment process (in person or via Skype). *Test interviews* with project managers, who were not involved into the research were also conducted, which also helped to determine the length of the interviews and the in the finalization of the interview questions.

In the *data collection and triangulation phase* included three main elements: a multilevel competency self-assessment and the semi-structured interviews with the project managers and the document analysis. Triangulation plays an important role in a qualitative research. It contributed to the information validation (Denzin 1978, 1988; Bowen, 2009; Cohen & Manion, 2000; Altrichter et al. 2008; Szokolszky, 2004). Both data and methodology triangulation was conducted. Interviews were conducted with the line managers of the project managers when they also evaluated the project managers' competencies.

The self-assessment was *analysed* based on the KPIs (key performance indicators) and measurements of the IPMA's ICB v.4. The semi-structured interviews were evaluated based on Görög's (2016) level of agreement methodology.

Before the final *evaluation* research outcomes need to be corroborated (Plutchik, R., 1983; Putnam, H. 1991), in order to achieve reliable generalization of the research results. A closing workshop was organised where the participants had the chance to give feedback to the first results of the research. Based on the feedbacks the final results were refined and finalized.

3.2 The selected company group and the research sample

The oil and gas industry is one of the classical project-intensive industries, which were defined by *Project Management Institute* (2013). The most important feature of these sectors that a broad spectrum of projects could be found in them and a significant percentage of the operation of the companies is implemented by projects.

The operation of the oil and gas industry could be divided into three sectors: upstream (E&P – exploration and production), midstream and downstream. Upstream deals with the exploration and the production of the hydrocarbon products, midstream mainly focuses on the transportation, storage and wholesale of the raw materials and refined

hydrocarbon products, while the downstream is focusing on the refinery process and the marketing and the retail of the final products (Csiszárík-Kocsir, 2015).

The research was conducted at a multinational company group, which was founded in Hungary. The company group's present in more than 30 countries and it has more than 26 000 employees. The group headquarter and those subsidiaries were involved into the research who have an active E&P activity and where actual production is also happening. Altogether seven companies were selected based on this criterion. In these companies the number project managers was 96. Altogether 25 project managers were involved into the research, which forms part 25,5 % of the whole population.

Table 1. Companies involved into the research

Company	Region
Group (headquarter)	Global
Subsidiary 1.	CEE – Hungary
Subsidiary 2.	CEE - Croatia (Egypt, Angola)
Subsidiary 3.	North Sea, UK
Subsidiary 4.	Middle East, Pakistan
Subsidiary 5.	Russia
Subsidiary 6.	Iraq

The following table provides an overview about the most important features of the project managers who were selected at random from the population.

Table 2. Sample

Average age	38,24 years	
Average project management experience	5,8 years	
Gender	Female	5 (20%)
	Male	20 (80%)
Qualification	Geologist	7 (28%)
	Geophysicist	1 (4%)
	Economist	5 (20%)
	Engineer	12 (48%)
	Hungarian	18 (72%)
Nationality	Yemeni	1 (4%)
	Pakistani	4 (16%)
	Polish	1 (4%)
	Croat	1 (4%)
Having any project management qualification (E.g. PMP, IPMA, postgraduate PM diploma etc.)		4 (16%)

4 Research results

4.1 Project success criteria and the project management competencies

This question was analysed from multiple perspectives. Based on the analysis of the documentation of the closed projects and from the interview feedbacks, it could be seen that the success of the project was mainly measured against the project triangle (92% percentage of the respondents mentioned). The client satisfaction, namely the projects

contribution to the fulfilment of the original strategic objective was not considered within the company, neither the satisfaction of the stakeholders. The project success is evaluated mainly based on the efficiency and not based on the effectiveness of the project. Even though project managers ranked people competence area as the most important, which was followed by practice and finally by the perspective competence area. The research also focused on the competency self-assessment of the project managers. They current competency level was the highest in the people competencies and the biggest lack was identified regarding the perspective competencies. Even though they confirmed that they intend to improve the people competencies the most, than the practice and they are focusing on the improvement of the perspective competencies the least.

Project managers were asked to evaluate the competence areas and elements contribution to the different project success criteria. A strong relationship was identified between the different competence areas and the success criteria. Based on the answers of the project managers 11 out of 13 practice competency element were contributing mainly to the primary project objectives, namely to the project triangle. Only the stakeholder management competency elements was matched with the stakeholder satisfaction project success criterion and the requirements and objectives competency element contributes to the client satisfaction. So the classical project management “hard skills” are contributing to the efficiency of the project.

All five perspective elements are contributing to the client satisfaction which success criterion measures the strategic alignment of the project.

7 out of 10 people competency elements were primarily mentioned at the stakeholder satisfaction success criterion. Only resourcefulness and self-reflection and self-management were contributing of the client satisfaction. Results orientation was the only people competency element which contributed to the project triangle. Table 3. introduces the results of the research.

Table 3. Competency elements and areas contribution to the project success criteria

SUCCESS CRITERIA	COMPETENCY ELEMENTS
Stakeholder satisfaction	Personal integrity and reliability (<i>People competency area</i>)
	Personal communication (<i>People competency area</i>)
	Relationships and engagement (<i>People competency area</i>)
	Leadership (<i>People competency area</i>)
	Teamwork (<i>People competency area</i>)
	Conflict and crisis (<i>People competency area</i>)
	Negotiation (<i>People competency area</i>)
	Stakeholders (<i>Practice competency area</i>)
Client satisfaction	Strategy (<i>Perspective competency area</i>)
	Governance, structure and processes (<i>Perspective competency area</i>)
	Power and interest (<i>Perspective competency area</i>)
	Culture and values (<i>Perspective competency area</i>)
	Compliance, standards and regulations (<i>Perspective competency area</i>)
	Resourcefulness (<i>People competency area</i>)
	Self-reflection and self-management (<i>People competency area</i>)
	Requirements and objectives (<i>Practice competency area</i>)
Project triangle	Project design (<i>Practice competency area</i>)
	Time (<i>Practice competency area</i>)
	Scope (<i>Practice competency area</i>)

	Quality (<i>Practice competency area</i>)
	Finance (<i>Practice competency area</i>)
	Resources (<i>Practice competency area</i>)
	Procurement (<i>Practice competency area</i>)
	Plan and control (<i>Practice competency area</i>)
	Risks and opportunities (<i>Practice competency area</i>)
	Change and transformation (<i>Practice competency area</i>)
	Results orientation (<i>People competency area</i>)

4.2 Organisational context and its effect on the project success

During the interviews the project managers highlighted a new aspect of the research field. According to their answers, the source of the project failure was not the lack of the project management competency in many cases, but it was an organisational constraint. Based on the feedbacks, four different organisational blocks were identified, which have a huge impact on the project performance and through that on the success of the projects as well. The most often mentioned constraints deriving from the organisational context are as follows: the weak authority of the project manager in the project organisational arrangement, the scarcity of the key resources in the project, the lack of integrated project control systems and the constantly changing organisational context. These organisational constraints are blocking certain competencies' effective contribution to the project success. Table 3. introduces the identified organisational constraints and the project management competencies on which they have the biggest effect on.

Table 4. The identified organisational constraints and their effect on the project management competencies

ORGANISATIONAL CONSTRAINT	PROJECT MANAGEMENT COMPETENCY
1. The weak authority of the project manager in the project organisational arrangement	LEADERSHIP (<i>People competency area</i>)
2. Scarcity of the key resources in the project	RESOURCES (<i>Practice competency area</i>)
3. Lack of integrated project control systems	PLAN & CONTROL (<i>Practice competency area</i>)
4. Constantly changing organisational context	GOVERNANCE, STRUCTURE & PROCESSES (<i>Perspective competency area</i>)

Projects were implemented most commonly in a weak matrix project organisational arrangement within the companies. In this project organisational arrangement the project manager has no line authority over the project team, so some classical tools of the leadership (*People competency area*), e.g. the task delegation, could be applied only in a limited way. It turned out that other competencies of the project manager could partly compensate this effect: personal communication (*People competency area*), negotiation (*People competency area*) and teamwork (*People competency area*) was mentioned most commonly.

Within the upstream sector there is a huge scarcity of certain human resources, especially certain field experts. Even if the project managers possess effective resource management competencies, the number of projects (the need for the special expertise) is

not in line with the demand. In these cases other competencies could contribute to the successful completion of the projects, and could “compensate” this situation, based on the feedbacks of the project managers, these are: relationship and engagement (*People competency area*), power and interest (*Perspective competency area*) and stakeholder management competency (*Practice competency area*).

Observing the actual project performance and compare it with the actual project plans is one of the most important part of the project implementation phase (*Görög and Smith, 1999*). During process control the project managers often suffered from the lack of integration between the companies’ ERP systems and the project management systems. At the company group the inputs for the project control reports were derived from the SAP system. Unfortunately, the project managers had no direct access to this system, so the data was provided by the financial department. The frequency of the data collection was not adjusted to the needs of the project but it was standardised and was available once in a month. *Görög (2013)* suggests the following regarding the frequency of the data collection in case of normal or long projects:

- *On a daily basis:* All the short time but critical activities (where the total float time of the activity is 0).
- *On a weekly basis:* All the critical activities. All those long time but non-critical activities (where the total float time of the activity is bigger than 0). that consume costly resources.
- *On a monthly basis:* All the project activities.

This could not be managed in this organisational environment, because the project managers are depending on the financial department’s monthly reports about the actual project spending. This blocks the effectiveness of the plan and control (*Practice competency area*) competency, so there other competencies, time (*Practice competency area*), finance (*Practice competency area*), and change and transformation (*Practice competency area*) could compensate the effect of it.

The organisational structure within the investigated companies are constantly changing. The organisational chart (structure) is changed frequently, the rules and regulations and the internal organisational processes also. This phenomenon has a negative effect on the governance, structure and processes (*Perspective competency*). Project managers are facing serious problems because of the changing processes, documentation, reporting etc. Those ones, who have strong competencies in requirements and objectives (*Practice competency*), change and transformation (*Practice competency*) and Compliance, standards and regulations (*Perspective competency*).

5 Conclusions

The research highlighted that the companies, which were involved into this research, are evaluating their projects mainly based on the classical project triangle even today and the other success criteria are not well-known in the given organisational context. Even though the project managers rank the human competencies to the first place over the classical technical competencies which focus on the classical project management tools

and techniques. The perspective competency area is the most underrated area, although these competencies are measuring the strategic alignment of the project.

Applying a multidimensional and hierarchical project success evaluation system could contribute to a much more detailed project success evaluation, in which the projects' strategic alignment and also the stakeholder satisfaction would be tested.

The research identified a relationship amongst the project success criteria and the different project management competency areas. This information could serve as an important input for the future competency development programs of the company group. The research also identified four organisational constraints which could block the project management competencies' contribution to the project success. The company should consider these constraints before planning the upcoming competency development programs, because in certain cases not the lack of the competence but these constraints are responsible for the project failure.

Highlighting the relationships between the project management competencies and the project success could increase the success rate within the organisations and can contribute to a better understanding of the complex nature of the project success.

References

- Altrichter, H. – Feldman, A. – Posch, P. – Somekh, B. (2008). *Teachers investigate their work; An introduction to action research across the professions* (2nd edition). Routledge.
- Association for Project Management (2009). *APM Competence Framework*, United Kingdom.
- Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International journal of project management*, 17(6), 337-342.
- Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, 9(2), 27-40.
- Crawford, L. (2005): "Senior management perceptions of project management competence. *International journal of project management*, 23(1), pp. 7-16.
- Creswell, J. W. – Clark, V. L. P. (2006). *Designing and conducting mixed methods research*, Sage Publications, Thousand Oaks
- Cohen, L. – Manion, L. (2000). *Research methods in education* (5th ed.). Routledge, New York.
- Csiszárík-Kocsir, Á. (2015). Szponzorok az olaj-és gázipari beruházások projektfinanszírozásban a 2014-es adatok alapján. *Tanulmánykötet-Vállalkozásfejlesztés a XXI. században V.*, 247-266.
- Denzin, N. K. (1978). Triangulation: A case for methodological evaluation and combination. *Sociological methods*, 339-357.
- Denzin, N. K. (1988). Triangulation. JP Keeves. *Educational research, methodology and measurement: an international handbook*
- El-Sabaa, S. (2001): The skills and career path of an effective project manager. *International Journal of Project Management*, 19(1), pp. 1-7.
- Görög, M. – Smith, N. J. (1999). *Project Management for Managers*. PMI Publications, Newtown Square.
- Görög, M. (2008). *Projektvezetés*. Aula Kiadó, Budapest.
- Görög M. (2013): *Projektvezetés a szervezetekben*, Panem, Budapest
- Heywood L, Gonczi A, Hager P. (1992): *A guide to development of competency standards for professions*, Australian Government Publishing Service, Canberra

- International Project Management Association (IPMA) (2015): IPMA International Competence Baseline, 4th ed.
- Lindahl, M. – Rehn, A. (2007). Towards a theory of project failure. *International Journal of Management Concepts and Philosophy*, 2(3), 246-254
- Pinto, J. K. (2016): *Project management : achieving competitive advantage*. Pearson, Boston
- Plutchik, R. (1983): *Foundations of Experimental Research*. Harper's Experimental Psychology Series, Joanna Cotler Books, New York.
- Project Management Institute (PMI) (2007): *Project Manager Competency Development Framework*, Newtown Square, PA: Project Management Institute
- Project Management Institute (2013). *Project Management Talent Gap Report*. Project Management Institute, Newton Square. [Retrieved: 2017.12.31, available: <https://www.pmi.org/learning/thought-leadership/pulse/talent-gap-2020>]
- Putnam, H. (1991). The “corroboration” of theories. *The philosophy of science*, 121-137.
- Shenhar, A.J. – Dvir, D. – Levy, O. – Maltz, A.C. (2001). Project success: a multidimensional strategic concept. *Long Range Planning*, 34(6), 699-725.
- Spencer, L. M. – Spencer, S. M. (1993). *Competence at work*. John Wiley & Sons, New York
- Szokolszky, Á. (2004). *Kutatómunka a pszichológiában*. Osiris Kiadó, Budapest

Knowledge-Based Participation to Identify Demands of a Future City Administration: Dresden Case Study

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Abstract

Due to accelerated structural changes in the city administration of Dresden, a new administrative center is planned for several thousands of employees. In the framework of a scientific collaboration, inter alia we researched and evaluated demands of future city administrations by way of a participative workshop-series in order to inquire the employee's and organisation's implicit knowledge as an information basis for decision making in the subsequent architectural design works.

In a series of workshops with representatives of the departments that will potentially move into the planned new building, explicit and implicit knowledge of the knowledge bearers was collected in various formats. The structure and content of the workshops was developed according to the Backcasting Method, which anticipates long-term objectives (framework specifications of the city administration and the project manager) and therefrom derives measures for achieving them. By analyzing the existing structures in the departments, discussing with the employees and validating their statements and needs made through the evaluation of references and the co-creative development of concept models, a catalogue of spatial needs was created.

By use of this preliminary planning-process we were able to set a scientific foundation for subsequent design-and-development processes for architects, civil engineers, and interior designers of the envisioned public construction project. The bottom-up-approach will ensure a sustainable design for organisational and spatial issues for the municipality by purposefully using the implicit knowledge of the prospective users. The collected data give intelligence about future office development and about specific interlinkages of the departments in regards to communication, working methods, operations and future consolidations.

The catalogue of spatial needs will be part of the architectural tender process for the “New Administration Centre” of Dresden 2019, which will be carried out in the format of a “Competitive Dialogue” between architectural offices and the city administration Dresden.

Keywords – cooperative creation workshop, knowledge based participation, future city administration, working environments, case study.

Paper type – Academic Research Paper.

1 Introduction: An architectural-administrative framework

One of the contemporary organisational challenges is the growing complexity and dynamics of organizations in private, non-profit and public sectors (Farazmand, 2002). At the same time, constantly changing constellations of actors and processes offer new change for strengthening the exchange of knowledge and information (Allen et al., 2007). Due to accelerated structural, organizational, cultural and technological changes in the city administration of Dresden, a new administrative center is planned to relocate a large amount of employees into a appropriate, contemporary work environment. Therefore, the city administration has set up two phases of demand planning that should explicitly involve the employees. Phase 1 consisted of an online survey conducted by an external consulting company. In the Phase 2, the TU Dresden WISSENSARCHITEKTUR Laboratory of Knowledge Architecture was commissioned to establish targeted and more profound requirements. Contractor for the scientific cooperation was the Construction and Property Management Office of the city administration. The content-related objective of the approach was to derive needs in terms of work processes and work contents through employee surveys, and to translate them into architectural design requirements – separately for each department, and also for the administration as a whole.

In the framework of a scientific collaboration, inter alia we evaluated demands regarding business operations of the employees in a series of participative workshops from May until November 2018 with the aim to transform the organisation's and employees' implicit knowledge into a data basis for architectural decision making. In this exploration, 13 of 36 departments of the city administration of Dresden were addressed. The preselection of the departments was made by the department of Construction and Property Management Office and can roughly be subdivided into the subsections of social departments and constructional departments. Upon the results of this study, a public tender was launched in April 2019 in the format of a "Competitive Dialogue" for general contractors (urban planners, architects and civil engineers).

2 Challenges of a future city administration

Due to cultural and technological changes, not only society and economy but also public administrations are facing new challenges. In order to outline the challenges as

well as internal and external factors that will influence the work environment of the New Administration Centre of Dresden, the so-called Backcasting Method was selected as a conceptual framework (Quist, 2008). This method appears feasible in this context, as on the one hand, changes in administration are subject to external conditions while, on the other hand, they bring along organizational, procedural, cultural, spatial and technological challenges on the side of the planners and end users of the new building. This case study will focus on a) organizational-processual, b) cultural and c) spatial challenges.

The planning project was subject to external conditions, which had to be taken into account in the overall design of the workshops to be carried out with the administration employees. First, the number of employees who were to move into the new building was set at 1,600. Second, there was a budget of 160 million Euros. Third, the size and shape of available construction space in the city center was determined by the Urban Planning Office.

A) **Organizational challenges** of future administrations partly are linked to their basic structure as defined by their organizational chart. In the case of Dresden, the chart is divided into seven “Business Areas” that cover specific topics. The business areas are divided into departments, each of which can be regarded a closed knowledge ecosystem. This ecosystem can be initially determined by knowledge exploration as baseline of the system (Valkokari, 2015). As it turned out, thematically close departments are often not co-located in the same place in the city. Here, organizational and spatial challenges overlap. Spatial distance prevents frequent, direct and informal exchanges between departments. Existing experiences cannot be shared and applied to similar issues in other departments. This means that every “ecosystem” has to go through its own experiences and learnings without being able to shorten the process through inter-department exchange. As is known from service-oriented global economies, flexible administrations need a knowledge-based fundament (Grodach, 2013). Another point of importance is the clarification of how flexible working time or mobile workplaces may play a role for the employees in future. Digitization has gradually driven analogue technologies out of work environments. The use of new communication media, EDP systems, etc. has created increasingly complex work processes which in turn lead away from traditional individual work, towards temporary project work in fast-changing teams, with a certain potential for new approaches and synergies in the work sphere (Booyesen et al., 2013).

B) **Cultural challenges** arise from the history of administrations, which formerly – according to the military models – were divided into stable units with clearly defined hierarchy (mayor > head of department > head of sub-department > head of subject area > employee. Hierarchies with sophisticated vertical specialization (Egeberg, 2003; Simon, 1957) establish strong control systems and coordination power, and thus influence directly the working environment (Christensen & Lægheid, 2010) as well as relationships and biases among employees. Hierarchy in administrations, for example, is reflected in the spatial layout by the provision of single offices for higher positions. In addition, the rising average age of employees will lead to critical demand for administrative staff in the next 10-30 years. Cultural differences due to age is especially significant in the

administrative context: the elder generation tends to rigid routine work, whereas the younger easily adopts new spatial concepts or technologies.

C) **Spatial challenges** may affect the new building in its overall structure and layout. Acute questions regard, for example, the need for citizen information, places for citizen participation, the arrangement of business areas or openness vs closeness of individual departments. Spatial requirements will change in connection with flexible working time. Depending on future activities and work processes of the respective departments, either project work or individual work will dominate, which in turn require suitable spatial solutions. Here, the distribution ratio between offices and meeting rooms becomes a key matter. One of the main reasons for the establishment of a central administrative complex was the current fragmentation and scattering of departments scattered throughout the city. This challenge, which reduces the accessibility for citizens as well as the exchange between departments, was taken as an opportunity for a spatial clustering of inter-related facilities at a central location in the city (Schlickewei et al., 2011).

3 Customized Workshop Design by Backcasting

Since the overall goal was defined by the client (Construction & Property Management Office) and by the project controller, the actual requirements in regards to workflow and spatial layout were investigated by way of bottom-up, participatory workshops with the end users, based on the Backcasting method (Quist & Vergrat, 2016). The client's specifications and input were based on best practices in administration buildings, such as Timmerhuis in Rotterdam or Coventry in London, which represent current paradigms such as open government for open source access, as well as citizen participation through new interaction and communication channels (Lathrop & Ruma, 2010). This was preceded by the requirement that the output of the workshops should contain a quantitative ratio between different room functionalities, e.g. individual office, open space offices, etc. for each department, based on the current and future work processes. With the collected requirements about spatial program, number of rooms, sizes, equipment etc. the public tender would be formulated in a later stage of the procedure.

In contrast to Phase 1 of the demand planning, in which middle managers were interviewed, the aim of the Backcasting workshops was to address a cross-section of employees, as broadly as possible. According to the bottom-up principle, all employees were thus equally involved to obtain an overall picture of the requirements and to address all key issues through co-creation activities. From these objectives, the necessary workshop activities were designed and packaged in groups activities for 10-20 participants.

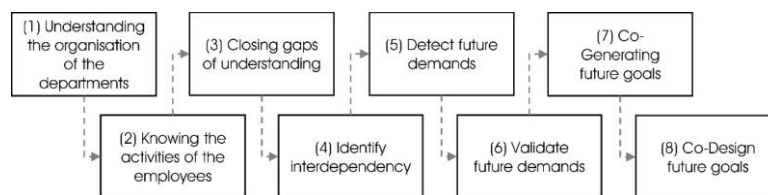


Figure 1: Content-flow and structure of the workshop design

The resulting eight measures (Fig. 1) were distributed over three workshops per department. First of all, it was necessary to understand the organisation of the administration (1) and the activities taking place in it (2), both in a large and small scope. First conclusions could be drawn from gaps in knowledge (3), whereupon the individual departments were determined within the institutional context (4). From then on, it was necessary to find out which knowledge ecosystems, which are largely detached from one another, have common and specific needs for the future (5) in order to have them validated by the ecosystem itself (6). Based on the needs, common goals for the future were generated (7) and finally approaches for achieving the goals and their spatial design were designed by the participants (8).

In Phase 2 of the demand planning, a series of workshops was held with 13 departments of the city administration designated to move to the New Administrative Centre. Each department went through three differently designed workshops that thematically built upon each other. The workshop design was identical for all departments, yet results differed considerably in some cases. The following departments had participated (the Municipal Utility: Children's Day-Care Facilities and the Children's Day Care Office participated as one representative):

Name of department	Abbreviation	Average amount of participants
Economic Development Office	Economy	5
Central and Personal Office	Personal	16
Municipal Utility: IT Services	IT	17
Schools Administration Office	School	10
Youth Affairs Office	Youth	11
Municipal Utility: Children's Day-Care Facilities & Children's Day-Care Office	Children	11
Urban Planning Office	Urban Planning	16
Office for Geodata and Cadaster	Geodata	13
Construction Supervision Office	Construction	13
Construction and Property Management Office	Property	28
Street and Public Work Office	Street	14
Public Green and Waste Management Office	Public Green	15
Environmental Office	Environment	13

In total, approximately 180 employees of the city administration participated in each workshops round, thus giving an appropriate representation of the city administration as a whole.

4 Application of Workshop Design for Empirical Values

The design of the workshop series aimed at developing query methods for the administration's employees based on the outcomes requested by the city administration and the project managers. The Backcasting Method was used to create individual steps which, building on each other, could cover the organisational, procedural and spatial needs of the future end users.

4.1 Workshop I – Outlining a process network

In order to bring all participants up to the same level of knowledge, the workshop started with a general introduction of the project “New Administration Centre”. First, the participants were asked in an open question and answer session about the internal processes, which were presented on a customizable organisation chart. Connecting lines (strings, threads, etc.) were used to illustrate on the spot which sub-departments and subject areas are exchanged particularly frequently and importantly. Especially the areas of finance, secretariat and public relations turned out nodal points of internal processes.

4.2 Workshop I – Building a trend view of activities

In a next step, the participants were asked four questions to assess their working methods, which they responded on behalf of their department or subject area. The questions stated two opposing answers, whereupon participants had to decide whether and to what percentage they work one way or the other (for example: 100% working method a = 0% working method b / 75% working method a = 25% working method b / 50% working method a = 50% working method b). The four questions were asked as follows: Assessment 1: “In what proportion does your work connect internally or externally of your department?” Assessment 2: “In what proportion is your working time fix or flexible?” Assessment 3: “In what proportion is your work individual or project-related?” Assessment 4: “In what proportion does your daily work take place in a concentrated or communicative way?”

Further requests asked in which proportion the work was carried out 5-10 years ago, how it is carried out currently and how it should be carried out in 5-10 years. For this purpose, the participants located labeled each period on a "Rating Scale" (see *figure 2*) in order to make their assessment visible to all other participants. The resulting discussions between employees in the same subject area thus lead to better assessments in the making.

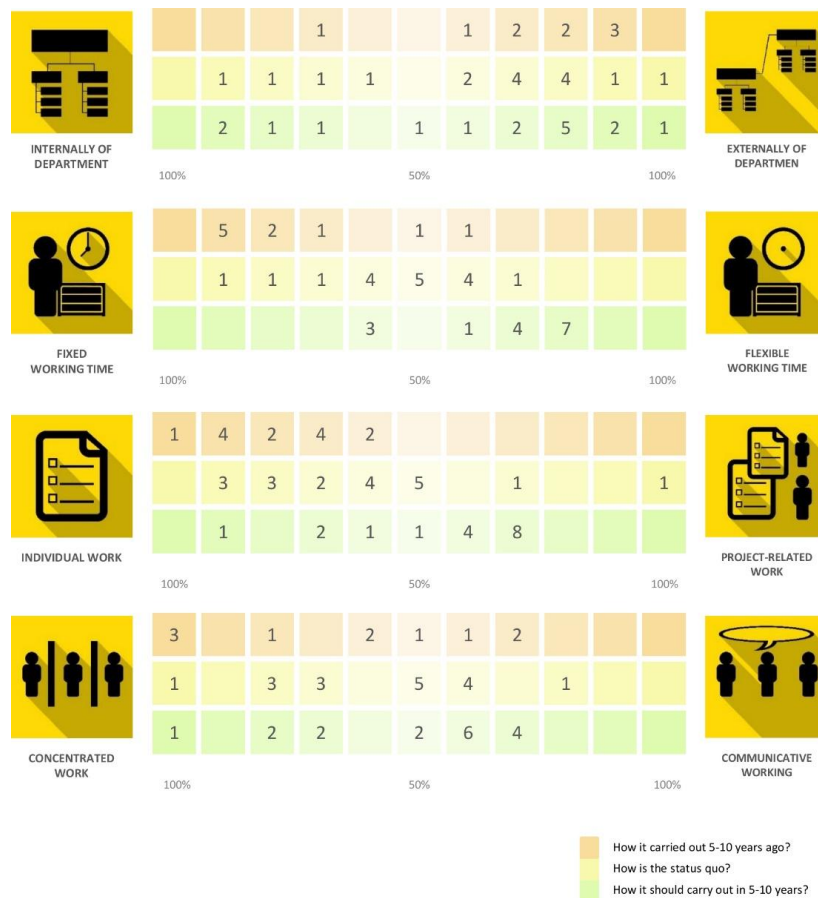


Figure 2: Example “Rating-Scale” of Urban Planning Office

The “rating-scale” of the Urban Planning Office shows by example how the results of the evaluation turned out. The numbers in the boxes mark how many participants have opted for the corresponding proposition. The red boxes indicate how the participants judge their past working method, yellow ones show the assessment of the status quo, and green ones show what the working method should look like in the future – as a potential goal to achieve in the new building. Average values were formed thereafter from the individual evaluations, which represent an overall estimate of the department. In case of the example shown above, the following average assessments are made by the representatives of the Urban Planning Office:

Average Assessments of Urban Planning Office

Assessments

- 1) Cooperation
- 2) Working Time
- 3) Activities
- 4) Working method

past (5-10 years ago)

52% internally
62% fixed
58% individual
59% concentrated

present (2018-2019)

51% internally
64% flexible
53% project related
54% communicative

future (in 5-10 years)

59% externally
76% flexible
61% project related
61% communicative

The average values of all offices were then summed up. The result is a tendency of the working methods to be translated into spatial requirements.

Average Assessments of all 13 departments

Assessments	past (5-10 years ago)	present (2018-2019)	future (in 5-10 years)
1) Cooperation	55% internally	51% internally	55% externally
2) Working Time	54% fixed	56% flexible	71% flexible
3) Activities	59% individual	51% individual	56% project related
4) Working method	56% concentrated	50:50	55% communicative

In general, it was observed that there is a desire to work more closely with other departments. This also reflects the tendency of project-related work. The communication, which is also expected to increase, makes these assumptions plausible, as there is a strong interaction between the three indicators. The greatest change can be seen in the working time or working time model. Compared to the past, this has risen to over 70%.

4.3 Workshop I – Extended demand assessment

In an open discussion with the workshop participants, questions were asked through a guided dialogue that would identify deeper needs of the employees. By using the “Programming” method, the answers were live-documented on index cards, and concerns were illustrated in real time (see Figure 3).

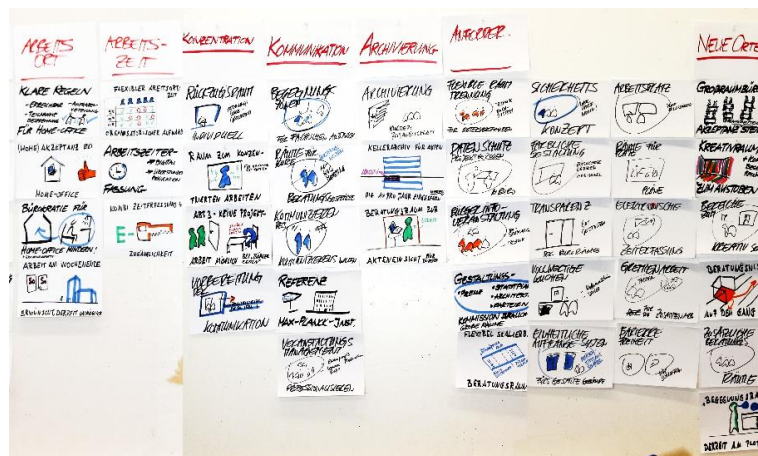


Figure 3: Output of a Programming session

The guideline divided all questions into three categories: Cross-department, Own Department and Own Workplace. Each category had sub-topics, which were asked according to the flow of conversation such as: cooperation, image of the administration, promotion of young talent, use of public areas (cross-department); cooperation, accessibility and security, processes, digitalization and electronic files, archiving and storage, visitors and citizens (own department); requirements, equipment, communication

and concentration (own working place). The evaluation and comparison of the discussion rounds of all departments served as a qualitative basis for the definition of the space required by the planned “New Administration Centre”. Approximately 90 comments, feedbacks and criticisms were documented per office, which could later be included in the architectural programme.

4.4 Workshop I – Identification of communication density

In order to determine how the departments should be located in relation to each other in the planned new building, the interfaces at which most cooperation prevails and is likely to prevail were queried. The participants filled out a survey to find out which other departments they communicate with and how often. They could choose *never*, *occasionally* or *regularly* to communicate and should rate this for the media telephone, letter/e-mail and face-to-face. In addition, a further communication medium could be added. The survey was conducted once from today's perspective, from the perspective of the past (how was it 5-10 years ago) and from the perspective of the future (what should it be like in 5-10 years). The results were brought together in a communication matrix (see figure 4).

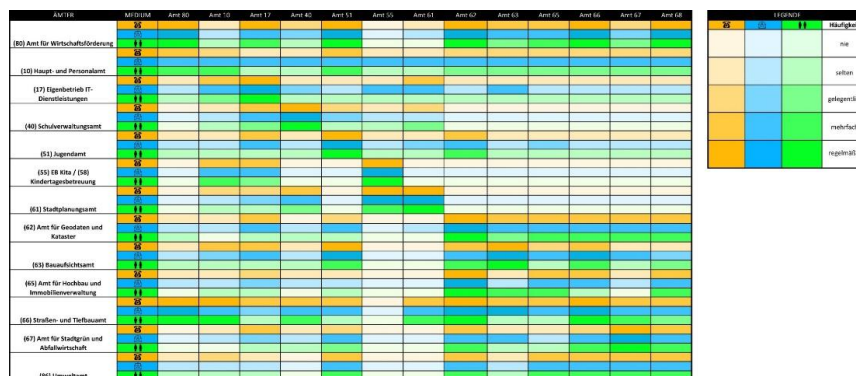


Figure 4: Communication matrix from the perspective of future demands

The yellow fields of the communication matrix stand for communication via telephone, the blue for correspondence via letter/e-mail and green for direct face-to-face exchange. The darker the fields are, the more frequently should/will communication at the corresponding interface between two offices fail in the future (5-10 years). The dark diagonal from top left to bottom right represents the internal communication, which is expected to take place regularly. It serves as a comparative value.

Compared to the communication of 5-10 years ago, the frequency of inter-department communication has generally increased today. The dense cluster of construction and environmental departments (Urban Planning, Geodata, Construction Supervision, Street and Public Work and Public Green and Waste Management) should be emphasized.

According to the workshop participants, the density of communication is expected to increase strongly over the next 5-10 years and, in addition to currently established

communication nodes, other frequently used interfaces will be added. Furthermore, it can be observed that personal conversations (face-to-face) are gaining in importance.

The following figure (see *figure 5*) shows the most important communication connections as they have been classified by the employees for the future (in 5-10 years). The figure is limited to direct communication via face-to-face. The dark connections represent the regular communication and the bright connections represent the occasional communication.

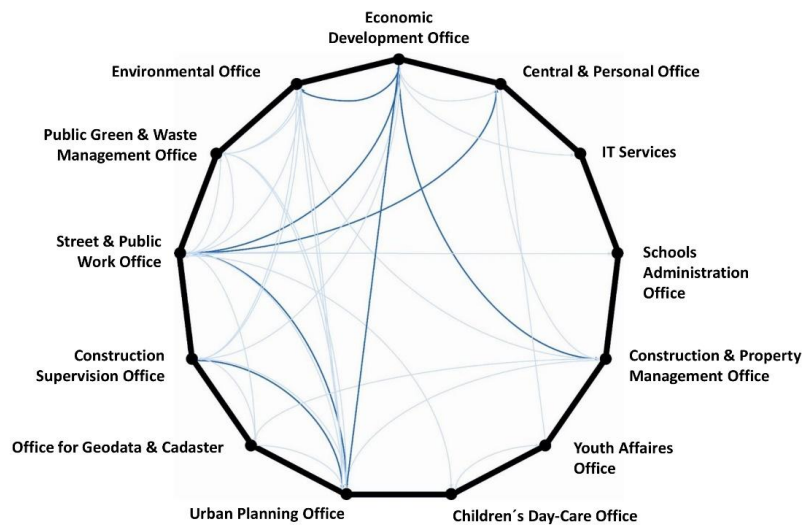


Figure 5: Tendency of expected future communication via face-to-face

Contrary to expectations, the two cross-sectional fields (Central & Personal Office and IT Services) do not provide the most regular communication to all other departments. Instead, there is a tendency for the Economic Development Office, the Urban Planning Office, the Street & Public Work Office and the Environmental Office to be the most regular providers of communication in this case.

4.5 Workshop I – Identification of Future Issues

In the last step of the first workshop, 20-30 recurring programming topics (see Chapter 4.2) were preselected. The topics with most relevance for the future operations got evaluated by the participants. Therefore, each participant was allowed to assign 5 points to one or more topics. The future related topics with the most points were integrated into the second follow-up workshop, see *figure 6* as exemplary example of voted future issues by one of the departments:

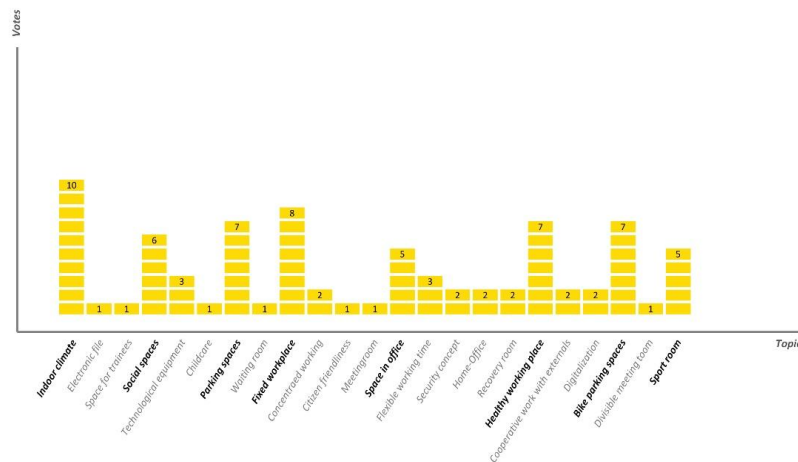


Figure 6: Exemplary future topics of a department of Dresden city administration

In this way, a total of 52 future-relevant topics were filtered out from the discussion round and get evaluated. The overall evaluation of all participating departments resulted in the following ranking and shows the most relevant needs and challenges from the perspective of the employees of the city administration:

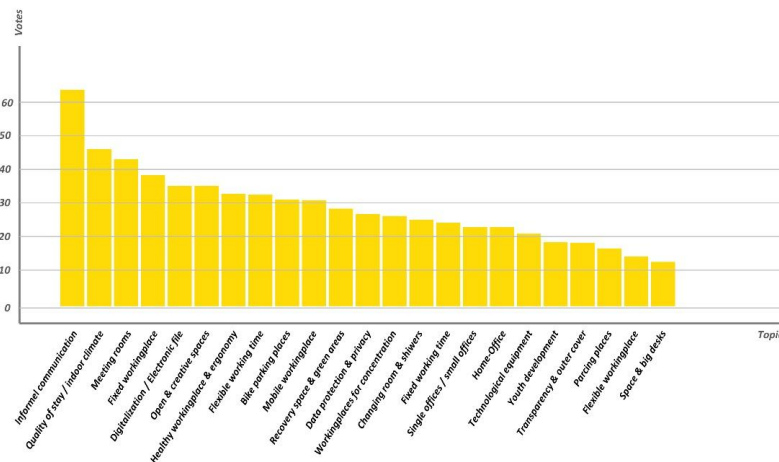


Figure 7: Overview of future topics of all 13 participating departments

4.6 Workshop II – Validation of spatial demands

On the basis of the first workshop round, best practices of administration buildings and companies were selected for four main architectural topics: 1) reception area, 2) office, 3) meeting room and 4) social space. For each of these topics, the participants of the second round of the workshop were shown three very different references, which they were asked to evaluate. The participants were asked whether and what they liked or disliked about the a) concept, b) the function, c) the material and d) the atmosphere. The

individual comments were recorded and collected quantitatively and qualitatively, so that at the end an overall mood picture was created for each reference.

4.7 Workshop II – Develop visions to create measures

In order to describe the topic-specific requirements of employees of the city administration, visions had to be created by the workshop participants following the idea of an idea-driven knowledge ecosystem (Landry, 2008). Starting point were four topic areas, which turned out to be common denominators of all 13 departments in the first workshop: digitization, workplace, cross-office issues and adaptivity. For each department, specific sub-topics were selected for each topic area, for which the participants were asked to create visions. The topics resulted from the identification and evaluation of future topics from the first workshop (section 4.5). After describing the vision (e.g. “communication zones, public dialogue and exhibition spaces, building guidance systems for citizens”), concrete measures were lined out using the Backcasting Method. The vision was formulated as a goal and it was considered which long-term measure is necessary to achieve it (in which period, with which means, with which partners, etc.). From this, the respective initial steps could be derived, which would have to be tackled in the medium term and in the short term.

4.8 Workshop III – Co-Design for implicit knowledge request

In the first two rounds of workshops with the departments, thematic focuses were identified and organisational, procedural and spatial needs and visions were developed. In the third workshop, the resulting spatial typologies and formats were implemented by the participants alone or in groups as a built concept model and arranged in an integrative overall model. The models in their different forms and inscriptions allowed conclusions about the implicit knowledge of the knowledge carriers, which could be translated into architectural requirements. Models for the same room functions (e.g. waiting area, meeting room or creative zone) were compared and translated into spatial patterns.

5 Evaluations

In advance, it can be reported that communication within and between the individual departments is lagging behind the current needs. It could be observed that interim results were not distributed completely or at a late point in time among employees. Already the communication between planners and participants was misguided. A first publication of an architectural concept was misinterpreted by the workshop participants as a finished architectural design, which led to a need for explanation for the introduction of the first workshop. The presentation of selected reference objects to validate the architectural requirements of the employees also had to be discussed, as there was a lack of general architectural understanding and a degree of abstraction, especially for participants from departments that are not assigned to building. The understanding of terms such as

“project” and “project-related work” between the departments was also unequal and needed explanation.

The dynamically evolving departments of the city administration can be considered as closed knowledge ecosystems that live from the exchange of internal actors (Wallner & Menrad, 2011). Despite existing personnel changes between different departments, there is only a small exchange of knowledge between the individual knowledge ecosystems. On the one hand, this is due to the routine of the employees, which is based on the necessary processes, on the other hand, a direct and constant exchange is made more difficult by the geographical distance. Synergies can already be created on a small scale through the spatial proximity of departments with the same topics. One result of the Phase 2 of demand planning were proposals for the arrangement of the departments to each other. For example, it is proposed that departments that already show the same flexible working methods (see Ranking Scale status today: flexible working time and see programming: mobile workplace) be arranged in relation to each other. It is also conceivable to combine departments with similar technical backgrounds or to synchronize them by spatial proximity (e.g. Urban Planning Office, Construction Supervision Office and Street and Public Work Office).

The most frequently mentioned future topics of the participants showed a diversity of opinions on the topics of workplace and working time model between different departments. The fixed workplaces were chosen as the fourth most important topic for the future with ~40 votes, but at the same time mobile workplaces (~30 votes) and flexible workplaces (~15 votes) were also named. In addition, ~30 votes were cast in favour of flexible working time, whereas ~25 participants voted in favour of fixed working time. Spatially, the spectrum also goes in both directions, which has to be compensated by flexible, adaptable architecture in the later course of the planning project: For closed work areas such as the single office and the working space for concentration (both with ~25 voices each), open creative spaces (~35 voices) and meeting rooms (~40 voices) are opposed. This diversity is reflected in the catalogue of spatial requirements and guidelines, which was defined as a result of the workshops. Thus, depending on the statement of the departments, a percentage for concentrated and communicative work was determined and translated into architecture in the same proportion.

6 Impact & Outlook

It was found that employees were encouraged to reflect on the current working environment in terms of, for example, outdated technologies, ergonomics and lack of cooperation between departments. The architectural awareness could also be sharpened by reference buildings. In addition, within the framework of the planning project, an overview of the existing workplaces and positions available to the city administration was prepared. The results of the workshop series were brought together and compiled into a catalogue of spatial requirements and guidelines. A fact sheet was then drawn up for each office. The findings on organisational and process-related aspects of the working environment, which were queried as by-products, were iteratively integrated into the

catalogue and can be made available to the respective offices in order to analyses and, if necessary, adapt their own processes. The demand catalogue serves as a basis for the project controllers of the planning project to process the collected data. These are entered in the invitation to tender of the "Competitive Dialogue" and considerable data concerning the departments are added as an appendix. On the basis of the tender documents, the general contractor is selected who will start planning and implementing the New Administration Centre at Ferdinandplatz Dresden from 2019.

References

- Allen, J., James, A. D., Gamlen, P. (2007). Formal versus Informal Knowledge Networks in R&D: A Case Study using Social Network Analysis. *R&D Management*, Vol. 37, Nr. 3: 179-196.
- Booyesen, I. (2012). Creative Industries, Inequality and Social Development: Developments, Impacts and Challenges in Cape Town. *Urban Forum*, Vol. 23: 43-60.
- Christensen, T., Lægreid, P. (2010). Complexity and Hybrid Public Administration – Theoretical and Empirical Challenges.
- Egeberg, M. (2003). How bureaucratic structure matters: An organizational perspective. In B. G. Peters & J. Pierre (Eds.), *Handbook of public administration*. London: Sage.
- Farazmand, A. (2002). *Modern organizations: Theory and practice*. Westport: Praeger.
- Grodach, C. (2013). Cultural economy planning in creative cities: discourse and practice. *International Journal of Urban and Regional Research*, Vol. 37, Nr. 5: 1747-1765.
- Landry, C. (2008). *The Creative City. A Toolkit for Urban Innovators*, second edition: xvi.
- Lathrop, D., Ruma, L. (2010). Open Government. Collaboration, Transparency, and Participation in Practice: 345.
- Quist, J. (2008). Backcasting for sustainability in the Netherlands: impacts after ten years, policy relevance and a methodological framework. *Third International Seville Seminar on Future-Oriented Technology Analysis: Impacts and implications for policy and decision-making*: 6.
- Quist J., Vergrat, P. (2006). Past and future of backcasting: the shift to stakeholder participation and a proposal for a methodological framework, *Futures* 38(9): 1027-1045.
- Schlickewei, S., Schröter, S., Waldmüller, J. (2011). Kreativwirtschaft. In: Christa Reicher, Katharina Heider, Sven Schlickewei, Sabrina Schröter, Johannes Waldmüller (eds.): *Kreativwirtschaft und Stadt. Konzepte und Handlungsansätze zur Stadtentwicklung. Dortmunder Beiträge zur Raumplanung Bd. 138*. Dortmund: Informationskreis f. Raumplanung: 17-51.
- Simon, H. (1957). *Administrative behavior*. New York: Macmillan.
- Valkokari, K. (2015). Business, Innovation, and Knowledge Ecosystems: How They Differ and How to Survive and Thrive within Them. *Technology Innovation Management Review*: 21.
- Wallner, T., Menrad, M. (2011). Extending the Innovation Ecosystem Framework. In *Proceedings of XXII ISPIM Conference*. Hamburg, Germany.

The Use of ITC in the Automotive Area to have a more Competitive Service

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Abstract

At the present technologies have been advancing with huge steps of witch we have seen them not only in educative areas, also in the business and those are tools easy to use and they are cheaper for companies.

This has been reflected in different areas of the industry, in this research the Automotive Industry was taken.

We analysed the traditional model with the new model of the ICT application.

We use for this research a non-probabilistic sampling of conventional type, it's mixed, quantitative as qualitative, this is a consequence of technological changes as in consumer habits, for a variety of products and services with a lower cost and response time.

With this new model and the use of ICT we will have a positive result of competitiveness in the Automotive Industry area.

In the actuality technologies have grown faster, we have seen it not only in the educative area, also in the business field and those are tool easy to use and those aren't expensive for business.

This has been seen on different business areas; on this research we took the Automotive Industry.

It's important to take note about the CRM to get information about guest and we could be more competitive. It's necessary to understand the guest since the first contact, or the result of a purchase or when try to do a purchase, and more important things like to handle with complaints, and post-purchase service. (Basa, 2011)

The economy is a current environment characterized by components like the increased of competitiveness, technological innovation and the global nature of markets (Castells, 1977) We analysed different models like DEMING PRIZE, model IBEROAMERICANO of the excellence in the management (FUNDIBQ).

We used documental research, it's supported by a field research with a questionnaire, interviews, polls and observation, it's qualitative and quantitative, this is because the technological changes just as costumer habits.
With this new model and the use of ITC we will get results and could be more competitiveness on the Automotive field.

Key words: CRM, service, ITC, Competitiveness.

Paper type – Academic Research Paper

1. Introduction

The service in Automotive Industry is very important and also it's important customer satisfaction in the workshop area. It's important to listening the customers (CRM), so we could obtain a satisfactory approval in the maintenance or repair process of your unit.

Industries that don't incorporate technologies are at risk to fail, with drastic changes to stay in the market. It's important to understand who it Works ITC and their impact on real life business, companies competitiveness and workers productivities. Shutterstock. (2017).

With good use, ITC allow companies to have a bigger amount of work, with better quality on a short time.

Companies should learn to use ITC, and obtain more advantage, and try to educate their employers and customers on the right way to use them.

The American Marketing Association (AMA) acquired the concept in 1960. The Committee Definition as "Activities, benefits or satisfactions that are offers for consideration or that are provided together with the goods" This definition was refined in 1981 in the following terms "services are essentially intangible activities that can be identified in isolation, provide satisfaction and they aren't necessarily linked to sale of goods"

You have to create customer loyalty to the agency and mainly in the workshop area, so we could give confidence and consequently this will result in more units purchase. This will generate a competitive advantage towards their competitors.

Justify

It's important to integrate ICT in the workshop area, in order to provide a better service which photos of the part that needs to be repaired will be sent to you, with all the necessary information and the cost if the owner authorizes or not the repair.

The new competitiveness, with new brands and guarantee for almost 7 years, were not good for old companies, and they look for a better service on the workshop area to create more confidence with customers. We can use Whatsapp, to remind your appointment, an notification when your car is done, this can use for more personalized attention.

Other is try to train more people with ICT (tablet), train them to use tablets and recording the unit inside and outside to show to customer how it looks their unit.

2. Problem, Hypotheses and Rationale of the Study

In 2013m drastic changes took place in the Automotive Industry in which several automobile brands entered with greater technology, guarantee and proposals for the after-sale, such as service (not only to a number of kilometers) but for years. This affected some Automotive companies in the workshop area, as wall was in the purchase of new units

They came with very aggressive proposals for existing ones. This caused to the agencies to analyze and promote new strategies to continue with their clients and increase their confidence, to maintain them with their loyalty and thus attract more clients.

In which they analyzed the current ones and detected that when the car entering the workshop area they had a traditional method without the use of ICT, and this resulted in some clients abusing the service as (blows in their unit), fuel expense, damage within the unit that for some reason was omitted in the signage in document (traditional) and the client demanded a payment.

This resulted in the same customers passing the word that they didn't have 100% income control and they ware paid the damages.

Research questions.

How can ITC help at the Automotive workshop area to be more competitiveness?

Specific questions

What kind of model we can use to be in touch with the client and they could know about their car process?

Which factors are important for client loyalty to bring us their car?

Which are the reasons customers change to a new brand and new agency?

What is the reason customers come back to the Automotive agency?

General Objectives

Planning new strategies with ITC, together with the olds models to maintain customers loyalty to the brand and with the service.

Specific Objectives

Determinate which factors are importer for customers to keep their loyalty for the service.

Present a new faster, safe and reviewed model.

Base training for ITC

Analyze CRM strategies, if those are successful or fail to give a better service

Hypothesis

1. Better customer communication, more loyalty.
2. Better information and tracing about their car (e-mail, whatsapp), more reliability.
3. Better information about price for their car material, more security to pay.
4. Better post-sell service, more acceptance at the service area.

3. Literature Review

The Automotive Industry in Mexico. 2017 was full of important news for the Automotive Industry in Mexico and the rest of the world, some of them were about the beginning of the production of chine car JAC, release of the first hybrid car of KIA assembler, strikes by unions of workers of ship-owners, recruitment of human capital and renegotiation of North American Free Trade Agreement (NAFTA) that it hasn't ended yet, the cancellation of Ford plant in San Luis Potosi, the suspension of production of Corolla in the plant of Paseo el Grande, Guanajuato, and others.

On the last 5 years Automotive industry in Mexico has record numbers in production and exportation automobiles sells.

Automotive industry has been really important for the world and national economy, it has acted as a promoter of development of other sectors of high added value. Due to this fact, several countries, including Mexico seek to strengthen and develop this sector, this has been the result of events and transformations, from the evolution of globalization to the creation of industrial policies at the national level.

Currently, automotive sector contributes more than 3% of the Gross Domestic Product (GDP) and 18% of Mexico's manufacturing GDP, achieves a trade of more than 52 billion dollars a year, it has a wealth of foreign direct investment of more than 51 thousand 200 million dollars (11%) and it's responsible for about 900 thousand direct jobs.

Automotive industry in Mexico faces new challenges that could potentially changes the structure of the sector in the future. There are at least three trends that will determinate in the coming years: convergence with digital economy changes in the concept of mobility and consumption patterns, and regulatory requirements in the field of safety, environment and energy efficiency.

At 2017, investments by foreign companies in Mexico continued. However, the first days of 2017, Ford Company announced the cancellation of their plants in Villa de Reyes, San Luis Potosi. Even when the plant had more than 20% of construction.

"Although, the cancellation of investments like Ford in Mexico and others that could continue in the immediate future would have a negative impact, a massive and generalized investment cancellation" said by Oscar Silva, a leading in the firms' Global Strategy Group area, in a report published last February 2018.

Those days in Mexico, cars are produced that they are sold around the world, auto parts are successfully integrated into the value chains of the global industry and strengthened as the segment of premium vehicles. In addition, year after year the country

increases their participation in engineering, design and research and development activities.

Currently 80% of Mexico automotive production is exported, to other two members of the North American Free Trade Agreement (NAFTA). Mexico has become the seventh world producer and the fourth largest vehicle exporter in the world

Mexico has been the destination of 9 of 11 assembly plants that have been announced in North America since 2011, that's why the production of lightweight cars could increase to reach nearly 5 million units in 2020.

Until September 2017, AMIA once again reported record production and export figures for assembled automobiles in Mexico. In this accumulated figure, 2 million 829,761 cars were produced, 9.8% above the units manufactured in the country, just like last year.

In the case of exportation, it was sent to other nations 2 million 287 thousand units from Mexico, in the first nine months of the year, it was 11.5% higher than the last year 2016. This said Cluster Industry magazine (2017).

Service

There are so many definitions about service, however we take care about three things: service as a product from the industry, service as a value added, and service as a customer.

From the point of view of the authors Montoya and Boyero (2013), they said that service consists about experiences resulting from the contact between the organization and the client, which is why it's considered the best way to generate an adequate relationship. According to these authors, the satisfaction given through the service, came from company that wants to retain the client, therefore it must understand the importance of this practice.

Aguilar and Vargas (2010) considers that service consists of a process or set of actions that generally surrounds the right moment of purchase, that why those are intangible goods, that are consumed at the time of the production.

Meanwhile, Montoya and Boyero (2013) define customer service as the set of actions that a provider provides to their clients, to achieve service that it receives that means a differentiation with the rest of the organizations that offer similar services. The same is achieved through the improvement of the different aspects involved in the process to satisfy the customer.

Characteristics of customers service

1. Intangibility

According to Zeithaml and Bitner (2002), it represents the most outstanding difference between products and services, since these are not physical tangible, possible to be seen or tasted, and advantage with other tangible products. For that reason, service can't be experience before use.

In the same way, Serna (1999) considers that bases on this characteristic, the evaluation of the service depends on the perception of client and some other subjective elements.

2. Integral

All the member of the organization have to share responsibility in the production of the service, since each one intervenes in the final result that it's delivers to the customer, according to Serna (1999).

3. Heterogeneity

According this aspect, the service is not always provided in the same way, since it depends on the human resource, made up of a group of different individuals to each other, influenced by their own nature, with the changing mood at any time.

Sometimes, customer associates service directly with the employer.

4. Simultaneous production and consumption

To this characteristic, in terms of marketing services, three limitations are observed: first, there is difficulty in generating them in a massive way, Secondly their quality depends on the way it develops in the moment in front of the client, who tends to get involved, in a positive or negative way, this generate in some cases difficult users. Also Serna (1999) said, Service is a process where the supplier is also part of their production and therefore, it can't be separated from it.

5. Perishable

Serna (1999) explains in this sense, the difficulties of greater weight for he marketing of service are first of all, that it's no possible to anticipate a demand, since they cannot be stored, Secondly it's impossible to re-sell or return them, so they must have solid strategies to compensate and recover the client.

6. Basic promise

For the authors, the offer of customer service will be the standard through which it will be measured if it's accordance with their expectations. The organization must assume offer as the "hook" of their service, therefore once the client is motivated to act, this promise must be fulfilled based on their demands.

7. Satisfaction

To a large extent, their satisfaction will depend on the way in which this opportunity is used, as well as the efficiency with which it's produced and offered to the users, Serna (1999).

Added value

Serna (1999) explain that providing customer service integrally adds value, which represent a successful strategy to offer competitive advantages and it will be a differentiating factor in market, where there are large number of competitors.

From the point of view of Zeithaml and Bitner (2002), a tendency prevail in the user services, in terms of involving the attributes or components of the same way they discuss their value, because for them it's important they received based on the payment.

According to Aguilar and Vargas (2010), which are mentioned below:

- You can't be stored or accumulated

You can't see how or what happens with the products.

- You can't previously establish your final quality level.
- The basis of this process is the information.
- They aren't permanent, they are at the time of consumption.
- It depends on the individuals.
- The personnel that produces the service have contact with the users.
- Workers are responsible for the information.

To summarize, Aguilar and Vargas (2010) said that in order to develop the qualities of a good service it must be taken into account that it's not a product but a process, therefore, it can't be standardized either. This also makes control more difficult in an exact manner, making it difficult to control the process.

CRM

Pyne and Frow (2005) value that improves the development of appropriate relationship with key customers and segment customers, it unites the relationship of strategies and (IT) to create relationship with long-term customers and other key customers. CRM provides the use of data and information to understand customers as co-create value with them.

ITC Work area

In the work area, it has made it possible to streamline the automation of information, optimize good results by generating productivity in a company and improving the procedures that achieve the reduction of time in an effective way. It's important to know that ITC guarantees the work to be done and generate great opportunities in a company.

Advantages of ITC

- Guarantee more efficient procedures
- Allows the exchange of information in different areas of work
- Reduction of working time, to be able to perform other work activities.
- Increase the competitive advantage with other companies.
- Increase innovative responses to the challenges of the future.

It's a standard communication tool; it allows equal access to information and knowledge.

The right use of ITC allows companies to produce more quantity faster, better quality and less time and help to competitiveness. Ticxlabiralc. (20017).

Deming Prize model

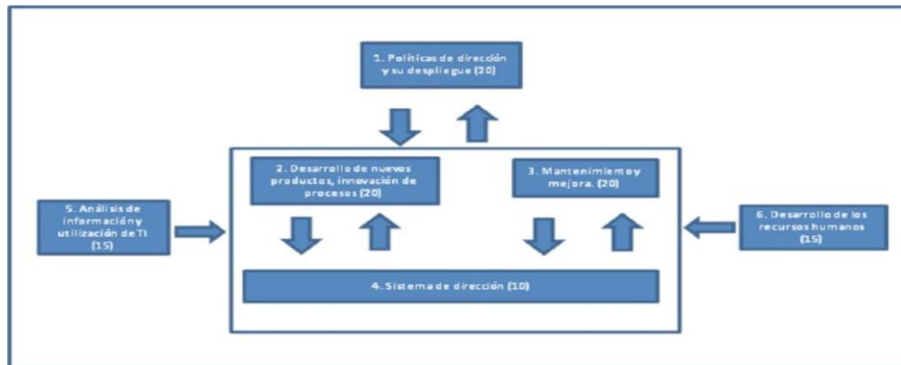
This model has been presented in Japan since 1951; it was created with becoming tool to improve the companies in that country.

This model is to promote control of quality and opportunities for excellence.

This model in 2004 had the following criteria:

- a) Management policies and their deployment in relation to the management of quality.
- b) Development of new products and/or process innovation
- c) Maintenance and improvement of operational and product quality

- d) Establishment of systems to manage quality, quantity, delivery, costs and safety and environment.
- e) Development of human resources-



The Deming Prize Guide 2004

IberoAmericano excelente management Model

This Iberoamericano excelente management model was pushed by FUNDIBEQ (Iberoamericano foundation for quality management)



FUNDIBEQ

This modal has important points like:

- I. Leadership and management style
- II. Policies and strategies
- III. Development of people
- IV. Resources and associates
- V. Customers

Criteria results with clients, development with people for a global result.

4. Analysis of Results

Methodology

Initially consists of a documentary research, supported by a field investigation with questionnaire, interviews, surveys and observation. It recommended to apply it later to the documentary to prevent duplication of information (Osirio, 2009)

A mixed research, qualitative and quantitative, on this research they survey data was analyzed as in the SPSS program to perform the crossing of variables.

The measuring instrument was divided into 6 sections.

Section	Items	Concept to size
A	6	General data
B	6	Reasons to go to the agency
C	6	Experience at the service area
D	6	Direct contact with the customer using ICT

Note: Measuring instrument. Own elaboration.

We used Likert scale with five options which they were list to 1 to 5, 1 is lower value and 5 higher value.

Hypothesis 1 Bigger communication with the customer, more loyalty

Reason to go to the agency (service area)

ANOVAS	SIG.
Security	.004
Prestige	.000
Feedback	.000
Team work	.002
Competitive	.000
Quality	.000

Hypothesis 2. Better information about prices for their unit, more security to authorize. All variables were 0. Hypothesis accepted.

Contact with the agency service.

ANOVAS	SIG
Attention	.000
Confident	.000
Communication	.000
Knowledge	.000
CRM with the client	.000

Hypothesis 3 and 4 Better tracing and information with ITC, better confidence Contacts with the customer with ITC

ANOVAS	SIG.
Attention	.002
Technology use	.000
Whatsapp	.000
E-mail	.000
CRM with ITC	.000
Discount with ITC	.004

Statistical reliability

Alfa de Cronbach	No. items
.832	30

Nota: Alfa de Cronbach.

5 Conclusions

With all the transformation that we have with the comercial agreemeent and the behavior of global world, Automative field is competitive. It has been accpeted the use of ITC, which clients show more interest to their units. We noted that the result of post-sell were better.

The use of e-mail, whatsapp, photos from the begging, journey and end, it give more security and confident that the pieces are news, and this depends of the service that it's done.

One of the biggest advantage are that ITC send e-mail with photos, that was a big proposal, with the whatsapp reminder it continue with CRM

With the use of e-mail, we add comments with the photos.

6 Proposal for future research

Automative cluster is reserve in Mexico and only allow some agency to do this kind of research.

One of the biggest problems were the lack of hydrocarbons (gasoline in Mexico) affected in the sell, car manufacturing.

This gave the opportunity to the hybrids cars, which we don't know many things about them.

It has lack of catering to carring hybrids cars and Mexico is just beginning with the proposal to change and this change it will be for sell area.

We are waiting that in Mexico, they can have a better regulation and it doesn't affected produccion and economy of the country

References

- Aguilar y Vargas (2010) Aguilar, Jorge y Vargas, Jaime (2010). Servicio al cliente. Asociación Oaxaqueña de Psicología A.C. México.
- Bassa, C., L., (2011) “Modelos para el análisis de atributos contemplados por los clientes una estrategia de Marketing Relacional” Barcelona España.
- Catelles, M. (1997) , La era de la información, económica, sociedad y cultura. Vol 1, la sociedad en la red. Madrid: alianza D.L.
- Clúster Industrial (2017) Revista: ENLAZANDO NEGOCIOS. 25 de diciembre del 2017.
<https://clusterindustrial.com.mx/post/3150/desarrollo-de-la-industria-automotriz-en-mexico-2017>
- Del Cid, A. Méndez, R. Sandoval, F. (2011). Investigación. Fundamentos y metodología. (2a. ed.). México: Pearson educación
- FUNDIBEQ (2003a) Fundacion Iberoamericana para la Gestion de la Calidad –FUNDIBEQ. Presentacion. Fundacion iberoamericana para la gestion de la calidad.
- FUNDIBEQ (2003b) Bases Premio Iberoamericano de Excelencia de la Gestión. Fundacion Iberoamericana para la Gestión de la Calidad.
- JUSE (2004^a), Walt is the Deming Prize? Union of Japanese Scientists and Engineers, Tokio. Documento disponible en www.juse.or.jp.
- Montoya y Boyero (2013) Montoya, César y Boyero , Martín (2013). El CRM como herramienta para el servicio al cliente en la organización. Revista Científica “Visión de futuro”. Volumen 17, número 1. Argentina. (Pp. 130-151).
- Osorio AL, et al. (2009) *The histone deacetylase Rpd3p is required for transient changes in genomic expression in response to stress*. Genome Biol 10(5):R57
- Serna, Humberto (1999). *Gerencia estratégica . Planeación y gestión* (Cuarta Edición). 3R Ediciones. Colombia.
- Shutterstock.(2016) El impacto de las TIC en la productividad Laboral. UNI^ERSIA España (17 de Noviembre 2016).
- Ticslaboralc.(2017) <https://ticslaboralc.wordpress.com> 14-Septiembre del 2017
- Zeithaml y Bitner (2002), Zeithaml, Valerie y Bitner, Mary Jo (2002).Marketing de servicios. (Segunda Edición). Editorial McGraw–Hill. México.

Dynamics of Value in Technology Inspired Value Co-Creation: Case in Homecare Value Network

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Abstract

This paper addresses the value co-creation in homecare value networks. The paper aims to answer the following research questions: What are the fundamental elements of value from different parties' perspective? What types of practices support value co-creation among the network? What kind of outcomes can the value co-creation (inspired by the new technology) have on the network?

The paper takes advantage of a longitudinal interventionist case (2016-2019) investigating the technology implementation process in a homecare organization. The data is supported by seven other similar implementation projects concerning the same technology.

Uniquely, the article provides empirical evidence on the antecedents, roles and outcomes of the value co-creation in the homecare value networks. An in-depth access to the value network enabled capturing value elements that emerged due to the value co-creation in the customer selection, customer recruitment and service implementation phases. The article also provides examples of different types of value co-creation dynamics.

The article develops understanding of value co-creation dynamics in home care, helping homecare managers map and measure the outcome of value creation practices. The article also gives insights for managers wanting to co-create value in complex value networks.

Keywords – Value dynamics, value-in-use, value co-creation, value network, home care

Paper type – Academic Research Paper

1 Introduction

Well-being is co-created by many different parties involved in the healthcare value networks. Homecare represents an example where customers (patients), nurses,

municipalities, healthcare technology providers and many others work together in order to ensure the desired value for the customer and the society. This paper addresses the value co-creation in such a setting, with a focus on the dynamics of value creation from different parties' perspectives.

The point of departure for the paper is the value network approach (Lusch et al., 2010) that provides a basis for understanding value co-creation involving several parties. However, as a theoretical tension motivating the paper, prior research shows that whilst a value network approach is useful for studying the governance of value creation in networked operations, research does not adequately cover the responsibilities and roles of customers or value co-creation in such networks (e.g. Grönroos, 2011). In response, in-depth case examinations are desirable for unveiling the value co-creation dynamics to enable anticipating and managing such dynamics within the value networks.

In the health care context, there is the interface between the public and private sectors. Besides, both the society and individual patients can be seen as the customers of the health care processes, which increase the complexity of the research setting also regarding the value co-creation (Frow et al., 2016). Although collaboration or "co-creation" between public and private organizations can spark innovation and development (Hartley et al., 2013), there is not enough knowledge under which circumstances public-private collaboration is a usable source of innovation (Hartley et al., 2013). Unveiling the dynamics of value co-creation could help in identifying and enhancing these innovation processes as well.

To unveil the value creation especially in homecare, this paper investigates the dynamics of value creation and co-creation in value networks when a healthcare technology enables a shift towards more self-service in the value creation process of the customer. This type of change can usually occur when automation technology is introduced to the value creating process. However, it is not self-evident, how the value creation actually would change after the technology introduction, and how different parties involved in the value network would contribute to the value co-creation. Indeed, the role of some parties might change much more than the role of some others.

Altogether, the paper aims to answer the following three research questions.

1. What are the fundamental elements of value from different parties' perspective?
2. What types of practices support value co-creation among the network?
3. What kind of outcomes can the value co-creation (inspired by the new technology) have on the network?

These research questions are examined within the processes of homecare network including a technology provider inspiring change. The paper takes advantages of an interventionist cases study in homecare value networks (2016-2019), enabling an in-depth access to examine the dynamics of value creation. The empirical data of the paper consists of several meetings and discussions conducted in a longitudinal interventionist case study. The next section sets the theoretical base, on which we aim to contribute with this paper. We then present the research methodology employed to collect the empirical data of the paper. The fourth section will present the empirical case in more detail, with a

focus on different phases of value co-creation within the homecare context. Finally, empirical findings and their implications are discussed.

2 Literature on value co-creation in value networks

Addressing the dynamics of value co-creation requires understanding the value creation in general. Such approach is suggested by the service literature that places an emphasis on a thorough understanding on the elements of value and value creation in the processes (Grönroos 2008; 2011, Lusch et al., 2010; Laine et al. 2012). While value is created through the activities undertaken by the parties involved, it is not enough to embed value potentials to the characteristics of the goods and services, if they are not actually utilized in the value creation processes. Thus, we draw on the service logic where value is considered to be mainly created by customers as value-in-use (Grönroos, 2008; 2011).

According to the service logic, resources such as goods only have value potential (Grönroos, 2008). This potential, or value foundation, is utilized by the customer and transformed into value-in-use (Grönroos, 2008; 2011), which also means that often the role of supplier is to help the customers create value by providing the necessary resources or skills to do that. This distinction on who creates and who co-creates value is an important difference between the service dominant logic by Lusch and Vargo (2010; 2014) and the service logic discussed by Grönroos (2008; 2011), which we want to point out, since our paper takes the service logic approach to analysing value creation.

However, value creation and value co-creation are seldom occur with one party creating value and the other co-creating value. More often, value is created and co-created in a value network (Lusch et al., 2010). Lusch et al. (2010) see value networks as responsive and temporal structures, where different actors interact to co-create value. Our interpretation in the service logic context (Grönroos, 2008) looks at the network of stakeholder that have the temporal possibility or responsibility through interaction to help the customers create value-in-use. Due to the complexity of value especially within value networks, we also distinguish that customer value can be separated to individual value elements (e.g. Anderson et al., 2009) to better understand the dynamics in the creation of each value element

Some literature, such as Frow et al. (2016) define co-creation practices as collaborative integration of resources with the ideal outcome of having a positive impact on the ecosystem. However, we make the distinction of looking into practices, individual or collaborative that support value co-creation. Hence, these practices include but are not tied to co-creation practices only, since our focus is on both how value-in-use is created and co-created (Grönroos, 2008). The dynamic nature also suggests that value creation has temporal (Woodall, 2003; Lusch & Vargo, 2010; 2014; Grönroos, 2008; 2011), which is why we investigate the temporality of value from three dynamic temporal positions: designing, realizing and measuring value.

3 Research Methodology and Case Context

3.1. Research Methodology

We investigate the topic through a longitudinal interventionist case study (2016-2019) (Lyly-Yrjänäinen et al., 2017; Jönsson & Lukka, 2007), conducted in the homecare context. Within the interventionist approach, we utilize active participant observation as the main qualitative research method (Jönsson & Lukka, 2007; Gummesson, 2000). The topic is researched within homecare context, investigating the dynamics of customer value within the stakeholder networks involved in technology implementation pilots. Homecare context can be considered unique due to the complexity of the stakeholder network (Frow et al., 2016), and the notion of health as value (e.g. Porter, 2010). The empirical data can also be described in more detail, since the studied organizations are public organizations. As a case, the home care has some characteristics of an extreme case, providing an example of how complex can value dynamics become (Flyvbjerg, 2006), at least when examined with a uniquely in-depth, longitudinal approach.

The researchers and the homecare technology provider (from now on called TechCo) collaborate in a publicly funded research project. In the researchers study the drivers of customer value in home care in Finland. As part of the project, the researchers were invited to study the effectiveness of the service in eight different homecare organizations. Due to scarce analytics resources of municipalities, the researchers were openly invited to the field. As part of the intervention, the researchers supported the customer selection phase, by sharing findings from previous cases. They also provided analytics for the performance review by documenting the before-and-after impact and evaluating the cost effect of the robots. Figure 1 presents an overview of the steps of the interventionist case study and the longitudinal case with one of the homecare organizations (from now on called HCare), which is described as the empirical case. Regarding the case of HCare, the empirical data consisted of

- 8 meetings
- Around 100 emails, phone calls and skype calls
- 2 customer recruitment events
- 1 event for delivering the robots to customers
- 1 seminar for local municipalities

The analysis is supported by empirical data from more than 70 meetings with TechCo and its customers and over thousand emails and phone calls concerning TechCo exchanged.

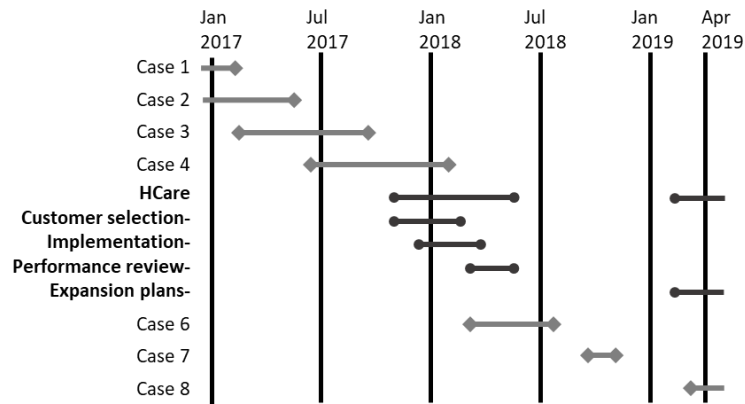


Fig. 1. Timeline of the interventionist research conducted in the project.

3.2. The description of the studied technology and the homecare network

TechCo provides automated medicine-dispensing robots to homecare organizations. The robots are placed at the end customer's (i.e. patient's) home where using voice notifications they instruct the customer in taking the medicine. The robot automates most of the dose dispensing activity at the patient's home, requiring only to be filled every second week. The robot also alerts the homecare personnel, if the end customer does not take the medicine, providing additional security for the end customers. The service evolves around caregivers interacting with the customer, but the network is more complex with stakeholders such as doctors, pharmacies, relatives, other customers, suppliers and other social and health care providers. The network becomes even more complex when technology by TechCo is introduced, as illustrated in Figure 2. Hence, it becomes difficult to identify who actually creates value, how, and to whom.

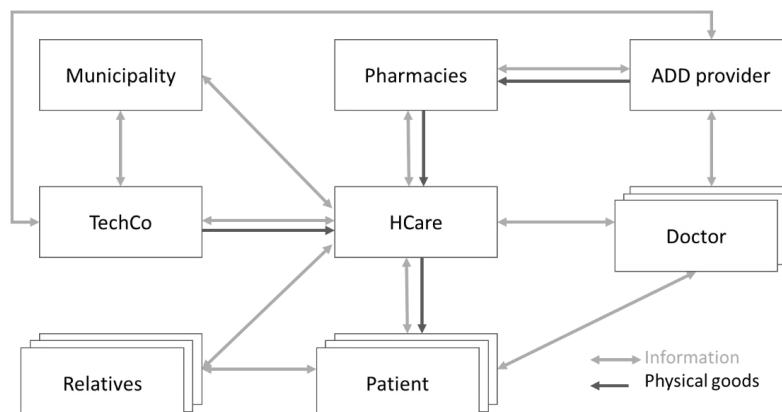


Fig. 2. The main stakeholders in the value network.

In the stakeholder network we can make a distinction between supplier level (TechCo, Pharmacies, automatic dose dispensing (ADD) -provider), service provider level (Municipality, Home care and Doctor) and customer level (Patients, Relatives and even

society). All stakeholders have their own tasks, goals and perspective on value. Table 2 shows the perspectives on the automation of medication from stakeholders that are directly involved in implementing and operating the robots.

Table 2. Stakeholders' value elements in the automation of homecare medication.

Stakeholder	Value elements in automating medication with a customer
Customer	Health outcomes, independency, social interaction and security.
Homecare organization (HCare)	Health outcomes of customers, flexibility, ability to serve customers better and reduction in workload and in work related stress.
TechCo	Growth, enabling creation of value, information, reference cases
Municipality (management)	Well-being of citizens and employees, cost-efficiency, municipality ranking

The other stakeholders naturally have their own perspectives as well, but it seemed that their role was more about approving or enabling the implementation of the robot. Additionally, the health improvement of the customer has several indirect effects that are hard to identify, but which can affect all the members in the value network. While TechCo had identified a specific demand for the robot, there was still some uncertainty in who would be the suitable end customers. To be able to use the robot, the end customer had to be open towards medication, be suitable for ADD medication and have sufficient ability to function independently. In addition, the robots had to enable creation of value by providing clear benefits for the customer and/or the homecare organization. After all, the homecare organization, the municipality and ultimately the society are expected to gain benefits from more purposeful care for end customers.

4 The Empirical Case

4.1. Presenting the technology – identification of value elements

HCare is a public organization operating in a Finnish municipality with around 20 000 residents. HCare falls under the jurisdiction of the municipality's 'services for elderly and the disabled' and they are responsible for arranging both homecare and home healthcare services in the municipality. HCare arranges around 300 homecare visits daily, with visits per customer varying up to seven visits per day. The municipality started the pilot in late 2017 and we were invited to study the pilot right from the start. Based on our experience in the previous pilots, we wanted to get understand the customer selection phase better, since it seemed to have a significant impact on the performance of the pilot. Before the customer selection, we presented discussed what kind of cooperation we could do during the pilot project. As part of the presentation, we discussed our findings and showed the performance documentation we had provided for the other municipalities. In another meeting, the representative of the TechCo presented the machine and caregivers had the possibility to try out the machine. During the event, there seemed to be certain level of

surmise towards the robot amongst the caregivers. However, the possibility to see the functionality from the perspective of the customer seemed to arouse some interest.

4.2. The customer selection – value co-creation for value realization

The customer selection -meeting was arranged two weeks after, with the objective of shortlisting customers, to whom the caregivers could start “selling” the robots. During the meeting, we discussed the ways how caregivers could create value or help create value with the customers. The emphasis of the discussion was on what types of activities help create value during the visits.

“It is the benefit of the customer, if we can sit [and talk] peacefully. Like we have flexibility on both sides and then the visits are more balanced. We can understand the memory issues and other things if there would be more discussion [with the customer].” – Caregiver, HCare

The caregivers were still uncertain about who should they deliver the robots to. We also requested to present our findings from previous cases as well as the logic of the payback period. The caregivers quite quickly identified the logic and started discussing their customers one by one with a following process: one of the caregivers brings forth the name of the customer and then the caregivers discuss about possible benefits, visit reduction potential, challenges and if the customer might be interested in using the robot. After the discussion, we asked the caregivers if we should shortlist that customer as a possible user for the robot and how many visits they estimate that could be reduced.

While most of the discussion happened in consensus, there were some points where they felt more insecure. There was also some discussion on what should be the objective of the customer selection and why they should select particular customers.

“Let us think about it the other way around so that if the customer is worried about getting his medicine, then the robot would improve his quality of life. He can feel more in control, if he can independently take care of his medication.” –Caregiver, HCare

While trying to identify potential end customers, the caregivers identified several barriers with some of the customers. Some of these related to the bundle of services that the particular customer had as illustrated by a comment by one of the caregivers.

“The night shift caregiver is required to help with support hoses and other small help. [...] The robot could make the dosing more secure, but there might not be other direct benefits.” –Caregiver, HCare

However, in most cases, the caregivers seemed to agree on particular customers and the ten-customer shortlist could be developed during the two-hour meeting. On one hand, they went quite far in making sure that the customers would be appropriate for using the robot. On the other hand, they wanted to remain flexible towards trial and error, as described by one of the caregivers during discussions about the customers’ openness towards the robot.

“We cannot know that [if the customer accepts the robot], but in that case we carry it [the robot] away from there.”

We also tried to develop an initial budget for the customer selection based on the discussion as well as the visit reduction estimations that could be used for reference later during the performance evaluation. An overview of the budget can be found on the left side in Fig 3. We also reported the initial budget to both HCare and TechCo, for further use.

Budget				Actual			
Customer selection		Implementation		Performance review		Expansion phase	
Customer	Change	Customer	Change	Customer	Change	Customer	Change
C01	-60	C11	-28	C21	-26,2	C31	-36,4
C02	-30	C12	-22	C13	-21,2	C21	-23,3
C03	-30	C13	-18	C22	-16,1	C13	-22,1
C04	-26	C14	-4	C14	-5,8	C14	-5,6
C05	-22	C15	-4	C23	-5,6	C23	-4,5
C06	-20	C07	-2	C08	-4,1	C32	-3,2
C07	-2	C08	0	C16	-3,6	C16	-3,2
C08	0	C10	0	C07	-2,1	C07	-1,9
C09	0	C09	0	C09	-2,1	C15	11,7
C10	?	C16	0	C15	-1,1	C09	17,4
						C08	21,8
						C33	34,0

Fig 3. The evolution of customer selection and the change in monthly homecare visits throughout the case.

Before the customer “recruitment”, a session with the top management of the municipality and TechCo was arranged, where the provided customer value from the perspective of health to the customers, cost savings for the municipality as well as well-being for the caregivers were discussed without the representatives of HCare. There, the management wanted to know more about the benefits or possibilities enabled by the robot, but during the discussion, they also started identifying new areas of impact that had not been brought up before, such as the high level of caregiver sick leaves that might ease out if the workload can be decreased.

4.3. Customer recruitment – enabling value-in-use

The next important phase in the implementation was customer “recruitment”, where the caregivers try to convince the customers to try out the robot. The recruitment was started just a few days after the customer selection and was conducted during scheduled homecare visits. One of the authors participated in the recruitment visits of customers C03, C07, C10, C14 and C16. During the recruitment, the caregivers presented the idea of the robot to the customers, emphasizing how it would make their life easier. They focused on the concerns that the customers might have and emphasized that you have to know your customer when “selling” something.

“For example, if you mention to him that his daughters think something then he will agree. These kinds of little things are important when you have to sell something.” – Caregiver, HCare

The caregivers also emphasized openness towards the service by encouraging customers to try the service and that it can be cancelled at any time if they wish so. Some of the customers did not seem to have a clear opinion on the robot, but were open towards trying the new way of service that the caregivers were proposing, as illustrated by the comment by another homecare customer.

“I guess I’ll have to learn to live with the mister robot then.” – Homecare customer C07

Two weeks after the recruitment, they started delivering the robots to the customers. During the deliveries, the researcher participated in the delivery for customers C03, C07 and C10. However, the robot of C03 was removed after the first day, because the customer had disconnected the robot from the power socket. During the delivery, some of the customers seemed to be a bit surprised by both the size of the robot or by the situation. However, the caregivers ensured the customers that they would not have worry since they would be there to assist with taking the medicine as long as the customers want. At this point, the budget was also updated based on the current shortlist of customers with some customers already using the robot. The changes are illustrated in Figure 3.

4.4. Performance review and 1-year after

The municipality, the homecare organization and TechCo had agreed on a six-month pilot. Already in March 2018, the homecare organization wanted to start evaluating the achieved performance. To do that they asked the researchers to analyse the impact of the robots on a more operative level by utilizing ‘enterprise resource planning’ (ERP) – information. The ERP-information from all homecare visits between August 2017 and March 2018 was gathered, which gave the possibility to inspect three months before and after. This information was analysed using spreadsheet computation to investigate the impact with customers using the robot and on the homecare organization level, and used to construct the report in Figure 4.

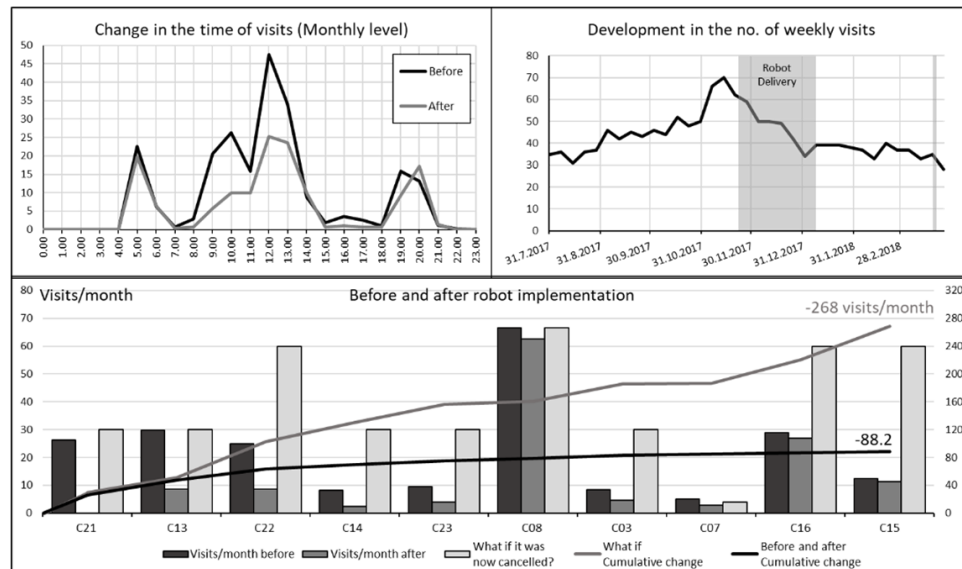


Fig 4. An overview of the performance evaluation documentation with HCare.

The documentation focused on before-and-after analysis based on the ERP-data. Based on the learnings from previous cases, we also sent a query to the homecare organization, asking the caregivers the question: how many homecare visits would be required to provide the equivalent level of care if the robot was now taken away? The role of this question was to identify changes that are not visible as operational changes, such as the possibility to keep the number of homecare visits from increasing. Due to practical reasons, the caregivers independently gathered and reported a list that was added as part of the report and discussed during the performance review discussions.

“We need something that we can use. [...] We need a good report that we can use to show that we should keep them [The robots]. We need to be able to show cost savings.” – Director of elderly care, The municipality

When asked about what kind of specific benefits there had been, they commented on the security and flexibility it brings for the caregivers. Since the robot alarms the caregiver if the customer does not take the medicine, they know more about the situation of the customers even if they cannot visit them. One of the homecare managers commented that the robot is the safe way to manage the medicine dosages.

“They said that it [ADD] would make the medicine dosing safe, but now with the robot it is actually safe.” –Homecare manager, HCare

There was also some discussion on the customer selection, since many of the originally planned customers were not included in the final customer base. While the results were positive, they were hoping for a larger operational change, measured mostly through changes in monthly homecare visits. The caregivers said that they cannot remember the specific reasons but during implementation, they ran into barriers that they

had not identified and for which they could not implement the robot with the particular customers. In these cases, they felt pressure to find someone suitable for the service and they felt more confident in choosing customers who can already operate independently. Once the customers started using the robots, it was difficult to change the customer since almost all customers learned to like the robots. One of the caregivers commented the process as an important learning objective.

“It is funny how now that the pilot is over, we know better what should be done.” – Caregiver, HCare

Hence, during the discussion they seemed to identify the role of customer selection in defining the amount of customer value that can be created using the robot. They thought about new customers with whom they could gain significant operational benefits, but at the same time, they had several other pressing matters to attend to. After the performance review, the homecare management decided to continue with the ten machines that they had, but wanted to delay the discussions on machine expansion, until they had clearer plans of developing their operations.

At the beginning of 2019, the homecare organization contacted us researchers, since they wanted to get an update on their current situation. They had been negotiating an expansion with TechCo, but wanted to still know more about their current performance and how to get the most out of the expansion. The director of elderly care emphasized the role of cost savings similarly as during the performance review half a year ago.

“If we want to expand the amount of robots, we need to be able to show that our current robots have saved costs.” –Director of elderly care, HCare

Between the previous and current discussions, the organization had also increased their installed machine base by two new robots. One of their customers had been transferred to institutionalized care, which meant they had recruited three new customers after the pilot, as seen in Figure 3. At this point, they wanted to understand the different cost effects better than before and make sure that they identify the best possible customers for the new robots. Hence, the plan was set out for spring 2019 for the new customer selection.

5 Discussion and conclusions

The empirical case represents a unique example of health care value network, with complex, dynamic value co-creation, which is as such a contribution. This contribution can be taken further by reflecting on the three research questions of the paper. First, the value creation represents different things for different parties involved in the process. While the health outcome for the customer could be seen as one of the driving value elements, other stakeholders still had their own motivations, such as the cost efficiency perspective of the municipality. This identification of value elements makes it easier to understand the value creation in total (Anderson et al., 2009), and provides a basis for understanding value co-creation practices.

However, through careful analyses and discussions, different types of value co-creation may be enabled during the implementation. As a contribution, distinction was made between customer selection to customer recruitment and performance evaluation to possible expansion plans. The role of different stakeholders varies, but the co-operation seems to have the capability of benefitting participating parties. The customer selection evolved significantly during the pilot, emphasizing the temporariness of customer value (Woodall, 2003). However, as mentioned by the homecare manager during performance evaluation, there is always some learning curve in when a new technology is adopted. Hence, the supplier can only facilitate or co-create value, but the homecare organization and the customers are still responsible for value creation (Grönroos, 2008; 2011).

Different co-creation practices occurred throughout the case. While the outcome of the pilot was favourable for the technology supplier, it is most likely that the outcomes would have evolved differently if the co-creation practices had been different. While both TechCo and the researchers supported the customer selection phase, only 40 % of the selected customers ended up even trying the robot. Thus, some level of co-creation occurs through interaction, but it is difficult to define or measure what were the outcomes of value co-creation. As a contribution, it seemed that documenting the created value with any meaningful metric can inspire discussion around value creation practices and pursued outcomes. Ironically, the measuring of outcomes and the related discussion can again also act as a significant value co-creating practice as illustrated by the discussions on expansion.

Furthermore, the case seems to support the value co-creation discussion of Grönroos (2008; 2011). For example, labelling all the rich interactions during the different steps as value co-creation takes the focus away from value creating practices. It is easy to call something value co-creation when the nature of how value is actually co-created becomes fuzzy. This can undermine the type of value co-creation in question and make the concept lose its substance (Grönroos, 2011).

Finally, our research is limited in generalization due to the rich but extreme case (Flyvbjerg, 2006). Our research also expresses the complexity of customer value dynamics, but lack in providing a general framework for them. Nevertheless, this paper can help managers facing challenges concerning technology diffusion to identify ways to co-create value. It also provides homecare professionals insight to mapping value-creating practices and measuring outcomes. We also propose that future research investigates and categorizes the types of co-creation through the analysis of empirical data. Indeed, there are more levels to value co-creation than the current literature understands and to understand the dynamics of value networks, these levels need to be identified and understood.

References

- Anderson, J. C., Narus, J. A., & Narayandas, D. (2009). *Business market management: understanding, creating and delivering value*, Pearson Education Limited, 3rd Ed, 470 p.
- Flyvbjerg, B. (2006) Five Misunderstandings About Case-Study Research, *Qualitative Inquiry*, Vol. 12, No. 2, pp. 219-245.

- Grönroos, C. (2008) Service logic revisited: who creates value? And who co-creates? *European Business Review*, Vol 20, No 4, pp. 298-314.
- Grönroos, C. (2011) Value co-creation in service logic: A critical analysis, *Marketing Theory*, Vol. 11, No. 3, pp. 279-301.
- Gummesson, E. (2000) *Qualitative methods in management research*, Sage, Thousand Oaks (CA), 2nd Ed., 250p.
- Hartley, J., Sørensen, E., & Torfing, J. (2013) Collaborative innovation: A viable alternative to market competition and organizational entrepreneurship. *Public Administration Review*, Vol. 73, No. 6, pp. 821-830.
- Jönsson, S., & Lukka, K. (2007) There and back again: doing interventionist research in management accounting in: Chapman, C., Hopwood, A., & Shields, M. (Eds.), *Handbook of management accounting research*, Vol. 1, Elsevier, Amsterdam, pp. 373-397.
- Laine, T., Paranko, J., & Suomala P. (2012) Using a business game concept to enhance servitization: a longitudinal case study, *Managing Service Quality*, Vol. 22, No. 5, pp. 428-446.
- Lusch, R. F., Vargo, S. L., & Tanniru, M. (2010) Service, value networks and learning, *Journal of the academy of marketing science*, Vol. 38, No. 1, pp. 19-31.
- Lusch, R. F., & Vargo, S. L. (2014). *Service-dominant logic: premises, perspectives, possibilities*, Cambridge: Cambridge University Press, 225 p.
- Lyly-Yrjänäinen, J., Suomala, P., Laine T. and Mitchell, F. (2017) *Interventionist Management Accounting Research: theory contributions with societal impact*, Routledge Studies in Accounting, New York, 192 p.
- Porter, M. E. (2010). What is value in health care, *New England Journal of Medicine*, Vol. 363, pp. 2477-2481.
- Woodall, T. (2003) Conceptualising 'Value for the Customer': An Attributional, Structural and Dispositional Analysis. *Academy of Marketing Science Review*, Vol. 2003, pp. 1-26.

Investigating Creativity and Knowledge Flows through Patent Citations Networks

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Abstract

This study aims at analyzing patented innovations for blockchain applications as well as to mine cross-country creativity and knowledge flows underlying the corresponding technological trajectories. In particular, this paper aims at answering the following research questions by analyzing patent citation networks: (a) how cross-country creative/learning flows can be methodologically investigated with new algorithmic approaches; (b) whether countries of current patent owners have benefited from creative and/or knowledge flows related to patent acquisitions from abroad; (c) whether there are any country clusters with relevant country-country patenting interactions; (d) whether those clusters include or differ from the most relevant countries on the technology development of blockchain patented applications. 50,046,982 granted patents were considered initially, thus, refining the dataset based on the following constraints: (a) granting date within 2008-2018 – after Nakamoto's (2008) paper on blockchain; (b) at least one cited patent in order to ensure the analysis of patent acquisition effects without any methodological bias; (c) title/abstract including "blockchain" or related keywords; (d) further qualitative refinement by reading the main information on patents to ensure that they pertain to blockchain applications. Records with incomplete data have been eliminated after a qualitative check - including the comparison between International Patent Classification (IPC) and the Cooperative Patent Classification (CPC) codes and labels. Despite the strong multi-faceted interest - e.g. economic, business, security, societal - towards blockchain and its applications, specific studies on their technological trajectories, creative cross-country effect and knowledge transfer dynamics are still unexplored (also under the methodological perspective). Hence, this gives room studies on patent citation networks to be improved and contextualized. Findings provides an in-depth understanding of cross-country creativity and knowledge flows and the corresponding effects in terms of learning from the patent vendee's side. Findings prove to what extent the acquisition of patents from inventors' in other countries may help generating subsequent citations and affecting the technological evolution of those industries. Study relevance and implications can be summarized as follows: (a) policy-makers are provided with supporting data and guidelines to set ad hoc measures for blockchain applications in those industries deemed relevant to national interest - e.g. by nurturing the acquisition or birth of industry-strategic innovations; (b) managers of patenting firms are interested in monitoring, acquiring or anticipating possible advancements - i.e. in terms of creative concepts as well as generated knowledge and

technology -, identifying in advance potential technological innovations and recognizing evolutionary pathways in the technological scenario.

Keywords – Patent Citation Networks; Creativity; Knowledge; Innovation; Technology management

Paper type – Academic Research Paper

1 Introduction

Studies on patent citations have been extensively conducted, so far, in order to analyze both networks of patenting inventors and technological trajectories associated with the scope and intensity of knowledge and technology diffusion (Griliches, 1990; Trajtenberg, 1990; OECD, 1994; Harhoff, Narin, Scherer, and Vopel, 1999; Lanjouw and Schankerman, 2004; Breschi, Lissoni and Montobbio, 2005; Hall, Jaffe and Trajtenberg, 2005). Nonetheless, some limitations still apply with regard to the widespread literature on patent citation studies (Giglio, Musmanno and Palmieri, 2018).

First, to the best of author's knowledge, most of the studies on the flows underlying knowledge and technology diffusion did not move on to consider the peculiarity of diffusion properties (Bacchiocchi and Montobbio, 2010), like the technological field and the procedures of patent offices (also known as patent office bias) (Caballero and Jaffe, 1993; Jaffe, Trajtenberg and Henderson, 1993; Jaffe and Trajtenberg, 1999; Jaffe and Trajtenberg, 1999; Hall, Jaffe and Trajtenberg, 2001; Maruseth and Verspagen, 2002; Bottazzi and Peri, 2003; Peri, 2005; Criscuolo and Verspagen, 2008; Breschi and Lissoni, 2009; Bacchiocchi and Montobbio, 2010).

Second, extant patent citation studies dealt with a geographical perspective, identifying a predominant inclination of patent inventors towards self-citations and same-country citations, and against more relevant cross-country citations of technologically closer patents (Jaffe, Trajtenberg and Henderson, 1993; Jaffe and Trajtenberg, 1999; Maruseth and Verspagen, 2002; Bottazzi and Peri, 2003; Peri, 2005; Criscuolo and Verspagen, 2008; Breschi and Lissoni, 2009; Bacchiocchi and Montobbio, 2010).

This work is structured as follows: after the introduction, the second section provides a literature review about the analysis of cross-country creativity and knowledge flows in patent citation networks - including possible industry-specific studies, if relevant -, as well as the motivation of the paper; in the third section, the data collection and the overall methodological approach are described; the fourth section includes some discussions about results; in the last section, conclusive remarks are presented.

2 Literature review and motivation

2.1 Patent citation studies

Both a macroeconomic and microeconomic views emerge from the analysis of extant contributions on cross-country knowledge flows in literature (Griliches, 1990; Bacchiocchi and Montobbio, 2010), whilst only one work has recently tackled the analysis of “patented creativity” flows (Giglio, Musmanno and Palmieri, 2018).

The macroeconomic perspective on knowledge flows between different countries focuses on a comprehensive set of variables such as nature, type, scope and intensity of knowledge diffusion (OECD, 1997; Hu and Jaffe, 2003; Maruseth and Verspagen, 2002; Hu and Jaffe, 2003; Malerba and Montobbio, 2003; Malerba, Mancusi and Montobbio, 2007; Park, Lee and Park, 2009; Shih and Chang, 2009; Chen and Guan, 2016) as well as joint industry collaborations, social interactions, public-private co-operations (Gomes-Casseres, Hagedoorn and Jaffe, 2006; Shin and Park, 2007; Hong, 2008; Guan and Chen, 2009; Nakajima, Tamura and Hanaki, 2010; Inoue, Souma and Tamada, 2010; Chen and Guan, 2016; Stople, 2002; Fleming, King and Juda, 2007; Mina, Ramlogan, Tampubolon and Metcalfe, 2007; Verspagen, 2007; Chen and Guan, 2010; David, Fernando and Itziar, 2011; Bekkers and Martinelli, 2012).

Under the microeconomic perspective, the leadership on a technological trajectory of a minority group of countries may influence the economic value of patents, the realization of the technology potential and, finally, firms’ competitiveness within the pertaining industry (Griliches, 1990; Jaffe and Trajtenberg, 1999; Belderbos, 2001; Frietsch and Grupp, 2006; Storto, 2006; Verspagen, 2007; Deng, 2008; Ma, Lee and Chen, 2009; Chen and Guan, 2016).

Finally, macroeconomic and microeconomic perspectives, which have been adopted separately in the reviewed literature contributions, are worth being dealt with concurrently in order to derive from them some mutually reinforcing measures set by policy-makers and company managers.

2.2 Case study-related literature

As regards the case study-related literature, scientific works focusing on patent analyses (including, but not limited to patent citation studies) have not been conducted on blockchain (BC) technology. This further reinforces the motivation for a real-world application of this study as well as for comparing the findings on BC with similar studies on other technological fields (Caballero and Jaffe, 1993; Jaffe, Trajtenberg and Henderson, 1993; Jaffe and Trajtenberg, 1999; Jaffe and Trajtenberg, 1999; Jaffe, Trajtenberg and Fogarty, 2000; Hall, Jaffe and Trajtenberg, 2001; Maruseth and Verspagen, 2002; Bottazzi and Peri, 2003; Duguet and MacGarvie, 2005; Peri, 2005; Criscuolo and Verspagen, 2008; Breschi and Lissoni, 2009; Bacchiocchi and Montobbio, 2010).

Blockchain is a disruptive technology (Dutra, Tumasjan and Welp, 2018) dating back to 2008, with the potential to be applied and to act as a game changer in many

industries (Casino, Dasaklis and Patsakis, 2019; Gartner, 2018; Zhao, Fan and Yan, 2016; Swan, 2015; Veitas and Weinbaum, 2017). BC is defined as a peer-to-peer network exploiting distributed ledger technology to store and manage digital asset records (Alkudary, Brusset and Fenies, 2019; Chen, 2018; Davidson, De Filippi and Potts, 2018; Risius and Spohrer, 2017; Savelyev, 2018; Gürkaynak, Yılmaz, Yeşilaltay, and Bengi, 2018).

In one decade, BC proved to have strong relevance and implications under many perspectives – e.g. economic (World Economic Forum, 2015), business (McKinsey, 2018; CBInsights, 2018; IBM, 2016), security (World Economic Forum, 2015), societal (World Economic Forum, 2015).

Since BC was conceived by the anonymous Nakamoto in 2008 (Nakamoto, 2008), thousands of BC-based technologies have been patented¹. However, academic research on this field has not kept the pace of patenting activity and technology development (Alkudary, Brusset and Fenies, 2019; see also: Petticrew and Roberts, 2016; Thomé, Scavarda and Scavarda 2016). Hence, this gap in literature gives room alternative studies in order to shed some light on different facets of BC and its implications for managers, policy-makers, academicians and other stakeholders.

Finally, since alternative studies need alternative sources of data on the BC technology development, the aforementioned (see Section 1) noticeable amount of patented blockchain applications - i.e. 4,120 granted patents¹ in 2008-2018 - is the main unbiased alternative data source to investigate BC technology and its implications.

3 Data collection and methodological approach

3.1 Sample and methodology

A comprehensive view on the methodological approach adopted in this study is detailed in Figure 1.

¹ 4,120 patents were retrieved by searching for the following keywords in the title/abstract fields based on Alkudary, Brusset and Fenies' (2019) search strategy: "blockchain" OR "blockchains" OR "block chain" OR "Consortium Chain" OR "smart contract" OR "distributed ledger" OR "distributed ledger technology" OR "automated escrow" OR "public ledger" OR "public digital record" OR "cryptographic hash" OR "proof-of-work" OR "proof-of-stake" OR "proof-of-existence" OR Hyperledger OR "Hard Fork" OR "decentralized consensus" OR "51% attack".

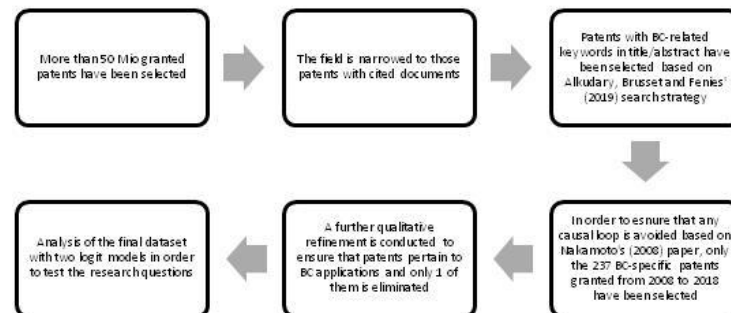


Figure 1. Methodological approach and stages.

The methodological approach relies on a single period including both cited and citing patents. This methodological choice takes into account the peculiarities of the emerging BC technology (Bacchiocchi and Montobbio, 2010), namely, BC's recent technological foundations and non-mature positioning within the Gartner Hype Cycle (Gartner, 2018). BC technology differs from the conditions under which previous patent citation studies were applied to other technologies (Giglio, Musmanno and Palmieri, 2018; Li-Ying, Wang, Salomo and Vanhaverbeke, 2013). Extant literature does not indicate a time interval for “learning-by-patent-acquisition”: literature suggests minimum 5 years (Jaffe and Trajtenberg, 1996; Jaffe and Trajtenberg, 1999; Hausman and Griliches, 1984; see also: Johnson, 2002; Ahuja and Katila, 2001; Hall, Jaffe and Trajtenberg, 1999), coherently with the proposed decade 2008-2018.

Data have been analyzed with two logit models in order to understand whether beneficial creativity and knowledge flows could be identified for owning firms - and, more broadly, for their headquarter countries, under a macroeconomic perspective.

3.2 Variables and measures

Coherently with previous methodological contributions, the analysis was conducted based on Kessler and Bierly (2000), Verspagen (2007) and Li-Ying, Wang, Salomo and Vanhaverbeke (2013). BC-related patents citing other patents are assumed to be originated from such prior arts, thus, suggesting a “learning-by-acquisition” effect enabling further technological advancements (Verspagen, 2007; Li-Ying, Wang, Salomo and Vanhaverbeke, 2013). If prior knowledge is not utilized - that is it is not cited in new patents -, hence, creativity replaces it as an innovation trigger (Verspagen, 2007; Li-Ying, Wang, Salomo and Vanhaverbeke, 2013; Giglio, Musmanno and Palmieri, 2018).

The dependent variable is defined as a binary cross-country learning variable, “DepVar” (0 = no cross-country learning, 1 = cross-country learning). The existence of a cross-country learning is reported whereas the citing patent cites one or more prior acquired patents, whereby all current owners and all inventors come from different

countries - i. e. the learning process is fostered by prior cross-country knowledge flows. The independent variable is the number of cross-country patent acquisitions, “IndVar”, that is the amount of patents with current owners’ nationalities different from inventor’s ones.

Since possible issues affecting patent citation studies - same country- and self-citations, technology- and patent office-specific aspects etc. - have been analysed in both Section 1 and 2, some control variables are considered (Li-Ying, Wang, Salomo and Vanhaverbeke, 2013), while a variant of their model is proposed for creativity flows. In detail, the methodological approach checks for technology- and firm-level as well as environmental variances. In Table 1.a and 1.b, control variables are detailed for knowledge flows and creativity flows, respectively.

Based on the binary dependent variable, the logit model is adopted (Greene, 2003; Li-Ying, Wang, Salomo and Vanhaverbeke, 2013). Two logit tests are conducted - “Knowledge Flow” and “Creativity Flow” models, respectively.

Table 1.a. Variable details for knowledge flows*.

Variables’ levels	Variables’ codes	Variables’ name	Variables’ brief description
Technology	TechAge	Technology Age	Average years between cited patent granting date and cross-country citing date
	PatCiVal	Patent Citation Value	Average citations count after cited patent granting date (within the selected time interval)
Firm	FiSize	Firm Size	Number (ln) of employees of the current owner’s firm
	AppExp	Application Experience	Number of owner-firm’s patent applications before the cross-country acquisition date (within the selected time interval)
Environment	CoPaSt	Country Patent Stock	Average number of patent applications per million people (within the selected time interval)

*All variables in Table 1.a are treated as scale variables in IBM® SPSS® Statistics 25.

Table 1.b. Variable details for creativity flows*.

Variables’ levels	Variables’ codes	Variables’ name	Variables’ brief description
Technology	PCD	Patented Creativity Degree	Number of citations by owner’s patents acquired from abroad divided by number of cited acquired patents
Firm	FiSize	Firm Size	Number (ln) of employees of the current owner’s firm
	AppExp	Application Experience	Number of owner-firm’s patent applications before the cross-country acquisition date (within the selected time interval)
Environment	CoPaSt	Country Patent Stock	Average number of patent applications per million people (within the selected time interval)

*All variables in Table 1.b are treated as scale variables in IBM® SPSS® Statistics 25.

4 Results and discussion

The statistical analysis has been conducted by means of IBM® SPSS® Statistics 25. In Table 2.a and Table 2.b, correlations among independent variables are tested in order to investigate about possible multicollinearity issues.

Table 2.a. Correlation test for the Knowledge Flow model.

		IndVar	TechAge	PatCiVal	FiSize	AppExp	CoPaSt
IndVar	Pearson Correlation	1	.597**	.824**	.002	-.005	.002
	Sig. (2-tailed)		.000	.000	.605	.230	.492
	N	56	56	56	56	56	56
TechAge	Pearson Correlation	.799**	1	.696**	.032	-.147	.001
	Sig. (2-tailed)	.000		.000	.787	.251	.798
	N	56	56	56	56	56	56
PatCiVal	Pearson Correlation	.825**	.887**	1	.109	-.029	.023
	Sig. (2-tailed)	.000	.000		.777	.299	.645
	N	56	56	56	56	56	56
FiSize	Pearson Correlation	.145	.134	.109	1	.385**	.282**
	Sig. (2-tailed)	.906	.726	.845		.000	.002
	N	56	56	56	56	56	56
AppExp	Pearson Correlation	-.099	-.267	-.276	.699**	1	.452**
	Sig. (2-tailed)	.342	.179	.183	.000		.000
	N	56	56	56	56	56	56
CoPaSt	Pearson Correlation	.113	.195	.109	.282**	.343**	1
	Sig. (2-tailed)	.669	.787	.599	.009	.000	
	N	56	56	56	56	56	56

**Correlation is significant at the 0.01 level (2-tailed).

Table 2.b. Correlation test for the Creativity Flow model.

		IndVar	PCD	Country	FiSize	AppExp	CoPaSt
IndVar	Pearson Correlation	1	.455**	-.237	.145	.195	.232
	Sig. (2-tailed)		.001	.437	.446	.601	.302
	N	80	80	80	80	80	80
PCD	Pearson Correlation	.402**	1	-.237	.181	.218	.009
	Sig. (2-tailed)	.000		.002	.342	.426	.454
	N	80	80	80	80	80	80
Country	Pearson Correlation	-.231	-.132	1	.103	.210	.219
	Sig. (2-tailed)	.348	.185		.874	.523	.201
	N	80	80	80	80	80	80
FiSize	Pearson Correlation	.210	.209	.175	1	.232*	.423
	Sig. (2-tailed)	.323	.347	.886		.291	.322
	N	80	80	80	80	80	80
AppExp	Pearson Correlation	.182	.210	.101	.208*	1	.455**
	Sig. (2-tailed)	.540	.376	.492	.065		.000
	N	80	80	80	80	80	80
CoPaSt	Pearson Correlation	.092	.012	.201	.254	.401**	1
	Sig. (2-tailed)	.322	.453	.083	.212	.000	
	N	80	80	80	80	80	80

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

In Table 2.a and Table 2.b, some variables show potential collinearity, as expected. Correlation is high between the main independent variable and the technology-level variables. In Table 2.b, the country-level analysis shows to be not significant, instead.

This may suggest that, in the BC field, the time needed to develop new patents, the amount of citations and the degree of creativity tend to affect the attractiveness of “foreign patents” to be acquired. Likewise, in both logit models, the firm-level control variables show a significant correlation with each other. This may suggest that big-sized firms in the BC field tend to have a high number of patent applications, also before the cross-country patent acquisition that calls for inclination towards knowledge absorption. Moreover, a number of employees in big firms provide highly differentiated/specialized skills, endowed with more resources boosting innovation processes. Significant cross-level correlation is found between firm- and environment-related control variables: it is lower than other correlation values in Table 1.a, whilst it is relatively high in Table 1.b. Firms are generally affected by the external environment and relevant stakeholders. National innovation systems offering a breeding environment are associated with firms with high innovation potential and knowledge generation performances, especially in creativity-based contexts: this may explain the relatively higher correlation between firm- and environment-related control variables in Table 1.b compared to Table 1.a. Results also show that the micro- and macro-economic analyses should be conducted jointly: the underexplored combined approach is one of the motivations of this work. Finally, as for the inter-level correlations, no collinearity is detected between the technology and firm levels.

In Tables 3.a, 3.b and 3.c, the results of the two logit models are shown whereas high reliability is confirmed by high overall percentages of predictability.

Table 3.a. “Knowledge Flow” logit model: classification table***.

	Observed	Predicted		Percentage Correct
		DepVar .0000	1.0000	
DepVar	.0000	33	0	100.0
	1.0000	26	0	.0
Overall Percentage				96.9

***Constant is included in the model. The cut value is .500.

Table 3.b. “Knowledge Flow” logit model: test results****.

		Score	df	Sig.
Variables	IndVar	50.701	1	.000
	TechAge	121.476	1	.000
	PatCiVal	71.540	1	.000
	FiSize	.210	1	.545
	AppExp	3.472	1	.214
	CoPaSt	.142	1	.875

****Significance threshold is 5%.

Table 3.c. “Creativity Flow” logit model: classification table****.

	Observed	Predicted		Percentage Correct
		DepVar ,0000	DepVar 1,0000	
DepVar	,0000	180	0	100,0
	1,0000	56	0	,0
Overall Percentage				93,7

***Constant is included in the model. The cut value is .500.

5 Conclusions

This work claims a threefold originality. Firstly, it focuses on the underexplored “learning-by-acquisition” effect in the BC field, whereas firms tend to acquire patents and hire people enabling them to further build on the acquired knowledge, finally mastering entire technological trajectories and shaping the whole industry scenario. “Learning-by-acquisition” helps understanding if and to what degree a firm is committed to further developing and shaping its own industry and technological trajectory.

Secondly, few studies have analyzed the spillover properties characterizing specific technological fields. Hence, this work enriches also this perspective of analysis.

Thirdly, studies on knowledge and creativity flows and patent citations have a two-pronged significance - macroeconomic and microeconomic -, but extant literature neglects their combination. This work fills this gap.

Under the methodological perspective, patent office bias limitations are overcome through IPC and CPC standards. In addition, the first creativity measure on patents is proposed, coherently with the methodology developed by Li-Ying, Wang, Salomo and Vanhaverbeke (2013).

As for the results, current owners operating cross-country patent acquisitions are able to internalize inventors’ knowledge and to file subsequent patents in the BC field as well as to maintain their own creativity levels. Firms increase their innovation potential and their business competitiveness, while countries strengthen their national innovation systems and foster their economic growth. Policy makers may, then, conceive measures nurturing the BC field, encouraging firms to acquire foreign patents - e.g. incentives, tax-reduction - to develop new patents or stimulate creativity. As for firms, managers should select foreign technology by strategically analyzing its age and patent citations to increase the likelihood of benefitting from the “learning-by-acquisition” effect or the creative cross-country effect. Patents with the highest innovation potential need a short time to generate new (creative) patents. The most promising patents should have high patent citation levels.

Finally, this study has some limitations. Despite both “learning-by-acquisition” and creative cross-country effects are proven, nothing can be said about to what extent owner-firms have learned/been creatively stimulated. Moreover, the whole picture is still missing: only some variables have been investigated, without testing possible moderating/mediating effects. Hence, this work paves the way for future research efforts

on knowledge and creativity flows, patent citations and both the “learning-by-acquisition” and the creative cross-country effects.

References

- Ahuja, G. and Katila, R. (2001). Technological acquisitions and the innovation performance of acquiring firms: a longitudinal study. *Strategic Management Journal*, 22(3), 197–220.
- Alkhudary, R., Brusset, X., and Fenies, P. (2019). Blockchain Technology: A Systematic Literature Review. PROLOG Conference 2019, June 19th-21st, 2019, Metz (France) [accepted].
- Bacchiocchi, E. and Montobbio, F. (2010). International Knowledge Diffusion and Home-bias Effect: Do USPTO and EPO Patent Citations Tell the Same Story?. *Scand. J. of Economics* 112(3), 441–470.
- Bekkers, R. and Martinelli, A. (2012). Knowledge positions in high-tech markets: trajectories, standards, strategies and true innovators. *Technological Forecasting & Social Change*, 79, 1192–1216.
- Belderbos, R. (2001). Overseas innovation by Japanese firms: an analysis of patent and subsidiary data. *Research Policy*, 20, 313–332.
- Bottazzi, L. and Peri, G. (2003). Innovation and Spillovers in Regions: Evidence from European Patent Data. *European Economic Review* 47, 687–710.
- Breschi, S. and Lissoni, F. (2009). Mobility of Skilled Workers and Co-invention Networks: An Anatomy of Localized Knowledge Flows. *Journal of Economic Geography* 9, 439–468.
- Breschi, S., Lissoni, F. and Montobbio, F. (2005). The Geography of Knowledge Spillovers: Conceptual Issues and Measurement Problems, in S. Breschi and F. Malerba (eds.), *Clusters, Networks and Innovation*, Oxford University Press, Oxford.
- Caballero, J. R. and Jaffe, A. B. (1993). How High Are the Giants’ Shoulders: An Empirical Assessment of Knowledge and Creative Destruction in a Model of Economic Growth, in O. Blanchard and S. Fisher (eds.), *National Bureau of Economic Research Macroeconomics Annual*, Vol. 8, MIT Press, Cambridge, MA.
- Casino, F., Dasaklis, T., and Patsakis, C. (2019). A systematic literature review of blockchain-based applications: Current status, classification and open issues. *Telematics and Infomatics*, 55–81.
- CBInsights (2018). Blockchain Startups Absorbed 5X More Capital Via ICOs Than Equity Financings In 2017, [available at] <https://www.cbinsights.com/research/blockchain-vc-ico-funding/> [last accessed 04/14/2019].
- Chen, Y. (2018). Blockchain Tokens and the Potential Democratization of Entrepreneurship and Innovation. *Business Horizons* 61(4):567–75.
- Chen, Z.F. and Guan, J.C. (2010). The impact of small world on innovation: an empirical study of 16 countries. *Journal of Informetrics*, 4, 97–106.
- Chen, Z. and Guan J. (2016). The core-peripheral structure of international knowledge flows: evidence from patent citation data. *R&D Management*, 46(1), 62–79.
- Criscuolo, P. and Verspagen, B. (2008). Does it Matter where Patent Citations Come From? Inventor vs. Examiner Citations in European Patents. *Research Policy* 37, 1892–1908.
- David, B.-T., Fernando, J.-S. and Itziar, C.-M. (2011). Mapping the importance of the real world: the validity of connectivity analysis of patent citations networks. *Research Policy*, 40, 473–486.
- Davidson, S., De Filippi, P., and Potts, J. (2018). Blockchains and the Economic Institutions of Capitalism. *Journal of Institutional Economics* 14(4):639–58.
- Deng, Y. (2008). The value of knowledge spillovers in the U.S. semiconductor industry. *International Journal of Industrial Organization*, 26, 1044–1058.

- Duguet, E. and MacGarvie, M. (2005). How Well Do Patent Citations Measure Flows of Technology? Evidence from French Innovation Surveys. *Economics of Innovation and New Technology* 14, 375–393.
- Dutra, A., Tumasjan, A., and Welp, I. M. (2018). Blockchain Is Changing How Media and Entertainment Companies Compete. *Mit Sloan Management Review*.
- Fleming, L., King, C. and Juda, A.I. (2007). Small worlds and regional innovation. *Organization Science*, 18, 938–954.
- Frietsch, R. and Grupp, H. (2006). There is a new man in town: the paradigm shift in optical technology. *Technovation*, 26, 463–472.
- Gartner (2018). Gartner Hype Cycle, [available at] <https://www.gartner.com/smarterwithgartner/5-trends-emerge-in-gartner-hype-cycle-for-emerging-technologies-2018/> [last accessed 04/14/2019].
- Giglio, C., Musmanno, R., and Palmieri, R. (2018). Cross-country learning from patents: An analysis of patent citation networks in the aviation industry. 25th IPDMC - Innovation and Product Development Management Conference 2018, June 10th-14th, Porto (Portugal).
- Gomes-Casseres, B., Hagedoorn, J. and Jaffe, A. B. (2006). Do alliance promote knowledge flows? *Journal of Financial Economics*, 80, 5–33.
- Greene, W. (2003). *Econometric analysis* (5th ed.). Upper Saddle River: Prentice-Hall.
- Griliches, Z. (1990). Patent Statistics as Economic Indicators: A Survey. *Journal of Economic Literature* 28, 1661–1707.
- Guan, J.C. and Chen, Z.F. (2009). The technological system of Chinese manufacturing industry: a sectorial approach. *China Economic Review*, 20, 767–776.
- Gürkaynak, G., Yılmaz, I., Yeşilaltay, B., and Bengi, B. (2018). Intellectual Property Law and Practice in the Blockchain Realm. *Computer Law & Security Review* 34(4):847–62.
- Hall, B. H., Jaffe, A. B. and Trajtenberg, M. (1999). Market value and patent citations. Paper presented at the NBER working paper, Paris.
- Hall, B. H., Jaffe, A. B., and Trajtenberg, M. (2001). The NBER Patent Citation Data File: Lessons, Insights and Methodological Tools. NBER Working Paper no. 8498.
- Hall, B. H., Jaffe, A. B. and Trajtenberg, M. (2005). Market Value and Patent Citations. *Rand Journal of Economics* 36, 16–38.
- Harhoff, D., Narin, F., Scherer, F. M. and Vopel, K. (1999). Citation Frequency and the Value of Patented Inventions. *Review of Economics and Statistics* 81, 511–515.
- Hausman, J. A. and Griliches, Z. (1984). Econometric models for count data with an application to the patents-R&D relationship. *Economic and Political Weekly*, 27, 909–938.
- Hong, W. (2008). Decline of the center: The decentralizing process of knowledge transfer of Chinese universities from 1985–2004. *Research Policy*, 37, 580–595.
- Hu, A.G.Z. and Jaffe, A. B. (2003). Patent citations and international knowledge flow: the cases of Korea and Taiwan. *International Journal of Industrial Organization*, 21, 849–880.
- IBM (2016). IBM Invests to Lead Global Internet of Things Market – Shows Accelerated Client Adoption, [available at] <https://www-03.ibm.com/press/us/en/pressrelease/50672.wss> [last accessed 04/14/2019].
- Inoue, H., Souma, W. and Tamada, S. (2010). Analysis of cooperative research and development networks on Japanese patents. *Journal of Informetrics*, 4, 89–96.
- Jaffe, A. B. and Trajtenberg, M. (1996). Flow of Knowledge from Universities and Federal Laboratories: Modelling the Flow of Patent Citations over Time and across Institutional and Geographic Boundaries. *Proceedings of the National Academy of Sciences* 93, 12671–12677.
- Jaffe, A. B. and Trajtenberg, M. (1999). International Knowledge Flows: Evidence from Patent Citations. *Economics of Innovation and New Technology* 8, 105–136. Jaffe, A. B.,

- Trajtenberg, M. and Henderson, R. (1993). Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations. *Quarterly Journal of Economics* 108, 577–598.
- Jaffe, A. B., Trajtenberg, M. and Fogarty, M. S. (2000). Knowledge Spillovers and Patent Citations: Evidence from a Survey of Inventors. *American Economic Review* 90, 215–218.
- Johnson, D. K. N. (2002). ‘Learning-by-licensing’: R&D and technology licensing in Brazilian invention. *Economics of Innovation & New Technology*, 11(3), 163–177.
- Kessler, E. H. and Bierly, P. E. (2000). Internal vs external learning in new product development: Effects on speed, costs and competitive advantage. *R&D Management*, 30(3), 213–224.
- Lanjouw, J. O. and Schankerman, M. (2004). Patent Quality and Research Productivity: Measuring Innovation with Multiple Indicators. *Economic Journal* 114, 441–465.
- Li-Ying, J., Wang, Y., Salomo, S. and Vanhaverbeke, W. (2013). Have Chinese firms learned from their prior technology in-licensing? An analysis based on patent citations. *Scientometrics*, 95, 183–195.
- Lobo, F. (2003). Time, Closed Timelike Curves and Causality. *The Nature of Time: Geometry, Physics and Perception*. NATO Science Series II. Kluwer Academic Publishers.
- Ma, Z.Z., Lee, Y. and Chen, C. (2009). Booming or emerging? China’s technological capability and international collaboration in patent activities. *Technological Forecasting & Social Change*, 76, 787–796.
- Malerba, F. and Montobbio, F. (2003). Exploring Factors Affecting International Technological Specialization: The Role of Knowledge Flows and the Structure of Innovative Activity. *Journal of Evolutionary Economics* 13, 411–434.
- Malerba, F., Mancusi, M. and Montobbio, F. (2007). Innovation, International R&D Spillovers and the Sectoral Heterogeneity of Knowledge Flows, CESPRI Working Paper no. 206.
- Maruseth, P. B. and Verspagen, B. (2002). Knowledge Spillovers in Europe: A Patent Citations Analysis. *Scandinavian Journal of Economics* 104, 531–545.
- McKinsey (2018). Blockchain beyond the hype: What is the strategic business value?. Company authors: Brant Carson, Giulio Romanelli, Patricia Walsh, and Askhat Zhumaev, [available at] <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/blockchain-beyond-the-hype-what-is-the-strategic-business-value> [last accessed 04/14/2019].
- Mina, A., Ramlogan, R., Tampubolon, G. and Metcalfe, J.S. (2007). Mapping evolutionary trajectories: applications to the growth and transformation of medical knowledge. *Research Policy*, 36, 789–806.
- Nakajima, R., Tamura, R. and Hanaki, N. (2010). The effect of collaboration network on inventors’ job match, productivity and tenure. *Labour Economics*, 17, 723–734.
- Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System, [available at] <https://bitcoin.org/bitcoin.pdf> [last accessed 04/14/2019].
- OECD (1994). Using Patent Data as Science and Technology Indicators—Patent Manual, OECD, Paris.
- OECD (1997). National Innovation Systems OECD Publications, Paris 9–10.
- Park, J., Lee, H. and Park, Y. (2009). Disembodied knowledge flows among industrial clusters: a patent analysis of the Korean manufacturing sector. *Technology in Society*, 31, 73–84.
- Peri, G. (2005). Determinants of Knowledge Flows and Their Effect on Innovation. *Review of Economics and Statistics* 87, 308–322.
- Petticrew, R., and Roberts, H. (2006). *Systematic Reviews in the Social Sciences. A Practical Guide*. Malden, MA: Blackwell.
- Risius, M., and Spohrer, K. (2017). A Blockchain Research Framework. *Business and Information Systems Engineering* 59(6):1–25.
- Savelyev, A. (2018). Copyright in the Blockchain Era: Promises and Challenges. *Computer Law & Security Review* 34(3):550–61.

- Shih, H.Y. and Chang, T.L.S. (2009). International diffusion of embodied and disembodied technology: a network analysis approach. *Technology Forecasting & Social Change*, 76, 821–834.
- Shin, J. and Park, Y. (2007). Building the national ICT frontier: the case of Korea. *Information Economics and Policy*, 19, 249–277.
- Smith, N. J. J. (2013). Time Travel. *Stanford Encyclopedia of Philosophy*.
- Stople, M. (2002). Determinants of knowledge diffusion as evidenced in patent data: the case of liquid crystal display technology. *Research Policy*, 31, 1181–1198.
- Storto, C. (2006). A method based on patent analysis for the investigation of technological innovation strategies: the European medical prostheses industry. *Technovation*, 26, 932–942.
- Swan, M. (2015). *Blockchain: Blueprint for a New Economy*. O'Reilly.
- Thomé, A. M. T., Scavarda, L. F., and Scavarda, A. J. (2016). Conducting Systematic Literature Review in Operations Management. *Production Planning & Control* 27(5):408–20.
- Trajtenberg, M. (1990). A Penny for Your Quotes: Patent Citations and the Value of Innovations. *Rand Journal of Economics* 21, 172–187.
- Veitas, V., and Weinbaum, D. (2017). Living Cognitive Society: A ‘Digital’ World of Views. *Technological Forecasting and Social Change* 114:16–26.
- Verspagen, B. (2007). Mapping technological trajectories as patent citation networks: a study on the history of fuel cell research. *Advances in Complex Systems*, 10, 93–115.
- World Economic Forum (2015). Deep shift: Technology tipping points and societal impact. September 2015, [available at] http://www3.weforum.org/docs/WEF_GAC15_Technological_Tipping_Points_report_2015.pdf [last accessed 04/14/2019].
- Zhao, J., Fan, S., and Yan, J. (2016). Overview of business innovations and research opportunities in blockchain and introduction to the special issue. *Financial innovation*.

Education – Challenges in the Digital Era

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Abstract

In the Digital Era, education is a complex component of human existence that must meet the challenges of contemporary society. The paper is based on a qualitative research, conducted on a sample of 100 persons (students in the first year of study at the Faculty of Administration and Business, University of Bucharest). The key questions raised at this point are: Starting from the importance of digital in the field of education what is the profile of the student of the future? How about the teacher of the future?

The research approach used emphasis on the importance of technology in academic life. In contemporary context technology should be seen as a future instrument in learning. Nowadays virtual reality creates new immediate learning experience.

This methodology highlighted the importance of knowing which teaching style should be used in an efficient instructive-teaching process. The main objectives of the study are: presenting the main education styles in virtual environment, highlighting the challenges and opportunities of education in digital era, analysing marketing research results that distinguished an innovative student profile and a successful teacher profile in the context of digitization.

The outcomes of the application underline the importance of education in digital era. The topic of the paper is popular and has potential for further research as in contemporary context students' needs and demands are changing according to New Information and Communication Technology. This fact leads to major changes in academic life. The educational context becomes more and more complex, facing challenges of contemporary realities which must not be neglected.

Keywords – education, digital era, learning styles, individual intelligences, personality traits.

Paper type – Academic Research Paper

1 Introduction

This paper sets forth to explore, surely within limits, a reality that becomes more and more present in our lives.

The present study is addressed to teachers and students / pupils, to each individual who searches throughout his/her life to understand a complex and great word, <<education>>.

The success of an instructive – educative process depends on the teachers' "craftsmanship" of using modern educational means. The successful teacher should have: ability to analyse and synthesize, flexibility, creativity, originality, clarity, expressiveness, the qualities of attention, readiness, memory qualities, pedagogical skills. Family is the exogenous variable which exerts the most powerful influence on individual behaviour. The harmonious development of the individual depends on the way in which moral education is achieved.

In present day context the role of teacher in school and society is crucial. B.F. Skinner says that the role of a teacher as a human being is amplified by the use of educational means. Augusto Cury (2011, p. 9) considers that "each individual (...) is a unique star on the life scene". Young generations should be taught how to explore a world that is waiting to be explored. And now, the role of teacher is ... crucial!

2 Literature review

In the context offered by New Information and Communication Technologies, a variety of learning styles are recognized, the roles of the teacher and learner being explicitly modified in comparison with classical roles (Ceobanu, 2016).

Literature review highlights many contemporary psychological theories that refer to different educational styles: cognitive, learning, thinking (Ceobanu, 2016). It is considered that the three educational styles are complementary, that is "it starts from a certain style of thinking, it turns into a specific cognitive style and reaches a personal learning style" (Ceobanu, 2016).

In his paper "Psychological types," Carl Jung argued that any human personality is defined in relation to three aspects: 1. introversion-extraversion; 2. intuitive personality - meticulous personality; 3. rational people (who are logical and analytical) - emotional people (who judge in terms of feelings and values) (Ceobanu, 2016).

In literature review, starting from the personality types described by Carl Jung, the Myers-Briggs Type Indicator is presented, thus highlighting four criteria for defining types of personality (Quenk, 2009; Ceobanu, 2016): 1. "Depending on where the individual focuses his attention," we distinguish the extraverted type and the introverted type; 2. "Depending on how the information is acquired", we distinguish the sensing type and the intuitive type; 3. "Depending on how the decision is made", we distinguish between the thinking type and the feeling type; 4. "Depending on how the individual orients on to the outer world" we distinguish the judging type and the perceiving type.

In this context, it is important to mention the perspective of H. Gardner who proposed eight intelligences such as: verbal intelligence, logical-mathematical intelligence, spatial intelligence, kinesthetic intelligence, musical intelligence, interpersonal intelligence, intrapersonal intelligence, ambient or naturalist intelligence (Bratianu, Dima, Vasilache and Orzea, 2011). Also, "multiple intelligences can process both explicit and tacit knowledge, both cognitive and emotional knowledge" (Brătianu, Dima, Vasilache and Orzea 2011).

3 Methodology

In order to obtain the necessary empirical information, a qualitative research was used. A sample of convenience consists of 100 students from the Faculty of Administration and Business, University of Bucharest, Romania. The data collection tool was a semi-structured questionnaire, comprising nine questions. Focus-groups consisting of 25 students were made during the seminar's meetings in March 2019. The questionnaire contains a large number of open questions.

The scope of the research consists in achieving the innovative student's profile.

According to key questions the objectives of the research are:

O₁: Identifying the learning styles in the context of virtual environment;

O₂: Shaping the innovative student's profile;

O₃: Shaping the success teacher's profile.

4 Research findings and discussion

In order to achieve a qualitative research, four groups (twenty-five students in each group) were formed. The discussion began according to an interview guide.

The interview questions were the following:

1. Mention some requirements that would make learning interactive in the classroom and / or seminar.
2. Do you think that the use of technology in the educational process can help you achieve your educational standards? Argument the answer.
3. Do you think technology is your "learning partner"? Argument the answer.
4. List the main advantages / disadvantages of using the technology in the educational / learning process.
5. What are the personality traits of the teacher of the future?
6. What about those of the student of the future?
7. What teaching method do you prefer: modern or traditional? Argument the answer.
8. What do you think are the personality traits of the teacher who practices an authoritative educational style? What about a flexible one?
9. What is the first word that comes to your mind when thinking about learning in a virtual environment?

At question 1, respondents mentioned some requirements that would make learning interactive in the classroom and / or seminar and the following points of view were highlighted: involving students in team activities and debates; performing imaginative exercises such as "What would you do if ...?"; the existence of undemanding bilateral communication; creating a pleasant environment by encouraging opinions; the existence of an empathic teacher-student relationship; including in the teaching process a session of questions-answers on the topic discussed; creating an interactive and comfortable working environment.

Question number two highlighted the following relevant responses: "I believe that the use of technology in the educational process is very useful in achieving educational

standards, because we can benefit from a great flow of information in a way that is familiar to us"; "Yes, because we are in the age of technology"; "Yes, because our generation is attracted to technology to a great extent, and its use can catch our attention easier".

Question three has provided both positive and negative answers, such as: "Yes, technology is "a learning partner" for me because I have access to extensive information in addition to the course material, and so I try to synthesize information to learn more easily"; "I think technology is "a learning partner" because it helps us find out new things"; "I consider technology "a tool" that helps us learn effectively"; "I couldn't say. I prefer more classical methods, especially handnotes. However, it is often extremely useful when I need extra information"; "In some cases, technology may even represent a disadvantage when we need to focus as it can distract us."

Question number four highlighted the following advantages and disadvantages of using the technology in the educational process, such as: advantages - speed, wide range and variety of information, easy processing of multiple data, high accessibility, time saving, it captures attention; disadvantages - some online information may be wrong, it "makes us lazy", convenience.

Question number five provided answers that outlined the following profile of the teacher of the future in the view of young students, starting from the importance of digital in the field of education. Therefore, the teacher of the future should be: flexible, calm, patient, indulgent, charismatic, happy, dedicated, open-minded, enthusiastic, cheerful, imposing, balanced, optimistic, punctual. The following interesting points of view were also highlighted: The teacher of the future must be "an open, fair and empathic person. A person who knows how to be loved and respected by his/her students, who can adapt to his/her students and make them want to know what he / she has to offer "; "The teacher of the future is a flexible teacher who combines pleasure with utility, who uses technology, but doesn't disregard old methods of teaching"; " The teacher of the future must have a strong personality, he/she must be motivated and vigilant."

Also, question number six brings forth information about the profile of the student of the future, starting from the importance of digital in education. Thus, the student of the future must be: patient, kind, hard-working, persevering, intelligent, ambitious, diligent, punctual, honest, receptive, curious, creative, responsible, cheerful, motivated, pragmatic, extraverted. He or she must engage in the learning process by searching for relevant information using technology attentively. So if he/she carefully chooses what he/she is studying, he/she will manage to learn and acquire information faster and in a pleasant way, all contributing to his/her harmonious development.

With respect to question number seven: 76% of the respondents mentioned that they prefer the modern teaching method, 5% said they prefer the traditional teaching method, and 19% mentioned that they prefer both teaching methods. The following points of view were highlighted: "The modern teaching method seems much more interactive and interesting, so you can acquire more information."; "The modern teaching method is much more accessible and flexible."; "The modern teaching method is efficient and fascinating."; The modern method of teaching is much easier and more practical for us,

the students, because we live in the century of speed, and things have to move fast."; "I personally prefer the traditional teaching method because in my case it is much safer: I have the written lesson, I pay attention to explanations, I can not lose the information and I have reliable sources that guide my learning."; "I believe that an effective teaching method is a combination of the modern and traditional teaching method."; "I prefer a combination of the two, because both have advantages and none of them should disappear or be replaced.

The next question in the questionnaire highlighted the following answers presented in the following table:

Tabel no.1 – The features of the teacher who practices different educational styles

The features of the teacher who practices an authoritative educational style	The features of the teacher who practices a flexible educational style
Authoritarian, rigid, demanding, severe, harsh, pretentious, strict, solemn, imposing, precise, serious, conservative, introverted, analytical	Patient, flexible, calm, cheerful, mild, creative, tolerant, detached, permissive

Source: personal research

The students also competed in expressing their opinion on the two teaching styles. The following views were thus outlined: "When a teacher is authoritarian, he/she lacks understanding and patience, as opposed to a flexible teacher who has more qualities and is loved by his/her students."; "A teacher who applies a flexible learning style is open-minded and closer to student requirements. On the other hand, an authoritative teacher captures students' attention quicker"; "Whether a teacher is authoritative or flexible if his/her defining features revolve on capitalizing his/her professionalism it gains the student's trust.". There was no delay in making statements such as: "When a teacher is authoritative, he/she is respected by students, and when he/she is flexible he/she is loved by students", "Teachers who practice flexible teaching can not only teach effectively but can sometimes change opinions and mentalities".

At the last question in the questionnaire respondents mentioned the following words that can characterize learning in the virtual environment: future, innovation, seriousness, interactivity, brilliance, creativity, interesting, flexible, evolution, novelty, desire.

5 Conclusions

The access to information has transformed the whole world. Great ideas are shared faster through one simple "click" that goes to an interaction between people and technology. The information "explosion" requires major changes in the sphere of education. In this context, education must be continuously revised, both at the individual and organizational level. Education takes place in space and time, it does not know limits and it is an expression of individuals' life. In this context "it is clear that the professor is playing a social role" (Bacellar and Ikeda, 2006), and more over "learning is the process of creating knowledge" (Kolb and Kolb, 2005).

Nowadays the quality of education must take into account a holistic vision that leads to a better understanding of the whole instructive-educative process. Teachers should have a strong personality. Pedagogical tact, the spirit of observation, pedagogical attitude, humanism and – the most important – love for children are just a small part of teachers' personality traits who must take responsibility for "shaping" young generations.

School, family and young generations are institutional factors that provide a social framework driven by principles, norms and values.

However, we must not forget what is essential for the educational process in order to be effective, whether we are the main educational actors or we are individuals who uninvolved, just observe this complex process: <<education>>. Therefore, "to educate means to engrain in a person the responsibility of self-reflection and self-fulfillment. Such a leaning towards yourself is the core of any true education." (Cucos, 2017).

References

- Bacellar, F.C.T., Ikeda, A.A. (2006). Marketing professors: paths and perspectives, *European Business Review*, Vol.18, No.3, pp.231-241.
- Brătianu, C., Dima, A.M., Vasilache, S., Orzea, I. (2011). "Nonlinear integrators and intellectual capital dynamics", Editura Curtea Veche, București.
- Ceobanu, C. (2016). *Învățarea în mediul virtual: ghid de utilizare a calculatorului în educație*, Editura Polirom, Iași.
- Cucos, C. (2017). *Educația: reînțemeieri, dinamici, prefigurări*, Editura Polirom, București.
- Cury, A., (2011). *Copii străluciți, elevi fascinanți*, Editura For You, București.
- Greener, S., (2013). *Case Studies in e-Learning Research for Researchers, Teachers and Students*, Academic Publishing International Limited, Reading, RG49SJ, United Kingdom.
- Kolb, A.Y., Kolb, D.A. (2005). Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education, *Academy of Management Learning & Education*, 2005, Vol. 4, No. 2, pp.193–212.
- Marginson, S. (2010). Higher Education in the Global Knowledge Economy, *Procedia Social and Behavioral Sciences* 2, pp. 6962–6980.
- Marinescu, M. (2009). *Tendențe și orientări în didactica modernă*, Editura Didactică și Pedagogică R.A., București, p.10, pp. 39-40.
- Nicola, I. (1980). *Pedagogie școlară*, Editura didactică și pedagogică, București.

Road Map for Creative Problem Solving Techniques

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Abstract

Creativity is one of the vital skills for the 21th century as stated by the European Union. In our earlier work (Buijs et al, 2009) we gave a syntheses of the literature and practice on creativity resulting in an overall model for creative problem solving in groups. This model was called iCPS and consists of four interlinked sub processes Content Finding, Information Finding, Acceptance Finding and Project Management (Buijs & van der Meer,2013).

Building on this work the present paper focuses on techniques that can be applied within the framework of iCPS. Based on an extensive literature study combined with the experiences of over three decades training creative facilitation of groups at the Delft University of Technology all techniques found in literature were clustered to 40 specific techniques supporting the different stages of iCPS and 8 so called session duties. 5 methods significant different than iCPS were identified. For using the 40 techniques a technique selector is proposed.

The paper ends with some directions and suggestions for further research to make the shift in research on techniques for creative problem solving in groups from a merely guru driven topic to an evidence based approach.

Keywords: Creativity, Group sessions, Creative Problem Solving

Type of paper: Practical paper

1 Introduction

Creativity is a complex and complicated phenomenon (Runco et al,1999). It has to do with talent and traits of people, it has to do with surprising new solutions, it has to do with specific actions people take, and it has to do with circumstances and situations. Rhodes (1961) divided the research in creativity into four specific aspects. Since all aspects have a label beginning with a P his work is referred to as the *4P theory on Creativity: Person, Process, Press and Product*. Since in practice we only find the Process part useful when

we design tools for creative sessions (Buijs & van der Meer, 2013) we use the working definition of the most cited author on creativity Theresa Amabile:

“Creativity is the process that leads to novel and useful solutions to given problems”. (Amabile, 1996)

Creative Facilitation is not suited for all types of problems. Usually two types of problems are distinguished: close-ended and open-ended problems (Rickards, 1974). In the rest of the text we will focus on open problems thus leading to our working definition of creativity:

“Creativity is the process that leads to novel and useful solutions to given open problems.”

2 History of Creative Problem Solving

One of the oldest descriptions of the creative process in stages has been given by Wallas (1926 in Vernon 1970). In the first stage the problem is "investigated ...in all directions" (page 91). In the second stage the problem solver is not consciously thinking about the problem. In the third stage suddenly the "happy idea" appears (page 92). And in stage four the idea is checked for its proper value. Although in later works a fifth and even sixth step can be found the four stage representation of the creative process is still the most used (Sadler-Smith, 2015).

The research in creativity made a major leap when Guilford (1950) delivers his acceptance speech as the new president of the American Psychological Association. In this speech he proposes to separate the diverging and converging capacity of the brain. Ever since, stimulating creativity and supporting people in Creative Problem Solving (CPS) has become an explicit academic and professional domain.

Diverging is at the heart of CPS. Getting many options in order to get one or two good ones for further development is the basic line of reasoning. The option generating technique *Brainstorming* (Osborn, 1953) made this way of thinking popular. The core message of diverging in brainstorming is “postponing judgment” and “quantity breeds quality”, so generating lots of options without judging any of them. The consequence of diverging is that you also have to converge later in the process. If you produce hundreds of options, you have to select a couple of good ones to continue with since it is impossible to develop all of them. This sequence of divergence (generating) and convergence (selecting) led to the well-known ‘*creative diamond*’: an expanding diverging phase followed by a narrowing converging phase. See figure 1.

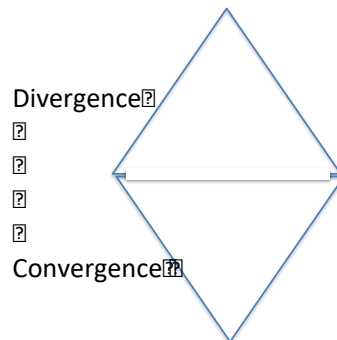


Figure 1: Modelling the sequence of diverging and converging thinking in the form of the "Creative Diamond". Horizontal the number of ideas, vertical the time. Based on Guilford's and Osborn's thinking.

In those early days of creativity research the emphasis was on diverging: if you could produce many ideas you were a creative potential. Torrance (1974) developed different tests to measure people's ability to diverge, among which the well-known TTCT: Torrance Tests of Creative Thinking. The four main aspects to judge divergence are according to him:

1. *fluency* (the number of options per time unit),
2. *flexibility* (the number of categories the options are based on or fit in),
3. *elaboration* (the depth or filling out of the option) and
4. *originality* (the degree of newness of the options)

One of the presuppositions of our approach to Creative Facilitation (Buijs & vander Meer 2013) is that you can influence *Fluency* and *Flexibility* by using techniques and this will then lead to *Originality*. A good facilitated creative process will subsequently protect *Originality* and foster *Elaboration*.

Whereas Osborn and his followers of the Buffalo school focused on *Fluency* and came from the advertising world another group active in the 1950s focused on *Flexibility* and *Elaboration* and came from the technical invention world. Training groups of mainly technicians to come up with technological breakthroughs they experienced the power of *Metaphors* and the mechanism of *Forced Fitting* options from a completely different field to the problem at hand. Their approach to creativity is often referred to as 'Synectics' (Gordon, 1961).

The Brainstorming and Synectics practices are the main foundations of what is now referred to as CPS or Creative Problem Solving (Parnes et al, 1977, Isaksen et al, 2000). Other well known authors in the CPS tradition are de Bono (1971) and Van Gundy (1988). An important aspect of CPS is that it is always intended to be a group activity. Small groups of people execute the CPS-process. From now on we will refer to this group as the Resource Group.

Part of this group process is the particular task or role of the so-called *Facilitator*. This person is responsible for organizing and managing the CPS-group process. There is

consensus among the academics and practitioners in the field of CPS that the ideal size of a Resource Group should be 5 – 8 persons to work effectively under the guidance of one facilitator. Larger groups should be split up and thus need more facilitators (Isaksen et al, 2000).

In the CPS tradition (Parnes, 1967) the process the Resource Group will follow is not limited to one single creative diamond but consists of a sequential series of five separate diamond shaped steps:

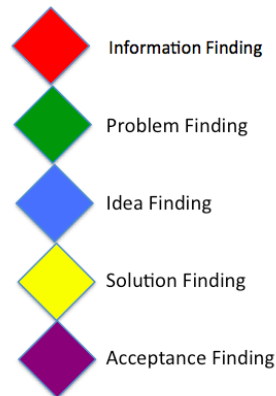


Figure 2: The five CPS-stages based on Parnes, 1967

3 iCPS: Delft's expansion of the classical CPS-approach

Since the roots of Creative Problem Solving can be found in the USA and is as such rather USA culture biased while the classical (linear) CPS approach remains a challenge for European CPS practitioners. *Integrated Creative Problem Solving (iCPS)* is the attempt of the Delft University of Technology (DUT) to cope with these challenges (Buijs & van der Meer, 2013). The main characteristics of *iCPS* will be elaborated in the following paragraphs in four steps:

1. *The four sub-processes of iCPS:* Instead of concentrating on the *Content Finding* process only, *iCPS* consist of four interdependent sub-processes: Project Management, Information Finding, Acceptance Finding and Content Finding (see figure below)

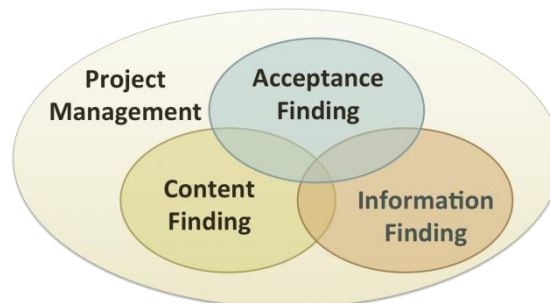


Figure 3: The basics of iCPS

This leaves for the Content Finding sub-process only 3 diamonds as shown in the following figure.

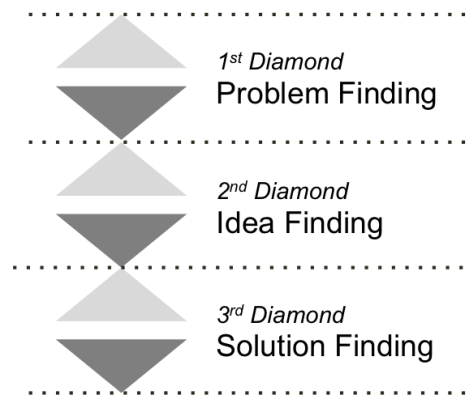


Figure 4. The 3 diamonds of the Content Finding sub process

2. *Creative Diamond 2.0*: *iCPS* added a step of Reverting in the traditional two-step Creative Diamond of a Diverging followed by Converging step. This three-step Creative Diamond is called Creative Diamond 2.0.

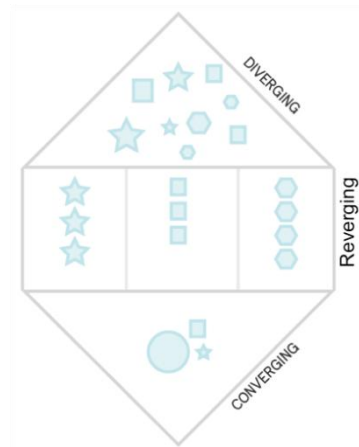


Figure 5 The Creative Diamond 2.0

3. *iCPS basic module*: *iCPS* expanded the Creative Diamond 2.0 into the *iCPS basic module*. On top of Creative Diamond 2.0 a step called *Task Appraising* is added. After the converging step a *Reflecting* step is added. Thus the *iCPS basic module* consists of five steps: (1) Task Appraising – (2) Diverging – (3) Reverting – (4) Converging – (5) Reflecting.

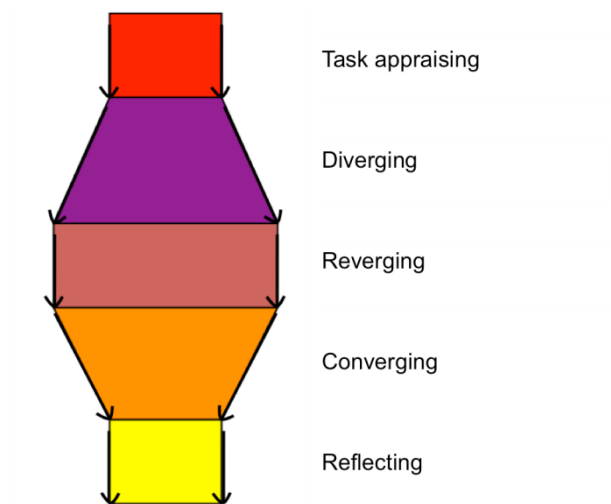


Figure 6. The iCPS Basic Module

4. *The active role of the Facilitator in both process and content: iCPS put emphasis on the active role of the Facilitator and the need of content knowledge to be a good leader in the creative process.*

4 Methods besides iCPS

Besides CPS there are other methods known for complete problem solving processes. Aristotle provides us with a basic framework for our thinking on problem solving. First he separates essential knowledge (or closed problems as we suggest) from inessential knowledge (or open problems as we suggest). For essential knowledge Aristotle proposes one instrument: *analitica* we now know as *logica* or logical reasoning. For the inessential knowledge Aristotle proposes two instruments *rhetorica* and *dialectica*. The first being the art of persuasiveness in (oral) presentations and debates the latter being inquiry in a topic by dialogue. The rules for a good dialogue (see for instant the rules of Socratic inquiry; Jackson, 2001) show remarkably resemblance with iCPS.

In the following picture we place the essence of iCPS and the other methods in a matrix using the insights of Aristotle and whether the method is designed for groups or for individuals.

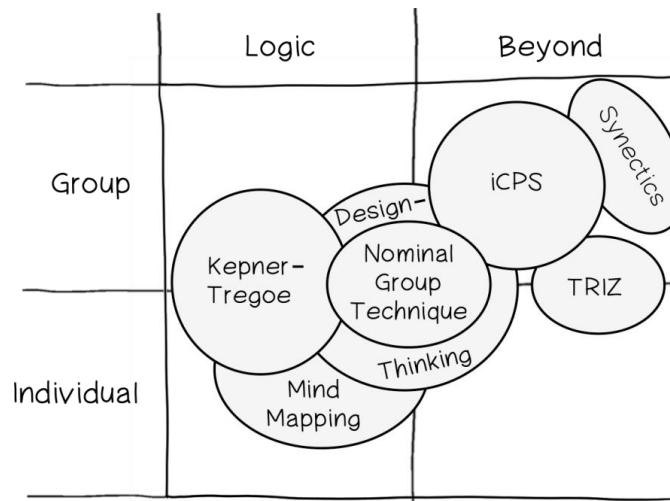


figure 7: An overview of methods

4.1 Kepner-Tregoe Method

The K(epner-)T(regoe) Method was developed in the 1960s by Charles H. Kepner and Benjamin B. Tregoe (1965), two social scientists conducting research on breakdowns in decision making at the Strategic Air Command. The KT-Method aims at rational analyses and decision-making. This method is used to solve problems in the logical domain aiming at implementing trouble shooting and to make a solid problem analysis. It is still one of the most used and trained method of rational problem solving in corporate settings (Spitzer & Evans, 1997). It is a rich source for techniques in the Problem Finding stage and for all convergent stages.

To break through the traditional patterns of long processes and indecision Kepner and Tregoe (1965) provide a series of four rational processes in which four fundamental questions are reflected:

- *Situation appraisal*: This clarifies the problem situation (what's going on?).
- *Problem analysis*: Here the actual cause of the problem and the relationship between cause and effect are searched for (why did this happen?).
- *Decision analysis*: Based on the decision-making criteria, choices are made to arrive at potential problem resolutions (which course of action should we take?).
- *Potential Problem analysis*: Here potential future problems are anticipated and preventive actions are developed (what lies ahead?).

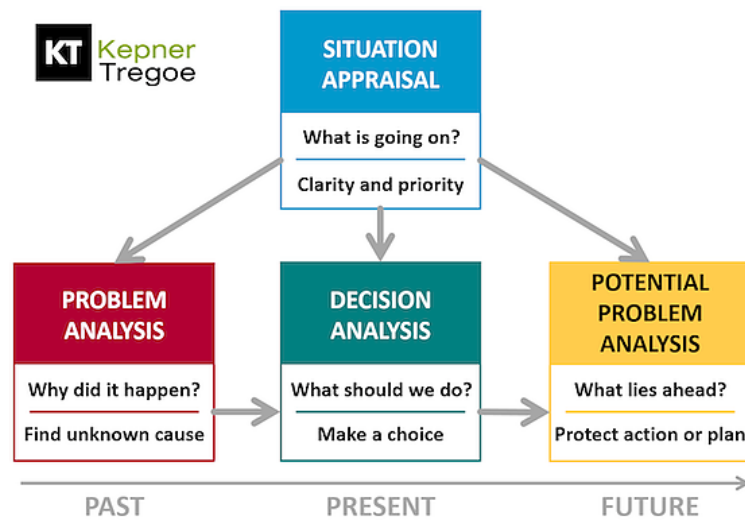


Figure 8: KT-Method (based on Kepner & Tregoe, 1965)

4.2 TRIZ

TRIZ a Russian acronym for Theory of Inventive Problem Solving was developed by Altshuller [Altshuller, 1984] and is continually being developed and modified. Genrich Altshuller (1926-1998) was a Russian researcher with German roots working at the Russian navy on the Caspian Sea shortly after the Second World War. He had an office job preparing patents for inventions made there by the military and surrounding services. From that position he had to go through dozens of patents every day to see if something had not been invented before. Slowly but gradually he got a view of the underlying patterns in all those patents. Even though it involved very different types of inventions, from new materials to engine parts it turned out to having a number of common elements. After criticism on the soviet regime he was send to the Gulag but was released after the death of Stalin. Unfortunately . A few years later he wrote his first articles and books on "TRIZ", a theory of creative problem solving (Altshuller & Shapiro, 1956) .

TRIZ is composed of a few distinct problem-solving and problem-definition procedures and principles as well as a unifying algorithm called ARIZ (Horowitz ,1999). The two most used procedures are:

Contradiction table. In this table the knowledge on solutions found in patents is represented. It is a two dimensional look-up matrix that connects pairs of physical attributes representing physical contradictions (e.g. length and weight) to operators that are known from past experience to be capable of resolving the specific contradiction.

Principles. Based on the specific type of contradiction, defined by the variables involved, that a case can potentially resolve. For example, if a problem involves a conflict between the *length of a mechanical element* and its *strength* (increasing length deteriorates the strength), the method directs the problem-solver to look at relevant principles f.i. principle 40 "Replace homogeneous materials by composite ones".

TRIZ has proven to be a strong method to provide for Flexibility (compare also Synectics).

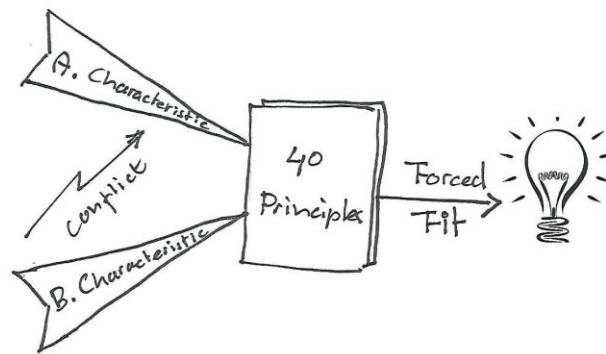


figure 9: TRIZ is an Invention Machine

4.3 Nominal Group Technique

One of the challenges of Traditional Brainstorming is about sharing out loud options. Some Resource Group members may feel limited in their participation because of these distractions. Similarly, during the converging stage, some individuals may be too influential as well, due to personality or hierarchy. In the 70s Delbecq and van de Ven developed a group approach to minimize these influences: the Nominal Group Technique (1971).

Nominal groups are groups in which individuals work in the presence of one another but do not actively interact. As such, the Nominal Group Technique is a highly structured method used to build consensus in a group during diverging, reverging and converging, while minimizing bias and influence of individuals in the group. The Resource Group is asked to write down multiple options in silence. In turn, the options will be shared with the group, one option at a time, without discussion. Once all ideas are listed (and numbered) the ideas will be discussed for clarification (not for evaluation). Again in silence, a first round of independent voting or ranking will be conducted. After counting the votes, the results will be discussed plenary. If desired, another round of voting will be done. NGT is highly appreciated for setting up studies in the social domain (see also Engaged Scholarship by Van de Ven, 2007).

4.4 Mind Mapping

The original use of Mind Maps was for studying and memorising lectures and books and preparing papers. It is a system “to organise knowledge”(Buzan, 1974; p. 12). In the

later use of the method we see also mind maps for analyzing situations and preparing speeches or other actions.

Mind mapping is about finding keywords to describe the topic at hand. In the original version one should start with the central theme in the form of picture. From this central theme one should add associations (or connected keywords) on lines by words or pictures. For words one should use PRINT and the use of colours is promoted to highlight or structure. Adding two more rules the "Seven Laws of Mind Mapping" than are (Buzan, 1973):

1. Image in the centre
2. Words on connected lines
3. One word per line
4. WORDS IN PRINT
5. Colours
6. More images
7. Free Flowing Mind

In the work of Buzan (1974, 1993) the way to get a Free Flowing Mind is not explained although in his first works he combines it with physical exercise and a short interval of concentrated work and a long interval of break. Only a couple of pages in the work are devoted to the use of Mind Maps in groups and even then it starts with individually making mind maps and sharing them in an effort to make one big mind map. The method emphasis on diverging or "radiant thinking" as Buzan (1993) calls it and is very shallow on converging.

4.5 Design Thinking

Most of the methods on problem solving date back 50 years or more. A rather recently advocated method is Design Thinking. According to Dorst (2009) the term 'Design Thinking' has been part of the collective consciousness of design researchers since Rowe used it as the title of his 1987 book (Rowe, 1987). Tim Brown of the American design agency IDEO popularized Design Thinking in a highly cited article in Harvard Business Review (Brown, 2008). Studying the way designers work and adopting some designerly practices can be interesting to other fields because designers have been dealing with open, complex problems for many years, and the designing disciplines have developed elaborate professional practices to do this. Multiple models of design thinking have emerged since 1990, based on widely different ways of viewing design situations and using theories and models from design methodology, psychology, education.

Design thinking is build up from diverging and converging stages like our three diamond iCPS content finding model. Special attention is given to Information Finding for our first diamond (Problem Finding). An often used technique here is the Customer Journey (see f.i. Van Boeijen et al, 2013). We found no other techniques for ideation in the design thinking community than Traditional Brainstorming, Brainstorming with Post Its and Interactive Brainsketching. For our last diamond (Solution Finding) design thinking proposes Fast Prototyping & Testing and the techniques used here are depending

on the domain the design thinking is applied for. Since the method is often used in the development of digital tools for the web, A/B testing can be found regular. It seems too early to conclude upon the contribution of Design Thinking for the Creative Problem Solving field but in using it in other fields than strict design one should cope for the possible lack of designer knowledge and experience in the Resource Group. The criticism that starts on Design Thinking lately could stem from underestimating the necessity of these special qualities in other members in the RG than educated and experienced designers.

5. iCPS Techniques Categorized

In the methods many techniques can be found. Since the field of CPS is rather guru biased and each guru added some specific smaller or larger variants of these techniques (see f.i. de Bono 1971; VanGundy 1998; Van Leeuwen & Terhürne, 2010; Aznar & Bléas, 2018) are presented as “new” techniques. In total we found over 500 techniques in literature. Most techniques presented concentrate on the diverging stages. Only a few authors put also emphasis on techniques for converging (see f.i. Isaksen et al, 2000; Byttebier et al, 2007) and hardly any technique on reverging can be found (Heijne & Smit, 2018). Removing all doubles in these techniques we suggest a set of 40 essential techniques characterized by the following:

Type of problem (Divergent techniques only): iCPS can be applied to a wide variety of themes, such as thinking of new products or services, developing a commercial, thinking of new applications of existing products or technologies, developing a vision for a joint venture etc. It is found that some techniques are more suitable to certain themes than others. However, in essence, it is about two things: Is the Problem as Given (PaG) Complex or Single. This classification factor builds on what Souder and Ziegler (1977) refer to as ‘Ill-defined’ versus ‘well-defined’ problem statement and whether it is ‘well-understood’ versus ‘not well-understood’. Complex problems benefit from techniques with a more holistic approach and provide for some deep thinking. While Single problems thrive best on fluency and/or high energy techniques.

Type of options (Divergent techniques only): This classification factor is closely linked to ‘type of problem’ and depends on what the Problem Owner is aiming for: are ‘obvious’ options desired or is there a specific need to aim for options ‘beyond the obvious’? In many situations obvious options will be satisfying, especially if the aim of the session is to harvest existing options from a Resource Group or to build consensus about an intended decision. When truly new ideas, solutions or opportunities are desired or when a shift in paradigm is needed, it is recommended to choose a technique that is designed for generating options beyond the obvious.

Number of options (Revergent and Convergent and Acceptance Finding techniques only): Once a set of options is generated, it is time for reverging, followed by converging. The amount of options is essential for choosing an appropriate technique. Some reverging and converging techniques take more time and energy than others. Acceptance Finding techniques are also included in this classification factor, since it is a valuable indicator.

Instead of providing exact numbers, we created the following ranges: suitable for 1-3 options, up till 5 options, up till 10 options, up till 50 options or up till 100+ options. These ranges mean that techniques that are suitable for 100+ options can also be selected for reverging or converging 20 options.

Level of Experience (Facilitator and Resource Group): Traditional Brainstorming is an example of a technique that seems quite easy, since a lot of people claim to apply it often. In fact, it is one of the most difficult techniques in our collection to apply. The Facilitator needs a lot of expertise, and in addition, the Resource Group should have quite some experience and/or training as well. Other techniques are easier to apply, and require less rigid facilitation, like Brainwriting 6.3.5.. We suggest to classify all iCPS techniques, Session Duties and Methods into three buckets to indicate the level of experience required to apply them effectively: Novice, Intermediate and Expert.

Time: This factor is indicating the minimum amount of time required for an activity during the creative session.

Fun Factor: A scale of 1-5 (1 is low, 5 is high) is suggested to indicate the fun factor. Some techniques provoke a fun environment, which may foster both fluency and flexibility. The techniques with a high fun factor are beneficial for creating a positive and open climate and are particularly suitable for team building purposes. The fun factor is often linked to the group energy level, but not in all cases. It is a subjective factor we based on student ratings.

Other factors that are relevant for selecting and using the 40 techniques are:

Size Resource Group: The ideal size of a Resource Group is between 5 and 9 participants, given that there is one Facilitator. All iCPS techniques and Session Duties described in this paper are suitable for 5-9 participants. With larger groups, it is wise to split up the group into subgroups and involve more Facilitators.

On- or offline: The approach and techniques described in this paper are mainly focused on Resource Groups working in a face-to-face setting. However, sometimes a creative session is needed with participants who are working at different locations. Online sessions could be a solution, in which participants can work remotely, and in some situations even asynchronous (e.g. Collective Notebook). Although there are plenty of attempts to take (parts) of creative sessions online, it remains a challenge to respect the basic principles of good facilitation. Some interesting attempts are being developed at Stormz.me and Nureva.

In the table below the 40 essential techniques are presented. Since a lot of the materials presented in the literature on creativity techniques are more general in nature and cannot be represented in the techniques nor in the iCPS framework we suggest to represented these in so called session duties. We came to 6 clusters as represented in the table below.

Table 1 the 40 techniques and 6 Session Duties

Content Finding - Problem Finding	
<i>Diverging</i>	<i>Reverging</i>
Co Making a Collage	CI Spontaneous Clustering
FA Flower Association	IG Idea Gallery
HP Excursion 3: Hidden Presumptions	Sq Sequencing
H2 How To's or H2's	<i>Converging</i>
LA Ladder of Abstraction	HD Hits or Dots
MM Mind Mapping in Group Sessions	RP Restating the Problem
PA Excursion 9: Personal Analogy	
PP Picture the Problem	
SC SCAMPER	
5W 5W1H	

Content Finding - Idea Finding	
<i>Diverging</i>	
Bs Brainstorming (traditional)	Exc 6: Random Objects
Bw Brainwriting with Post-its®	Exc 7: Visual Stimulation
B6 Brainwriting 6.3.5.	Exc 8: Guided Fantasy
CC Creative Confrontation	Exc 9: Personal Analogy
Co Making a Collage	Exc 10: Direct Analogy or Metaphor
FA Flower Association	Exc 11: Symbolic and Fantasy Analogy
MA MATEC	
MS Morphological Synthesis	<i>Reverging</i>
SC SCAMPER	CI Spontaneous Clustering
40 40 Inventive Principles of TRIZ	IG Idea Gallery
X1-11 Excursions 1-11:	Sq Sequencing
Exc 1: Criminal Round	CB C-Box
Exc 2: Take a Walk	
Exc 3: Hidden Presumptions	<i>Converging</i>
Exc 4: Absurd Questioning	HD Hits or Dots
Exc 5: Random Words	PC Paired Comparison

Content Finding - Solution Finding	
<i>Diverging</i>	
Co Making a Collage	
IB Interactive Brainsketching	
SC SCAMPER	
<i>Reverging</i>	
CI Spontaneous Clustering	
EP Elevator Pitch	
IG Idea Gallery	
Sq Sequencing	
SM SML	
<i>Converging</i>	
CR Criteria & Ranking	
MP Making a Poster	
UA UALo	

Acceptance Finding	
DA Devil's and Angel's Advocates	
FF Force Field Analysis	

Information Finding	
PL Parking Lot	

Session duties	
Bp Briefing by the problem owner	
Br Break	
En Energizers	
Ic Icebreakers	
Pu Purge	
SP SPARK the PaP	
We Welcome & introduction	
Wr Wrap-up & closing	

In the figure below a visualization of the 40 and their place in the iCPS frame work is given.

The 3-diamond overview

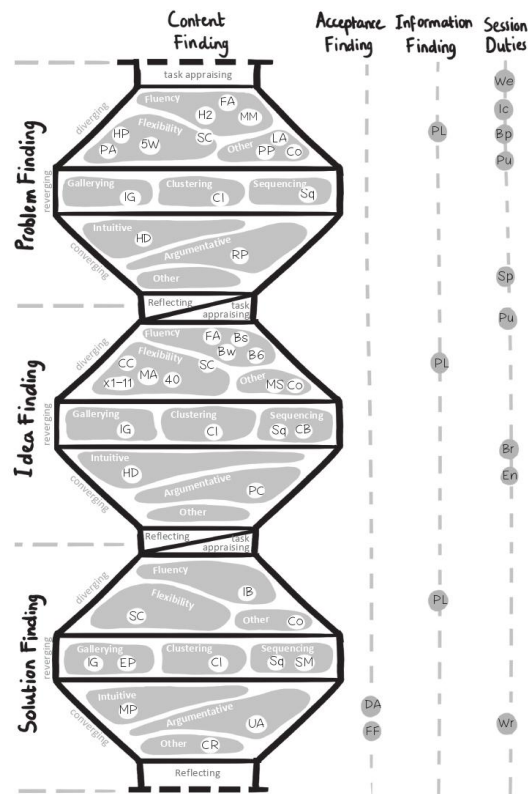


Figure 10 Techniques in iCPS

6 Conclusions and recommendations for further research

Guru driven

Most of the works on creativity techniques are guru driven and their books do not stand in an academic tradition. Similar techniques are presented with new names or slightly changed principles as complete new insights. The set of 40 techniques and 6 session duties within the iCPS framework is a first attempt to come to a standardized B(ody) O(f) K(nowledge). This BOK can be used to position the claims of new guru's.

From practitioners rule of thumb to evidence based

Techniques and methods in creative problem solving come from practice. Hardly any attempt is made to prove the efficiency and efficacy of the claims the authors of the various techniques and methods make. An exception can be made on the claims of the training in CPS. These claims are evidence based. Future research should try to fill the gap between the claims and evidence on technique and methods. A standard set of techniques (f.i. problem finding with 5W1H and restating the problem with H2's; idea finding diverging with a purge using Brainstorming with Post Its combined with a Creative Confrontation approach with a simple excursion like "What thoughts do a Blue Banana provoke in you" , reverging with Spontaneous Clustering and converging with Hits and Dots; Making a Poster for solution finding) could be the standard for a double blind procedure.

References

- Altshuller, G. S., & Shapiro, R. B. (1956). 'Psychology of Inventive Creativity'. *Voprosi of Psihologi (Russian journal 'Issues of Psychology')*. 6, 37-49.
- Altshuller, G. S. (1984). *Creativity as an exact science: the theory of the solution of inventive problems*. Gordon and Breach, New York.
- Altshuller, G.S. (2005). *40 Principles Extended Edition: TRIZ Keys to Technical Innovation*. Technical Innovation Center, Inc. Worcester, MA, USA
- Amabile, T. M. (1996). *Creativity in context: Update to 'the social psychology of creativity.'* Westview Press.
- Aznar G. and Bléas A. (2018), *99 Idées pour trouver des Idées, tout seul, à deux ou à plusieurs!* Paris :Eyrolles,
- de Bono, E. (1971). *Lateral thinking for management*. New York: Mc Graw Hill.
- Brown, T. (2008). Design thinking. *Harvard business review*, 86(6), 84.
- Buijs, J., Smulders, F., and Van Der Meer, H. (2009). 'Towards a more realistic creative problem solving approach.' *Creativity and innovation management*, 18(4), 286-298.
- Buijs, J., and van der Meer, H. (2013). *Integrated Creative Problem Solving*. The Hague, NL: Eleven International Publishing.
- Buzan, T. (1974). *Use your head*. BBC Books, London
- Buzan, T., & Buzan, B. (1993). *The mind map book. Radiant thinking the major evolution in human thought*. BBC Books, London
- Byttebier, I., Vullings, R., and Spaas, G. (2007). *Creativity today: tools for a creative attitude*. Amsterdam, The Netherlands: BIS Publishers.
- Cross, N., Dorst, K., & Roozenburg, N. (Eds.). (1992). *Research in design thinking*. Delft, The Netherlands: Delft University Press.
- Dalkey, N., & Helmer, O. (1963). An experimental application of the Delphi method to the use of experts. *Management science*, 9(3), 458-467.
- Delbecq, A.L., & Van de Ven, A.H. (1971). A group process model for problem identification and program planning. *The Journal of Applied Behavioral Science*, 7(4), 466-492.
- Guilford, J.P. (1950), 'Creativity.' *American Psychologist*, Vol. 5, Issue 9, 444-454.
- Gordon, W. J. (1961). *Synectics: The development of creative capacity*. New York : Harper & Row.
- Horowitz, R. (1999). *Creative problem solving in engineering design*. PhD. diss., Tel-Aviv University.

- Heijne, K.G. and Smit, L. (2018). 'The Creative Diamond Revisited: Reverting, an Essential Transition Step between Diverging and Converging.' In: *Societal Impact of Knowledge and Design: Proceedings of the 13th IFKAD Conference 2018*. (pp.1228-1244). ISBN: 978-88- 96687-11-6 / ISSN: 2280787X.
- Isaksen, S. G., Dorval, K. B., and Treffinger, D. J. (2000). *Creative approaches to problem solving: A framework for change*. Kendall Hunt Publishing Company, Dubuque IA.
- Kepner, C. H., & Tregoe, B. B. (1965). *The rational manager: A systematic approach to problem solving and decision making*. McGraw-Hill.
- Nolan, V. (1989). *The Innovator's Handbook: The Skills of Innovative Management: Problem Solving, Communication and Teamwork*. Penguin, London.
- Nolan, V. (2003). Whatever happened to Synectics?. *Creativity and Innovation Management*, 12(1), 24-27.
- Nolan, V. & Williams, C. (2010). *Imagine That! Celebrating 50 years of Synectics*, Synecticsworld. www.synecticsworld.com
- Osborn, A. F.(1953). *Applied Imagination; principles and procedures of creative problem-solving*. Buffalo, NY: The Creative Foundation Press, 3rd revised edition, 1993.
- Parnes, S.J. (1967) *Creative Behavior Guidebook*, New York: Charles Scribner's Sons
- Parnes, S. J., Noller, R. B., and Biondi, A. M. (1977). *Guide to creative action*. New York: Charles Scribner's Sons.
- Prince, G. M., (1970). *The practice of creativity: A manual for dynamic group problem solving*. Harper & Row, New York.
- Rowe, P. (1987). *Design thinking*. Cambridge MA: MIT Press
- Rickards, T.(1974). *Problem solving through creative analysis*. Epping: Gower Press.
- Rhodes, M. (1961). 'An analysis of creativity.' *The Phi Delta Kappan*, 42(7), 305-310.
- Runco, M. A., Pritzker, M. A., Pritzker, S. R., & Pritzker, S. (Eds.). (1999). *Encyclopedia of creativity* (Vol. 2). Elsevier.
- Sadler-Smith, E. (2015). 'Wallas' four-stage model of the creative process: More than meets the eye?' *Creativity Research Journal*, 27(4), 342-352.
- Spitzer, Q., & Evans, R. (1997). *Heads, You Win!: How the Best Companies Think*. Simon & Schuster, New York
- Torrance, E. P. (1974). *The Torrance tests of creative thinking-TTCT Manual and Scoring Guide: Verbal test A, figural test*. Lexington, KY: Ginn.
- Van Boeijen, A., Daalhuizen, J., van der Schoor, R., & Zijlstra, J. (2013). *Delft design guide: Design strategies and methods*. BIS Publishers, Amsterdam.
- VanGundy, A.B. (1988) *Techniques of structured problem solving (2nd ed.)*. New York: Van Nostrand Reinhold.
- Van Leeuwen, M., and Terhürne, H. (2010). *Innovation by Creativity: Fifty-one Tools for Solving Problems Creatively*. Penryn, UK: Ecademy Press. (Original publication in Dutch in 1999.)
- Wallas, G. (1970). 'The art of thought.' In: P.E. Vernon (Ed.). *Creativity*. New York, Penguin Books. (Original work published 1926.) Pp. 91-97.

The Traveling Ideas as the Contextual Infection of Art

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Abstract

This paper discusses arts as practice for business and society studies. Given that arts are necessary to develop business and society; how can valuable arts practices be learned? This conceptual paper is investigating how collective knowing develops in business contexts using art by unconventional painters such as Edvard Munch as examples of this process. The necessity of art is giving us a societal meaning of the process of knowing or a scripted story for enterprise action based upon the knowledge of art. The reflection and dialogue based on art might contribute to creativity and innovation in the business process. The paper develops a theoretical framework and theory for how this works.

Key words – Art management, Ideas, Creativity, Knowledge management, Innovation

Type of paper – Academic research paper

1. Introduction

This paper adopts a view that artwork can offer significant ways of experiencing and knowing that they can become of practical interest for business and society. The artwork at the University of Oslo became significant for manifesting Edvard Munch's paintings as a lasting value for Society (Ydstie, 2011).

As already contended by the philosopher David Hume (1739/1969), exciting experiences are fundamental for human understanding. However, a rich understanding of human knowledge and experiential capacities has tended to become lost in mainstream management studies, control of knowledge is stressed rather than its creation (Von Krogh, Ichijo and Nonaka, 2000). The process of working greener and smarter through new practices require time for reflection, learning and knowledge sharing. The slowness in adapting to emerging ecosystems might be found in hierarchical, top-down management

systems not allowing ordinary people to deliver extraordinary results based upon art, new cultural and social meanings.

We will in this paper investigate how collective knowing develops in art and business contexts giving us an expanded meaning of the process of knowing in practice. Our primary interest lies in how collective knowing develops based on art and culture experiences. Related research questions are what kind of understanding do we share, what means that are used to enable this development and at what pace this development takes place. We also need to account for the simultaneous existence of less known aspects or even non-knowing, when facing new or unfamiliar matters or concepts.

To illuminate arts as ongoing practices of knowing and non-knowing, we draw on works in two periods of the painter Edvard Munch. Born in Norway, Munch worked and exhibited in several European countries, he self-reflected in both visual artworks and poetic texts and took part in public exhibitions and debating with others. Although being met with much skepticism, he created seminal works for the future.

By addressing arts as a practice of both collective knowing and non-knowing in performances of high interest for society, our paper seeks to contribute to the future of businesses for society. The implication of art as practice in the knowledge process in businesses is an ambitious task, but we aim to find a theoretical framework for how this works and to state our point of view.

The remainder of this paper first explores modes of knowing and forms of representability as two fundamental notions in the art as practice. The paper then describes the emergence of particular artistic ways of illuminating and gaining new perspectives on collective knowledge. We are anticipating that the modes of knowing and non-knowing are resonating with on-going individuated and collective processes in art and business. The knowledge dynamics of art and business and an expanded dialogue might thus give meaning both to arts and business.

2. Methodology

We base the methodology of the paper on an exploration of clarified subjectivity concepts. We are exploring the concepts of knowledge together with the concepts of art and business. Our concepts are sensitizing seeking directions along which to look as opposed to definitive concepts seeking already predefined directions. We are further exploring the connections between art and businesses. We are not explaining the connections. We are instead using logic and clarification through our argumentation. We define this as a clarified subjectivity as opposed to pure subjectivity. Our methodological support is found in Feyerabend's book "Against methodology" (1993). Feyerabend argues that any pure falsification and a pure logic process will destroy any creativity or novelty in any science. We are not falsifying anything, but instead exploring possible directions along which to look for art and business. We draw on examples from unconventional artists like Edvard Munch. He explored new ways of painting and printing throughout his lifetime and became influential for international art practices as well as for

arts concerning business and society. Munch's art practices are thus of interest for both arts and business.

3. Modes of knowing

Rather than talking about types of knowledge, we will discuss ways of knowing as it is our perception that understanding is an always ongoing process. Types of knowledge only provide us with a snapshot of this process and thus give a static image of expertise. Hence, our modes of knowing model consist of a fluid scale from non-representable knowing to non-representative making the knowledge into representable knowing, where the boundaries between the aspects or levels are unclear. Non-representable and non-representative knowledge might also be labeled tacit knowledge, and the representative knowledge might be labeled explicit knowledge (Polyani, 1959). The tacit aspects of the knowledge process are challenging to explore. To explain the process towards the concrete result might be impossible both in art and business. Rotating professional roles and observation might give others the possibility to deliver similar results or knowledge about the imitation of the tacit process. The management process is also tacit in the way that we cannot say what works in different situations. When Thompsen (2019) summarized management to "all you need is love" that also pinpointed the subjectivity of what works in management. The processes of love, emotions, and intuition are indeed working, but how and when to use them remain a part of the tacit experienced way of leadership. There are also composition rules to follow and learn in art practices, but how to make them into high art remain a tacit process. Take the process of simplification of anything. There is nothing more challenging and difficult demanding professional knowledge, experiences and attitudes in all crafts, art, and businesses. The Japanese artist making the sea wave made it in a couple of hours, and it is spread all over the world as better than the reality (Gombrich, 1986).

Table 1 The different modes of knowing in art and business

Knowledge perspectives	Individual	Collective Group or Organization
Expressive theories Unfolded origins Nonrepresentative tacit knowledge	Immanent Subjective Original Human "Core"	Latent Unique Core (possibly distinguished) competences Access to talented people
Transformative theories Interplay and co-creation Experience as creation Representative knowledge	Creating Experiencing Feeling intelligence Participating	Performative as process and product Encounter in communication. Enlivened experience in a collective
Mimetic theories Influencers Representative knowledge	Absorbing Imitating role models Rehearsals	Sharing intentions, exemplary works Copying with others Inspiration and imitative exercises
Non-knowledge and ignorance theories Nonrepresentable tacit knowledge	Not-sensing Overlooking Imagining from invisible sources	Blindfolded organizing Performing outside the standard operating procedures Sharing situations of new or unfamiliar practices

Representability refers to what degree knowledge creations visualized or externalized and represented in texts, art, and metaphors. We have chosen to name three knowing modes. One is named non-representable knowing, which refers to the fact that it is impossible to represent. Another is named non-represented, which means that through specific processes or means it is possible to externalize parts of the knowledge. Finally, representable knowing is externalized and represented in art and texts, videos or other media. We can refer to, explain and help transfer or progress this knowledge through different forms of representations. Representable knowledge is the junior professional knowledge used in any training and is the foundation for the superior professional knowledge incorporating knowledge, experiences, and attitudes into own wisdom as an artist, designer or leader.

4. Non-representable knowing

Non-representable knowing is a mode that individuals or groups develop over time and that cannot be made explicit. Non-representable knowing itself thus takes place as individuals or groups gain experience, but it remains non-representable. Examples of non-representable knowing on an individual level are intuition, imagination, and emotions. It may not be easy to express why we make a particular decision, but our "gut-feeling" tells you that it is the right thing to do either you are in business or the arts.

We define non-representable knowing as "What we do not know that we do not know" and "What we do not know that we know." We will be striving to work with this knowing/non-knowing, which involve tacit and less articulable aspects, but from any great piece of art and a great piece of science and innovation, we know that suddenly one day we feel that we see the light.

5. Non-represented knowing

The scale of representability flows on towards non-represented knowing. This mode resonates with the tacit knowledge that Nonaka and Takeuchi (1995) saw as transferable through observation. It can be seen as implicit know-how and is a result of experiences that individuals, groups or societies have. Studying manuals or texts do not lead to this non-represented knowing – it also requires practical experience. Orr explained this mode of knowing as "both the ability to do things without being able to explain them completely and also the inability to learn to do them from a theoretical and a craft understanding of the task" (1990: 170).

6. Representable knowing

Towards the end of the scale, we find modes of knowing that we are more easily expressing or representing. We may communicate representable remembering through art, texts, symbols, and products. It recognizes that individuals and collectives rapidly can share and exchange. An example of representable knowing is what we are expressing in

this paper. What we can read is however only a snapshot of our knowing. Hence, we see one state of our work printed on paper, whereas it may have developed somewhere else – on paper, in our computer or our mind. These snapshots may be an art exhibition, a piece of literature, a business decision, a service or a product.

We define representable knowing as "What we know." This explicit knowing might be communicated as state-of-the-art knowledge and explained.

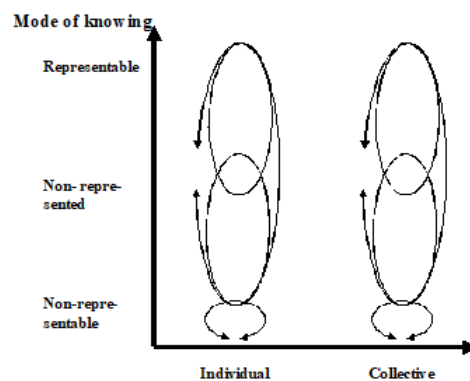


Figure 2: Modes of knowing

Figure 1 illustrates the modes of knowing that we have discussed above. The model visualizes how the different styles interact with each other and how they can shift from one degree of representability to another as we can see in the figure non-representable knowing only tangents the other modes. The little interaction intends to illustrate that the non-representable style of understanding has an impact on the different patterns, but it is difficult to shift it into more representable modes. The style impression has an impact on any piece of art. We experience it as the art of Edvard Munch or Hakon Bleken (see later sections). How do we make it non-representative and representative for businesses?

The ellipse with an arrow in on each end illustrates that knowing can shift in both directions, e.g., both towards, from, and within a mode. Missing in the figure are the linkages between individual and collective knowledge. This is the linkage that we would like to explore next.

7. Knowing and non-knowing as a collective activity

Sharing or appreciating unfamiliar knowing is not necessarily something that happens. From common sense, observations and articles we can conclude that shared knowledge is a result of a long and continuously ongoing process of uncertainty, conflict, needs and wants. There must be some prerequisites for collective intelligence to take place, and there also seems to be a need for a matter, means or tools that enable shared knowing. What these are and how they support shared knowing is the next thing we will try to establish.

Blackler argued (1995) that knowing both in art and businesses are purposive and object-orientated, which could limit specific knowing merely to clear aims. The existence of a purpose – whether articulated or habitually taken for granted – may be beneficial when seeking to enable the actual sharing of knowledge. A purpose does however not just arise out of nowhere. There must be a context or a situation in which identify a need or desire for knowledge.

Even experts may tend to stay in their current position doing more of what they have been doing before although they may have the possibility to explore the anomalies or unexpected phenomena. Kuhn (1962) describes how scientists are doing whatever they can to keep their paradigm as a normal science even if the paradigm is outdated.

Art may thus help us appreciate the knowledge gap and non-knowing but how? Through the socialization of art and businesses, we may get art to talk to us in a different way giving our business more creativity and an ability to walk in another direction. Individuals are often not aware of their own, deeply rooted, assumptions until a situation occurs where the assumptions surface and are made conscious in an interaction between individuals. Thus taking part in interactive and unfamiliar situations can create an opportunity for non-representable knowing to move into other known modes.

8. Illumination: Munch's art practices

In the following, we shall draw on research and arts-based texts grounded in art practices of Edvard Munch (1863-1944), an internationally renowned painter and graphic artist born in Norway. Munch worked for more than sixty years and produced a rich variety and quantity of paintings and prints. He is most famous for a few of his iconic paints such as *The Scream*, *Madonna*, *Vampire*, and *the Sick Child*. *The Scream* has become one of the most iconic images of world art, and one of four original versions was sold at Sotheby's in 2012 for a price of 120 mills. USD.

Beyond Christiania Munch came to spend time in nearby regions. He painted and sought inspiration outdoors. He traveled especially to Germany and France which offered artistic stimulations, places to exhibit, cafés, friends as well as enemies. The provincial town Christiania had artists like Henrik Ibsen, Edvard Grieg, Gustav Vigeland, Ludvig Karsten, Knut Hamsun (later Nobel prize winner), Harald Sohlberg, Nikolai Astrup, Bjornstjerne Bjornson (later Nobel prize winner). All of them were in opposition to the accepted paradigms within their arts. The contemporary European art, literature and classical music were through them present in Christiania. Explorers like Roald Amundsen and Fridtjof Nansen and new industrial businesses were also forming the city. Art, literature, music, and businesses were transforming Christiania in a new democratic nation striving to find an identity.

9. Vignette 1: The Life Frieze

Several of Munch's most famous paintings – called *The Life Frieze* – reveal inner states of anxiety and illness and they are often linked what has been called the symbolism

period, which also inspired German expressionism. Particular anxiety and strangeness associated with *The Scream* (1893) originated in Munch's walk outdoors in Oslo and a sudden moment of visual and emotional impressions. It is however not an explicit self-portrait or another recognizable person portrayed when walking in the sunset. Instead, it is depicted through a highly abstracted man or creature's apparent scream coming towards us in scenery where the whole landscape is in a whole disturbing move. Munch himself recalled that he had been out for a walk at sunset when he suddenly sensed "an infinite scream passing through nature" (Stang, 1977).

10. Vignette 2: The university paintings

The Aula decorations and Laboratory materials thus enable us to revisit an artist's work as well as his reflexive writings. Munch was breaking away from the Greek assumptions of what and how to portray in mural decorations and worked hard to find other radical ways of representing knowledge and non-knowledge. The works are a part of expressive German art. The expressionism is evident in Munch's decoration of the University Hall. Munch, who had gained fame in 1892 through his "scandal" exhibition in Berlin, discussed his drafts with German art friends and presented them at the exhibition in Berlin 1913. Highly acclaimed, they contributed to ensuring Munch the commission of decorating the University Hall. He created his paintings between 1909 and 1916 dedicated to representative and non-representative knowing of the past, present, and future melting together in a search for the unknown light.

11. Towards understanding arts as a practice

From Munch's art practices, we can learn how the shared context and situations matter in nontrivial ways. His difficult childhood did not merely harm this artist; Munch found several ways of dealing with and transgressing the dark sides when he painted and repainted *The Sick Child* in a close up more direct fashion that broke away from the conventional images. Knausgård (2017) underlines that Munch is expressing the presence of the death itself.

Interestingly, the contemporary Norwegian painter Håkon Bleken – who also experienced a challenging childhood and ambiguous relation with his father – also excels by zooming in on the dark sides including painting his dying father and mother in close-up, unconventional ways. In an interview Bleken explains how pace was an enabling factor; in fact, he painted very quickly with few broad strokes to avoid the conventional assumptions. In retrospect, he felt it had opened up for a better portrayal (Bleken, 2018). He also feels that painting fast give a better expression of the Holocaust, the Utoya and the Middle East tragedies. The fastness is not representable, and non-representative knowledge was becoming representative to paintings that question the essential existential situation for how we are willing to meet the tragedies of today and yesterday. Bleken paints them as ever existing situations we always have to handle. Bleken paints the

climate crisis as an invitation to recreate businesses and societies as sustainable ecosystems. The black death is meeting the blue survival.

Looking afresh at Munch's *Scream* painting reveals that the human creature approaching has the mouth wide open and with hands running up quickly as in a shocking inner state to embrace the head. The agonized face in the middle of this painting has become an iconic image of art seen as symbolizing the anxiety and uncertainty of modern man. What we are seeing make us scream.

We are moving from individual to collective knowing and vice versa. Munch engaged in various relations with significant others. The arts circles and café encounters offered some highly skilled and engaged people recurrent possibilities to share and debate contemporary artwork. Munch's way of evoking another presence in a variety of daily situations breaks with earlier artistic practices, for example, making a crowd appear ugly and hostile rather than beautifully painted. In this manner, the artist opens up for another proximity and even darker sides of human encounters. This darker side compares to Bleken's darker sides and presents an engaged art talking to us and confronting us with a life and death situation that does not leave us.

12. Opening up for new mental models

There are individual and shared mental models (Kim, 1993). In a socialization process, an individual's conceptions, understanding, and mental models change. However, the redefinition of the individual mental models can only take place when the individuals face a situation that is relevant to them (Richmond, 2000).

Trying to make mental models representable may however not be easy. It may also be an uncomfortable process because by expressing our deeply rooted assumptions we also expose them to critique and revision. Blackler (1995) argued that it is incoherencies, inconsistencies, and conflicts that offer learning opportunities. By facing incoherencies, disagreements, and disputes an individual is exposed to alternative assumptions and can thereby choose to adopt these or stick to the old ones. Bleken and Munch might give assumptions on sustainable and engaged businesses.

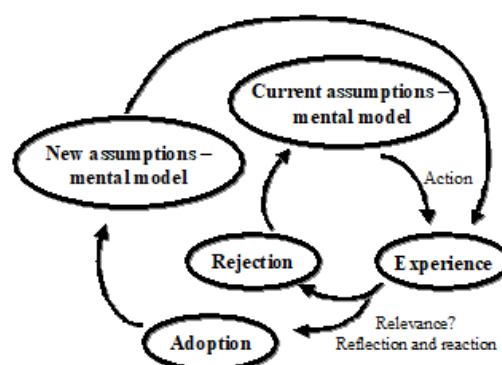


Figure 3: Development of new assumptions and mental models

13. Communication, language, and metaphors

Weick (1995) stated that "language is both the tool and the repository of learning. It is the critical tool for reflection, both at the inter- and intra-personal level. Also, language is a social phenomenon or stated differently, learning is embedded in relationships or relating learning is an inherent property not of an individual or an organization, but rather resides in the quality and the nature of the relationship, between levels of consciousness" (1991:18). From Munch, we may learn that both visual arts and poetic language can support individuals and collectives to make their knowing representable. When the Christiania Bohemians were talking with each other, writing and painting, some of their knowing/non-knowing became expressed and materialized. Their art became a manifest in a variety of ways of representing and non-representing knowing. Moving into non-representable knowing also means that metaphors partly determine the future collective knowing; "Metaphor is not merely the first step of transforming tacit knowledge into explicit knowledge; it constituted an important method of creating a network of concepts which can help to generate knowledge about the future by using expressions from any existing knowledge" Nonaka (1994:21). These expressions are a part of Munch and Bleken's paintings.

14. Observation and imitations

Figure 3 below illustrates the dynamics of knowledge between individuals and collectives and within a collective. The ellipses with the arrows in both ends visualize knowing moves within as well as between the modes and organizations. As in figure 1, non-representable knowing serves as a basis for the other knowing styles, since it filters what impressions, alternative assumptions and mental models that a group adapts.

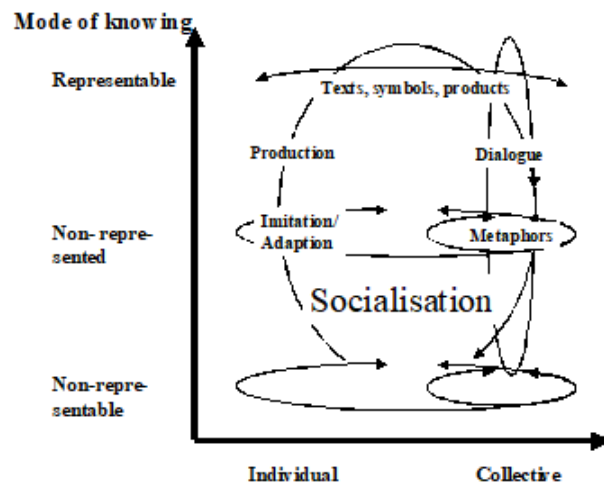


Figure 4: Knowing as a collective project activity

In the figure we also find the means or tools that enable and support the link between individual and collective knowledge. Socialisation contributes to all modes of knowing, but is especially crucial for non-represented and non-representative knowing. We have illustrated this with the horizontal ellipse that connects individual knowing to collective non-represented and non-representable knowing. Socialization contributes to both individual and collective knowledge since it provides a context within which both personal and shared mental models are challenged. Socialization and dialogue also give individuals an opportunity to develop and share metaphors and stories, which links non-represented knowing to non-representable knowing (illustrated by the vertical ellipse that flows through all three knowing modes). We use art and texts as a means for distributing metaphors and stories. However, because documents are static, only a one-way link is enabled, from representable to non-represented knowing. Dialogues, on the other hand, allow the interactive development of a story. In figure 4, the line that links the individual to collective representable knowing illustrates this.

The question often posed is if art can change the world or the actual behaviour. The traditional way of thinking is that art cannot transform businesses and society. Ideas and concepts can only do this transformation. We propose that art may also be converting the business community like the works of Munch. The conversion might be instantly or continuous. The Life magazine photo of the American soldier killing a pregnant woman in the Vietnam war changed the attitudes instantly. The Munch Scream describes the anxiety of modern times anytime. Picasso's Guernica changed the way we were and are looking upon the Spanish Civil War (Gombrich, 1986). Art is in transit between the non-representative and representative and might of this reason change an individual and collective perspective. Bleken's picture "Living the sales" shows the "best" in life is to save money on every seasonal sale. Having seen it, we reflect upon our life. We are concluding that art certainly can change perspectives, attitudes, and behaviour. Art may be vital for any business.

15. The pace of sharing knowledge: a proposed conceptual framework

What we have not accounted for hitherto is the pace at which knowing takes place. Knowing takes place and is shared at a different speed depending on what mode it is in, that means that we use and on the individuals involved. We can for example almost instantly share representable knowing, whereas non-representable knowing can take years to share.

All knowing takes place over time but at what pace is determined by how well the individuals know each other and what kinds of means they use to support recognizing. Our understanding is that the more time individuals spend together, the faster is the pace at which knowledge becomes collective. On the other hand, a problem can be that after a while collective non-representable knowing becomes so strong that it may be difficult for the group to adopt new assumptions and mental models.

Finally, the pace at which knowing shifts between the different modes depends on the circumstances under which knowing takes place. If the knower is contributing necessary

ingredients or a leader in a collective, it is more likely that knowing is adopted than if the knower is at a lower level or working in unrecognized enclaves of the organization. Art may influence what we think about the knower. In figure 4, we have illustrated the dynamics of knowing within a team and between individuals and organizations.

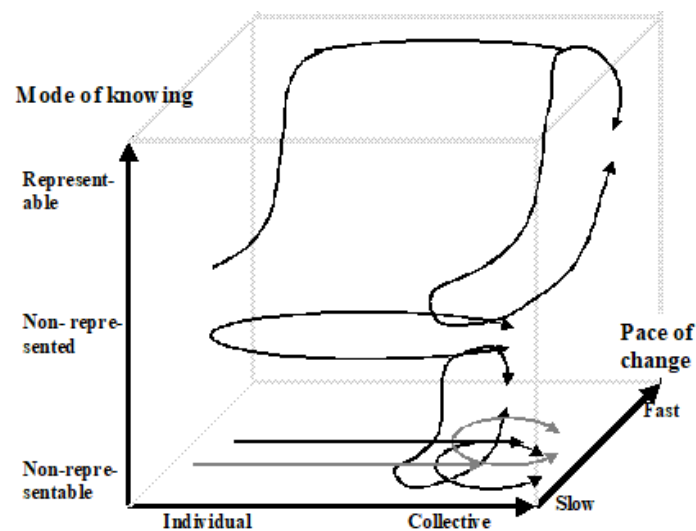


Figure 5: Pace of change within a collective and between individuals and collectives

The greyed-out lines in the figure illustrate that there are no absolute ends on the scales. In a new team, it takes some time to get to know each other, define the individual roles, and to develop a shared culture and shared mental models. The black circle in the lower right corner illustrates this. Further, at this early stage of the establishment of a team, the influence of new members is faster than it is when the team becomes more established. The lack of a strong-shared culture makes it easier to influence the development of a collective culture. The black line that goes from individual to collective non-representable knowing illustrates this. The lower grey line, on the other hand, demonstrates that, once the team culture is becoming established, the team tends to be critical towards new ideas and assumptions, which also makes it slower to change. As team members get to know each other better the pace of non-representable knowing is faster than in new teams.

16. Conclusion

Firstly, we identified three similar modes of knowing in art and businesses. The non-representable knowledge is what we do not know that we do not know and what we do not know that we know. We can thus not make the knowledge representable, but suddenly we will know that this is the painting, the book or innovation to be made. Non-Representative knowledge is what we do not know. We are still able to see or feel or make a kind of representation. Munch made multiple sketches and recurred to motives.

The representative knowledge is what we know and how we can represent the knowledge through a piece of art, a book or a product. In the making, we revisit our tacit knowing and non-knowing and explore their boundaries further in process and product. A piece of art might then start as well as nurture the process of a business idea or an innovation.

Secondly, we recognized that what makes theory and a piece of art exciting and influential is that it challenges our assumptions in some significant way. The piece of art or theory talks to us in a way which we can use it in our daily life.

What is it that people (re)present in the present and the future? Collective knowing are ideas and concepts that a collective and its interests engage in and develop over time, and that guides and give meaning to actions in a specific context. However, collective knowledge with its implicit shadowing may need confrontation and illumination of possibly veiled non-knowing of dark or ignored sides to test and renew our assumptions of true beliefs. We have revealed that art practices and their collective apprehension can become transformed into new meanings of societal importance, as exemplified in the paintings of Munch and Bleken.

Thirdly, the boundaries between individual and collective knowing are blurred, and it is difficult to determine how they affect each other. Everyone has individual mental models, but also share assumptions and mental models with others, and this implies that art unfolds and travels between individuals and groups. Art is vital for creative and innovative mental models.

Finally, art might also start a process of business and societal responsibility looking at Bleken's picture of the tragedies of Utoya, Holocaust, the Middle-East and the Climate. Art represents a form of its ecosystem where Bleken's tragedies and Much's actual Aula pictures might be the start of thinking about sustainable ecosystems in businesses. These eco-systems are today represented in the way that we know that we are reaching a global warming crisis, but we do not know how to recreate businesses into eco-friendly systems and by that the survival of the earth.

References

- Blackler F. (1995) "Knowledge, knowledge work and organizations," *Organization Studies*, 16(6) 21-30
- Csikszentmihalyi, M. (1996). *Creativity*, HarperCollins, New York.
- Feyerabend, P. (1993) *Against methods*, Verso, London.
- Gombrinch, H.(1986). *The history of modern art*, Faber, London.
- Hume, D. (1739/1969) *A Treatise of Human Nature*. Penguin, London.
- Kim D.H. (1993) "The link between individual and organizational learning," *Sloan Management Review*, 41(4)31-50.
- Knausgård, K.O. (2017) *Så mye lengsel på så liten flate*, Oktober, Oslo.
- Morgan G. (1986) *Images of Organization*, Sage, London.
- Nonaka I. (1994) "A dynamic theory of organizational knowledge creation," *Organization Science*, 5,(February), 29-41.
- Nonaka I. & Takeuchi (1995) *The Knowledge-Creating Company*, Oxford University Press, Oxford.

- Richter I. (1998) "Individual and organizational learning at the executive level towards a research agenda," *Management Learning*, 29 (3) 17-31.
- Stang, R., (1977) *Edvard Munch*, Aschehoug, Oslo.
- Von Krogh, G., Ichijo, K., Nonaka, I. (2000) *Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation*. Oxford University Press, Oxford.
- Weick K. (1993), "Collective mind in organizations" *Administrative Science Quarterly*, 38(Nov-Des) 103-144.
- Ydstie, I. (ed.), 2011 *Munch's Laboratory*, Munch Museum, Oslo.

Making Knowledge Management Creative, Engaged and Relevant: a Comparative Philosophy of Science Study of IFKAD Papers in 2016, 2017 and 2018

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Abstract

The purpose this paper is analysing and comparing all the papers in the proceedings of IFKAD in 2016 (Dresden), 2017, (St. Petersburg) and in 2018 (Delft). The study is classifying the papers according to methodology, analysis, discussion and conclusion regarding their contribution placing them into the four paradigmatic boxes. The approach is to use a philosophy of science framework and compare this to the content of the research papers. We will use the findings in four representations of knowledge, two typologies of concepts, four paradigmatic classifications and in the concluding framework for knowledge management research.

All three conferences have a heavy emphasis upon knowledge-itis and instrumental-itis and much less emphasis upon problem-itis. The papers are mostly centred around existing knowledge and accepted methodology and less related to new problems.

The IFKAD studies both in 2016 and 2017 have rather low complexity presented in an empirical and materialistic paradigmatic framework through definitive concepts representing a form of atomistic research. The complexity to more problem based studies are increasing slowly in 2018. The 2018 conference represented a more inductive research based upon sensitizing concepts and action paradigms. The progress is however slow. What would IFKAD have been with a higher degree of complexity in action and subjective paradigmatic frameworks through sensitizing concepts representing a form of holistic research? Probably a more creative, engaged and relevant conference. Objectivity is in demand, but subjectivity is needed to come up with proposals for working greener and smarter.

To move ahead for better quality in the research it is necessary to break free from the empirical paradigm and the materialistic paradigm and move into the clarified subjectivity and action paradigm. Paradigmatic ecumenism will tend to a fiercer, but an idea-generating debate. This pluralistic approach will give more engaged practical research representing more sustainable societies and businesses.

Keywords - Paradigms, Concepts, Perspectives, Knowledge creation, Knowledge accumulation

Paper type –Academic research paper

1 Introduction

Tornebohm (1983) conceives social science as a sequence of partly cumulative and partly non-cumulative transformations of knowledge (K), problems (P) and instruments(I). Tornebohm (1983) argued that if the sciences and social sciences are going to progress there has to be a balance between K, P and I. An overemphasis on any of them will hinder a free scientific discourse and by that the development of any scientific field. A central notion for instance from the compound (K1, P1, I 1) to (K2, P1, I2) occur when the problems P1 are solved to increase the stock of knowledge from K1 to K2. In the problem-solving process, new instruments may be developed or borrowed from other disciplines, at this moment changing I1 to I2. If one of the three aspects is allowed to dominate the other two, the discipline becomes less relevant. Overemphasis on knowledge ("knowledge-itis") may result in empirically empty structures irrelevant to the problems. Empty content structures are the case for business school research in general (VendeVen 2007, Olaisen and Revang 2017) where business schools are producing more and "better" research than ever, but the practical business world finds the results less relevant than ever. Preoccupation with problems ("problem-itis") may mean shallow pragmatism and conceptual malnutrition. Finally, too much attention to instruments ("instrument-itis") may erode the substantive core of a discipline. The focus of the studies is how to practice the research methodology in itself. The researchers end up testing themselves if they can master the instruments and not the theories. Tornebohm (1983) identifies these imbalances in the researcher's orientation as a lack of commonly agreed upon perspectives and something less than social science and something more than fiction. Kuhn(1970) identifies it as a pre-scientific situation where any discipline might remain until the discipline dies or advances a new paradigm.

The initial KPI maps the aspect of interest (in this case feature of knowledge structures or processes). The KPI compound in this process filters through what is called the "researchers orientation and worldview" or perspectives in Tornebohm's words (1983) or paradigms in Kuhn's words (1970) or research domains in Olaisen's words (1985). These authors are all referring to the fact that there are alternative ways of approaching the social sciences and by that also knowledge management research. The aspects studied are not given once and for all. New knowledge widens the boundaries, as might happen after the broadening of the knowledge management research. Thornebohm's idea is that pluralism is needed in any discipline to get an accumulation of knowledge and if this pluralism is lacking over time any discipline will erode and be a form of mechanistic puzzle solving of more and more irrelevant problems. The relevance will be found in other disciplines replacing a discipline over time. Kuhn (1970) labeled this as normal

science activities where the scientists agree upon what is good science reproducing obvious results in quasi scientific ways to gain respect within a smaller and smaller circle.

Galtung's (1972) idea was to identify four ways of approaching the social sciences in a triangle of theory, data and values:

- (1) Empiricism – is what we are presenting true or false (if true consonance if false dissonance)
- (2) Criticism – is what we are presenting acceptable or not acceptable (if acceptable consonance if not acceptable dissonance)
- (3) Constructivism – is what we are presenting adequate or inadequate (if adequate consonance if not adequate dissonance)
- (4) Pluralism – a triangulation of empiricism, criticism and constructivism (if congruence consonance if not congruence dissonance)

Galtung (1972) assumes that a common goal of all social sciences is to establish what is called sentences dichotomizing their "world space" by including some defining the empirical world by including some "world points" and excluding others. Hence, data sentences are reports explaining the empirical world by including what they observe and eliminate what they do not see or imagine. Theory-sentences (hypotheses or propositions) on the other hand, define the foreseen world, including aspects which are predicted by the underlying theory. Finally, value sentences refer to the preferred world, including what is accepted and excluding what is rejected. Galtung's idea was that all the social sciences could be analysed according to this framework. This is the first time Galtung's and Tornebohm's approaches are used to analyse knowledge management research.

Blumer (1969) argued that research concepts in any of the social sciences might be divided into definitive concepts and sensitizing concepts. The concepts have an essential role in any scientific inquiry. They are usually the anchor point in the interpretation of findings.

The purpose of the definitive concept is to:

Describe-Explain-Predict and Control and Rule (A definitive and objective process).

Bunge (1967) named this process as "the process of all serious systematic research".

The sensitizing concepts have another purpose:

Describe-Explore-Reflect-Participate and Change (A subjective and relative process).

Glaser and Strauss (1967) named this process "Grounded-theory-research".

Olaisen (1985) divided any kind of knowledge into four types of knowledge:

- (1) What we know defining
- (2) What we don't know implying
- (3) What we don't know that we know as a part of
- (4) What we don't know that we don't know

According to Olaisen to get a scientific, intuitive and creative movement between these four types of knowing represent the essence of representable and non-representable knowing modes in any science and social science.

Olaisen (1985) divided the social sciences into four paradigms in a quadrate of harmony versus conflict and objectivity versus subjectivity:

- (1) The empirical paradigm
- (2) The materialistic political paradigm
- (3) The clarified subjective paradigm
- (4) The action paradigm

2 Methodology

The purpose this paper is analysing and comparing all the papers in the proceedings of IFKAD in 2016(156 papers), 2017(164 papers) and 2018 (171 papers). A total of 491 academic research papers within a framework of 5000 words for each paper. The approach is to use a philosophy of science framework and compare this to the content of the research papers.

We have used five philosophy of science frameworks to analyse all the papers:

- (1) Tornebohm's knowledge, problem and instrument description (1983)
- (2) Galtung's scientific perspective triangle (1972)
- (3) Olaisen's four kinds of knowledge identification (1985)
- (4) Blumer's two kinds of scientific concepts (1969)
- (5) Olaisen's four kinds of paradigms identification (1985)

This paper has combined (4) and (5) as a pluralistic proposal for future the progress for knowledge management research.

Each paper has been classified according to:

- (1) Problem
- (2) Methodology
- (3) Theoretical foundation
- (4) Propositions and/or hypotheses
- (5) Analyse
- (6) Discussion of results
- (7) Conclusions
- (8) Theoretical and practical implications

For each academic paper a decision has been made for each of the five frameworks according to which format the paper fits into. The decision is based upon the reading of the paper. For two thirds of the papers the decision of placing them into a category was clear. For one third of the papers we had to make a subjective decision for which category we placed them into. The decision is based upon our notes from each paper and if in doubt we have reread the paper.

3 Knowledge-it is, instrument-it is and problem-it is

The papers are suffering from "instrument-it is" and to some extent from "knowledge-it is," but they are certainly not suffering from "problem-it is." Problem-oriented research is demanding and require systematic and logic argumentation (Lawrence 1992). Problem-orientated research might be a weakness for knowledge management researchers. The researchers do the statistical tests well and the researchers present the data in "nice" total packages as a form of truth. Very few results are however in conflict with existing results or anything at all. 2 of 3 hypotheses are found to be correct and 1 of 3 hypotheses are found to be incorrect. In papers dealing with knowledge sharing and knowledge management there are many similar hypotheses/propositions (44%) while 51% reach the same result and 49% reach a different result for similar propositions and hypotheses. The Popperian falsification process (1973) are used for both explicit and tacit knowledge processes even if 82% in 2017 and 84% in 2018 of the papers do not make any distinction between tacit and explicit knowledge processes. This might represent a lack of theoretical sophistication. Two third of the papers lack a definition of knowledge, information, management, leadership or the situations these concepts are used in. The lack of definitions give a kind of storytelling where a story exemplified with statistics is told. This is what Kuhn (1970) named a pre-scientific situation where anything might be equal in importance or what Popper (1973) described as the situation for psychology as a field. Kuhn (1970) called this "something less than research". The lack of problem-it is makes it difficult to make progress. There is an improvement in 2018 where as much as 18% of the papers are concentrated upon the problem itself and not the instruments, data or solutions.

More than 50% of the papers write about the need for new ways of knowledge leadership, knowledge management, and knowledge organizing. The papers however are centred around traditional leadership, management and organization issues. The papers label and marketing that they are proposing new ways of leadership, management and organizing, but they do neither define the situation today compared with the situation tomorrow nor how we are going to take us to tomorrow. The problems in the papers are centred around solvable matters and very seldom if anytime related to unsolvable problems. We are defining such "instrument-it is" and "knowledge-it is" in knowledge management research as a misdirecting striving for respectability. Twenty-one of 491 papers discuss the problems of our ecological systems and what we need to do to solve the climate crisis through sustainable businesses. These green ecological papers ask a number of questions they are not able to answer and are thus speculative and are all conceptual papers without any empirical basis.

4 The aspects of the world studied

We are making a distinction between four areas of knowledge in management research: "What we know"(1), "What we know that we don't know"(2) and "What we don't know that we know (3) and What we don't know that we don't know"(4). Area (1)

will define the area (2) while there will be a misinterpretation and bias towards area (3) and area (4).

(1) WHAT WE KNOW	(4) WHAT WE DON'T KNOW THAT WE DON'T KNOW
(2) WHAT WE DON'T KNOW	
(3) WHAT WE DON'T KNOW THAT WE KNOW	

Figure 1 Knowledge representations (Olaisen 1985)

For area (3) and area (4) will imagination and intuition be necessary f

If we want to move between area one and two the logical, empirical studies ("secure and clean studies") will be ideal, but the source of bias and misinterpretations start as soon as we move into what we do not know anything experienced. We will here begin to involve imagination and intuition. Experience-based intuition is the start point of any essential research effort while the movement from area one to area two is only instrumental puzzle-solving most often without any knowledge accumulation (Minzberg 1979, Morgan 1980). The way to improve our technique is not to attempt to analyse things into their elements, reduce them to measure and determine functional relations, but to educate and train our intuitive powers (Knight 1936). If our role is only to produce some publishable or travelable research, then we are reduced to mechanic puzzle solving demonstrating that we can master the techniques we were learning in our Ph. D's. Between 80 and 90% of the research papers in 2016 and 2017 represent this kind of mechanic puzzle solving (Morgan 1980). We are sending out a questionnaire to a large sample getting a response rate of 5-20% applying statistics and getting a classification of research results in nice tables, diagrams and figures getting more of the same trivial already known knowledge. In the 2018 conference the mechanic puzzle solving is reduced to 70%, but the response rate is at the same low level.

5 Scientific orientations

Galtung (1972) assumes that a common goal of all social sciences is to establish what is called sentences dichotomizing their "world space" by including some defining the empirical world by including some "world points" and excluding others. Hence, data sentences are reports explaining the empirical world by including what is observed and excluding what is non-observed. Theory-sentences (hypotheses or propositions) on the other hand, define the foreseen world, including aspects which are predicted by the underlying theory. Finally, value sentences refer to the preferred world, including what is accepted and excluding what is rejected. Most of the papers (65%) in 2016 and 63% in 2017 do not develop hypotheses but do only describe the findings of the theory without

concluding it into hypotheses for testing (Bunge 1967). This is increasing to 72% in 2018. The research is, however, comparing data-sentences with theory-sentences without using Poppers falsification principle (Popper 1972). A dissonance does not result in producing new theory sentences while a consonance occurs in noting that the research results are in line with mainstream knowledge management research. Criticism is the type of scientific activity where data-sentences are confronted with value-sentences. By the tenets of this orientation, consonance is created by producing new data sentences by changing the aspect of reality into an acceptable condition. Criticism is not a large part of the IFKAD 2016, 2017 and 2018 papers (15% versus 16% versus 18%). Criticism is needed through values, speculations and ad hoc methods to advance a field even if the validity and reliability are low.

Constructivism implies comparing theory sentences with value sentences to see to what extent the foreseen world is also the preferred world. Consonance refers to what is adequate and dissonance to what is inadequate. In the case of dissonance, theory and value sentences are about equal in priority, and both might be changed in knowledge management research. Constructivism represents around 20% of the papers. The business reality is today complex and global. A combination of the understanding of both wholisms and atomisms is needed in a good research strategy (Minzberg 1979) and for actionable puzzle solving (Morgan 1980). Imagination and intuition are required for this process (Bunge 1967, Alvesson and Skjoldberg 2009). The intuitive powers seem to be less trained among the IFKAD researchers. Intuition, imagination and creativity is needed to handle a high degree of complexity like scenarios for the business future or the green environmental future. Such complex scenarios are only handled in 11 of the papers (5%) where both criticism and constructivism are handled at the same time to come up with what is acceptable and not acceptable for the society going on with what is further adequate and what is inadequate for the businesses. This might as a result give us a greener, smarter and safer world where the businesses and societies walk hand-in-hand. This subjective and actionable research for a better future is missed in the IFKAD papers. Also missed is what kind of leadership will take us into a more responsible sustainable world.

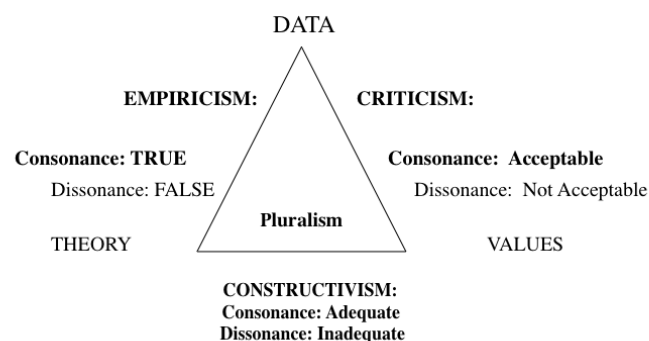


Figure 2 Empiricism, criticism and constructivism

6 The rise and fall of paradigms

The essence of Kuhn's position (1970) is that paradigms serve a normative and conserving function. When a standard prevails in a discipline, so-called "normal" science practice evolve as the puzzle-solving activity. During normal science, the scientific community works under the assumption that "it knows what the world is like," and is prepared to defend this assumption "at any cost." (Kuhn 1970: 5). Very often normal science suppresses "major novelties, conceptual or phenomenal" (Kuhn 1970:36). Thus scientists are only preoccupied with solving problems/puzzles according to accepted specific rules that are according to the traditional viewpoint or preconception.

Kuhn writes that "there can be a sort of scientific research without paradigms, schools, perspectives" ... (1970:11), in such research "... though the field's practitioners were scientists, the new findings of their activity were something less than science or social science" (1970:13). He further notes that "... every individual researcher starts over again from the beginning" (1970: 13), that some competing schools are directing their publications where they may be published, and a continued discussions over the same fundamentals and no progress is made at all" (1970: 159).

We may sum up Kuhn (1970) in this way:

1. Only readily available facts are collected.
2. At this stage, all facts seem equally relevant.
3. The instruments are overemphasized and often presented in "quasi-fanciful" ways to get "false" respect.

If we look at knowledge management research at IFKAD, we conclude that this is the situation for more than 80% of the papers. In fact, the 2017 papers were slightly less scientific than the 2016 papers – 81% versus 83%. While the 2018 papers improved to be to 76%. There is some progress in making knowledge management more scientific and robust. We found that Kuhn's description fit the situation in knowledge management research very well. It looks like every researcher starts over again from the beginning was easily collected survey, and case data are assembled and presented in fancy scientific ways.

For Feyerabend (1974), this was the situation in the management literature where one case description follows the other case report without any accumulation of knowledge. According to Feyerabend, this is a storytelling tradition where the marketplace gives new stories all the time. The faster the marketplace develops, the more the researchers will be in dissonance with the market. They will according to Feyerabend (1987) produce more and more "hard science" stories without basis in reality, but with a kind of basics in business schools further and further from the firm itself. The businesses itself will find the highest rated research less and less relevant (Van-de-Ven 2012, Olaisen and Revang 2017). The ruling group in business schools is its own exclusively audience and often behaves like a mob against revolutionary thoughts. The group is dogmatic, authoritarian and narrow-minded. They represent a groupthink. The mind is with other words temporary closed. The highest aim is to control the field and the rules for the accepted puzzle-solving activity. The rules of the puzzle solving activity become the most

important issue. There is a Matthew effect in work – those who do it the most accepted way shall get more, and those who do not do it the accepted way shall not be published or getting tenure (Merton 1968). Most researchers in knowledge research are trained in Ph. D. programs with an emphasis on empirical studies. They know that to get papers accepted, they have to follow the "correct" researchers, have a representative sample and use a proper statistical package to prove your results and end up with decent results or a proposal for another knowledge framework.

7 Alternative concepts

The concepts have an essential role in any scientific inquiry. They are usually the anchor point in the interpretation of findings (Blumer 1969 and Baugh 1990). The concepts are the glasses we have used since we got our Ph.D's. We discuss two different worlds of ideas. The definitive concept is based on empirical data or "evidence" and often with the search for causal relationships.

The more definitive concepts are linked to "what we know and "what we know that we do not know, while the more sensitizing concepts will be related to "what don't know that we know and "what we do not know that we do not know." Sensitizing concepts will advise where to look and will set up and compare alternative views. They will be more indications on relationships, and they will be dependent on inductive research methods and precise descriptions. Definitive concepts represent deductive quantitative research methods. For induction, the sample of 0 (imagined sample) or 1 might be good enough while deduction requires large samples. Induction is closeness while deduction is distance. Induction is participation and involvement while we do not interfere at any price. Induction might be exploring, and actionable while deduction might be explaining without action.

In knowledge management studies, the definitive concepts are taking over the ground of the sensitizing concepts. Taking all the papers and dividing them into one of these ideas around 70% of the studies rely on definitive deductive theories while 30% rely on inductive sensitizing concepts. In the IFKAD 2018 about 65% rely upon definitive concepts while 35% rely upon inductive sensitizing concepts. The induction process described as "directions along which to look and use intuition and curiosity" instead of facts or data is less used. Intellectual curiosity might be the path to choose for creative scholars. The papers are becoming more deductive and definitive in the 2017 conference compared to the 2016 conference. While the papers are becoming slightly more inductive in the 2018 conference.

8. Alternative research paradigms

It is here proposed to analyse knowledge management research in four main perspectives. These alternative realities are different meta-theoretical assumptions about the nature of social science. The empirical paradigm where its explanatory power consists of establishing causal variables between variables. The knowledge systems and the

knowledge technology relations have a concrete, real existence and systematic character producing quantitative and qualitative findings according to the need for the societies and businesses. The business world is considered primarily as conflict-free and harmonious at a higher level of aggregation. 50% of the studies in 2016 versus 45% of the 2017 papers versus 40% of the 2018 papers belong here.

The materialistic political paradigm is physical events and behaviour where the surface is manifestations of underlying mechanisms. The materialistic paradigm relies on the assumption of predictable uniformities in the knowledge systems. The world of knowledge systems exchanges is defined by concrete, measurable, ontologically real structures and the interdependencies in knowledge systems. 20 % of the studies in all three conferences are found here.

The clarified subjectivity paradigm holds social reality does not exist in any concrete sense but is the product of the subjective and inter-subjective experience of individuals and organizations. According to this paradigm; knowledge behaviour must be understood from the viewpoint of the employee and organization rather than from the outside observer. We can only get such understanding by direct, give-and-take interaction with the employees and organizations. We can, of course, get in surveys as questionnaires, but then we are defining the questions and the business situation. 25% of the studies in 2016 are here versus 27% of the 2017 studies and 30% of the 2018 studies. The action paradigm (5% of the studies in 2016 and 8% of the studies in 2017 against 10% in 2018) also assumes that what passes for reality is socially determined. The role of knowledge research is to identify the stakeholders in the systems, their goals, interests and power bases to describe the conflicts and contradictions of the knowledge systems and also show the way to emancipation, for instance, working smarter or greener. Knowledge management researchers inspired by the action paradigm are concerned with discovering how individuals can link thought and action as a means of transcending their alienation. The papers often analyse the situation where the author is a consultant, owner or employee. The relationship to the investigated firm is close. The results are own experiences, knowledge, and attitudes from the actual situation resulting in practical and theoretical recommendations.



Figure 3 Research paradigms

9 The fall of knowledge management as objective research?

The action-driven and the clarified subjectivity paradigms represent a different degree of complexity and subjectivity. They represent both harmony and conflict. Various levels of complexity require different research paradigms; Pluralism is demanded to catch different aspects of reality. Subjectivism is necessary to capture complexity.

As a consequence, we will have to define this discipline as a subjective multidiscipline, and we will have to innovate, simulate an experiment to a much higher degree. We will have to accept ad-hoc hypotheses and ad-hoc methodological solutions and the clarified subjectivity. We need to cooperate with businesses and the society to participate in getting research from sustainable societies and businesses supporting a greener, smarter and safer solutions. A more engaged knowledge management research field is needed to be a part of the sustainable, global and digital businesses replacing traditional businesses.

Feyerabend (1974,1987) represents this anarchistic, irrational and artistic view of science and social science. However, in reality, scientists follow "irrational" rules in any science, and there is progress. Therefore it is not needed any rules and a research strategy supporting this (Minzberg 1979). As a consequence, we will have to define this discipline as a subjective multidiscipline, and we will have to explore, innovate, simulate and experiment to a much higher degree. We need more subjectivity, conflicts and less harmony and objectivity in our research. There is a movement in leadership and organizational methodology towards phenomenon research taking research out of the iron jacket into a flexible and soft jacket opening up for alternative realities (Doh 2015, Schwartz and Stensaker 2014, von Krogh et al. 2012).

10 Synthesis and conclusion

Figure 4 presents a form of synthesis of our reflections. One of the axes represents the degree of complexity and the other the level of subjectivity. The definitive concepts represent a small degree of subjectivity (i.e., the high degree of objectivity if that is possible) while the sensitizing concepts express a high degree of subjectivity. The four paradigms might be subjective or objective. Objectivity does not exist any longer. The problematic question is: if we choose one model, will it then be possible to move on from a low degree of complexity to a higher level of complexity (i.e., can we generalize from a tiny part of reality to a more substantial portion of the fact). Are the models interchangeable? It might be impossible or desperate to move up the line from origo to a higher degree of complexity and also from the top to Origo (Alvesson and Skjolberg 2009, Bunge 1967). The knowledge research reality in both businesses and climate conflicts offer global complexity. To understand this, we have to apply subjective paradigms combined with empirical investigations. Eisenhardt and Grabner (2007) describe this kind of theory building. We have to use sensitizing concepts coupled with actionable definitive ideas. We have a field like knowledge research to understand whatever we are applying it is subjective, but it is systematic and logical rigid.

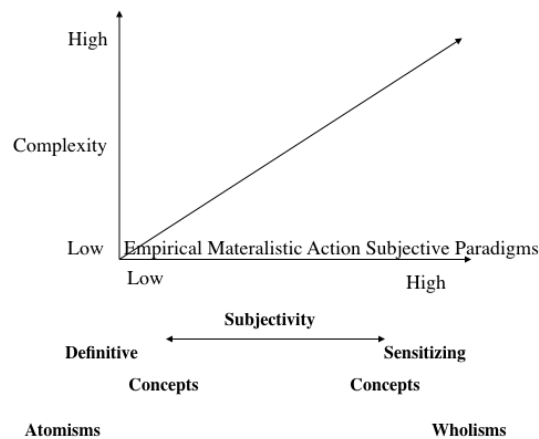


Figure 4 Complexity and subjectivity versus paradigms and concepts

References

- Alvesson, M., and Skjolberg, K., (2009) *Reflexive methodology*, Sage, London.
- Blumer, H., (1969) *Symbolic interactionism*, Prentice Hall, New York.
- Bunge, M.; (1967) *Scientific Research*, Springer Verlag, New York.
- Doh, J.P., (2015) "Why We Need Phenomenon-based Research in International Business," *Journal of World Business*, Vol. 50, No. 9, pp. 609-611.
- Feyerabend, P. (1974), *Against Methodology*, Verso, London.
- Feyerabend, P., (1987) *Farewell to Reason*, Verso, London.
- Eisenhardt, K. M., and Graebner, M. E. (2007) "Theory Building from Cases: Opportunities and Challenges," *Academy of Management Journal*, Vol. 50, No. 1, pp. 25-32.
- IFKAD, (2016, 2017 and 2018) *Proceedings*, Dresden, St. Petersburg and Delft.
- Knight, F.H, (1936) *The ethics of competition*, Longman, London.
- Kuhn, T., (1970) *The Structure of Scientific Revolutions*, Chicago University Press, Chicago.
- Nonaka (1985) *The knowledge creating company*, Wiley, New York.
- Merton, R., (1968) "The Matthew Effect in Science," *Science*, Vol. 47, No. 1, 56-63.
- Mintzberg, H., (1979) "A Strategy for Research," *Administrative Science Quarterly*, Vol. 24, No. 1, pp. 582-589.
- Morgan, G., (1980) "Paradigms for Puzzle Solving", *Administrative Science Quarterly*, Vol. 25, No. 6, pp. 605-622.
- Olaisen, J., (1985) "Alternative Paradigms in Information Science", *Libri*, Vol. 35, No. 2, pp. 129-150.
- Olaisen, J., and Revang, O.,(2017) "Working smarter and greener." *International Journal of Information Management*, 37,1, 1441-1448.
- Popper, K, (1968) *The logic of scientific discovery*, Harper&Row, New York.

- Schwarz, G., and Stensaker, I. (2014) "Time to Take Off the Theoretical Straightjacket and (Re-) Introduce Phenomenon-Driven Research," *Journal of Applied Behavioral Science*, Vol. 50, No. 4, pp. 478-501.
- Tornebohm, H., (1983) *Research reflections and research sentences*, Gothenburg University Press, Gothenburg.
- Vendevan, A. H., (2007) *Engaged scholarship*, Oxford University Press, Oxford.
- Von Krogh, G., Rossi-Lamastra, C., and Haefliger, S. (2012) "Phenomenon-based Research in Management and Organisation Science: When is it Rigorous and Does it Matter?", *Long Range Planning*, Vol. 45, pp. 277-298.

The New Groupthink and Idea Generation – an Investigation of Hybrid Brainstorming as Key to Introverts' Enhanced Contribution to Ideation

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Abstract

Working in collaborative groups and teams now represents the practice predominantly adopted by organizations aspiring to create innovation and to remain competitive (Korde & Paulus, 2017; Paulus, 2000). However, this trend towards boundless collaboration at work is harshly criticized by a theory called the “New Groupthink”, which argues for a resulting discrimination of introverted employees (Cain, 2012, 2013). According to this perspective, introverts suffer from working conditions that inhibit individual and quiet work. The theory consequently argues that the current shift towards limitless collaboration overall elicits lower creativity and achievement levels due to the resulting suppression of introverts (Cain, 2013). Provided that the “New Groupthink’s” claim is reasonable, this inefficiency hence depicts a relevant issue for companies by reason of creativity and innovation’s decisive stake in today’s turbulent environments.

This paper examines the existing performance gap between introverts and extraverts in group brainstorming. This research aims at assessing whether hybrid brainstorming can equate introverts with extraverts by balancing their idea contribution and therewith lower the effect theorized by the “New Groupthink”. It is intended to suggest solutions to both introverts, with regards to enhancing their stake in brainstorming, and companies, with regards to how to apply this ideation method in its most efficient way.

The research at hand is of quantitative nature, whereas the methodological approach selected constitutes an experimental study. The sample consists of a total of 87 business students; personality types are differentiated according to the introversion-extraversion dimension. Based on the obtained results, inferences can be made about the effectiveness and suitability of the traditional and hybrid brainstorming methods considering the proportionate idea-contribution and post-brainstorming satisfaction levels of the two personality types. Results indicate that applying hybrid brainstorming is suggested to be

suitable for both introverts, who feel omitted in traditional brainstorming, and companies, to better include introverts' ideas and to enhance overall results. The study adds original contributions to the creativity and brainstorming literature by providing first suggestions of how to counter the "New Groupthink" effect. It emphasizes the need to further explore the scarcely researched factor of personality in brainstorming and to search for solutions to strengthen the contribution of introverts. Further studies are required to elaborate on the hybrid methods' potential with regards to the empowerment of introverts in ideation.

Keywords – New Groupthink, Brainstorming, Creativity, Introverts vs. Extroverts

1 Introduction

Today, increasingly globalized competition, new possibilities for production, as well as fast-paced technological developments jointly force companies to find strategies to assure their competitive advantage and long-term survival (Mumford, Scott, Gaddis, & Strange, 2002; Tang, 2016). Resulting therefrom, creativity and innovation have become central areas of interest as well as key success factors (Anderson, Potočnik, & Zhou, 2014; Mumford et al., 2002; Tang, 2016). In this context, working in collaborative groups and teams now represents the practice predominantly adopted by organizations aspiring to remain competitive (Korde & Paulus, 2017; Paulus, 2000). However, this trend towards boundless collaboration at work is harshly criticized by a theory called the "New Groupthink", which argues for a resulting discrimination of introverted employees (Cain, 2012, 2013). According to this perspective, introverts suffer from working conditions that inhibit individual and quiet work. The theory consequently argues that the current shift towards limitless collaboration overall elicits lower creativity and achievement levels due to the resulting suppression of introverts (Cain, 2013). Provided that the "New Groupthink's" claim is reasonable, this inefficiency hence depicts a relevant issue for companies by reason of creativity and innovation's decisive stake in today's turbulent environments.

In this regard, another focus of criticism by the "New Groupthink" theory is the most widely applied collaborative ideation method of group brainstorming. Since this prominent method normally does not allow for individual and quiet ideation, introverts are supposed to fall behind extraverts in this form of idea generation (Cain, 2013). Apart from the claims of this critical theory, the application of traditional group brainstorming was effectively found to bear several shortcomings that can be ascribed to multiple factors (Diehl & Stroebe, 1987, 1991; Lamm & Trommsdorff, 1973; Mullen, Johnson, & Salas, 1991; Paulus, Larey, & Ortega, 1995; Rietzschel, Nijstad, & Stroebe, 2006; Taylor, Berry, & Block, 1958). Indeed, one of the factors that cause restriction, constitutes the factor of participants' personalities, although it has only sparsely been scientifically explored so far (Callaghan, 2009; Camacho & Paulus, 1995; Furnham & Yazdanpanahi, 1995; Jung, Lee, & Karsten, 2012). In particular, earlier research accredited variations in performance levels of introverts and extraverts by indicating that introverts generally tend

to fall behind extraverts with regards to idea generation in traditional group brainstorming (Bradshaw, Stasson, & Alexander, 1999; Callaghan, 2009; Camacho & Paulus, 1995). This finding consequently supports the claims made by the “New Groupthink” theory. However, existing research on the actual impact that limitless collaboration has on introverted employees is limited and so are findings on the impact of personality differences in brainstorming. Accordingly, by now there do not exist any solutions for closing the performance gap between introverts and extraverts in group brainstorming and therewith for limiting the effect supposed by the “New Groupthink”.

Although this problem has yet to be scientifically approached, there are some indications for potential solutions. One flexible method, namely hybrid brainstorming, that consists of an alternation between individual and group brainstorming, was already shown to possess the power to enhance overall brainstorming performance (Korde & Paulus, 2017). Since introverts were generally found to prefer quiet ideation time (Callaghan, 2009; Culp & Smith, 2005), an alternating brainstorming method could be favorable to their performance. However, no research has yet investigated whether hybrid brainstorming helps to overcome the discrepancy between introverts’ and extraverts’ contributions in group brainstorming. Therefore, the fundamental aim of this research is to ascertain whether hybrid group brainstorming can empower introverts in brainstorming by balancing the idea contribution of introverts and extraverts.

This paper is structured as follows. Chapter 2 will review the existing body of literature, which serves as the theoretical framework for this research. This includes a discussion of the “New Groupthink” theory and a review on brainstorming with regards to both the methods’ advantages and inefficiencies as well as the link between personality and brainstorming performance. It concludes with the concept of hybrid brainstorming and a derivation of hypotheses. Subsequently, chapter 3 will introduce the methodological approach selected in this research. Next, chapter 4 encompasses the depiction of the obtained results and an outline of the hypotheses tests. In this turn, the fundamental research question is answered. Finally, chapter 5 includes a discussion of the results and chapter 6 contains the study’s overall conclusions and its major limitations, implications and recommendations for further research.

2 Theoretical background

2.1 Collaborative creativity and the “New Groupthink”

Business and society are experiencing a shift from the “Information Age” towards the “Creativity Age”, where economies classify “creativity” as their core characteristic and the production of ideas is valued over that of things (Dubina, Carayannis, & Campbell, 2012; Sawyer, 2012). For these reasons, creativity and innovation are moving into the center of organizational settings and are increasingly seen as vital for organizational performance, competitive advantage, and long-term survival (Anderson et al., 2014; Mumford, Hester, & Robledo, 2012; Tang, 2016; West, 2002). One widely-adopted approach in this regard is to refrain from rigid, hierarchical structures and move towards

more organic and flexible organizational forms. In doing so, the team rather than the individual becomes the basic building block of companies and collaboration moves in the center of work (Tjosvold, West, & Smith, 2003). Recent management literature places its major focus on collaborative forms of creativity and promotes the establishing of teamwork with regard to innovation (Anderson et al., 2014; Hülsheger, Anderson, & Salgado, 2009; Kozlowski & Ilgen, 2006; Paulus & Nijstad, 2003; West, 2003; West & Altink, 1996). Group work is seen to increase the effectiveness of the growingly complex organizations and the adaptability to their fast-changing environments (Kozlowski & Ilgen, 2006; West & Altink, 1996).

However, this all-encompassing, dominating thought of collaboration is not without controversy. Likewise, the continuing development towards boundless collaboration in every aspect of work is criticized as being counterproductive for introverted employees, i.e. for individuals who oftentimes enjoy solitude, need to consider ideas individually before discussing them in groups, and prefer depth over superficiality (Cain, 2013; Deresiewicz, 2009; Dossey, 2016). (Cain, 2012, 2013) argues against the rising notion of collaboration being the sole key to creativity and innovation. In this regard, she criticizes the elevation of teamwork above everything else, as well as the widespread belief that exclusively gregarious places allow for creativity to take place. Cain (2013) raises concern over the effectiveness of today's development towards compelled collaboration and vouches for the consideration and recognition of introverts, by calling this phenomenon the "New Groupthink". According to Jung's publication "Psychological Types" (1921, reprinted 2017), Cain (2013) characterizes introverts as individuals drawn to their inner world, who try to make meaning of the happenings around them and who reenergize through solitude. Other publications confirm this arguments, where introverts are oftentimes described as quiet, reserved, retiring, shy, silent, and with-drawn (Culp & Smith, 2005; McCrae & John, 1992). Cain (2012) furthermore states that introverts oftentimes show higher creativity levels compared to extraverts and refers to several studies demonstrating this causality (Feist, 1998, 1999). However, this argument is not universally valid. In fact, findings on the creative personality revealed that creative people can be both extraverted and introverted (Eysenck, 1995). Studies with reference to the widely-adopted five-factor model of personality (Goldberg, 1990) found that individuals high on openness to experience and low on conscientiousness, are the most creative (Batey, Chamorro-Premuzic, & Furnham, 2010). Since both factors represent subscales of the introversion-extraversion scale, introversion cannot be a reliable indicator for creativity by default. However, based on the former characterization of introverts and findings on their creativity levels, Cain (2013) conclusively argues that introverts need silence and privacy to perform at their best and therefore claims that solitude, on the contrary to contemporary claims, can be a vital key to creativity. In her point of view, "collaboration kills creativity" (Cain, 2013, p. 71); resulting therefrom, she proposes to find the right balance and to create conditions that allows both for individual and group work in order to accommodate extraverts as well as introverts.

Existent studies indicate poor performances when using group brainstorming (Dunnette, Campbell, & Jaastad, 1963; Furnham, 2000), showing that group

brainstorming lacks effectivity. One reason might be the fear of judgement by others, also known as evaluation apprehension (Diehl & Stroebe, 1987). Dossey (2016, p. 157) also calls for more individual work in ideation phases by stating that “brainstorming is an extroverted strategy par excellence”. He argues that in order to understand the inefficiencies of group brainstorming, one has to understand the differences between introverts and extraverts. However, none of the authors conducted own research to legitimate their arguments but availed themselves of other scholar’s findings.

2.2 Advantages and inefficiencies of brainstorming

Brainstorming is regarded as the most commonly adopted approach for generating creative ideas and maintains widespread acceptance (Rietzschel et al., 2006). In this regard, it is generally assumed that sharing ideas in groups increases both the number and novelty of ideas generated (Korde & Paulus, 2017). Brainstorming can correspondingly be defined as a “problem solving technique that involves the spontaneous distribution of ideas from all members of a group” (Furnham, 2000, p. 23). Its underlying purpose is to produce as many different ideas as possible, while relieving participants from inhibition, self-criticism, and criticism by third persons (Taylor et al., 1958). The method was first introduced by Osborn (1957, reprinted 2013), who argued for its outstanding effectiveness in terms of quantity and quality of ideas generated, compared with individual brainstorming. He introduced four basic rules that characterize the traditional-, interactive group brainstorming method (called “traditional group brainstorming” hereafter), namely (1) any criticism is ruled out, (2) lateral thinking is welcomed, (3) quantity is wanted, and (4) combinations and improvements of ideas are sought.

Nonetheless, Osborn did not scientifically prove the method’s effectiveness (Henningsen & Henningsen, 2013). Notwithstanding, there are scholars who found brainstorming to be an important source of creativity and underpin its positive effects on performance outcomes. To illustrate, Paulus (2000), discovered that a certain extent of excitement and synergy, which is commonly present during brainstorming, can facilitate idea generation. Further advantages are social and cognitive stimulation, since participants benefit from mutual stimulation of associations that go beyond individual imagination. However, it is assumed that exclusively under certain conditions can idea sharing in groups be productive. Only if participants pay attention, i.e. follow their colleagues as well as incubate and reflect on ideas, can the idea exchange process in groups lead to enhanced performance (Heslin, 2009; Paulus & Yang, 2000). Furthermore, Sutton and Hargadon (1996) demonstrated that the use of traditional group brainstorming can have positive effects on organizations that go beyond classic measures of productivity, such as the quantity of ideas. In this regard, also an increase in group cohesiveness can be observed over time within brainstorming groups, which is believed to bring about socioemotional advantages to the organization (Henningsen & Henningsen, 2013).

On the contrary, a number of scholars found traditional group brainstorming to be less productive in comparison to an equal number of individuals brainstorming alone, so-called nominal groups, and consequently raise concern over its widespread utilization.

Taylor, Berry and Block (1958) were the first authors to demonstrate that nominal brainstorming groups outperform interactive groups in terms of the number of ideas generated. By means of an experiment comparing both types of brainstorming groups, they concluded that “group participation when using brainstorming inhibits creative thinking” (Taylor et al., 1958, p. 43). Ever since, multiple researchers replicated the finding of interactive brainstorming groups being less productive in terms of both quantitative and qualitative measures, compared to nominal groups (Diehl & Stroebe, 1987, 1991; Lamm & Trommsdorff, 1973; Mullen et al., 1991; Paulus et al., 1995; Rietzschel et al., 2006). Despite all evidence for its ineffectiveness, traditional group brainstorming persists in being a commonly used practice and popular method for idea generation in organizations (Callaghan, 2009; Diehl & Stroebe, 1991). As a result, a central issue in brainstorming literature has been the identification of factors that inhibit the performance in interactive brainstorming groups (Camacho & Paulus, 1995). Three of these are primarily discussed in literature, namely (1) social loafing, i.e. some individuals rest while others do the work, (2) production blocking, i.e. only one person is able to talk at a time and (3) evaluation apprehension, i.e. the fear to disgrace oneself in front of other group members (Diehl & Stroebe, 1987). Referring to more recent literature, Paulus, Dzindolet and Kohn (2012) underpin that psychological or participative safety as well as cohesion and trust are factors that influence general team creativity.

2.3 Personality and brainstorming

Personality traits are defined as “consistent patterns in the way individuals behave, feel, and think” (Pervin & Cervone, 2010, p. 228). The scholarly field on personality traits is approaching consensus on a general taxonomy, namely the “Big Five” personality dimensions. This model is a joint work of researchers developed over time, representing a common framework of diverse perspectives (John & Srivastava, 2001). One of the model’s dimensions is the personality trait of extraversion (McCrae & John, 1992). As a higher-order personality trait, it is composed of several more specific traits and can be understood as a broad continuum that reflects the dimension of individual differences, ranging from introversion to extraversion (Watson & Clark, 2007). Basically, it can be interpreted as the general level of sociability. Individuals who are high in extraversion, were found to be active, assertive, energetic, enthusiastic, outgoing and talkative, whereas individuals low in extraversion are rather quiet, reserved, retiring, shy, silent, and withdrawn (McCrae & John, 1992). In addition, extraverts prefer to generate ideas in groups and express their thoughts in front of others, while introverts excel when they have quiet time to think things through and process their thoughts before speaking (Culp & Smith, 2005).

Since individual personality was found to affect team creativity, the factor of personality increasingly gained significance within the brainstorming literature (Hoff, Carlsson, & Smith, 2012; Paulus et al., 2012). However, to date, only a comparatively small body of research concerning the connection between personality and brainstorming performance is available (Callaghan, 2009; Camacho & Paulus, 1995; Furnham & Yazdanpanahi, 1995; Jung et al., 2012). In this regard, it was found that group members’

personalities generally affect the overall group performance by influencing individual creativity levels and thinking styles (Bolin & Neuman, 2006; Hoff et al., 2012; Jung et al., 2012). Previous research provides evidence that particularly differences in the introversion-extraversion dimension can play a significant role in brainstorming. Primarily, introverts seem to produce fewer ideas when compared to extraverts in traditional group brainstorming. Callaghan (2009), for instance, conducted an experiment with undergraduate students exploring the connection between brainstorming performance and personality type in cross functional, new product development teams. By means of the MBTI® personality test (Briggs Myers, 1995), she found that introverts were generally less involved than extraverts in brainstorming rounds. This agrees with Dossey (2016), who affirms that when involved in group idea-generation, introverts usually fall behind extraverts regarding idea expression. In addition, Aguilar-Alonso (1996) pointed out that extraverts produce more original outcomes in brainstorming. Jung et al. (2012) further reinforced this finding by confirming significant performance differences between extraverts and introverts in terms of unique and diverse ideas. In accordance, Bradshaw et al. (1999) demonstrated that one single introverted group member leads to lower productivity and increased evaluation apprehension. Camacho and Paulus (1995) were the first scholars to indicate that individual differences could actually be accountable for the performance gap between nominal and interactive brainstorming groups. This underpins Dossey's (2016) opinion that in order to understand the reasons for brainstorming inefficiencies, one has to understand the differences between introverts and extraverts. Taken as a whole, the findings obtained in these studies point to the critical conclusion that the involvement of introverted group members in traditional group brainstorming entails productivity impairment. Even though Camacho and Paulus (1995) have already discovered personality differences as being key in solving the performance gap between interactive and nominal brainstorming groups, no research has yet to find ways to empower introverts in group brainstorming and therewith enhance overall productivity. Accordingly, no solution was found that can overcome the effect of the "New Groupthink" on ideation.

Therefore, the following is hypothesized (H1): In traditional interactive group brainstorming, introverted group members contribute significantly less to the total amount of ideas generated, compared to extraverted group members.

2.4 Hybrid brainstorming

2.4.1 Development of hybrid brainstorming

Apart from investigating the factor of personality, some authors have already discovered brainstorming methods which generally help to bridge the performance gap between interactive and nominal brainstorming groups. Still, no research has proved these methods to overcome the inequalities in brainstorming performance between introverts and extraverts. First, there is the so-called "brainwriting" method, which is "the silent, written generation of ideas by a group of people" (VanGundy, 1984, p. 68). This method entails several forms and can overcome various inefficiencies such as minimizing status

differences between participants. Furthermore, research has revealed that it leads to superior idea generation compared with both non-sharing or nominal brainstorming groups (Paulus & Yang, 2000). Nevertheless, social interaction and active discussions are oftentimes critical for group success, which is why brainwriting cannot always be selected as an alternative to interactive group brainstorming (VanGundy, 1984). Second, there is the method of electronic brainstorming, which is an “e-collaboration method that employs networked computer terminals and software designed to allow group members to communicate electronically during idea generation exercises” (DeRosa, Smith, & Hantula, 2007, p. 1550). On the one hand, electronic brainstorming was found to both increase productivity and satisfaction with the interaction process compared with traditional face-to-face brainstorming. On the other hand, overall benefits of this method were found to be limited and electronic brainstorming groups had to consist of more than 7 people to outperform nominal groups (DeRosa et al., 2007). Besides, the synergistic effect of group collaboration was missing, which made the method unsuitable to apply universally (Korde & Paulus, 2017). Third, the so-called “hybrid brainstorming” method, which combines individual and group brainstorming phases by switching between individual brainwriting and group brainstorming. This method was likewise found to overcome several productivity barriers and enhance the overall effectivity of the brainstorming process (Korde & Paulus, 2017). Some early findings have already indicated that an alternation between the conditions makes sense and therewith provided first hints concerning the method’s advantages over traditional group brainstorming. In fact, Osborn (1957, reprinted 2013) already noted that an alternation between group and individual ideation has the power to produce maximum results, although not empirically verifying his argument. Subsequently, several studies suggested that the exposure to other persons’ ideas may enhance brainstorming performance (Jung et al., 2012). Likewise Paulus et al. (1995) stated that “group brainstorming may be most useful after individuals have generated ideas individually for a period of time and need the additional social stimulation” (p. 252). Girotra, Terwiesch and Ulrich (2010) conducted an experiment to assess two brainstorming conditions, namely a group and a hybrid condition, where individuals initially brainstormed alone and then together. The authors found strong support that the best ideas generated in the hybrid condition were better than those generated in the group condition. Besides, the hybrid groups generated three times as many ideas as the traditional groups. Accordingly, Korde (2014) conducted studies to achieve better performance by means of hybrid brainwriting methods. She found that the hybrid condition outperformed the traditional group condition. In addition, hybrid brainwriting was experimentally tested in an industrial setting at an international company and again, the hybrid condition yielded more ideas than the group condition. Therefore, the authors recommend alternating group review sessions with private idea generation when brainwriting (Paulus, Korde, Dickson, Carmeli, & Cohen-Meitar, 2015). The most recent experiment by Korde and Paulus (2017) once again demonstrated the benefits of hybrid brainwriting compared to alone and group brainwriting reflected in the number of ideas generated. Still, these findings of Korde and Paulus (2014; 2017) are exclusively

valid for the hybrid brainwriting method, which does not involve interactive group discussions, but brainwriting as such.

2.4.2 Personality and hybrid brainstorming

Since hybrid brainstorming was found to narrow the general productivity gap between nominal and interactive brainstorming groups, it can be questioned whether this method likewise helps overcome the performance gap between introverts and extraverts in group brainstorming. However, hardly any studies have investigated the effect of personality type on hybrid brainstorming to date. Nevertheless, some of the studies previously discussed, provide first hints that hybrid brainstorming could be favorable for introverts' enhanced contribution to ideation. Camacho and Paulus (1995) have indicated that interactive group brainstorming would be best suited for individuals low in social anxiety since introverts might be too concerned about the reactions of others. Correspondingly, evaluation apprehension, i.e. the fear to disgrace oneself in front of other group members, has been identified as one major factor inhibiting brainstorming performance early on (Diehl & Stroebe, 1987). Furthermore, it was found that the minor performance in interactive brainstorming groups can be assigned to differences in personality types (Camacho & Paulus, 1995), mainly due to the underperformance of introverts. Since introverts usually prefer to think quietly before talking, e.g. reaching conclusions before discussing their thoughts, and need time to recharge their energy (Callaghan, 2009; Culp & Smith, 2005), an alternating brainstorming process could be favorable to their performance. Hence, hybrid brainstorming, which includes individual phases that allow for quiet thinking before discussing the ideas as a group, could potentially narrow the performance gap between introverts and extra-verts in group brainstorming.

Based thereupon, the following is hypothesized (H2): In hybrid brainstorming, introverted group members contribute significantly more to the total amount of ideas generated, compared to traditional interactive group brainstorming.

Furthermore, Korde (2014) strived to investigate the general increase in performance in hybrid brainwriting. Hence, she hypothesized that participants high in extraversion will generate the most ideas within the hybrid condition. However, this hypothesis was not supported, even though the hybrid method did yield an increase in overall brainstorming performance. Since extraverts do not necessarily exhibit an increased performance in hybrid conditions, the increase in overall performance could be ascribed to the improved performance of introverts. This could implicate that extraverts do not fundamentally perform in a superior manner, but that the brainstorming method as such causes the performance gap between the personality types. If hybrid brainstorming can overcome this gap, the contributions of extraverts and introverts should converge accordingly. A similar effect was noted by Camacho and Paulus (1995) for the general productivity gap between nominal and real groups in brainstorming. They noted that if social anxiousness and hence individual differences are minimized, group brainstorming can be as productive as nominal group brainstorming.

Therefore, the following hypothesis (H3) is stated: In hybrid brainstorming, introverted and extraverted group members contribute equal shares to the total amount of ideas generated

In addition, Korde and Paulus (2017) have already established that the order of individual and group phases in hybrid brainstorming is of minor significance to the outcome. However, neither has a study investigated the effect of the number of changes between the two conditions nor its impact on the performance of introverts compared to extraverts. Some studies on hybrid brainstorming have utilized one individual and one group phase (Girotra et al., 2010; Paulus, Larey, & Dzindolet, 2000; Paulus et al., 2015), others employed experimental designs with two aligned sequences of individual and group phases, i.e. four phases per group (Korde, 2014; Korde & Paulus, 2017). However, these scholars did not argue for the number of switches between the two conditions. Nevertheless, the general exposure to the ideas of others can lead to an overall increase in ideas generated (Paulus et al., 2015). In this regard, it was shown that individual reflection after group discussion leads to associations and the further development of others' ideas (Paulus et al., 2015; Paulus & Yang, 2000). On the contrary, if phases last too long or if only brainstorming as a group without individual phases, a steady decline of generated ideas can be observed (Korde & Paulus, 2017). Besides, Kasof (1997) argued that introverts have a narrower attention span than extraverts. Therefore, the involvement of frequent individual phases allows them to recharge their energy for the subsequent group discussion (Callaghan, 2009; Culp & Smith, 2005).

Hence, the following is hypothesized (H4): In hybrid brainstorming, introverted group members contribute significantly more ideas if frequent changes between individual and group phases are included, compared to less frequent changes.

2.4.3 Individual satisfaction in hybrid brainstorming

Although satisfaction was found to be an important factor for understanding overall brainstorming performance, metrics in brainstorming experiments oftentimes exclusively focus on the quantity of ideas generated (Bolin & Neuman, 2006; Callaghan, 2009). However, despite all scientifically proven inefficiencies, the general satisfaction with brainstorming remains repeatedly named as one reason for its widespread utilization. In fact, people seem to enjoy brainstorming, since it satisfies their need for social interaction (Heslin, 2009; Paulus, 2000; VanGundy, 1984). Besides, group brainstorming leads to more favorable perceptions of individual performance (Paulus et al., 2000). However, hardly any studies have investigated satisfaction levels of introverts compared to extraverts after traditional group brainstorming or hybrid brainstorming. Callaghan (2009) conducted one of the rare studies exploring satisfaction levels of introverts and extraverts, although she did not involve any hybrid methods. In two out of three brainstorming sessions, a lower satisfaction level was measured for introverts. The only case in which introverts reported a slightly higher satisfaction level compared to extraverts, involved a brainstorming method that allowed introverts to think longer and to be introspective. In addition, introverts oftentimes perceive meetings and group discussions, such as

interactive brainstorming, to be an energy drain, since they commonly reenergize through being alone (Cain, 2013; Culp & Smith, 2005).

Based thereupon, the following is hypothesized (H5): Introverted group members show a lower satisfaction-level after traditional interactive group brainstorming compared to extraverted group members.

As already stated above, no study has investigated participants' satisfaction after hybrid brainstorming rounds, regarding their personality type. However, since hybrid brainstorming entails individual reflection phases, it can be assumed that introverts enjoy hybrid brainstorming over traditional group brainstorming. This is underlined by their general preference of having quiet time to think things through (Culp & Smith, 2005). Callaghan's finding (2009) that a method which allows introverts to think more leads to increased satisfaction levels, already provides a first hint that introverts may prefer hybrid brainstorming over traditional methods.

Accordingly, the following is hypothesized (H6): Introverted group members show a higher satisfaction-level after hybrid brainstorming compared to traditional brainstorming.

3 Methodology

3.1 Research methodology

This research is of quantitative nature, following a deductive approach while testing 6 hypotheses (H1a-H2b) that were derived from prior scientific findings (see table 1 for an overview). Accordingly, the research is based upon the fundamental philosophy of postpositivism, common for experimental designs and surveys. This perspective holds that causes determine certain effects or outcomes (Creswell, 2008). In this research, a relationship between the independent variables (IV) personality type and brainstorming methods and the dependent variables (DV) brainstorming outcome and post brainstorming satisfaction is advanced in form of hypotheses. Correspondingly, since this research is based upon objective scientific observation and empirical enquiry by means of a controlled experiment, the postpositivistic perspective frames the present study. However, absolute truth cannot be found at any point, which differentiates postpositivism from the traditional positivistic perspective (Creswell, 2008).

Table 1: Overview of tested hypotheses.

Hypotheses	
H1	<i>In traditional interactive group brainstorming, introverted group members contribute significantly less to the total amount of ideas generated, compared to extraverted group members</i>
H2	<i>In hybrid brainstorming, introverted group members contribute significantly more to the total amount of ideas generated, compared to traditional interactive group brainstorming</i>
H3	<i>In hybrid brainstorming, introverted and extraverted group members contribute equal shares to the total amount of ideas generated</i>

- H4 *In hybrid brainstorming, introverted group members contribute significantly more ideas if frequent changes between individual and group phases are included, compared to less frequent changes*
 - H5 *Introverted group members show a lower satisfaction-level after traditional interactive group brainstorming compared to extraverted group members*
 - H6 *Introverted group members show a higher satisfaction-level after hybrid brainstorming compared to traditional brainstorming*
-

The methodology of this thesis consists of two elements. In the first instance, the underlying research methodology is an experimental design for testing the hypotheses H1-H4. This method entails “manipulating levels or amounts of selected independent variables (causes) to examine their influence on dependent variables (effects)” (Brown & Melamed, 1990, p. 1). Such causal conclusions can be drawn most appropriately within experimental research, since variables other than the variables of interest, are controlled (Kirk, 2013). In the case of this research, the influence of personality types (introverted, extraverted) and selected brainstorming methods (traditional group brainstorming and two hybrid brainstorming methods) on the outcome of brainstorming, will be investigated. Since the impact of changes in two causes, i.e. personality type and brainstorming methods, are explored, this research employs a factorial design (Gray, 2004). Selfsame methodology is well-suited for such research since it allows to test the hypothesized relationship between personality type and brainstorming method on brainstorming outcome while controlling for nuisance variables (Kirk, 2013). Besides, scholars who conducted previous studies that investigated the relationship between brainstorming and personality types, likewise applied the methodological approach of experiments (Bolin & Neuman, 2006; Callaghan, 2009; Furnham & Yazdanpanahi, 1995; Jung et al., 2012; Korde & Paulus, 2017). This makes it reasonable to continue the research stream by choosing a comparable approach. By these means, the results of this re-search can directly be compared to and be discussed in light of earlier findings as laid out in chapter 2. Furthermore, the general intention of experimental research is to generate objective, valid and replicable results (Gray, 2004), which is likewise highly strived for within this study. Therefore, data derived from the experiment is subject to valid statistical analysis.

In addition, a second methodological element in form of a survey is utilized to test the hypotheses H5-H6. This methodology involves a systematic, highly standardized collection of data by means of data collection methods, such as questionnaires (Sapsford, 2007). These characteristics allow a statistical analysis of survey data, suitable for quantitative research. The conducted survey aims at measuring and comparing satisfaction levels of introverted and extraverted participants after each brainstorming round. This approach is in line with one prime purpose of surveys, namely to make planned comparisons between several groups (Sapsford, 2007). Hence, a survey suits the purpose of studying satisfaction levels and making statistical inferences about the difference between the perceptions of the two personality types well. In addition, previously conducted studies have chosen the same methodological approach, such as Korde (2014)

or Camacho and Paulus (1995). Selecting the same approach allows for a better comparability to previous literature and hence a constructive discussion of findings.

3.2 Sample

The sample of the present study consisted of business students from Germany, which were selected by applying a convenience sampling method (Quinlan, 2011). The total sample hence consisted of 87 participants, whereof 54 were male and 30 were female students; three participants did not indicate their gender. The age ranged from 19 to 32 years, with a mean of 22 years. During the course of the study, the sample was divided into three subsets: (1) introverted participants ($N = 16$), (2) extraverted participants ($N = 46$) and (3) average participants ($N = 25$), i.e. participants that rather fall into the middle of both personality types and could not be assigned to one of them. To include those participants classified as average in the later statistical analysis could have falsified the results, as they do not show distinct enough extraverted or introverted behavior. Therefore, these participants were not taken into consideration (see Table 2 for descriptive sample data).

Table 2: Descriptive sample data.

		Male	Female	Not indicated	Sum
Introverted	Day 1	3	1	1	5
	Day 2	4	3	-	7
	Day 3	2	2	-	4
	Sum	9	6	1	16
Extraverted	Day 1	8	5	-	13
	Day 2	11	8	2	21
	Day 3	8	4	-	12
	Sum	27	17	2	46
Average	Day 1	3	2	-	5
	Day 2	7	5	-	12
	Day 3	8	0	-	8
	Sum	18	7	-	25
Sum		54	30	3	87

Based on their personality type, the participants were randomly divided in a total of 23 brainstorming groups. A general group size of four was chosen because previous studies have chosen the same size (Bolin & Neuman, 2006; Callaghan, 2009; Henningsen & Henningsen, 2013). However, two groups consisted of three participants only, whereof one was subject of subsequent analysis. Besides, one group consisted of two participants only, however not being subject for analysis. The reason for their exclusion is that seven of the 23 brainstorming groups consisted of students classified as average within the personality test and were not taken into consideration. All remaining brainstorming groups were formed of one participant classified as introverted and two to three participants classified as extraverted. Conclusively, 62 participants (16 introverted, 46 extraverted), equalling 16 brainstorming groups, were taken into consideration for statistical analysis.

3.3 Measures and instrumentation

This research employs a 2 x 3 factorial design, crossing personality type (introverted, extraverted) with brainstorming method (traditional group brainstorming, hybrid method 1, hybrid method 2) to test the defined hypotheses H1-H4. This is complemented by a survey to test H5-H6. In order to test the research design in practice before carrying out the experiments, a pilot study was conducted upfront.

The first independent variable is personality type (IV-I), which includes the two levels of introverted and extraverted personality type. The classification and belonging of participants to one of these two levels is defined by means of a personality test, namely IPIP-NEO-120, developed by Johnson (2014). The test was developed as the short version of the initial IPIP-NEO-300 by Goldberg (1999), which is a 300-item inventory that measures personality constructs. The IPIP-NEO-120 is a 120-item inventory that can be administered on the World Wide Web and measures the five broad domains of the Five-Factor Model (Goldberg, 1990). These domains consist of Neuroticism, Extraversion, Conscientiousness, Agreeableness and Openness to Experience (Johnson, 2014), whereof Extraversion is the scale of interest to this study. The score ranges from 0-100, 100 being extremely extraverted. Students with a score below 40 are categorized as introverts, above 60 as extraverts and between 40 and 60 as average. The scores are reported as percentile estimates. To illustrate, a score of 70 means that the level on extraversion is estimated to be higher than 70% of persons of the same sex and age (Johnson, 2014). Cronbach's alpha reliability estimates are available for all IPIP scales, whereof the scales measuring extraversion yield a mean score of .84 to .89, depending on the sample the estimates were based upon. One determinant of the test's validity are the correlation coefficients to constructs similar to the IPIP-NEO-120, whereof the correlation to the NEO-PI-R totals .85 (Johnson, 2014).

The second independent variable is brainstorming method (IV-II), including the three levels of traditional group brainstorming, hybrid method 1 and hybrid method 2. These brainstorming methods entail three different conditions. First, the condition of the traditional group brainstorming method (G), which encompasses brainstorming in a group for a time of eight minutes. Second, the condition of hybrid method 1 entails first brainstorming individually for half of the time, i.e. four minutes, and consecutively, in a group for four minutes (IG). The third method, namely hybrid method 2, entails first brainstorming individually, then in a group, then again individually and then in a group for two minutes each (IGIG).

The dependent variable of the experimental design is defined as the average quantitative, non-redundant ideas generated per participant and personality type per group (DV- I), called "average ideas generated" hereafter, for reasons of simplicity. This implies that two scores are assigned to every brainstorming group after each of the three brainstorming rounds. First, one average score of non-redundant ideas produced by introverted, and second, one average score produced by extraverted group members. Since the underlying research question asks whether hybrid brainstorming can empower introverts to contribute an assimilable amount of ideas compared to extraverts, the focus of this research solely lies on the quantity of ideas produced. The quality of ideas is

neglected at this point. The dependent variable is measured by counting the numbers of ideas produced per group and personality type. Therefore, all participants receive sticky notes in different colors according to a predefined color code, so that ideas produced by introverts and extraverts can be differentiated.

The dependent variable of the survey is post-brainstorming satisfaction (DV-II). This construct is measured by the following four items: Were you satisfied with the (1) process, (2) the results, (3) your own contribution to this brainstorming round and (4) how satisfied were you overall. These items are measured using a questionnaire with 5-point Likert Scales, ranging from very unsatisfied (1) to very satisfied (5). The average of these four items is reported per participant. The short questionnaire, which includes four questions only, was partly adopted from Valacich, Dennis and Nunamaker (1992), who measured post-brainstorming satisfaction in computer-mediated groups. However, the questionnaire was tailored to the demands of this particular study. Overall, the scale was reliable (Cronbach's alpha: .74).

3.4 Data collection

The experiment was conducted during three different days (see figure 1 for an overview of the process of experiment). As a first step, test persons were asked to complete the online personality test IPIP-NEO-120 (Johnson 2014) using fictitious nicknames. Next, they were sorted into three subgroups (1) introverted (extraversion score below 40), (2) extraverted (score above 60), and (3) average (score between 40 and 60). Based on a provided list including their nicknames and their personality types, the test persons were assigned to one of the brainstorming groups, consisting of one introverted and two to three extraverted each. Thereafter, the participants received an introduction on the general procedure, including the idea generation and coding in brainstorming. The coding was based sticky notes in different colors in order to assign the ideas to different group members.

After having received the instructions, the participants conducted a small test-round to become familiar with the procedure. The first brainstorming round used the traditional group brainstorming method according to the rules of Osborn (called "G-condition"). Therefore, the participants were asked to brainstorm as a group for eight minutes. At day 1, their task was to consider possible product differentiations of a chocolate brand (the task is called "chocolate"). Since counterbalancing was used in this study, the order of tasks varied on each day (see figure 1). On day 2, the first task was to think of possible marketing actions for the promotion of a new product of smoothie brand (called "smoothie"), and on day 3, their first task was to think of products that could be sold under a newly introduced product line of a supermarket (called "supermarket"). After eight minutes, all ideas (sticky notes) were collected. Thereafter, the participants were asked to fill in the satisfaction questionnaires for round 1. Next, the second brainstorming round was conducted, employing hybrid method 1. This entails switching from individual phases to group phases. Therefore, the students first brainstormed individually (I) for four minutes and then in a group (G) for four minutes (called "IG-condition"). The final brainstorming round used hybrid method 2. The process first entailed an individual phase

(I), followed by a group phase (G), an individual phase (I) and a group phase (G) another group phase for 2 minutes each (called “IGIG-condition”).

The collected data hence consisted of two components. First, the sticky notes that are used to measure the DV-I, namely the average ideas generated and second, questionnaires that are used to measure the DV-II, namely post-brainstorming satisfaction. The data collected from groups with participants classified as average were disregarded for analysis.

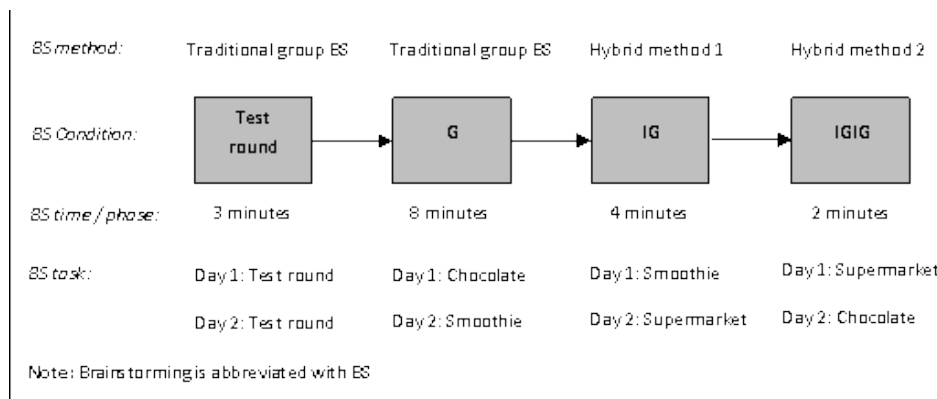


Figure 1: Process of experiment.

3.5 Data analysis methods

The primary hypotheses were tested using a two-way mixed design ANOVA, followed by several post-hoc tests. The statistical test of a two-way mixed design ANOVA compares the differences in means between groups that are split on two independent variables, as in the case of this research. These variables comprise one between-subjects factor that has two independent groups, i.e. introverted or extraverted, and one within-subjects factor that has three related groups and is repeatedly measured, i.e. three different brainstorming methods in this case. Since the statistical test perfectly reflects the design of this research, it was well-suited to choose for analysis. The primary purpose of using the two-way mixed design ANOVA is to understand if there is an interaction between the between-subjects and within-subjects factor in relation to the dependent variable (Cohen, 2008; Laerd Statistics, 2015a). To conduct the test, two average scores of non-redundant ideas, i.e. one average score for introverts and one for extraverts, were derived per group. These average scores represented the final data set used for statistical analysis in SPSS. Since the two-way mixed design ANOVA only reveals whether an interaction exists between the between-subjects factor and within-subjects factor on a dependent variable, the two-way mixed design ANOVA was consequently followed-up by independent-samples t-tests and paired-samples t-tests to test hypotheses H1-H4.

To understand if an interaction between personality type and brainstorming method that affects post-brainstorming satisfaction exists, the two-way mixed design ANOVA

was applied again. This involved the between-subjects factor of personality type, i.e. intro-verted or extraverted, and the within-subjects factor of brainstorming methods, including the three brainstorming methods applied. The hypotheses H5-H6 were further tested using paired-samples t-tests. This test is utilized to determine if there is a statistically significant difference between paired observations (Laerd Statistics, 2015b). To conduct the ANOVA and t-tests, the data from the questionnaire had to be coded (1 – very unsatisfied, 5 – very satisfied).

3.6 Validity and reliability

Experimental validity is defined as “the correctness or truthfulness of an interference that is made from the results of an experiment” (Christensen, 2008, p. 206). According to Sani and Todman (2008), three important aspects of validity apply to experiments, namely internal, external and construct validity.

Internal validity refers to “the extent to which causal conclusions can be drawn” (Gray, 2004). Since we cannot generally exclude the existence of other variables that influence our dependent variable, nuisance variables (NVs) need to be discussed and eliminated as far as possible (Sani & Todman, 2008). These variables are “undesired sources of variation in an experiment that affect the dependent variable” (Kirk, 2013). There are two ways of control, namely to eliminate the NV by keeping it constant throughout the experiment, or by turning it into a random variable (Sani & Todman, 2008). Even though there are no perfectly designed experiments, great diligence has been taken in creating a sound experimental design. Therefore, the random allocation of subjects to the groups has been assured, which is one controlling element for threats to validity (Gray, 2004).

External validity refers to “the extent to which it is possible to generalize from the data to a larger population or setting” (Gray, 2004). However, reducing the threat to internal validity and designing an experiment as representatively and realistically as possible, is contradictory (Sani & Todman, 2008). Therefore, external validity can only be improved to the degree that it does not hamper internal validity. First, regarding ecological validity, i.e. generalizing the findings to different settings (Sani & Todman, 2008), it can be stated that the experimental setting of a classroom for brainstorming sessions is somehow comparable to real-world settings. To illustrate, a meeting room at a company equals a classroom to a large extent. However, the presence of various brainstorming groups at a time is rather seldom. Second, referring to population validity, i.e. generalizing the findings to people differing from the sample (Sani & Todman, 2008), it needs to be noted that the results of students cannot fully be generalized to other populations. This is mainly due to differences in thinking and behavior compared to other groups such as workers.

“Construct validity is the extent to which a variable actually reflects the theoretical construct that we intend to measure” (Sani & Todman, 2008). The underlying condition is to operationally define all involved concepts before measuring them (Gray, 2004). In case of this research, the concepts of the IVs as well as the DVs were scrutinized and operationalized in chapter 2, leading to present construct validity.

Experimental reliability refers to “consistency, stability, or repeatability of the results of an experimental study” (Christensen, 2008). To conduct a reliable experiment, all components involved, i.e. number and identification of participants, as well as the dependent and independent variables, must be reliable. Regarding the number and identification of participants, a sufficient number of participants increases the reliability of the obtained results (Christensen, 2008). In case of this research, a total of $N = 87$, whereof $N = 62$ were subject for analysis, was regarded as sufficient to obtain reliable statistical results, since all statistical tests selected could be carried out while meeting the required assumptions. The subsequent partition into three sub groups based on personality type, relied on a reliable personality test (Cronbach’s alpha .08 to .89 for extra-version scale), namely IPIP-NEO-120 (Johnson, J. A., 2014).

4 Results

In the first instance, a two-way mixed design ANOVA was carried out to explore if there exists an interaction between the between-subjects and within-subjects factor in relation to the dependent variable, namely average ideas generated (DV-I). In the present case, personality type (IV-I) was the two-level between-subjects factor and brainstorming method (IV-II) the three-level within-subjects factor. Table 3 presents the means and standard deviations of average ideas generated (DV-I), sorted by personality type (IV-I) and brainstorming method (IV-II), respectively.

Table 3: Means and standard deviations of average ideas generated for traditional brainstorming, hybrid method 1, and hybrid method 2 according to personality type

	Traditional [G-condition]	Hybrid method 1 [IG-condition]	Hybrid method 2 [IGIG-condition]
Introverts			
M	3.81	4.13	5.94
SD	1.94	2.63	3.43
Extraverts			
M	6.77	6.87	8.29
SD	1.97	2.72	2.43

Figure 2 further graphically illustrates the derived results of the mean average ideas generated, sorted for personality type and brainstorming method.

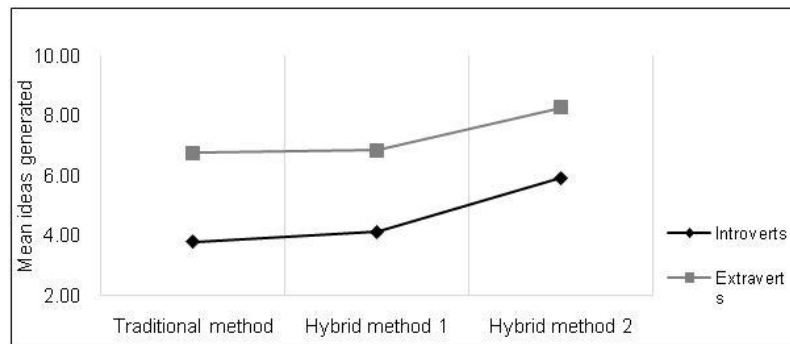


Figure 2: Mean average ideas generated in traditional brainstorming, hybrid method 1, and hybrid method 2 according to personality type

Investigating the assumptions of the two-way mixed design ANOVA revealed that there were no outliers in the present data set, as assessed by inspection of a boxplot and by examination of studentized residuals for values greater than ± 3 . In addition, DV-I was normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$) and by Normal Q-Q Plot. Besides, there was homogeneity of variances, as assessed by Levene's test of homogeneity of variance ($p > .05$) and homogeneity of covariances, as assessed by Box's test of equality of covariance matrices ($p = .063$). Mauchly's test of sphericity indicated that the assumption of sphericity was met for the two-way interaction $\chi^2(2) = .993$, $p = .609$. Running the test revealed that there was no statistically significant interaction between personality type (IV-I) and brainstorming method (IV-II) on average ideas generated (DV-I), $F(2, 60) = .201$, $p = .818$, partial $\eta^2 = .007$. Therefore, it was further tested for main effects. The main effect of brainstorming method revealed a statistically significant difference in average ideas generated within the three different brainstorming methods, $F(2, 60) = 8.537$, $p = .001$ ($p < .05$), partial $\eta^2 = .222$. This demonstrates that the average ideas generated significantly differed for the three brainstorming methods applied during the experiment. A pairwise comparison further disclosed that the mean difference is significant at the .05-level for (1) the traditional method (G-condition) compared to hybrid method 2 (IGIG-condition), as well as for (2) the hybrid method 1 (IG-condition) compared to hybrid method 2 (IGIG-condition). Likewise, the main effect of personality type showed that there was a statistically significant difference in average ideas generated between the two types $F(1, 30) = 14.023$, $p = .001$, partial $\eta^2 = .319$. This depicts an existence of significant differences between brainstorming performance according to personality type. The lack of statistically significant simple main effects, as laid out above, however, indicates that the differences in average ideas generated between the two personality types (IV-I) and three brainstorming methods (IV-II) cannot be traced back to the existence of an interplay between these two variables that jointly affect the DV-I. Still, the presence of main effects for both brainstorming method and personality type ascribes a general - though separate - effect of these two variables on average ideas generated (DV-I). Resulting therefrom, further post-hoc tests, namely independent-samples t-tests and paired-samples t-tests, were carried out to test hypothesis H1-H4.

Hypothesis 1: An independent samples t-test was run to determine whether there exists a significant difference in average ideas generated between introverts and extraverts when applying the traditional brainstorming method. Descriptive statistics indicated that extraverts (6.77 ± 1.97) generated more ideas on average compared to introverts (3.81 ± 1.94). Checking the independent samples t-test's underlying assumption revealed that there were no outliers in the data, as assessed by inspection of a boxplot. Average number of ideas generated for each level of personality, i.e. introvert and extravert, were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Besides, there was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .768$). Running the test indicated that there was a statistically significant difference in the mean average of ideas generated between extraverts and introverts, with introverts scoring lower than extraverts to a degree of -2.96 ideas (95% CI, -4.37 to - .55), $t(30) = 4.277$, $p < .0005$. Conclusively, H1 is accepted.

Hypothesis 2: To determine whether introverts generate significantly more ideas when applying a hybrid method compared to the traditional method, two separate t-tests were conducted.

First, comparing the traditional to the hybrid method 1, introverts generated more ideas on average while applying the hybrid method (4.13 ± 2.63) as opposed to the traditional brainstorming method (3.81 ± 1.94). A paired-samples t-test was used to determine whether there was a statistically significant mean difference in average ideas generated between the two methods. There were no outliers in the data, as assessed by inspection of a boxplot. The differences between the averages of ideas generated by introverts in the traditional and hybrid method 1 were normally distributed, as assessed by Shapiro-Wilk's test ($p = .554$). However, the observed increase is not statistically significant ($p > .05$).

Second, comparing the traditional to the hybrid method 2, introverts generated more ideas when applying the hybrid method 2 (5.94 ± 3.43) as opposed to the traditional brainstorming method (3.81 ± 1.94). There were no outliers in the data, as assessed by inspection of a boxplot. The differences between the traditional brainstorming method and hybrid method 2 were normally distributed, as assessed by Shapiro-Wilk's test ($p = .501$). The hybrid method 2 elicited an increase of 2.13 ideas generated (95% CI, 0.20 to 4.05) on average compared to the traditional method. This increase is statistically significant, $t(15) = 2.353$, $p = 0.033$ ($p < 0.05$).

Accordingly, H2 is rejected for the case of hybrid method 1, but accepted for the case of hybrid method 2, which caused a significant increase in average ideas generated by introverts compared to the traditional brainstorming method.

Hypothesis 3: To test whether introverts and extraverts contribute equal shares to the total amount of ideas generated when applying hybrid methods, it was first analyzed whether there still exists a significant difference between the types when applying hybrid method 1. Descriptive statistics indicated that introverts still contribute less ideas on average (4.13 ± 2.63) compared to extraverts (6.87 ± 2.72). The score of average ideas generated by introverts was 2.75 ideas (95% CI, -4.68 to -0.02) lower than of extraverts. An independent-samples t-test was run to determine if this difference is significant. There

were no outliers in the data, as assessed by inspection of a boxplot. Average number of ideas generated was normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Besides, there was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .627$). The difference in mean score of average ideas generated between introverts and extraverts was proven to be significant, $t(30) = -2.908$, $p = .007$. This demonstrates that the gap of average ideas generated between the two personality types could not be overcome by hybrid method 1.

Second, it was scrutinized whether the same is true for hybrid method 2. Therefore, another independent-samples t-test was run. Descriptive statistics indicated that the mean score of average ideas generated by extraverts (8.293 ± 2.43) was higher than of introverts (5.938 ± 3.435). Hence, introverts' score was 2.36 (95% CI, -4.503 to -0.207) lower than of extraverts. There were no outliers in the data, as assessed by inspection of a boxplot. Average ideas generated was normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$) and there was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .118$). Again, a statistically significant difference in the mean score of average ideas generated between introverts and extraverts was proven for hybrid method 2, $t(30) = -2.239$, $p = .033$. This result implies, that the method could overcome the gap of average ideas generated between introverts and extraverts either. Conclusively, H3 is rejected.

Hypothesis 4: To find whether introverts contribute significantly more ideas in hybrid method 2 compared to hybrid method 1, since more frequent changes are involved, a paired-samples t-test was conducted. Descriptive statistics already indicated that introverts generated more ideas applying the hybrid method 2 (5.94 ± 3.43) as opposed to hybrid method 1 (4.13 ± 2.63). The assessment of test assumptions depicted no outliers in the data, as checked by inspection of a boxplot. Further, the differences between the average ideas generated by introverts in hybrid method 1 compared to hybrid method 2, were normally distributed, as assessed by Shapiro-Wilk's test ($p = .612$). Result of the t-test indicated that the hybrid method 2 elicited a statistically significant increase in average ideas generated to hybrid method 1, $t(15) = 3.131$, $p = 0.007$. Therefore, H4 is accepted.

Hypothesis 5 & 6: To test the second part of the derived hypotheses, the results from the post-brainstorming satisfaction survey were analyzed. A total of $N = 62$, including 16 introverts and 46 extraverts, was considered for data analysis. First, the two-way mixed ANOVA was run to test whether there exists an interaction between personality type (IV-I) and brainstorming method (IV-II) that affects post-brainstorming satisfaction (DV-II). Results of descriptive statistics can be found in table 4.

Table 4: Means and standard deviations of post-brainstorming satisfaction for traditional group brainstorming, hybrid method 1, and hybrid method 2 according to personality type

	Traditional [G-condition]	Hybrid method 1 [IG-condition]	Hybrid method 2 [IGIG-condition]
Introverts			
M	3.86	3.86	3.94
SD	0.55	0.87	0.72
Extraverts			
M	4.12	4.10	4.25
SD	0.56	0.66	0.79

Figure 3 further illustrates the derived results by showing mean post-brainstorming satisfaction sorted for personality type and brainstorming method.

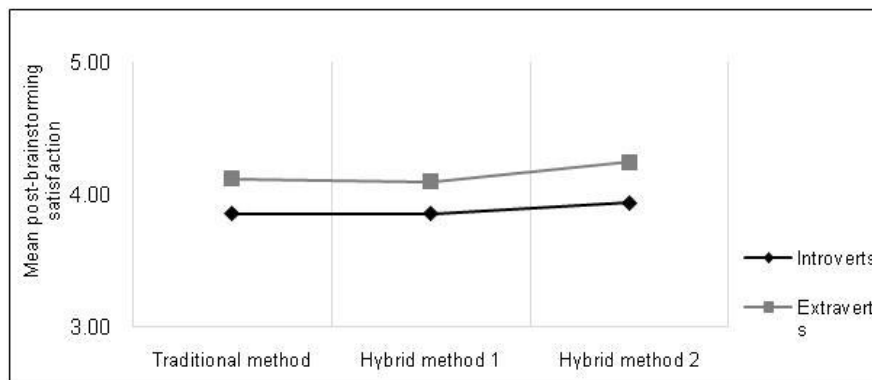


Figure 3: Mean post-brainstorming satisfaction after traditional group brainstorming, hybrid method 1, and hybrid method 2 according to personality type

An independent samples t-test was run to test H5, questioning whether introverts show a lower satisfaction level after traditional brainstorming compared to extraverts. Again, one outlier was detected that was more than 1.5 box-lengths from the edge of the box in a boxplot. Inspection of its value did not reveal it to be extreme and hence it was kept in the analysis. The score for average generated ideas was normally distributed in case of the needed data set, as assessed by Shapiro-Wilk's test ($p > .05$). Besides, there was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .471$). Descriptive statistics indicate that mean extravert satisfaction score (4.12 ± 0.56), after applying the traditional method, was higher than mean introvert satisfaction score (3.86 ± 0.55). However, this difference was not statistically significant, $t(59) = -1.592$, $p = .117$.

To test H6, a paired-samples t-test was used to determine whether there was a statistically significant difference between the post-brainstorming satisfaction level of

introverts after hybrid brainstorming compared to traditional brainstorming. First, satisfaction levels after the traditional and hybrid method 1 were compared. There were no outliers in the data, as assessed by inspection of a boxplot. The differences between the satisfaction scores of introverts applying the traditional brainstorming method and hybrid method 1 were normally distributed, as assessed by Shapiro-Wilk's test ($p = .221$). Descriptive statistics already revealed that introverted participants indicated an exact same satisfaction level after the traditional brainstorming round (3.86 ± 0.55) as opposed to the first hybrid brainstorming round (3.86 ± 0.87). Consequently, the hybrid method 1 did not elicit any increase in satisfaction level (95% CI, -0.386 to 0.386). There was no significant difference between the satisfaction levels ($p = 1.000$).

Second, the post-brainstorming satisfaction levels of introverts after the traditional and the hybrid method 2 were compared. The difference scores for the traditional method and hybrid method 2 were normally distributed, as assessed by Shapiro-Wilk's test ($p = .621$). According to descriptive statistics, introverted participants were more satisfied after hybrid method 2 (4.02 ± 0.67) as opposed to the traditional method (3.82 ± 0.54). Hence, the hybrid brainstorming method, elicited an increase of 0.200 (95% CI, -0.132 to 0.532) in post-brainstorming satisfaction compared to the traditional method. However, this increase was not significant, $t(14) = 1.293$, $p = .217$. Conclusively, both H5 and H6 are rejected. Finally, an overview of the results for all hypotheses can be found in table 5.

Table 5: Overview of hypotheses test results

	Hypotheses	Test results
H1	<i>In traditional interactive group brainstorming, introverted group members contribute significantly less to the total amount of ideas generated, compared to extraverted group members</i>	Accepted ($p < .0005$)
H2	<i>In hybrid brainstorming, introverted group members contribute significantly more to the total amount of ideas generated, compared to traditional interactive group brainstorming</i>	Rejected for hybrid method 1 ($p > .05$), Accepted for hybrid method 2 ($p < .05$)
H3	<i>In hybrid brainstorming, introverted and extraverted group members contribute equal shares to the total amount of ideas generated</i>	Rejected for hybrid method 1 ($p = .007$) ¹ , Rejected for hybrid method 2 ($p = .033$) ¹
H4	<i>In hybrid brainstorming, introverted group members contribute significantly more ideas if frequent changes between individual and group phases are included, compared to less frequent changes</i>	Accepted ($p = 0.007$)
H5	<i>Introverted group members show a lower satisfaction-level after traditional interactive group brainstorming compared to extraverted group members</i>	Rejected ($p = .117$)
H6	<i>Introverted group members show a higher satisfaction-level after hybrid brainstorming compared to traditional brainstorming</i>	Rejected for hybrid method 1 ($p = 1.000$), Rejected for hybrid method 2 ($p = .217$)

¹ H1: $\mu_{\text{introverts}} \neq \mu_{\text{extraverts}}$

5 Discussion

First, the results attested a general existence of differences in average ideas generated between introverts and extraverts. However, this cannot be traced back to an interplay between applied brainstorming method and personality type. Still, results indicate that both personality type and brainstorming method have an effect on the outcome of brainstorming. This fortifies earlier findings which have already accredited personality with an impact on brainstorming performance (Callaghan, 2009; Camacho & Paulus, 1995; Jung et al., 2012). What is more, previous research has also provided evidence that particularly differences in the introversion-extraversion dimension can play a significant role in brainstorming (Bradley & Hebert, 1997; Jung et al., 2012), which was likewise confirmed with this research. The findings of the present study hence support the “New Groupthink’s” claim that personality differences can be made accountable for variances in brainstorming productivity (Cain, 2013; Dossey, 2016). Besides, results also accredit a general difference in brainstorming performance of introverts between the traditional and hybrid methods. This provides a first indicator for the presence of a favorable effect of hybrid brainstorming on introvert’s contribution to brainstorming.

For hypothesis 1 (H1), it was predicted that in traditional interactive group brainstorming, introverted group members contribute significantly less to the total amount of ideas generated, compared to extraverted group members. This assumption was proved and therewith replicates previous research. Although only a few studies have broached this issue earlier, already Callaghan (2009) showed introverts to be less involved in brainstorming sessions. The present result again underlines the argument of the “New Groupthink” theory, stating that introverts fall behind extraverts in interactive group brainstorming (Cain, 2013).

Regarding hypothesis 2 (H2), the expectation was that in hybrid brainstorming introverted group members would contribute significantly more to the total amount of ideas generated, compared to traditional group brainstorming. This hypothesis was shown to be significant for hybrid method 2, however not for hybrid method 1. Still, introverts generated more ideas on average in both, hybrid method 1 (4.13 ± 2.63) and hybrid method 2 (5.94 ± 3.43), compared to the traditional method (3.81 ± 1.94). A general increase in ideas when applying hybrid brainstorming was attested earlier in literature, however regardless of personality type (Girotra et al., 2010; Jung et al., 2012; Korde, 2014; Korde & Paulus, 2017; Paulus et al., 1995). In the present research, based on the average ideas generated in the traditional method, introverts showed a relatively larger increase in mean ideas when applying hybrid method 1 (+8.40%) and hybrid method 2 (+55.91%) compared to extraverts (+1.48% in hybrid method 1 and +22.45% in hybrid method 2). However, the effect is not as large as in the study of Girotra, Terwiesch, and Ulrich (2010), who reported three times more ideas in a hybrid condition. Besides, hybrid method 2 elicited a significantly higher increase compared to hybrid method 1. This divergence in findings concerning the two hybrid methods can be traced back to more frequent changes between individual and group phases that are involved in hybrid method 2. This was predicted to be favored by introverts, since they oftentimes possess a shorter

attention span (Kasof, 1997). Conclusively, hybrid brainstorming methods have the power to enhance the contribution of introverts, whose performance can be maximized when frequent and fast changed between quiet and group phases are involved.

Hypothesis 3 (H3) forecasted that in hybrid brainstorming, introverted and extraverted group members contribute equal shares to the total amount of ideas generated. This prediction was statistically insignificant for both hybrid method 1 and hybrid method 2. Introverts still contributed significantly less ideas on average compared to extraverts, who generated the most ideas in each condition. The insignificant results mainly occur because not only introverts but both personality types experienced an increase in average ideas generated within the hybrid methods. Consequently, the performance gap could be reduced but not be closed. However, the difference in mean ideas generated between the two personality types narrowed when applying the hybrid methods. The difference between mean ideas generated by introverts and extraverts was hence decreasing from 2.96 (traditional method) to 2.74 (hybrid method 1) and finally 2.35 (hybrid method 2), respectively. On the whole, it can be concluded that even though introverts benefit slightly more from hybrid brainstorming compared to extraverts, and increase their overall amount of ideas, the method cannot overcome the performance gap between the two personality types.

For hypothesis 4 (H4), it was predicted that in hybrid brainstorming, introverted group members contribute significantly more ideas if frequent changes between individual and group phases are included. This hypothesis was accepted. Hence, introverts contributed significantly more ideas in hybrid condition 2 compared to hybrid condition 1. Neither has any study particularly investigated the effect of the number of changes between group and individual conditions, nor its impact on the performance of introverts. Therefore, this result adds original contributions to the respective body of research and cannot be directly compared to earlier findings. However, it is in line with inferences derived from prior studies in the field of brainstorming and personality (Korde & Paulus, 2017; Paulus, Dickson, Korde, Cohen-Meitar, & Carmeli, 2016; Paulus & Yang, 2000). In addition, the finding goes along with the general characterization of introverts. In this regard, Kasof (1997) found this type of personality to recharge energy through being quiet. Consequently, involving more frequent individual phases, such as in hybrid method 2, accommodates introverts. This likewise supports Cain (2013), who argues that introverts reenergize through solitude, which in turn functions as a catalyst to innovation.

With regards to post-brainstorming satisfaction of introverts, results indicated that post-brainstorming satisfaction cannot be directly traced back to personality type or brainstorming method. Since no other study has yet compared satisfaction levels of introverts and extraverts after hybrid brainstorming, this result cannot be compared directly to earlier publications.

Regarding hypothesis 5 (H5), it was expected that introverted group members show a lower satisfaction-level after traditional interactive group brainstorming compared to extraverted group members. This prediction had to be rejected. The satisfaction level of introverts was lower, however not significantly lower after traditional group brainstorming. This result is to some extent surprising when reviewing earlier literature.

In this regard, it was found that introverts oftentimes perceive meetings and group discussions, such as brainstorming, to be an energy drain (Culp & Smith, 2005). In case of the present research, irrespective of their inferior performance, introverts seem to enjoy traditional group brainstorming (satisfaction level: 3.86), although a little less than extraverts (satisfaction level: 4.12). Therefore, it can be concluded that irrespective of actual performance, traditional group brainstorming is much liked amongst introverts and slightly more amongst extraverts.

The hypothesis 6 (H6), which assumed that introverted group members show a higher satisfaction-level after hybrid brainstorming compared to traditional brainstorming, was likewise rejected. Since hybrid brainstorming comes along with individual reflection phases and hence time to think things through before discussing as a group, it was assumed that introverts prefer hybrid brainstorming over the traditional method (Callaghan, 2009). However, in contrast to expectations, no differences in introverts' satisfaction levels could be noted between the traditional and hybrid method 1. One reason for this discrepancy could be that introverts already reported quite high satisfaction levels after the traditional method and did not leave much room for higher scores. In this regard, they might have wanted to save credits for round 3. Another reason could be that introverts neither perceived any advantage over the traditional method nor felt more accommodated in hybrid method 1. Eventually, they generated ideas in the individual phase, but could not present them to the group within the group phase because extraverts took the floor. Since no second individual and group phase followed, introverts had no time to rethink about ways to enter the discussion. One may argue, that no learning effect could occur in hybrid method 1, since both phases were given only once. Regarding the difference of introverts' post-brainstorming satisfaction between the traditional and hybrid method 2, a slight – though not significant – increase could be observed. This increase can be traced back to the advantages that come along with the involvement of multiple changes between the two conditions, as discussed before. Conclusively, it can be stated that introverts feel more satisfied when applying hybrid brainstorming methods, while involving multiple changes between quiet and group phases satisfies them the most.

Finally, referring back to the research question, asking whether hybrid brainstorming can empower introverts to contribute an assimilable amount of ideas compared to extraverts, the following conclusion must be drawn: The method of hybrid brainstorming alone does not have enough power to close the performance gap between introverts and extraverts. In fact, extraverts still generate the most ideas in all brainstorming conditions. However, hybrid brainstorming helps to enhance both the contribution of introverts and their post-brainstorming satisfaction. Consequently, there is a tendency towards a narrowed contribution of introverts and extraverts in hybrid brainstorming, due to the enhanced performance of introverts caused by the change in method.

6 Conclusions, limitations and implications

6.1 Conclusions

To the extent that the results of the present experiment are generalizable, it can finally be concluded that the method of hybrid brainstorming has the power to enhance introvert's contribution to brainstorming and their post-brainstorming satisfaction, the latter however to a small extent. Therefore, applying this method can reduce the "New Groupthink's" effect on ideation. This entails that in hybrid brainstorming, introverts' performance and satisfaction is hampered less than in conditions that were shown to accommodate primarily extraverts, such as traditional group brainstorming. However, with reference to the research question, the method of hybrid brainstorming does not possess sufficient power to fully close the performance gap between introverts and extraverts. Extraverts still generate the most ideas in all brainstorming conditions and consistently show slightly higher satisfaction levels. Nevertheless, hybrid brainstorming helps to enhance the overall brainstorming performance of introverts to a larger extent than that of extraverts and therewith facilitates a more equal contribution of both personality types. However, in hybrid brainstorming, providing the right conditions was found to be crucial to achieving the desired effect. Therefore, multiple changes between individual and group discussion phases are required.

This research illustrated the "New Groupthink" theory's standpoint with regards to the widely-used collaborative ideation method of group brainstorming, still being the most commonly adopted approach for generating creative ideas (Korde & Paulus, 2017; Rietzschel et al., 2006). Since the method's application in its traditional form after Osborn (1957, reprinted 2013) was found to be to the detriment of introverts (Callaghan, 2009; Camacho & Paulus, 1995), one alternative method, namely hybrid brainstorming – which alters between individual and group brainstorming – was investigated within this research. Due to the fact that no research has yet investigated whether hybrid brainstorming helps to overcome the discrepancy between the contribution of introverts and extraverts in group brainstorming, this research has stepped into that gap. Consequently, the main aim of this study was to explore whether hybrid brainstorming empowers introverts to contribute an assimilable amount of ideas compared to extraverts.

Consequently, besides the overall conclusion as stated above, this research raises some relevant considerations regarding brainstorming. First, it can be stated that introverts tend to underperform in collaborative forms of ideation, which again underlines the existence of natural differences between introverts and extraverts that should not be disregarded. More specifically, this finding demonstrates that personality, although widely neglected in brainstorming literature, plays an important role in the search for the best brainstorming performance and that the empowerment of introverts constitutes a determining factor for success.

Furthermore, hybrid brainstorming was found to generally surpass traditional group brainstorming with regards to the quantity of ideas generated and post-brainstorming satisfaction levels. Hence, in contrast to traditional group brainstorming, this method possesses the ability of enhancing the overall brainstorming performance of introverts.

Besides, although to a smaller extent, extraverts also displayed higher satisfaction and performance levels when using hybrid brainstorming. This further demonstrates the method's general superiority over traditional group brainstorming. In particular, introverts were found to be most satisfied and to perform best when frequent changes between individual and group brainstorming were involved. This further emphasizes the importance of choosing the right method and designing the right brainstorming conditions to maximize overall performance. As a consequence, a need to rethink and adapt existing ideation methods to accommodate all personality types and finally obtain the best results arises.

Concerning satisfaction in brainstorming, it can be concluded that, irrespective of their lesser performance, introverts do not feel dissatisfied or unhappy after brainstorming. In fact, they seem to enjoy both the traditional and hybrid method, whereof the latter is slightly favored. This speaks for the existence of the positive effects this method can have on participants, which go beyond the pure quantity of ideas generated. Therefore, applying interactive group-, or hybrid brainstorming can satisfy participants. They generally feel productive and contributory – a factor that should not be neglected in both the brainstorming literature and the “New Groupthink” discussion.

The derived conclusions add original contributions to the respective body of research. First, they contribute new insights to the scarcely covered academic area concerning the personality's impact on brainstorming performance and underline its decisive role. Second, no previous research had found adequate solutions of overcoming the productivity barrier between introverts and extraverts in group brainstorming. Therefore, this study serves as a first step towards addressing this issue. What is more, it was the first of its kind to explore whether hybrid brainstorming has the power to close the performance gap between the two personality types. Third, unlike any other study, this research also compared satisfaction levels of introverts and extraverts in traditional group and hybrid brainstorming in addition to the widely-used measure of average ideas generated. This provided further insights into the methods' general degree of esteem.

6.2 Limitations

A number of limitations must be acknowledged with regards to the generalizability of this study. First, regarding the study's sample, it needs to be noticed that a non-random sampling method, namely convenience sampling, was applied for practical reasons. Although the sample size was regarded to be sufficient, including a larger sample would have facilitated a greater statistical power. Additionally, a commensurately higher number of brainstorming groups would have increased overall validity. Furthermore, an equal spread between introverted and extraverted participants per group would have been preferable, since an uneven distribution might have disadvantaged the contribution of the group's minority. This can mainly be attributed to potential group dynamics resulting from an uneven spread of personality types. Again, a larger sample size would have been needed to counteract this shortcoming. Besides, this study employed an experiment involving students, which is not equal to a natural group setting. Although this may be methodologically consistent with much of the research on brainstorming, this approach

presents some difficulty in generalizing the obtained results to real organizational settings.

Furthermore, it should be noted that the categorization of participants according to personality type was based on trust. This shortcoming is attributable to the fact that participants needed to independently report their test scores without being controlled. These scores consequently served as basis for their categorization. Since no other comparable and feasible test procedure was available to the researcher, this limitation was not restrictable.

To conclude, exclusively three brainstorming conditions were selected for investigation, whereas others were knowingly excluded due to the limited scope of this study. Accordingly, this study is limited to the specific conditions under investigation, namely one traditional and two hybrid conditions. Furthermore, the results exclusively refer to the employed time frame of eight minutes per brainstorming round, since no other time frames were tested. Hence, the obtained results cannot be generalized for the traditional group- or hybrid brainstorming method as such.

Lastly, referring to delimitations, this research exclusively employed quantitative measures without any qualitative elements. This is due to this study's particular focus on empowering introverts in brainstorming by increasing their numerical share to idea contribution. Likewise, the complementary satisfaction measures were solely of quantitative nature.

6.3 Implications and further research

This research intended to find ways to counteract the suppression of introverts' contribution to ideation caused by the rising trend towards boundless collaboration at the workplace. In particular, the collaborative ideation method of brainstorming was investigated to explore how to empower introverts and therewith lower the effect of the "New Groupthink". In general, the findings derived underline the importance in organizations to recognize differences between introverted and extraverted employees. For managers, this encompasses answering to employees' diverse and individual needs regarding personality, and to facilitate corresponding working conditions. It is hence recommended to find ways of accommodating both introverts and extraverts at work. In particular, organizational areas dealing with creativity and innovation should not regard collaborative ideation as the only true form, as it is however often the case. Especially in today's turbulent times, where creativity and innovation are key for organizations to defend their market position, it is of utmost importance to apply ideation methods in their most efficient forms. Accordingly, for teams who frequently apply traditional group brainstorming, a switch to hybrid methods is suggested, since findings have shown that this can lead to both an increase in overall results and the contribution of introverts. Besides, it is recommended that managers and team leaders make use of multiple ideation methods in order to accommodate and include the ideas of various personality types. In practice, including individual ideation phases in brainstorming may also take on different forms. To illustrate, a team could brainstorm about the same topic within several meetings and use the time in between to think individually before reconvening and continuing the

group discussion. Finally, for introverted employees who oftentimes feel overwhelmed by traditional group brainstorming, suggesting a hybrid approach to the group is also recommended.

Finally, the paper at hand provides a first step in approaching the underperformance and suppression of introverts in collaborative ideation methods. In particular, this research concentrated on the most widely applied ideation method of group brainstorming. Since there barely exist literature concerning the impact of personality differences on brainstorming, this academic area offers a large range of possibilities for further research. Especially hybrid brainstorming implies promising future research opportunities in the course of finding the most effective brainstorming method that balances the contribution of introverts and extraverts. Since creativity and innovation increasingly gain importance for organizations, investigating more ideation methods with regards to introverts' performances is recommended. Therefrom obtained findings could add valuable contributions to the search for methods that best balance the contributions of introverts and extraverts and yield most ideas. Since the conducted research found the specific hybrid brainstorming conditions to be crucial for the enhanced contribution of introverts, further research is necessary to explore which conditions are best-suited. This encompasses the investigation of the optimal amount of changes between group and individual ideation phases as well as the ideal time span of each phase. In addition, it is recommended to delve into a qualitative dimension, such as researching participants' reasons behind preferring one hybrid method over another. To conclude, conducting further studies in real settings, in order to obtain a higher level of generalizability of results, is recommended.

References

- Aguilar-Alonso, A. (1996). Personality and creativity. *Personality and Individual Differences*, 21(6), 959–969. [https://doi.org/10.1016/S0191-8869\(96\)00162-6](https://doi.org/10.1016/S0191-8869(96)00162-6)
- Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and Creativity in Organizations. *Journal of Management*, 40(5), 1297–1333. <https://doi.org/10.1177/0149206314527128>
- Batey, M., Chamorro-Premuzic, T., & Furnham, A. (2010). Individual Differences in Ideational Behavior: Can the Big Five and Psychometric Intelligence Predict Creativity Scores? *Creativity Research Journal*, 22(1), 90–97. <https://doi.org/10.1080/10400410903579627>
- Bolin, A. U., & Neuman, G. A. (2006). Personality, Process, and Performance in Interactive Brainstorming Groups. *Journal of Business and Psychology*, 20(4), 565–585. <https://doi.org/10.1007/s10869-005-9000-7>
- Bradley, J. H., & Hebert, F. J. (1997). The effect of personality type on team performance. *Journal of Management Development*, 16(5), 337–353. <https://doi.org/10.1108/02621719710174525>
- Bradshaw, S. D., Stasson, M. F., & Alexander, D. (1999). Shyness and Group Brainstorming: Effects on Productivity and Perceptions of Performance. *North American Journal of Psychology*, 1(2), 267–275.
- Briggs Myers, I. (1995). *Gifts Differing: Understanding Personality Type*. California: Davies-Black Publishing.
- Brown, S. R., & Melamed, L. E. (1990). *Experimental design and analysis. Quantitative applications in the social sciences: Vol. 74*. Newbury Park, California: Sage Publications.

- Cain, S. (2012, January 13). The Rise of the New Groupthink. *New York Times*. Retrieved from <http://www.nytimes.com/2012/01/15/opinion/sunday/the-rise-of-the-new-groupthink.html>
- Cain, S. (2013). *Quiet: The power of introverts in a world that can't stop talking*. London: Penguin.
- Callaghan, E. (2009). Personalities of Design Thinking. *Design Management Journal*, 4(1), 20–32. <https://doi.org/10.1111/j.1942-5074.2009.00004.x>
- Camacho, L. M., & Paulus, P. B. (1995). The Role of Social Anxiousness in Group Brainstorming. *Journal of Personality and Social Psychology*, 68(6), 1071–1080. <https://doi.org/10.1037/0022-3514.68.6.1071>
- Christensen, L. B. (2008). *Experimental methodology* (10th ed.). Boston, Munich: Pearson/Allyn and Bacon.
- Cohen, B. H. (2008). *Explaining Psychological Statistics*: Wiley. Retrieved from <https://books.google.de/books?id=xWENVdl6D0YC>
- Creswell, J. W. (2008). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks, California: Sage Publications.
- Culp, G., & Smith, A. (2005). Leadership Effectiveness and Behavior. *Leadership and Management in Engineering*, 5(2), 39–48. [https://doi.org/10.1061/\(ASCE\)1532-6748\(2005\)5:2\(39\)](https://doi.org/10.1061/(ASCE)1532-6748(2005)5:2(39))
- Deresiewicz, S. (2009). The End of Solitude. Retrieved from <https://www.chronicle.com/article/The-End-of-Solitude/3708>
- DeRosa, D. M., Smith, C. L., & Hantula, D. A. (2007). The medium matters: Mining the long-promised merit of group interaction in creative idea generation tasks in a meta-analysis of the electronic group brainstorming literature. *Computers in Human Behavior*, 23(3), 1549–1581. <https://doi.org/10.1016/j.chb.2005.07.003>
- Diehl, M., & Stroebe, W. (1987). Productivity loss in brainstorming groups: Toward the solution of a riddle. *Journal of Personality and Social Psychology*, 53(3), 497–509. <https://doi.org/10.1037/0022-3514.53.3.497>
- Diehl, M., & Stroebe, W. (1991). Productivity loss in idea-generating groups: Tracking down the blocking effect. *Journal of Personality and Social Psychology*, 61(3), 392–403. <https://doi.org/10.1037/0022-3514.61.3.392>
- Dossey, L. (2016). Introverts: A Defense. *Explore*, 12(3), 151–160. <https://doi.org/10.1016/j.explore.2016.02.007>
- Dubina, I. N., Carayannis, E. G., & Campbell, D. F. J. (2012). Creativity Economy and a Crisis of the Economy? Coevolution of Knowledge, Innovation, and Creativity, and of the Knowledge Economy and Knowledge Society. *Journal of the Knowledge Economy*, 3(1), 1–24. <https://doi.org/10.1007/s13132-011-0042-y>
- Dunnette, M. D., Campbell, J., & Jaastad, K. (1963). The effect of group participation on brainstorming effectiveness for 2 industrial samples. *Journal of Applied Psychology*, 47(1), 30–37. <https://doi.org/10.1037/h0049218>
- Eysenck. (1995). *Genius: The natural history of creativity*. In J. Gray (Ed.), *Problems in the behavioral sciences*, 12. Monograph. Cambridge, UK: Cambridge University Press.
- Feist, G. J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality and Social Psychology Review: an Official Journal of the Society for Personality and Social Psychology, Inc*, 2(4), 290–309. https://doi.org/10.1207/s15327957pspr0204_5
- Feist, G. J. (1999). Autonomy and Independence. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of Creativity* (pp. 157–163). San Diego, California: Academic Press.
- Furnham, A. (2000). The Brainstorming Myth. *Business Strategy Review*, 11(4), 21–28. <https://doi.org/10.1111/1467-8616.00154>
- Furnham, A., & Yazdanpanahi, T. (1995). Personality differences and group versus individual brainstorming. *Personality and Individual Differences*, 19(1), 73–80. [https://doi.org/10.1016/0191-8869\(95\)00009-U](https://doi.org/10.1016/0191-8869(95)00009-U)

- Girotra, K., Terwiesch, C., & Ulrich, K. T. (2010). Idea Generation and the Quality of the Best Idea. *Management Science*, 56(4), 591–605. <https://doi.org/10.1287/mnsc.1090.1144>
- Goldberg, L. R. (1990). An alternative "description of personality": The Big-Five factor structure. *Journal of Personality and Social Psychology*, 59(6), 1216–1229. <https://doi.org/10.1037/0022-3514.59.6.1216>
- Goldberg, L. R. (1999). A Broad-Bandwidth, Public Domain Personality Inventory Measuring the Lower-Level Facets of Several Five-Factor Models. In I. Mervielde, I. Deary, F. de Fruyt, & F. Ostendorf (Eds.), *Personality Psychology in Europe* (pp. 7–28). Tilburg, The Netherlands: Tilburg University Press.
- Gray, D. E. (2004). *Doing Research in the Real World*. Cornwall: Sage Publications.
- Henningsen, D. D., & Henningsen, M. L. M. (2013). Generating Ideas About the Uses of Brainstorming: Reconsidering the Losses and Gains of Brainstorming Groups Relative to Nominal Groups. *Southern Communication Journal*, 78(1), 42–55. <https://doi.org/10.1080/1041794X.2012.717684>
- Heslin, P. A. (2009). Better than brainstorming? Potential contextual boundary conditions to brainwriting for idea generation in organizations. *Journal of Occupational and Organizational Psychology*, 82, 129–145.
- Hoff, E., Carlsson, I. M., & Smith, G. J. W. (2012). Personality. In M. D. Mumford (Ed.), *Handbook of organizational creativity* (1st ed., pp. 241–270). Boston, Massachusetts, Amsterdam: Elsevier/Academic Press.
- Hülsheger, U. R., Anderson, N., & Salgado, J. F. (2009). Team-level predictors of innovation at work: A comprehensive meta-analysis spanning three decades of research. *Journal of Applied Psychology*, 94(5), 1128–1145.
- John, O. P., & Srivastava, S. (2001). The Big Five Trait Taxonomy: History, Measurement, and Theoretical Perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp. 102–138). New York: The Guilford Press.
- Johnson, J. A. (2014). Measuring thirty facets of the Five Factor Model with a 120-item public domain inventory: Development of the IPIP-NEO-120. *Journal of Research in Personality*, 51, 78–89. <https://doi.org/10.1016/j.jrp.2014.05.003>
- Jung, C. G. (1921, reprinted 2017). *Psychological types*. Routledge classics. Abingdon, Oxon, New York, NY: Routledge.
- Jung, J. H., Lee, Y., & Karsten, R. (2012). The Moderating Effect of Extraversion–Introversion Differences on Group Idea Generation Performance. *Small Group Research*, 43(1), 30–49. <https://doi.org/10.1177/1046496411422130>
- Kasof, J. (1997). Creativity and Breadth of Attention. *Creativity Research Journal*, 10(4), 303–315. https://doi.org/10.1207/s15326934crj1004_2
- Kirk, R. E. (2013). *Experimental design: Procedures for the behavioral sciences* (4th ed.). Los Angeles, California: Sage Publications.
- Korde, R. (2014). *Hybrid Brainwriting: The efficacy of alternating between individual and group brainstorming and the effect of individual differences* (Dissertation). University of Texas, Arlington.
- Korde, R., & Paulus, P. B. (2017). Alternating individual and group idea generation: Finding the elusive synergy. *Journal of Experimental Social Psychology*, 70, 177–190. <https://doi.org/10.1016/j.jesp.2016.11.002>
- Kozlowski, S. W. J., & Ilgen, D. R. (2006). Enhancing the Effectiveness of Work Groups and Teams. *Psychological Science in the Public Interest : a Journal of the American Psychological Society*, 7(3), 77–124. <https://doi.org/10.1111/j.1529-1006.2006.00030.x>
- Laerd Statistics. (2015a). Paired-samples t-test using SPSS Statistics. Retrieved from <https://statistics.laerd.com/>

- Laerd Statistics. (2015b). Two-way mixed ANOVA using SPSS Statistics. Retrieved from <https://statistics.laerd.com/>
- Lamm, H., & Trommsdorff, G. (1973). Group versus individual performance on tasks requiring ideational proficiency (brainstorming): A review. *European Journal of Social Psychology*, 3(4), 361–388. <https://doi.org/10.1002/ejsp.2420030402>
- McCrae, R. R., & John, O. P. (1992). An Introduction to the Five-Factor Model and Its Applications. *Journal of Personality*, 60(2), 175–215. <https://doi.org/10.1111/j.1467-6494.1992.tb00970.x>
- Mullen, B., Johnson, C., & Salas, E. (1991). Productivity Loss in Brainstorming Groups: A Meta-Analytic Integration. *Basic and Applied Social Psychology*, 12(1), 3–23. https://doi.org/10.1207/s15324834basp1201_1
- Mumford, M. D., Hester, K. S., & Robledo, I. C. (2012). Creativity in Organizations. In M. D. Mumford (Ed.), *Handbook of organizational creativity* (1st ed., pp. 3–16). Amsterdam, Boston: Academic Press. <https://doi.org/10.1016/B978-0-12-374714-3.00001-X>
- Mumford, M. D., Scott, G. M., Gaddis, B., & Strange, J. M. (2002). Leading creative people: Orchestrating expertise and relationships. *The Leadership Quarterly*, 13(6), 705–750. [https://doi.org/10.1016/S1048-9843\(02\)00158-3](https://doi.org/10.1016/S1048-9843(02)00158-3)
- Osborn, A. F. (1957, reprinted 2013). *Applied Imagination: Principles and Procedures of Creative Writing*: Read Books Ltd.
- Paulus, P. B., & Nijstad, B. A. (Eds.). (2003). *Group Creativity: Innovation Through Collaboration*: Oxford University Press. Retrieved from <https://books.google.de/books?id=6xRnDAAQBAJ>
- Paulus, P. B. (2000). Groups, Teams, and Creativity: The Creative Potential of Idea-generating Groups. *Applied Psychology: an International Review*, 49(2), 237–262.
- Paulus, P. B., Dickson, J., Korde, R., Cohen-Meitar, R., & Carmeli, A. (2016). Getting the Most out of Brainstorming Groups. In A. B. Markman (Ed.), *Open Innovation: Academic and Practical Perspectives on the Journey from Idea to Market* (pp. 43–67). Oxford University Press. Retrieved from https://books.google.de/books?id=Q-MSDAAAQBAJ&pg=PA43&hl=de&source=gbs_toc_r&cad=4#v=onepage&q&f=false
- Paulus, P. B., Dzindolet, M., & Kohn, N. W. (2012). Collaborative Creativity-Group Creativity and Team Innovation. In M. D. Mumford (Ed.), *Handbook of organizational creativity* (1st ed., pp. 327–357). Amsterdam, Boston: Academic Press. <https://doi.org/10.1016/B978-0-12-374714-3.00014-8>
- Paulus, P. B., Korde, R. M., Dickson, J. J., Carmeli, A., & Cohen-Meitar, R. (2015). Asynchronous Brainstorming in an Industrial Setting. *Human Factors: the Journal of the Human Factors and Ergonomics Society*, 57(6), 1076–1094. <https://doi.org/10.1177/0018720815570374>
- Paulus, P. B., Larey, T. S., & Dzindolet, M. T. (2000). Creativity in groups and teams. In M. Turner (Ed.), *Groups at work: Advances in theory and research* (pp. 319–338). Hillsdale, NJ: Erlbaum.
- Paulus, P. B., Larey, T. S., & Ortega, A. H. (1995). Performance and Perceptions of Brainstormers in an Organizational Setting. *Basic and Applied Social Psychology*, 17(1 & 2), 249–265.
- Paulus, P. B., & Yang, H.-C. (2000). Idea Generation in Groups: A Basis for Creativity in Organizations. *Organizational Behavior and Human Decision Processes*, 82(1), 76–87. <https://doi.org/10.1006/obhd.2000.2888>
- Pervin, L. A., & Cervone, D. (2010). *Personality: Theory and research* (11th ed.). Hoboken, NJ: John Wiley & Sons.
- Quinlan, C. (2011). *Business research methods*. Andover: Cengage Learning.
- Rietzschel, E. F., Nijstad, B. A., & Stroebe, W. (2006). Productivity is not enough: A comparison of interactive and nominal brainstorming groups on idea generation and selection. *Journal of Experimental Social Psychology*, 42(2), 244–251. <https://doi.org/10.1016/j.jesp.2005.04.005>

- Sani, F., & Todman, J. B. (2008). The Nature of Psychology Experiments (II): Validity. In F. Sani & J. B. Todman (Eds.), *Experimental design and statistics for psychology: A first course* (pp. 18–38). Malden, MA: Blackwell Publications. <https://doi.org/10.1002/9780470776124.ch3>
- Sapsford, R. (2007). *Survey research* (2nd ed.). London, Thousand Oaks, California: Sage Publications.
- Sawyer, R. K. (2012). *Explaining Creativity: The Science of Human Innovation* (2nd ed.). New York, N.Y.: Oxford University Press.
- Sutton, R. I., & Hargadon, A. (1996). Brainstorming Groups in Context: Effectiveness in a Product Design Firm. *Administrative Science Quarterly*, 41(4), 685–718.
- Tang, M. (2016). Creativity and Innovation: Basic Concepts and Approaches. In M. Tang & C. H. Werner (Eds.), *Handbook of the Management of Creativity and Innovation* (pp. 3–32). WORLD SCIENTIFIC. https://doi.org/10.1142/9789813141889_0001
- Taylor, D. W., Berry, P. C., & Block, C. H. (1958). Does Group Participation When Using Brainstorming Facilitate or Inhibit Creative Thinking? *Administrative Science Quarterly*, 3(1), 23. <https://doi.org/10.2307/2390603>
- Tjosvold, D., West, M. A., & Smith, K. G. (2003). Fundamentals of Organizational Effectiveness. In D. Tjosvold, M. A. West, & K. G. Smith (Eds.), *International Handbook of Organizational Teamwork and Co-operative Working* (pp. 3–8). Chichester: Wiley.
- Valacich, J. S., Dennis, A. R., & Nunamaker, J. F. (1992). Group size and anonymity effects on computer-mediated idea generation. *Small Group Research*, 23(1), 49–73.
- VanGundy, A. B. (1984). Brainwriting for new product ideas: An alternative to brain-storming. *Journal of Consumer Marketing*, 1(2), 67–74. <https://doi.org/10.1108/eb008097>
- Watson, D., & Clark, L. A. (2007). Extraversion and Its Positive Emotional Core. In R. Hogan & J. Johnson (Eds.), *Handbook of personality psychology* (pp. 767–793). Amsterdam: Elsevier. <https://doi.org/10.1016/B978-012134645-4/50030-5>
- West, M. A. (2002). Sparkling Fountains or Stagnant Ponds: An Integrative Model of Creativity and Innovation Implementation in Work Groups. *Applied Psychology: an International Review*, 51(3), 355–424.
- West, M. A. (2003). Innovation Implementation in Work Teams. In P. B. Paulus & B. A. Nijstad (Eds.), *Group Creativity: Innovation Through Collaboration* (pp. 245–276). Oxford University Press.
- West, M. A., & Altink, W. M.M. (1996). Innovation at work: Individual, group, organizational, and socio-historical perspectives. *European Journal of Work and Organizational Psychology*, 5(1), 3–11. <https://doi.org/10.1080/13594329608414834>

Territory Development through the Finance Innovation Tools

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Abstract

The aim of the paper is to analyse how innovative financial tools can contribute to the development and sustainability of the territory and his local products.

This research is supported by a qualitative research of case study (Yin, 2014). Thus, the paper applies the CAOS model of micro-entrepreneurship by Paoloni (2011) with a few changes which make it possible to describe all variables that involve the company in a certain economic context. Using such model, we're able to share some factors and to classify different types of connections, identifying several kinds of existing relations.

Into economic context of Sardina, a little island in south west of Italy, where there are more than 60,000 agricultural enterprises, of which 60% shepherds, there is a constant difficulty in obtaining funding. This difficulty very often is related to the uncertainty of seasonal activity. Our work show how the use of innovative financial tools can encourage access to credit capital, even non-banking, of SME operating in the agrifood sector, and then how these innovative tools can promote the development and sustainability of the territory and his local products. This could be possible through the aggregation and cooperation of firms The paper also shows the active role of local authority "Regione Sardegna".

Following the case study, also allows a possible valuation of local products (Pecorino cheese) as, through a rotary pledge, they are the basis of the guarantees offered to the subscribers of the bond. Our work contributes to expansion of studies on the innovative financial tools for the promotion and development of the local agri-food heritage. This can be possible, on the one hand, through the growth of private local companies by the marketing of local products, and then, through the financial sustainability of the public authority that indirectly will see increased tax revenue deriving from the production of

local activities. The future research will be focused on the analysis of the specific economic results of the financial operation described here. Furthermore, will be focused on possible similar cases with the aim to development local product through innovative financial tools

The limit of our research are related to the short observation time since the finance instrument was issued, only in 2018. Furthermore, another limit for our research is the narrow territorial base of observation.

Keywords – Food, Innovative Finance, Sustainability, Value, Mini Bond

Paper type – Academic Research Paper

1 Introduction

During the crisis, in the bank-oriented countries such as Italy, a lot of SME has reached their economic activity for the lack of financial resources needed to the development the business. The paper discusses about the sustainability of SME business and the development of their local products that represented a real agri-food and agricultural heritage for the territory. To development this topic the main research question is:

RQ: how innovative financial tools can contribute to the development and sustainability of the territory and his local products?

Our research starts from the effects that the financial crisis has caused into SMEs dimension and focusing on observation of a single case study that, through active role of local authority “Regione Sardegna”, has enabled a lot of local entrepreneurs to conglomerates and take full advantages of the economic benefits arising from the use of “innovative” financial tool: mini-bond. It’s the case study of a shepherds cooperative company¹ established from 1966 in Oristano a little country of Sardinia island, in south-west from Italy. In July 2018, following a long period of financial crisis, the company issued “Pecorino Bond” by EUR 1.75 millions with the aim of development his product.

The paper concerns a lot of relevant factors: active role of local authority, the innovative financial tools chosen, methods of financial risk coverage and, last but not least, particular kind of guarantee reserved for private investors. All of this factor has the common aim of protection and development the local product “Pecorino Cheese”, know around the world as agri-food and cultural heritage.

In order to answer our RQ, we’ve used single case studies methodologies (Yin 2014) by applying the qualitative analysis model of C.A.O.S. (Paoloni, 2011). With this model is possible to describe all of qualitative variables on the “Pecorino Bond” case studies and also is possible show the relevant relationship (cardinal of first –second and third types) which enabled the success of financial operation.

This paper is structured as follow. In section 2, the relevant literature about evolution money market, the shift from a bank-oriented to a market-oriented enterprise’s system and the literature about the Italian SMEs is examined. Section 3 framework of case study

¹ The company name is Cooperativa Agricoltori Ovisini.

methodology and CAOS model used. Section 4 discusses and finding of “Pecorino Bond” case study is examined. Finally, in section 5 is described the outlines conclusion, limitations of our research and the future perspective of them.

2 Literature Review

The money market is regulated by financial intermediaries which means the issuance of a financial security. According to Pilbeam (2018) financial security is asset for one party and a liability for the other party. Spulber (1996) say that thinking about the role of intermediaries in an economy, it is analytically useful to recognize three types of agents: consumers, market-taking firms and market-making firms. The market-making firms, make a significant contribution in the global economy (Qi, 1998, and Diamond & Rajan 2001). Is possible to find two different types of financial securities in the market: debt assets and equity assets (Ennew et al. 2013). The distinction between debt and equity assets is of relevant importance because the holders of debt instruments commonly face relatively low risks compared to holders of equity.

Equity financing allows a company to acquire funds (often for investment) without incurring debt. On the other hand, issuing a bond does increase the debt burden of the bond issuer because contractual interest payments must be paid-unlike dividends, they cannot be reduced or suspended. The bond market is vital for economic activity because it is the market where interest rates are determined. Interest rates are important on a personal level, because they guide our decisions to save and to finance major purchases (such as houses, cars, and appliances, to give a few examples). From a macroeconomic standpoint, interest rates have an impact on consumer spending and on business investment.

Focusing on Italian scenario the Italian economic system the small and medium size enterprises (SMEs) and “micro-firm” represent 90% of the total Italian economic entities. According to some Italian scholars (Bertini, 1969, Aureli, Cesaroni, Demartini, 2004), definition of small, medium and large company results from the role the companies play in a society development process and not only from quantitative parameters as defined in the traditional business literature. So the national wealth of “made in Italy” is increased by this small entities and by their manufactured products. Over the last decades the issue about SMEs, and in particular, SMEs in going global, has gained the attention of scholars and business experts as a key factor to improve competitiveness and lead the “made in Italy” all over the word (Ricci et al., 2011). This is most important because to the company dimension, following a different availability of the intermediaries (in terms of volumes and interest rates) to grant financial resources on loan (Ferri et al., 2013). In literature is easy to find evidence how suggest that the companies most affected by the reduction in the supply of credit - especially after financial crises - are precisely those smaller in size and more dependent on the banking channel, featured of a greater information opacity and a smaller capitalization (Chodorow-Reich, 2014).

In Italy the global economic crisis of 2007-2008, triggered in the US had a global impact, and then the national sovereign debt crisis of 2011-2012, had the consequence of

stiffening the intermediaries in credit granting procedures (Bassanetti et al., 2009). Therefore in this economic context is important for the all enterprises but in particular for SME find new alternative channels of debt assets and equity assets (Caratelli & Fattobene, 2018). In recent years, among the channels of supply of alternative financial resources to the banking system, a "new" financial instrument, known as a mini-bond, has attracted particular interest. With this deadline, reference is made to debt securities (of any maturity) issued by companies with listed or unlisted shares, following a series of regulatory changes introduced in Italy like "Crescita"¹ and "Destinazione Italia"².

As reported in the Consob (2018) report, having placed mini-bonds on the Italian market 137 companies, of which 56% Pmi (compared with 58% in 2016); of the 137 units, the 10-50 million euro turnover class stood at 33% in 2017, while the companies that do not exceed 10 million turnover are 25%. Considering this results mini-bond instruments is a good debt asset for SME.

In this paper we would like to understand how this new financial instruments, particularly referring to debt asset called mini-bond can help the Italian agriculture sector and small agro-food companies.

One of fundamental part of the Italian economic system is the food industry and is an important sector in its manufacturing industry. The food industry has not been affected by the wider decline and loss of competitiveness in the Italian industry. Italian manufacturing industry is composed mostly of small and medium sized agricultural farms (Rossi et al., 2015).

Regarding the financial statements, the most important problem is the undercapitalization. It's typical of the entire Italian agro-food system. It is nonetheless especially alarming when these data are viewed in conjunction with the investments made by companies that are already heavily indebted. This is a weakness and a problem for small and medium agro-food companies and could undermine their competitiveness (Rossi et al., 2012)

At the same time agro-food system is significant in the economic system, just to understand the importance Rossi et al. (2014) show that Italy's products of designated origin continued to increase in number, to 210 registered PDO (protected designation of origin) and PGI (protected geographical indication) products (22.6% of the EU total). Most of Italy's PDO and PGI products are fruits, vegetables and cereals (nearly 40%), extra-virgin olive oil (19%), cheese (17.6%) and prepared meats (almost 16%). In this paper, we try to understand how is possible to transfer money between an institutional government company and a group of agriculture producer of a typical Italian cheese called "Pecorino" and at the same time maintain and increase the value of agro-food system products.

¹ D.L. 83/2012

² D.L. 145/2013

3 Methodology

In order to analyze our RQ we'll be used the method of Case Study within a descriptive single-case design. The case study methodology including both quantitative and qualitative data, helps explain both the process and outcome of a phenomenon through complete observation, reconstruction and analysis of the cases under investigation (Tellis, 1997).

Case study method allows to closely examine the data within a specific context. Case studies explore and investigate contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions, and their relationships (Yin, 2014).

We'll be used the CAOS model (Paoloni, 2011) with a few changes which make it possible to describe all topics that involve the company in a certain context. So far CAOS model is only used to relation capital valuation. The topics are personal characteristics of the entrepreneur (C), the environment in which the micro-enterprise operates (A), organizational and managerial aspects (O) and then the motivations for starting a new business or particular stage where the SME is observed (S).

Personal characteristics of the entrepreneur (C): defines distinctive factors of each entrepreneur affecting the role played by entrepreneur within its firm and capability to build networks and take advantages from them. Elements composing these dimensions are the following:

- anagraphic information of entrepreneur or company (name, surname, age, education, experiences);
- micro-enterprise information (denomination, legal form, dimension, location);
- motivation supporting the business;
- business vision;
- management form;
- entrepreneur role in the firm;
- decision making process activation.

The environment in which the micro-enterprise operates (A): explains the socio-economic-cultural context in which the enterprise is located. The environment can influence connections that a company creates interacting with subjects in this context. Thus, the environment also impacts on the relationships coming from the italian economic system.

Organizational and managerial aspects (O): are connected to entrepreneur's objectives, tasks and responsibilities within the organization; to understand how agrifood system is set into italian economic system and which are financial characteristics:

- roles assignment;
- responsibility identification;
- operative and management procedures definition to define how execute roles and business actions.

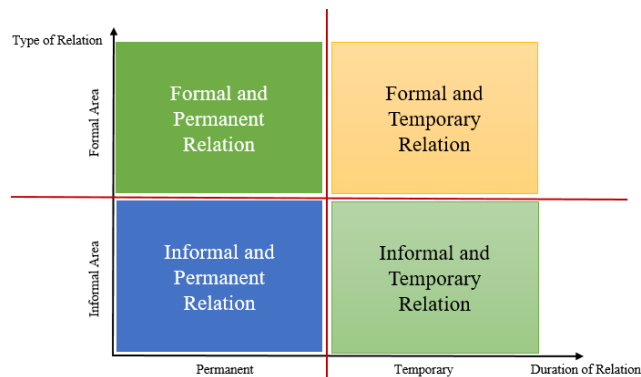
The motivations for starting a new business (S): It is the relevant phase in which the entrepreneur is focused on the following actions:

- study of the environment;
- write a business plan;
- find financial funds;
- choose legal form;
- build up the organizational structure;
- start the business

3.1 The model for analysing Case Study

The model we use to analyze the relations of SME in the single case study is found on the following Paoloni's matrix (Paoloni, 2011) based on four types of network relations. The matrix is composed by the intensity of the relation variable - permanent or temporary - and the type of relation variable - formal or informal.

The model identifies four network relations as shown in the figure 1.



Own Elaboration.

Figure 1 – Relations matrix

The relations are important to understand how the networks support the enterprise to development your business.

The process identified in the CAOS model (Paoloni, 2011) requires a careful analysis of the four elements. We will call the connections that link the point S with points C, O and A, cardinal links because they represent the cornerstone of all business relationships. Within these connections, there will be different kinds of relationships: formal, informal, temporary or permanent. The cardinal links are:

- first (S-C/C-S);
- second (S-O/O-S);
- and third (S-A/A-S).

4 The Case Study

The information data to describe the “Pecorino Bond” case study has provided to the authors from head legal of IFG Bank, banking institution responsible to operation

structure, and from manager of Pairstech Capital Management, PE fund responsible of placement of financial tools in the early stage.

4.1 Personal characteristics of the entrepreneur (C)

The company involved into “Pecorino Bond” is “Cooperativa Agricoltori Ovis” a cooperative company established from 1966 in Oristano a little country of Sardinia, island in south-west from Italy. Actually the company have 700 associates members, his mission is aggregate all the milk product by each individual shepherds and turn this into quality cheese. The leadership of the cooperative company is shared between shepherds. Each associates are expression of Sardinia’s history that contribute to the creation a cultural heritage. With same aim the company. has developed a property brand, since 2002 has ISO 9001 certification, and in 2008 has achieved IFS-FOOD quality standards. The performance data, pre cooperative-adjustment¹, and the balance sheet’s data for the period 2017 -2016 are:

Description	2017	2016
Revenues	30,42	27,18
EBITDA	5,45	1,67
EBIT	4,50	702,00
Firm Value	38,36	37,39
Working Capital	21,30	18,57
BV	10,13	5,82
Liabilities	28,23	31,57
BV+Liabilities	38,36	37,39

4.2 The environment in which the micro-enterprise operates (A)

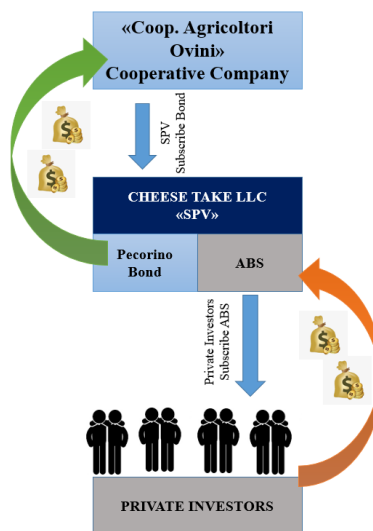
The environment where the company make her local product (Pecorino cheese) is Sardinia, a little island in south west of Italy. In this place, one of the most relevant economic activities is the dairy product that, over time, have become a really agri-food and cultural heritage know around the world as “Pecorino Cheese”.

The company establishments has equipped of high technologies for the milk transformation process. Their production capacity is over 180.000 milks liters by day and 22 million milks liters by year. The output is more diversify: from the only raw materials (milk) the company produce more than 25 kind of cheese.

4.3 Organizational and managerial aspects (O)

The figure 2 shows framework of financial operation:

¹ Cooperative-adjustment is a typical practice of agri-food labour cooperative company. This practice provides that at the time of the breeder’s milk contribution, he gets a down payment and, only when the production is finished the breeder can receive payment of the balance.



Own Elaboration

Figure2: Framework of Pecorino Bond

The company bond issuing has already just described into “C” section.

The SPV (Special Purpose Vehicle) is “CheeseTake LLC” company, established to SFIRS PLLCs, financial company owned to local authority “Regione Sardegna”. Cheese Take LLC has subscribed total of the “Pecorino Bond”. The financial resource needed for subscription, has been raised through the placement of ABS (Asset Backed Securities) instruments to private investors.

Through this “waterfall” framework the CheeseTake LLC, on the one hand, could subscribed the total of the bond for 1.75 million euro and then get from the company. repayment of principal with interest rate, on the other hand, could cover the bond risk-share instrument through the placement of ABS (Asset Backed Securities) instruments to private investors.

Moreover into Pecorino Bond operation has been planned a particular forms of guarantee about the financial tool.

A part of this are guaranteed by “Confidi Sardegna” PLLCs¹ and another part by a rotary pledge on Pecorino’s Cheese. Through this guarantee’s form, in the event of insolvency, the investors can be satisfied across the Pecorino. The percentage of cover is described in the next section “S” of CAOS model.

Finally, the entity that have implemented the legal framework is EFG Bank (Luxembourg), Italian head quarter.

¹ Confidi Sardegna PLLCs is the mutual guarantee funds established since 1974 by Confindustria Sardinia. Confidi Sardegna is also financial intermediaries supervised by Bank of Italy

4.4 The motivations for starting a new business (S)

In this section are described the relevant phase in which the “Cooperativa Agricoltori Ovini” company is focused on find financial funds. Our study starts with the observation of the crisis in the agri-food sector. In recent year, in Italy, the agriculture loans shall be regarded as equivalent of common firm lending with the major difference that the agriculture’s companies have a financial structure’s gap than a common merchant enterprise. Especially, the agriculture’s companies is failing to meet the request of real guarantee of Bank to credit access. In 2017 the agriculture and agroindustry loans amounted to EUR 332 million, of which EUR 160 million no performing loan (NPL).

For this reasons the local authority “Regione Sardegna” across her financial company SFIRS PLLCs, has actived a “protection” process of agrifood heritage through the minibond. In July 2018 SFIRS PLLCs, across her Special Purpose Vehicle (SPV) “CheeseTake LLC”, proceeded to subscribe total of minibond “Pecorino Bond” issuance by Cooperative Company. The loan period of Pecorino Bond is 24 month with redemption at maturity and yearly prefixed coupon payments to 3%.

At the same time CheeseTake LLC has issued ABS in the financial market, collateral to cover the bond risk-share instrument.

The local authority “Regione Sardegna” in order to raises for complete the financial operation has provided the ABS’s subscription a fund of eur 3 million. This financial resource can be used to a maximum of 20% per ABS.

Proportion of coverage of instrument are:

- 30% coverage by “Confidi”;
- 60% coverage by a rotary pledge on Pecorino’s Cheese;
- only 10% it’s without a coverage.

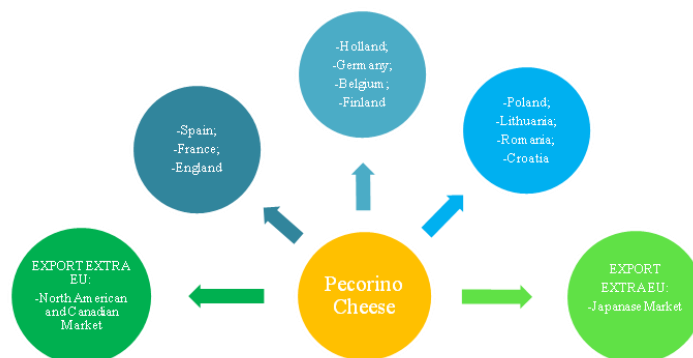
With this form of pledge, in the event of insolvency, the investors can be satisfied across the Pecorino. This coverage’s scheme causes that the Pecorino’s Cheese repossessed has an economic value at least 60% to face value of obligation outstanding. The pledge agreement provides for the appointment of Pecorino Cheese janitors. They’re chosen a member of “Cooperativa Agricoltori Ovini” and a member of Consortium of Pecorino Protection (Consorzio di tutela del pecorino).

The Consortium of Pecorino Protection (Consorzio di Tutela del Pecorino) and Agency Responsibility of Agriculture in Sardina (Italian acronym AGRIS) have been consulted by local authority “Regione Sardegna” in order to evaluation Pecorino Cheese for give an economic value in the pedge agreement.

The financial operation was concluded positively and it’s ongoing. Also ABS have been fully subscribed by private investors.

Financial operation “Pecorino Bond” is one of the first financial operation that a local authority - through a de-banked process – be try raises a private founds with the aim to safeguard development of local firms and their product, became a typical agrifood heritage.

Actually, the company has expanded her commercial network. The Pecorino is exported in many Europeans ed extra UE countries. The following figures (Figure3) show the destinations of Pecorino’s exportation:



Own Elaboration

Figure3: Destination of Pecorino Cheese Exportations

4.5 Analysis of Relationship

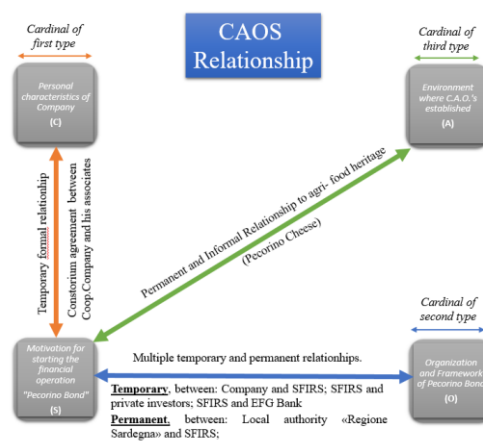
In order to the CAOS model the relationships that “The Pecorino Bond” has developments are:

- Cardinal links of first type (S-C): this phase is characterized by a formal and temporary relationship. The cooperative company has involved about 700 shepherds that, each for his contribution, are linked by a formal consortium agreement. All of shepherd will benefit from financial resource of Pecorino’s bond even if they must pay back the obligation at the end of 24 months;
- Cardinal links of second type (S-O): this phase is characterized by multiple formal relationship: few permanent and other temporary, but all linked to success of financial operation. The relationship formal temporary are:
 - Between Cooperative Company and SFIRS: across the SPV CheeseTake LLC the SFIRS has been underwrite all of Pecorino Bond. This relationship are limited for 24 months, as the maturity of the obligation.
 - Between SFIRS and private investors: those have subscribed ABS’s instrument issued by SPV CheeseTake LLC in order to guarantee her risk for the total underwrote of Pecorino Bond. Effectively this relationship could be permanent if the company will be insolvent in order to payback the debts. In this case, the relationship will last until the private investors will sell the Pecorino Cheese guaranteed seats by rotary pledge. But now we can’t refer on this.
 - Between SFIRS and EFG Bank: the credit institution has engaged to development legal framework of financial operation.

The formal permanent relationship are between local authority “Regione Sardegna”, company SFIRS and company Cheese Take LLC: for these there is a correlation equity’s share. The SPV CheeseTake LLC is owned by SFIRS and these is owned by local authority “Regione Sardegna”;

- Cardinal of Third Type (S-A): this phase is characterized by informal and permanent relationship. The link between the Pecorino Bond and the environment where the company is established it's just the agri-food heritage (Pecorino Cheese) which has always is part of Sardinia's territory. This proves it that that following financial crisis of shepherds the local authority "Regione Sardegna" is activated for build an operation that allow them financial resource for a fresh start: Pecorino Bond. Really the company and local authority "Regione Sardegna" are not related to any agreement but the intangible value that in the years the agri-food heritage (Pecorino Cheese) has built, it's been the value driver for preservation and development of local product and their production.

"Pecorino Bond" relations as shown in the figure 4.



Own Elaboration

Figure4: "Pecorino Bond" relations

5 Conclusions

Agro-food system is significant in the economic context, just to understand the importance Rossi et al. (2014) show that Italy's products of designated origin continued to increase in number, to 210 registered PDO (protected designation of origin) and PGI (protected geographical indication) products (22.6% of the EU total).

The small and medium size enterprises (SMEs) and "micro-firm" represent 90% of the total Italian economic entities. According to some Italian scholars (Bertini, 1969, Aureli, Cesaroni, Demartini, 2004), definition of small, medium and large company results from the role the companies play in a society development process and not only from quantitative parameters as defined. Our research investigates about how innovative financial tools can contribute to development and sustainability of the territories and his local product. In this way we examined, through a single case study (Yin 2014) and the CAOS model (Paoloni, 2011), a financial operation aimed to development a Sardinia's local products: "The Pecorino Bond". Through this case study it's possible to observe how this new financial instruments, particularly referring to debt asset called mini-bond

can help the Italian agriculture sector and small agro-food companies. Following the financial crisis period, the local authority “Regione Sardegna”, by her SPV “Cheese Take LLC”, has managed to cover financial resources for “Cooperativa Agricoltori Ovisini” cooperative company.

In July 2018 cooperative company has issued a minibond for 1.75 million, and only after the subscription, the “CheeseTake LLC” has issued ABS (Asset Backed Securities) instruments to private investors.

Through this “waterfall” framework the CheeseTake LLC, on the one hand, could subscribed the total of the bond for 1.75 million euro and then get from the company repayment of principal with interest rate, on the other hand, could cover the bond risk-share instrument through the placement of ABS (Asset Backed Securities) instruments to private investors.

Moreover into Pecorino Bond operation has been planned a particular forms of guarantee about the financial tool: a rotary pledge on Pecorino’s Cheese for 60% of minibond amount. This particular form of guarantee, in addition to ensuring the private investor, was designed with the aim to give an indirect economic value to Pecorino Cheese. In this way the Pecorino production, by the rotary pledge, has an economic value at least equal to 60% of the risk of insolvency of company.

The relationships between parties has illustrated in the CAOS model (Paoloni, 2011). It shows how the strongest relationship is that between the variables “S” and “A”: this phase is characterized by informal and permanent relationship. The link between the Pecorino Bond and the environment where company is established it’s just the agri-food heritage (Pecorino Cheese) which has always is part of Sardinia’s territory. This proves it that that following financial crisis of shepherds the local authority “Regione Sardegna” is activated for build an operation that allow them financial resource for a fresh start: Pecorino Bond. Really the Company and local authority “Regione Sardegna” are not related to any agreement but the intangible value that in the years the agri-food heritage (Pecorino Cheese) has built, it’s been the value driver for preservation and development of local product and their production. The other relationship, outlined in the body of the paper, between variable “S” and “C” and between “S” and “O” are characterized by formal and temporary relationship subsequent and consequent the informal and permanent relationship between the variables “S” and “A”: the territory (Company and local authority “Regione Sardegna”) and his local product (Pecorino Cheese).

The financial operation was concluded positively and to this day it’s ongoing. Also ABS have been fully subscribed by private investors.

In order to answer at our RQ, financial operation “Pecorino Bond” is one of the first financial operation that a local authority - through a de-banked process – be try raises a private funds with the aim to safeguard development of local firms and their product. Actually “Cooperativa Agricoltori Ovisini” has expanded her commercial network: Pecorino cheese is exported in many Europeans and extra EU countries.

The limitation of our research are related to the short observation time since the finance instrument was issued, only in 2018. Furthermore, another limit for our research is the narrow territorial base of observation.

The future research will be focused on the analysis of the specific economic results of the financial operation described here. Furthermore, will be focused on possible similar cases with the aim to development local product through innovative financial tools.

References

- Aureli S., Cesaroni F. M., Demartini P. (2004), "Processi di internazionalizzazione e comunicazione economico finanziaria delle piccole imprese", in *Piccola Impresa/Small Business*, n. 1
- Bassanetti A., Cecioni M., Nobili A., Zevi G. (2009), Le principali recessioni italiane: un confronto retrospettivo, *Banca d'Italia, Occasional papers*, n. 46.
- Bertini, U. (1969). Introduzione allo studio dei rischi nell'economia aziendale. Colombo Cursi.
- Caratelli M., Fattobene L., (2018), Strumenti alternativi di finanziamento per le Pmi: mini-bond, crowdfunding e business lending, *Bancaria* n. 11.
- Chodorow-Reich G. (2014), «The employment effects of credit market disruptions: Firm-level evidence from the 2008-9 financial crisis», in *The Quarterly Journal of Economics*, 129, 1, pp. 1-59.
- Consob (2018), Relazione per l'anno 2017, marzo.
- Diamond, D.W., & Rajan R.G. (2001). Liquidity risk, liquidity creation, and financial fragility: A theory of banking, *Journal of Political Economy* 109, 287-327.
- Ennew, C., Waite, N., & Waite, R. (2013). Financial services marketing: An international guide to principles and practice. Routledge.
- Ferri G., Bartoli F., Murro P., Rotondi Z. (2013), «Reti d'impresa, performance e assetti banca-impresa», in *Bancaria*, n. 1.
- Paoloni, P. (2011), La dimensione relazionale delle imprese femminili, Francoangeli, Milano.
- Pilbeam, K. (2018). Finance & financial markets. Macmillan International Higher Education.
- Qi, J. (1998). Deposit liquidity and bank monitoring, *Journal of Financial Intermediation* 7, 198-218.
- Ricci, P., Cillo, V., & Landi, T. (2011). The Italian SMEs in the global context: the accountability system role. *Esperienze d'Impresa*, (1).
- Rossi, M., Lombardi, R., Nappo, F., & Trequattrini, R. (2015). The capital structure choices of agro-food firms: evidence from Italian SMEs. *International Journal of Management Practice*, 8(3), 172-186.
- Rossi, M., Vrontis, D. and Thrassou, A. (2012) 'Wine business in a changing competitive environment – strategic and financial choices of Campania wine firms', *International Journal of Business and Globalisation*, Vol. 8, No. 1, pp.112–130.
- Rossi, M., Vrontis, D., & Thrassou, A. (2014). Agro business in a changing competitive environment–Campania firms' strategic, marketing and financial choices. *World Review of Entrepreneurship, Management and Sustainable Development* 5, 10(2-3), 312-333.
- Spulber, D. F. (1996). Market microstructure and intermediation. *Journal of Economic perspectives*, 10(3), 135-152.
- Tellis, W. M. (1997). Introduction to case study. *The qualitative report*, 3(2), 1-14.
- Yin, R. K., (2014), Case study research, Design and methods.

The Survey for Cultural and Economic Value Assessment of Food and Food-Ways in Bio-Districts: the Case of “*Bio-Distretto della Via Amerina e delle Forre*”

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Abstract

The knowledge and the cultural heritage concerning traditional recipes based on local and ancient crop varieties are very diffused in small rural areas and in local communities, in particular in Italy. This kind of knowledge, if well recognised and documented, can contribute to the sustainable development of territories in which it developed through oral transmission of local people. The traditional knowledge concerning food and foodways, that can be interpreted in terms of intangible heritage asset of the territory, in this paper is studied using the logic of Knowledge Transfer (KT). In fact, a crucial step for the preservation of the knowledge for future generations is the involvement of local communities, in order to elicit and to track the information of which they are custodians. The final goal is to engage them in the management of food knowledge for the sustainable economic, social and environmental development of their territory; in other words to preserve the social capital for future generation. The objective of the paper is to conduct a survey, in a very specific territory, that is the “Bio-Distretto della Via Amerina e delle Forre”, in Central Italy, in order to gather

information concerning the actual awareness of local people and organizations concerning their food heritage and the values (cultural and economic) they attribute to it. The information retrieved will then be used as a basis for the preparation of a theoretical framework of valuation and management of food heritage through citizen engagement in other areas/organizations. The survey will have the structure of a questionnaire, used to elicit awareness, feelings and wishes about the food heritage and their desired management for the development of the territory, in order to achieve information about cultural and economic values of this heritage. In particular, for the latter type of values, a Contingent Valuation Method (CVM) will be used. The expected result in terms of Knowledge Management and Transfer will be the development of a tool that can be interpreted as a Participatory Rural Assessment (PRA) method. Indeed, the mix of surveys and public engagement techniques aimed at understanding the values and knowledge that local populations in Bio-Districts wish to sustain allows an informed and communitarian preservation of food intangible heritage.

Keywords – Food, Traditional Knowledge, Contingent Valuation Method, Bio-District, Survey.

Type of paper: Academic Research Paper

1 Theoretical Background

Cultural heritage does not end at monuments and collections of objects. It also includes traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts. The importance of intangible cultural heritage is not the cultural manifestation itself, but rather the wealth of knowledge and skills that is transmitted through it from one generation to the next. The social and economic value of this transmission of knowledge is relevant for minority groups and for mainstream social groups within a State, and is as important for developing States as for developed ones.

Cultural heritage expressed as “food” is a complex moving target, manipulated by diverse people for diverse ends. It is both tangible and intangible, and falls under the UNESCO Convention on Intangible Cultural Heritage which states: “*The ‘intangible cultural heritage’ means the practices, representations, expressions, knowledge, skills—as well as the instruments, objects, artefacts and cultural spaces*” of social groups passed down through generations that contribute to identity, are grounded in place, and are ‘a mainspring of cultural diversity and a guarantee of sustainable development’” (Art. 2, point 2, p. 3). Cultural heritage in food includes both the material (landrace plants, tools, landscapes etc.) and the immaterial (traditional recipes, techniques, sensory awareness, philosophies of food and health etc.).

Food takes on great emotional weight when designated as “heritage” (Brulotte, Di Giovine, 2014). Prepared food is an expression of culture, while the folkloric study of foods is called *foodways* (including hunting, gathering, agriculture, aliment preparation

and consumption). Though cooking, sharing, and eating food with family and friends, or sometimes alone, are matters of physical survival as well as personal and community identity, foods are sometimes abstracted to carry other meanings. Food is more and more often seen as a particular experience that can give emotion and wonder when some dishes are tasted because they are considered real and true works of art, made by creative and sometimes inspired chefs. Gastronomic traditions and even the alimentary materials prepared and consumed are among the most pervasive and obvious constituents of cultural heritage. Perhaps more than any other element of human culture, cuisine and foodways provide indispensable insight into the history of humankind (Montanari, 2004).

Food becomes culture *when it is prepared* because, once the basic products of his diet have been acquired, man transforms them by means of fire and a carefully wrought technology that is expressed in the practices of the kitchen. Food is culture *when it is eaten* because man, while able to eat anything, or precisely for this reason, does not in fact eat everything but rather *chooses* his own food, according to criteria linked either to the economic and nutritional dimensions of the gesture or to the symbolic values with which food itself is invested. Through such pathways food takes shape as a decisive element of human identity (other than continuity, security, validation, economics and social control, comforting escape) and as one of the most effective means of expressing and communicating that identity (Montanari, 2004).

At the core of the study of food and foodways is the specific relationship between people and their food practices. Food carries many different meanings for people. Many foods represent religious and folkloric traditions, suggesting that they carry both overt and covert meaning for a group (Thursby, 2008). Recipes, which usually include instructions for ingredients, preparation, and the number of servings, range from those passed on by vernacular transmission, to thousands of written collections of ethnic and generic cookbooks. Beyond survival, the creative relationships established between people and food carry metaphoric and symbolic meanings.

The knowledge and the cultural heritage concerning traditional recipes based on local and ancient crop varieties are very diffused in small rural areas and in local communities, in particular in Italy. This kind of knowledge, that can be interpreted as Traditional Knowledge (TK), under the UN *Convention for Safeguarding of the Intangible Cultural Heritage* must be preserved for future generations (Labadi, 2013). Thus, it is important to identify and to develop some tools and techniques to obtain data for the valorisation and the promotion of food heritage in the light of TK (Inglis, 1993) and, in particular, Knowledge Transfer (KT). The interest of Scholars in Knowledge Transfer (KT) started at the beginning of the XXI century. In 2019, specific literature indexed by Scopus (www.scopus.com) on the topic accounts around 3,500 documents in the field of business, management and accounting studies with contributions by several countries. Thus, the knowledge creation and transfer intra and inter organizations is retrieved in numerous studies (Argote, Guo, 2016; Gil, Carrillo, 2016). The study of KT has been subject to some criticism by Scholars (Argote, Ingram, 2000) even if understanding the knowledge transfer is a relevant issue influencing organizational performance, business process and relationship with all stakeholders. KT is process of communications (Forsten-

Astikainen, 2010) and it is suitable for replication and adaptation (Williams, 2007) as well as for collective and individual transferring (Zhao and Anand, 2009). Additionally, knowledge transfer derives from the management of tacit and explicit knowledge (Nonaka, Takeuchi, 1995).

The study by Milagres and Burcharth (2019) analyse KT in inter-organizational partnership, proposing main factors influencing KT. They are following macro-environmental (e.g. industrial policy, macroeconomic policies, intellectual property regime), inter-organizational (e.g. cost-sharing and synergy-seeking motives), organizational (e.g. capabilities, intangible resources, behavioural aspects and internal processes) and individual levels (e.g. motivation, emotions, learning behaviour, resistance). Thus, Milagres and Burcharth (2019) argued “*factors impacting knowledge transfer gathers the most discussed topics in the literature, particularly those at the interorganizational and organizational (divided into the source and the recipient firm) levels of analysis*”.

The Knowledge Transfer Curve (KTC) by De Luca and Cano Rubio (2019) evaluate KT process following its speed instead of the content of the knowledge, identifying the relevance of KT for companies to compete in the market. However, knowledge is also shared through social practices (von Krogh, 2012) between two or more actors (Albino et al., 1998). Argote and Ingram (2000) stated that “*Knowledge transfer in organizations is the process through which one unit (e.g., group, department, or division) is affected by the experience of another.*”. Lastly, several authors investigated performance-based approach to measuring knowledge (Baum and Ingram, 1998; Darr, Argote, and Epple, 1995).

The knowledge concerning food and foodways, that is at the heart of the relationship between communities and their food habits, if well recognised and documented can contribute to the sustainable development of territories in which it developed through oral transmission of local people. In the process of Knowledge Transfer concerning foodways, a crucial step is the involvement of local communities, in order to elicit and to track the information of which they are custodians, their feelings as well as their attitudes and preferences towards the use of this intangible heritage. The final goal is to engage them in the management of food knowledge for the sustainable economic, social and environmental development of their territory; in other words to preserve the social capital for future generation. In the social sciences area, there is increasing interest in the concept of social capital; this concept could be defined as the norms and networks that enable people to act collectively. Some authors have investigated social capital could as a driver to economic development (Woolcock M. and Narayan D, 2000). Interdisciplinary work has suggested that social capital plays an important role in explaining the economic performance of contemporary societies (Whiteley P. F. 2000). There is a conventional macroeconomic approach of using indicators of social capital in formal growth models; as an example, some authors (Helliwell J. F., Putnam R. D, 1995) have also tried to build an indicator, the social capital index, and they have tested it in the Italian context. The index proposed is composed by 4 measures of civic community: a) newspaper readership, b) the availability of sports and cultural associations, c) turnout on referenda, d) incidence of

preference voting. Another approach in the empirical analysis is articulated in two stages carried out by means of a multivariate analysis and of a structural equations models analysis. However, there is a lack in this approach related to the effects of social capital on other aspects of development that can contribute in making growth more sustainable (Sabatini, 2000). In this study we want to try to fulfil this gap, investigating the relationship between communities and their food habits and the impact of the latter on the sustainable development of territories in which they developed.

2 Research Objective

The objective of the paper is to conduct a survey, in a very specific territory, that is the “*Bio-Distretto della Via Amerina e delle Forre*”, in Central Italy, in order to gather information concerning the actual awareness of local people and organizations concerning their food heritage and the values (cultural and economic) they attribute to it. The information retrieved will then be used as a basis for the preparation of a theoretical framework of valuation and management of food heritage through citizen engagement in other areas/organizations. The Bio-District seems particularly suitable for this kind of investigation, as it is a geographical area where farmers, citizens, tourist operators, associations and public authorities enter into an agreement for the sustainable management of local resources, based on organic production and consumption (short food chain, purchasing groups, organic canteens in public offices and schools) (Franco, Pancino, 2015). The local knowledge concerning food-ways and traditional techniques that smallholder farmers apply, indeed derive from the deep understanding of the context they interact with and are adapted to. As a matter of fact, all stakeholders of the Bio-District are a natural depositary of intangible heritage, potential sources of information and of subsequent management of their knowledge.

3 Methodology

To carry out this paper, a qualitative methodology (Eriksson, Kovalainen, 2015; Gummesson, 2000) will be applied. Particularly, an inductive approach, using the survey questionnaire method (Cooper et al., 2006; Hoque, 2018) will be used to collect data in order to derive a theoretical framework for assessing cultural and economic values of food heritage. The survey method allows for the collection of empirical information on the phenomenon analysed even if it originates some bias (de Villiers and Dumay, 2014).

The survey will be conducted in the Bio-District of “*Via Amerina e delle Forre*”, located in Lazio Region, in the Central Italy. Thus, we will use a structured questionnaire to elicit awareness, feelings and wishes about the food heritage and their desired management for the development of the territory. The objective is to gather information about cultural (historical, social and religious) and economic values of this heritage.

In particular, for the latter type of values, a Contingent Valuation Method (CVM) will be used (Ginsburgh, Thorsby, 2006). CVM is an approach designed to create the missing market for heritage considered as public goods by determining what people would be

willing to pay (WTP) for specified changes in the quantity or quality of such goods or what they would be willing to accept (WTA) in compensation for well-specified reductions/losses in the provision of these goods (Snowball, 2008). CVM circumvents the absence of markets for food heritage by presenting consumers with a choice situation in which they have the opportunity to buy or to sell the flow of services/benefits deriving from this kind of intangible heritage.

3.1 Sample selection and data collection

The sample derives from the Bio-District of “Via Amerina e delle Forre” (or Bio-District), located in Lazio Region, in the Central Italy. Thus, the sample of this research will be composed of companies and citizens belonging to the Bio-District. Additionally, email addresses will be collected in order to undertake the survey. Data will be collected using a survey questionnaire created through Google docs and directed to the Responsible of each selected company composing the BIO-District and to each citizen.

During July 2019, an email invitation to participate to the online questionnaire will be sent. In order to obtain a high rate of responses, a cover letter explaining the purpose of our paper will be sent.

The questionnaire will be divided into two main parts. The first part will contain questions concerning the cultural, historical and social perceptions of food and foodways. The second part will contain questions concerning the economic values, assessed through the CVM.

Additionally, the questionnaire will include both open-ended and closed-ended questions. The closed-ended questions will be structured in a five-point scale model ranging from “strongly disagree” to “strongly agree”.

The reliability of our questionnaire originates from pre-testing activities conducted by the authors. Additionally, the integrity of the proposed investigation is guaranteed by a joint work strategy among the authors. The results of the online questionnaire will be analysed and discussed among the authors to achieve implications on the topic analysed.

4 Expected Results and Conclusions

The expected result in terms of Knowledge Management and Transfer will be the development of a tool that can be interpreted as a Participatory Rural Assessment (PRA) method (Chambers, 1994). PRA not only aims at gathering knowledge about skills of local communities and their values, but it also aims directly at empowering citizens. Indeed, the mix of surveys and public engagement techniques aimed at understanding the values and knowledge that local populations in Bio-Districts wish to sustain allows an informed and communitarian preservation of food intangible heritage.

The main limitation of the paper is the restricted investigation area and the limited data collected. However, it can be a basis to develop a theoretical model for food-ways economic assessment.

References

- Albino, V., Garavelli, C. and Schiuma, G. (1998), "Document Knowledge transfer and inter-firm relationships in industrial districts: the role of the leader firm", *Technovation*, Vol. 19 No. 1, pp. 53-63.
- Argote L., Guo J.M. (2016), Routines and transactive memory systems: Creating, coordinating, retaining, and transferring knowledge in organizations, *Research in Organizational Behaviour*, Vol. 36, pp. 65-84.
- Argote L., Ingram P. (2000), Knowledge Transfer: A Basis for Competitive Advantage in Firms, *Organizational Behavior and Human Decision Processes*, Vol. 82, No. 1, pp. 150–169.
- Baum, J. A. C., & Ingram, P. (1998). Survival-enhancing learning in the Manhattan hotel industry, 1898–1980, *Management Science*, 44, 996–1016.
- Brulotte R., L., Di Giovine M. A., (2014), *Edible Identities: Food as Cultural Heritage*, Ashgate.
- Chambers R., (1994), The origins and practice of participatory rural appraisal, *World Development*, Volume 22, Issue 7, July 1994, pp. 953-969.
- Cooper, D.R., Schindler, P.S., and J. Sun (2006), *Business research methods*. New York: McGraw-Hill Irwin.
- Dallen J. T., (2016), *Heritage Cuisines*, Routledge.
- Darr, E., Argote, L., & Eppler, D. (1995). The acquisition, transfer and depreciation of knowledge in service organizations: Productivity in franchises. *Management Science*, 41, 1750–1762.
- De La Torre, M., (2002), *Assessing the Values of Cultural Heritage*, The Getty Conservation Institute.
- De Luca P., Cano Rubio M. (2019), The curve of knowledge transfer: a theoretical model, *Business Process Management Journal*, Vol. 25, No. 1.
- de Villiers, C., and J. Dumay (2014) "Writing an article for a refereed accounting journal". *Pacific Accounting Review*, Vol. 26, No. 3, pp. 324–350.
- Eriksson, P., & Kovalainen, A. (2015). *Qualitative methods in business research: A practical guide to social research*. Sage.
- Forsten-Astikainen, R. (2010), "External knowledge transfer mechanisms in service business acquisition", Doctoral dissertation, Lappeenranta University of Technology, Lappeenranta, Finland.
- Franco S., Pancino B., (2015), *Il Distretto Biologico*, Franco Angeli.
- Franco, S., Pancino, B., (2015), *Il Distretto Biologico*, Franco Angeli.
- Ginsburgh, V. A., Thorsby, D., (2006), *Handbook of the Economics of Art and Culture, Volume I*, Elsevier.
- Gummesson, E. (2000). *Qualitative methods in management research*. Sage.
- Helliwell J. F., Putnam R. D. "Economic Growth and Social Capital in Italy", *Eastern Economic Journal*, Vol. 21, No. 3, 1995, pp. 295-307
- Hoque, Z. (2018). *Methodological issues in accounting research*. UK: Spiramus Press Ltd.

- Inglis J. T., (1993), *Traditional Ecological Knowledge. Concept and Cases*, IDRC, Canada.
- Laaksonen, S., (2018), *Survey Methodology and Missing Data*, Springer.
- Labadi S., (2013), *UNESCO, Cultural Heritage and Outstanding Universal Value: Value Based Analyses of the World Heritage and Intangible Cultural Heritage Conventions*, AltaMira Press.
- Liyanage, C., Elhag T., Ballal, T., Li, Q., (2009) "Knowledge communication and translation – a knowledge transfer model", *Journal of Knowledge Management*, Vol. 13, No. 3, pp.118-131
- Lombardi, R. (2019), "Knowledge transfer and organizational performance and business process: past, present and future researches," *Business Process Management Journal*, vol. 25, No. 1
- Luca Simeone, Giustina Secundo, Giovanni Schiuma, (2017) "Knowledge translation mechanisms in open innovation: the role of design in R&D projects", *Journal of Knowledge Management*, Vol. 21 Issue: 6, pp.1406-1429.
- Milagres R., Burcharth A. (2019), *Knowledge Transfer in Interorganizational Partnerships: What Do We Know?*, *Business Process Management Journal*, Vol. 25, No. 1.
- Montanari M., (2004), *Food is Culture*, Columbia University Press.
- Nonaka, I. and Takeuchi, H. (1995), *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford University Press, New York, NY.
- Rosa Lombardi, (2019) "Knowledge transfer and organizational performance and business process: past, present and future researches", *Business Process Management Journal*, Vol. 25 Issue: 1, pp.2-9.
- Sabatini F., *Social Capital and the Quality of Economic Development*, *Kyklos*, Vol. 61 , n. 3, 2000, pp. 466-499.
- Snowball J., D., (2008), *Measuring the Value of Culture: Methods and Examples in Cultural Economics*, Springer.
- Snowball J., D., (2008), *Measuring the Value of Culture: Methods and Examples in Cultural Economics*, Springer.
- Thursby J. S., (2008), *Foodways and Folklore. A handbook*, Greenwood Press.
- Von Krogh, G. (2012), "How does social software change knowledge management? Toward a strategic research agenda", *The Journal of Strategic Information Systems*, Vol. 21 No. 2, pp. 154-164.
- Whiteley P. F. "Economic Growth and Social Capital", *Political Studies* Vol. 48, Issue 3, 2000, pp. 443–466
- Williams, C. (2007), "Transfer in context: replication and adaptation in knowledge transfer relationships". *Strategic Management Journal*, vol. 28, pp. 867-889.
- Woolcock M., Narayan D., "Social Capital: Implications for Development Theory, Research, and Policy", *The World Bank Research Observer*, Volume 15, Issue 2, 2000, Pages 225–249
- Zhao, Z. and Anand, J. (2009), "A multilevel perspective on knowledge transfer: Evidence from the Chinese automotive industry". *Strategic Management Journal*, vol. 30 no 9, pp.959-983.

The Italian “Network Contract”: Strategic Cooperation Tool for Competitiveness of SMEs in the Agribusiness sector

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Abstract

Over the last years, the worldwide agribusiness sector is facing challenges due to globalization, the increased customers' quality requirements in products and the development of new technologies. So, actors are looking for new business models able to guarantee competitive advantage in facing the global companies, to expand their operations, to improve the production processes as well as to develop new consumer market niches. A successful approach in order to support agri-businesses growth and competitiveness, helping them achieving higher performance is based on business network contracts. This organizational model enables networked agribusiness firms to operate on markets with the competitiveness of a medium-large firm without sacrificing their autonomy and flexibility. The paper investigates the phenomenon of Italian business networks contracts involving firms operating in the agricultural and agrifood sectors and which are localized in Southern Italy, as it results from the public database of RetImpresa, the dedicated Confindustria Agency for business networks in Italy.

By combining qualitative and quantitative analysis, the paper, on the one hand, analyzes how many business networks contracts have been formalized in Southern-Italy. On the other hand, the effects on firms' performance of business networks 'with legal subjectivity' (the so called 'reti soggetto', according to Law no.134/2012) are analyzed and compared to the 'contractual' business-networks ones.

The objective is to verify whether the network contract constitutes an effective organizational and production model that is functional to the needs of SMEs active in the various sectors of agribusiness industry or whether it is only considered a duplicate of other forms of collaboration.

Keywords – Business Network Contract, Small to Medium-Sized Networks, Agribusiness Sector, Agrifood Industry, Competitiveness

Paper type – Academic Research Paper

1 Introduction

The “business network contract” is a juridical-economic instrument designed and adopted in Italy in 2009 (the first out of all European Countries), to support and promote inter-firm cooperation processes and, so, to sustain the competitiveness of Italian firms (particularly of those smaller and less structured ones) on the domestic and international markets. It represents a model of strategic alliance between firms that, by signing the “network contract”, mutually agree to implement a common program: by co-operating in forms and fields fitting their own business activities; by sharing and exchanging information, know-how or industrial, commercial, technological services or facilities and/or mutually exercising one or more activities pertaining to the object of their respective businesses (Cafaggi, 2011). Over the time, the regulatory framework has been modified and amended (in 2010, 2012, 2014, 2016 up to the 2017 Italian Tax Revenue Agency's clarifications)¹ in order to enhance its attractiveness and encourage its dissemination.

Thereafter, the Decree Law No 179/2012 (on “Further urgent measures for Italy’s economic growth”), converted into Law No 221 of 17.12.2012, has allowed also the Italian agribusiness SMEs to conclude network contracts. The sector covers the whole food value-chain, from farm to fork: starting from the farmed produce all the way to the consumers’ plates, it includes ICT systems, equipment and machineries, transformation and packaging plants, logistics and food by-products and waste valorization. Most recently, the Decree-Law 24 June 2014, No.91 (article 1-bis, section 3), converted by Law 11 August 2014, No.116, introduced a dedicated discipline for network contracts stipulated, exclusively or mainly, between agricultural firms aimed at: expanding their individual and collective capacity to innovate; enhancing their competitiveness on the marketplace; promoting and supporting the processes of reorganization and modernization of the agricultural and agribusiness industry. The aim is to formalize

¹ The Italian “Business Network Contract” was established by the Law-Decree on 10 February 2009 No.5 (article 3, co. 4 ter), converted with some amendments in Law on 9 April 2009 No.33 (definition of the network contract). The Law was modified thereafter by: the Law-Decree No.78/2010 converted in Law No.122/2010 (allocation of tax benefits, administrative and financial services for companies belonging to the network); the Law No.221/2012 (creation of a mutual separate fund ascribable to the network and a common body within the network, which manages the execution of the contract in behalf of the partners); the Law No.134/2012 (conversion of Law-Decree No.83/2012; possibility for the network contract to acquire the legal subjectivity in presence of a common body and a patrimonial fund). The fiscal discipline of the Business Network contracts is regulated by the Tax Revenue Agency's Circular Letters No.20/E of 18th June 2013 (the juridical subjectivity of the business network determine a separate tax liability of the network) and No.75/E of 21th June 2017 (concerning the fiscal aspects related to the agricultural network contract in the light of the specific provisions governing the subject in the sector).

business aggregation through network contracts and/or consolidate the already existing partnerships to achieve a plurality of well-defined strategic goals on the basis of a joint network programme of activities¹, without the partner firms losing their juridical, economic and decision-making autonomy.

The entrepreneurs in the agricultural and agribusiness sector recognize to the networks a decisively important role in terms of solving critical problems, even serious, that characterize the sector (Censis-Confagricoltura 2012). In this respect, similarly to Europe, most firms operating in the sector belong to the SME category, very often they are family-owned (Istat, 6th General Agriculture Census, 2013), and they face with the difficulties of competing in an increasingly complex and supranational market. In a globalized market, the small size of firms reduces the competitiveness of Italian agribusiness industry (Eurostat, 2018a,b), especially in the functions in which the organizational dimension is decisive, such as innovation and internationalization (Ricciardi 2003, 2010). Other main obstacles that affect the development of SMEs are: limited managerial competences, generational turnover and lack of specialized professional skills; limited financial resources and unavailability of loans and credit from the banks (Bentivogli et al 2013), difficulties in exploiting technology. A further problem that the agricultural sector has to face is the balance between costs, which are always too high, and product prices, which are always too low to guarantee economic sustainability (ICE, 2018).

Cooperation and associationism are peculiar to the agricultural and agri-food sector, but still finds many obstacles to its full development. However, the environmental dynamics require: stable and constructive relationships (Powell et al. 1996; Dyer and Singh 1998; Ricciardi 2013), “equipped with effective knowledge sharing mechanisms; based on the participants’ sense making, extended in terms of ‘cross-sectorial’ and ‘cross-territorial’ dimensions (networks designed in order to exploit both global and local opportunities) and developed selecting carefully partners and their competences” (Massari et al. 2015:133).

Networks between firms are not therefore an option only to tackle the fragmentation of the agribusiness sector, but they seem to emerge as an alternative strategy to overcome the constraint of the small dimension of excellent agribusiness firms, often unable to compete in terms of innovation and internationalization (Ricciardi 2010; D’Arienzo, 2014 a,b).

Therefore, stable and well-governed networks could act as efficiency multipliers, generators of economies of scale and innovation (Ricciardi, 2003).

The reticular strategy (Williamson, 1996; Amstutz and Teubner, 2009; Cafaggi, 2008; Zazzaro, 2011; Anderson, 2013) could be a solution so as to successfully deal with the

¹ Among the most significant experiences emerge networks in which companies join together to conduct research in order to improve the quality of their products, find synergies and participate in shared financing projects. This is the case of the “CR 2050” network contract stipulated between sixteen Cremonese companies (of which 8 are agricultural and 8 industrial) to carry out research and experimentation programs in the field of crops capable of feeding biorefineries, which supply raw materials to companies that they operate in the chemical, biofuels, energy, cosmetics and pharmaceutical sectors. More specifically, the aim is to study methods of transforming agricultural production waste that enable the production of raw materials for chemical companies and biofuel producers.

critical shortcomings of agricultural and agri-food SMEs, particularly in the light of the strategic value of these industries for the Italian economy.

Together, the agricultural sector, the food and drink industry (processing and manufacturing), the distribution sector (wholesale and retail) are the driving forces of the food supply chain and the key pillars of Italian economy (Istat, 2018, 2019), accounting for approximately 13% of the national GDP (Ismea 2018) and for 11.2% of share of EU-28 total (Eurostat, 2018a) in 2017. Moreover, Italy reached its EU agri-food exports historic record (525 billion euros) and holds an 8% share (Ismea 2018), and recorded a particularly brilliant performance also in the export of machinery, both agricultural and processing, where it holds a world market share of 8.4% and 15.3% respectively (ICE 2018).

As a result, the Italian agri-food market plays a key role both nationally and internationally. Moreover, the Italian agribusiness, together with landscape, tradition, local culture and art, represents a great heritage of national identity. On the one hand, the great Italian territorial and climatic differences have been shaped in cultures, stories and traditions, exceptionally varied and unique. On the other hand, the great number of products bearing the prestigious PDO (Protected Designation of Origin), PGI (Protected Geographical Indication) and TSG (traditional Speciality Guaranteed) labels, which are exported all over the world, generate non-reproducible products and therefore a non-relocatable Made in Italy that no other country in the world has, thereby benefiting the territory's production system and economy. Some of the competitive advantages of the Italian food industry are:

- wide range of high quality products, high safety standards, and ability to combine tradition and constant process and product innovation. Producers, transformers, and all other players in the sector contribute to food safety, provide many high-quality products, and stand out in terms of technological innovation, sustainability, biodiversity and respect for tradition;
- close links with the territory and with the Italian cultural heritage. Farms and food industry firms improve the dynamism and social cohesion of the rural economy (contrasting phenomena such as the depopulation and desertification of rural areas), and their interest in the care of the environment fosters the production of local goods.

In this way, a virtuous circle is created: agriculture provides for the environmental protection (because the permanent link with the territory necessitates the preservation of ecosystems and biodiversity); the environment offers vast possibilities for tourism, since landscape, food and wine traditions, and local culture are a distinctive way of understanding the territory. This type of "circle" is one of the foundations of local development, because it respects and supports the territory.

That being so, the paper investigates, on the one hand, how many business networks contracts have been formalized by agribusiness firms operating in Southern Italy. On the other hand, the effects on firms' performance of "subjective business-networks" (with legal subjectivity) are analyzed and compared to the 'contractual' business-networks ones provided by Italian legislature. This choice is based on the consideration, supported by the

international literature (Williamson 1975; Storper and Harrison 1991; Oxley 1999; Fjeldstad et al. 2012; Ricciardi et al. 2014) that “subjective business networks” are more effectively governed and, therefore, work better by allowing partner firms to improve their economic performance and survive over time.

Therefore, the research aims to verify the following hypothesis: *the development of agribusiness network contracts in Southern Italy could give firms the possibility of increasing their critical mass without losing their autonomy, and so, increase the competitiveness of SMEs located in this area and, consequently, the competitiveness of Southern Italy, in line with the strategic objectives of the EU Regional Policy and Cohesion Policy.*

The remainder of the paper is structured as follows. After a brief review of the literature on business networks and the typicality of Italian regulation on the business-network contracts (section 2), the main features of business networks in the agricultural sector are described (section 3). Then, the methodology is described and findings are discussed (section 4). Finally, final remarks and suggestions for practical implications and future research are provided (section 5).

2 Business-network Contracts. Theoretical Foundations and Empirical

Aspects in Italy

Strategic business networks have been extensively studied in theoretical research and empirical work in the last thirty years, although with different approaches and under different perspectives. Many studies focused on the forms and characteristics of interorganizational relations (Todeva 2006), on inter-organizational trust (Zaheer et al 1998) which guarantees actions in the interest of collaboration and the motivations that lead companies to adopt cooperation strategies (Axelrod 1984; Child and Faulkner 1998) and their functioning, on competitive advantage and on the performance of companies (Alter and Hage 1993; Huxham and Vangen 2005); on the internal processes, the formal governance structure of the business networks (Brass et al 2004; Provan, Fish and Sydow 2007) and management practices network.

With most of Italy's economy made up of small-sized firms, specifically in the agribusiness sector (Wubben et al., 2013; Istat, 2018; Eurostat, 2018), networking strategies formalized in business contracts can help them to have easier access to global value chains and foreign markets (Accetturo et al. 2011; Giunta 2014; Agostino et al. 2015), and, by exploiting their complementarities (Castaldi et al. 2015), they may together reach the critical mass to do together what they cannot do alone (i.e. product and process innovations, development of network brands, implementation of shared certification procedures, or greater visibility on international markets), and then access benefits they wouldn't be able to obtain on their own.

This is a new production paradigm, with great potential for expansion and value creation. The network allows SMEs: a) to implement strategies and operate on markets with the competitiveness of a medium-sized firm without sacrificing their flexibility (Laperche and Liu 2013); b) to implement collective learning processes and reduce

uncertainty, benefiting from economies of scale (at the level of financial, human and technical resources, R&S, high quality) without the disadvantages of large size (Geretto and Zanin 2017); c) to achieve better economic performance (increased turnover and investments, reduction in costs and operational risk) and to improve creditworthiness compared to firms working stand alone, especially when the network organization is stable, planned and effectively governed (Tommaso 2009) and if the banks are able to evaluate the relational system (Ricciardi and Ingarozza 2018).

Then, SMEs grow; but in a virtual way, without exchanging holdings neither mergers and incorporation operations. This type of interaction among firms has gained attention at the European level, since several policies and actions in favor of micro and SMEs (see the Small business ACT for Europe, 2011) make reference to business networks, also by distinguishing them from the clusters. The essence of the network is that several SMEs carry out a common project exploiting their complementarity, without losing their classic attributes of flexibility and autonomy (Håkansson and Snehota, 1995).

In this respect, the firms belonging to networks have a wide negotiating autonomy in defining the subject of the network contract according to the strategic goals that participants want to achieve and fixing the kind of collaboration (i.e. horizontal or vertical networks) and the cooperation procedures. However, the Italian legislator has provided a *sui generis* model by regulating two different types of networks contracts: namely, “contractual-networks” and “subjective-networks”. Among these, partners can choose (and therefore adopt) the one best suited to the specific legal and economic circumstances. Networks operate on the market by making use of a “joint capital fund” (that is optional in the contractual networks) and by operating through a “joint body”, charged with managing, in the name and on behalf of the members, the execution of the contract, the single parties or the stages thereof. For the obligations entered into by the joint body in relation to the network program, third parties may exercise their rights exclusively over the joint fund.

The “contractual-business networks” (the pure business-network contract model) are networks based on contracts which, as such, do not acquire individual legal personality: the acts put in place by the network produce their effects directly in the juridical-subjective spheres of the participants in the network. The “subjective-contracts” are, instead, business-networks registered as such in the Italian Business Register held by the Chambers of Commerce, with a separate individual legal liability, networks representing separate new legal entities as regards the firms that are their members. As such, the subjective-network become an independent centre of rights and obligations towards third parties, and assumes a passive subjectivity for tax purposes (Revenue Agency Circular No. 20 / E of 18/06/2013), while the contracted network does not change the tax subjectivity of the contracting partners which therefore maintain total autonomy. The common body is no longer a proxy for the participants in the network but for the network itself.

Consequently, the business-network contracts and, particularly, the subjective networks emerge as a ‘typical contract’, and therefore distinct from other existing

contractual schemes, such as, for example, consortia and temporary associations of enterprises (ATI).

Moreover, it is a flexible tool, able to integrate and combine: business aggregation on shared programs; juridical autonomy of the firms, also for tax purposes; the benefits of the “market” with those of the “hierarchy” (Coase, 1937; Williamson, 1975; Sabel and Zeitlin, 2004). The small dimension, therefore, is no longer an intermediate stage compared to the large company but an independent phenomenon triggering alternative development paths to grow in size.

3. The Business-Network Contract in the Italian Agri-Business Sector

With the agricultural network contract agribusiness firms set up a stable organization aimed at exploiting their complementarities and, then, at improving production along the entire supply chain, through the implementation of quality standards, at reaching the necessary critical mass to achieve product and process innovations, at increasing their productivity significantly and developing high-range products in the typical Made in Italy productions (Compagnucci et al., 2016).

The conclusion of a business-network contract between agricultural firms, or between commercial and agricultural firms but having as their object “basic agricultural activities” (Tax Revenue Agency's Circular Letters No.75/E/2017)¹, can take the advantage of a special discipline (compared to the general one) aimed at fostering close collaboration between agricultural firms for joint exploitation of various potentials. Complying with requirements set out by Article 1-bis, Section 3 of Decree Law 91/2014 converted into law no. 116/2014, SMEs belonging to business networks which, individually or collectively, produce agricultural and agro-food products, are allowed to share land, equipment and machinery, tools, know-how (Ponte and Cheyns, 2013), but also to use joint hires of highly qualified human resources (with wages distributed among the partners who signed the contract) to achieve the purpose of the network contract, or to realize a common agricultural production that favors innovation and competitiveness in the agricultural market. Moreover, “the agricultural production resulting from the joint network's activities can be divided among the contracting parties in kind, by allocating to each of them, with originating status, the product's quota established by the network contract”. For example, if two farmers put an equal surface of land on the net and one of them grows wheat, while on the land of the other, maize is grown, at the end of cultivation each farmer owns half wheat and half corn as his own production. This means that the production obtained also in the land of other network operators, is as if it were obtained in its own land with all the positive effects foreseen by the fiscal legislation (Russo 2015).

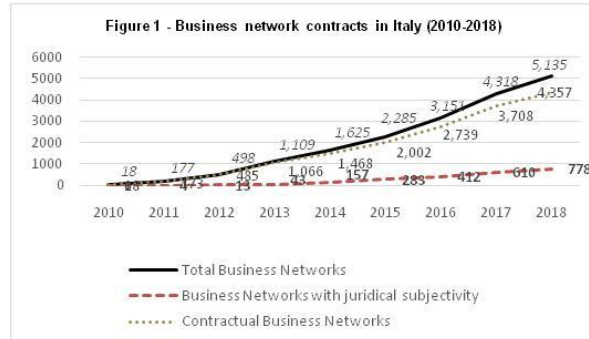
¹ For example, the agricultural network cannot be configured if there are producers of grapes and one only makes the transformation into wine. This means that everyone must produce grapes together, including the owner of the winery and possibly the production of wine for all the firms cooperating within the network could be compensated by the greater workings in the vineyards by the producers without the cellar.

Therefore, thanks to a stable cooperation, working together on agricultural and processed agricultural products and distribute them among the individual firms sharing the factors of production, the costs of both equipment and workers (that a company alone could not afford) become economically accessible and can be reduced.

The advantages of business network agreements should provide the right drive for aggregations in agriculture and agri-food sector, overcoming the boundaries between the various sectors, in order to create a more modern and innovative system. The network contract makes all of this possible, as the lawmaker provided a broad frame that the members can modify and customize in autonomy, with their own intentions and according to their cooperation needs (Massari et al., 2015).

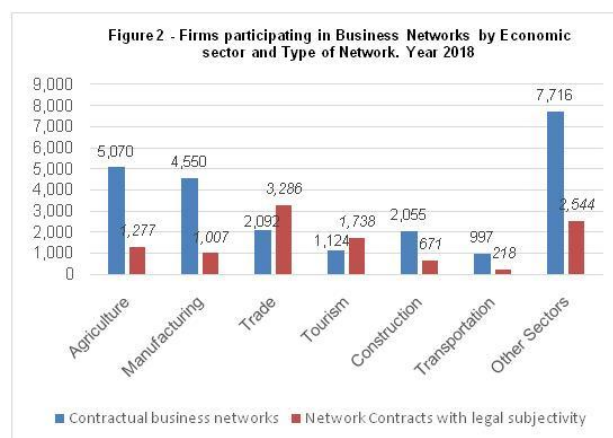
However, the Italian agricultural entrepreneurial tradition are firmly anchored in family logics. Small and medium agricultural entrepreneurs, given the family structure of their company, have little confidence in the possibility of establishing relations of reciprocal influence with other subjects (RetImpresa, 2013), and therefore, their strategic behavior tend to be tightly individualistic and autonomous (Ansoff 1987).

Numbers highlight the gradual affirmation of the business-network contract, as both a tool for programming and governing strategic collaboration between firms, and as important instrument of industrial policy successfully welcomed by Italian firms. At the end of 2018, the Italian system of business networks recorded 5,135 (Figure1): 85% are contractual-network (4,357), and 15% are subjective networks (778), for a total of 31,405 companies involved (+34.5% compared to 2017).



Source: Our processing of RetImpresa data (based on Infocamere data)

As for sectors (Figure2), based on the Ateco classification of economic activities, the sectors of origin of the networked firms are mainly related to agriculture (19%; 6,347 firms), manufacturing activities (16%; 5,557 firms), and trade (15.7%; 5,378 firms). In 2018, compared with the previous year, the agricultural firms involved in business-network contracts grew by 38% compared to + 34.5% of the overall national average.



Source: Our processing of RetImpresa data (based on Infocamere data)

As for agriculture, 79% of the networked firms in the sector favor the form of the network-contract. A similar trend also for firms that carry out activities related to manufacturing (80%).

The comparison of regional data (Figure3) also shows that agricultural firms belonging to networks have increased considerably in excess of the national average (+38%), especially in Umbria (+294%), Valle d'Aosta (+180%) and Campania (+113%) and more generally in the South and Islands (+63%). All this against a substantially stable picture of the number of farms registered in the Business Register (750,115 in 2018, equal to -0.24% compared to 2017).

	2017			2018			Var. % 2017-2018
	Contractual networks	Subjective networks	Total	Contractual networks	Subjective networks	Total	
Piemonte	192	19	211	247	21	268	+27,0%
Valle d'Aosta	5	0	5	14	0	14	+180,0%
Lombardia	177	108	285	202	105	307	+7,7%
Trentino Alto Adige	50	13	63	69	14	83	+31,7%
Veneto	281	9	290	373	18	391	+34,8%
Friuli Venezia Giulia	745	5	750	878	5	883	+17,7%
Liguria	58	18	76	82	29	111	+46,1%
Emilia Romagna	161	11	172	230	16	246	+43,0%
Nord	1.669	183	1.852	2.095	208	2.303	+24,4%
Toscana	498	77	575	565	67	632	+9,9%
Marche	137	4	141	144	6	150	+6,4%
Umbria	48	17	65	59	197	256	+293,8%
Lazio	471	88	559	548	252	800	+43,1%
Abruzzo	140	1	141	151	2	153	+8,5%
Centro	1.294	187	1.481	1.467	524	1.991	+34,4%
Molise	3	1	4	3	1	4	-
Campania	409	49	458	760	218	978	+113,5%
Puglia	169	61	230	190	155	345	+50,0%
Basilicata	50	6	56	73	6	79	+41,1%
Calabria	105	20	125	133	24	157	+25,6%
Sicilia	73	99	172	131	107	238	+38,4%
Sardegna	199	16	215	218	34	252	+17,2%
Sud e Isole	1.008	252	1.260	1.508	545	2.053	+62,9%
Total	3.971	622	4.593	5.070	1.277	6.347	+38,2%



Source: Centro Studi Confagricoltura based on Infocamere data

Fig.3 - Agricultural firms in Networks by type of Network (2017-2018)

According to the last (2019) Centro Studi Confagricoltura Report, at the end of 2018, the business-networks mainly constituted of agricultural firms (i.e. the lead firm is

agricultural) are in 674, equal to 13.1% of the business networks in which agricultural firms participate.

Therefore, agricultural network contracts should be favored because aggregation, even in a light form, has now become a necessity to be competitive on international markets and to overcome the limits stemming from the small size of firms. In this respect, agricultural business networks have already received subsidies, tax credits and contributions and could still have some, both for the Italian legislator's favor with respect to collaborative strategic networks (in terms of both creation of new business networks and development of new activities by formalizing existing relationships) and for the EU-level regulatory and policy recommendations on encouraging and supporting the business networks development and enhance inter-firm collaboration at European level (European Commission 2011; Ecorys, 2014).

Agri-food business networks need to be developed, prioritarly in the South. In this area, it seems vital to project SMEs beyond their internal dimension, and weave deeper collaborations, aimed at increasing the quality and competitiveness of both the individual and the network in his together, at strengthening of the supply capacity, at the development of paths of internationalization, innovation and enhancement of the territory. Different types of collaboration and network types can to be tailored to the results/benefits sought (objectives).

4 Research methodology

This study carries out an evaluation of the effectiveness of the network contract for the agri-food firms by comparing the performance of a sample of firms before and after the formalization of the network contract. The analysis is carried out both on the firms of the contract networks and on the firms of the networks with legal subjectivity in order to verify if:

- a) participation in contract networks makes it possible to improve the performance of agri-food firms;
- b) participation in networks with legal subjectivity makes it possible to improve the performance of agri-food firms;
- c) the firms involved in networks with legal subjectivity, better planned and governed, improve their performance more than the firms involved in the contract network.

These research hypotheses are tested through a ratio analysis (Thanassoulis et al., 1996; Caves et al., 1982; Psillaki et al., 2010; Amado et al., 2017) on the firms located in Southern Italy that formally established a network contract, both as “contractual business-networks” (or network-contract) and “business networks with legal subjectivity” (or network-subject) in the years from 2010 to 2016, as it results from the public database of the Italian register of business network contracts (managed by the industrial association *Confindustria-Retimpresa*), dated March 3 2019.

Taking into account the rich and diversified literature about the relationship between participation in a business network and performance of the enterprise (Gulati 1995), some of accounting measures of performance are selected to estimate the ‘network effect’ on

the performance of enterprises belonging to networks (Franco 2011; Kawai 2012). Accounting performance measures were chosen for two reasons: firstly because economic and financial objectives are fundamental requirements for firms' survival (Cantele and Vernizzi, 2015); secondly, because they are the most useful and accessible tools for measuring firm performance (Beamish and Lupton, 2009; Baker, 1992, 2000; Budde, 2007; Cantele and Vernizzi, 2015).

Within the vast number of economic and financial measures, the main selected measures of performance at the enterprise level are the following (Table 1):

- profitability and growth measures (Hill et al 1992; Goerzen and Beamish 2005; Goerzen 2007): Return on Assets (ROA), Return on Equity (ROE), Return on Sales (ROS), Sales, Ebitda;
- productivity variable (Koka and Prescott 2008; Gronum et al 2012): value added created/employees;
- capital structure and liquidity: Financial debt/Equity ratio (Cantele and Vernizzi, 2015), liquidity ratio, Coverage of fixed assets.

Finally, a measure of debt sustainability (Ebitda/Gross Interest) has been considered.

Table 1 - Indicators/Measures of performance at firm level

Firm performance	Indicators	
Profitability and Growth	ROA	Ebit/Total Assets
	ROS	Ebit/Sales
	ROE	Net income/Equity
	Sales	
	Ebitda	Earnings before Interest, Taxes, Depreciation and Amortization
Productivity	Added value per employee	Value added/Employees
Capital structure and Liquidity	Liquidity ratio	(Total current assets - Inventories) / Payables due within 12 months
	Coverage of fixed assets	(Shareholders' funds + Payables due beyond 12 months) / Total fixed assets
	Financial debt/Equity	
Debt sustainability	Ebitda/Gross Interest	

Source: Own Elaboration

Using these variables the networking effect on companies' performance has been assessed by testing the different performance evolution demonstrated by firms that have joined a business-network contract before (one year preceding the signing of the contract) and after participating in the network (one year and two years after signing).

For each network we selected the year of drafting the network contract because we were interested in analyzing the evolution of performance indicators from the time (the year of the contract) in which the enterprises began to participate to business networks. A 2-years span after the network-contract drafting was considered a reasonable time to evaluate the effects of network participation on enterprises' performance. However, many companies included in the sample signed contracts in 2016 and, considering the availability of financial data (2009-2017, no financial data is available after 2017), for these companies it was possible to analyze only the performances achieved in the year 2017 and, therefore, only for one year following the signing of the contract. At the end, it was analyzed the evolution of performance indicators with two different lags: one year

(n+1) and two years (n+2) after the network-contract drafting compared with the one year before (n-1).

4.1 Sample

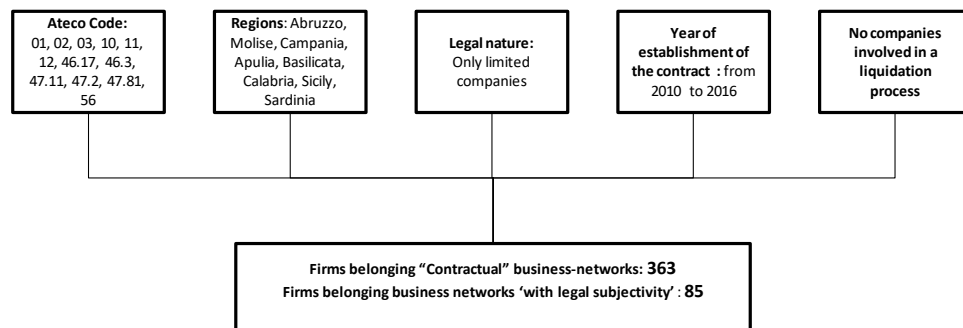
In order to test the research hypotheses formulated, starting from the total of 31,968 firms belonging to 4,503 networks-contract and 784 networks-subject, 363 firms involved in networks-contract and 85 firms involved in networks-subject of Southern Italy were selected.

The companies were selected by Ateco codes, Regions, legal nature (only limited companies) and year of establishment of the contract.

Economic-financial information has been obtained from the AIDA dataset in order to create a structured database comprising balance sheet figures of the above mentioned limited companies.

All the enterprises under a liquidation process at the time of data extraction (2019, from AIDA database) were not taken into account for a total of 12 firms (11 of the companies participating in the subject networks and 1 among the taken participants in contract networks). Finally, the quantitative analysis has been carried out on a sample of 448 enterprises, which includes 363 enterprises belonging to contractual networks and 85 enterprises belonging to networks with legal subjectivity.

The procedure used for the selection is shown in Figure4.



Source: Own Elaboration

Figure 4 – Sample selection

4.2 Results

In order to examine whether a significant difference exists between the performance in the period before network contract and the performance after network contract the Wilcoxon signed rank tests, as proposed by Wilcoxon (1945), was used.

The reasoning behind the Wilcoxon Signed Rank test is relatively simple. In our study, the null hypothesis is that the median difference between the performance observed before and after network contract is equal to zero. If the null hypothesis is true, we expect the distribution of differences in performance to be approximately symmetrical around the null value; that is, whilst some firms may have improved their performance, others would

have deteriorated. Furthermore, we would not expect the firms that have improved (or deteriorated) their performance to appear systematically at higher (or lower) ranks. In this respect, the sum of the ranks should be approximately equal, without extreme values in one of the sums. If an extreme value is observed in one of the sums, it means that there is a high probability that the null hypothesis of no performance differences is rejected (Amado et al., 2017).

Tables 2 and 3 and Tables 4 and 5 highlight the results of the performance analysis for business networks ‘with legal subjectivity’ and for “Contractual” business-networks respectively. The first column includes the profitability, productivity, financial situation and debt sustainability variables. The second column includes the p-value of the used test (Wilcoxon Signed-Rank Test). The third column includes the number of firms in the two paired samples (network firms before and after signing the contract) whose variables were available for the test. The fourth and the fifth columns show the median values at the year n-1 and n+1 (or n+2). The sixth and seventh columns comprise the average values at the year n-1 and n+1 (or n+2). Finally, the last three columns show the number of enterprises for which there are better performances, worse or no difference compared to the year n-1.

The analysis of Tables 2 and 3 indicates that belonging to the network allows companies to obtain significantly better performance two years after the signing of the contract, while there are no significant differentials in performance after only one year. In particular, significant improvements concern:

- profitability and growth;
- productivity;
- debt sustainability.

With reference to profitability and growth:

- ROS on a median basis moves up to 2.79 (year n + 2) from 2.14 (year n-1) and the improvement concerns 18 companies out of 26;
- sales increases in 24 cases out of 31 (from 859 thousand euros to 1,514 thousand euros);
- the median value of Ebitda doubles from 53,000 to 106,000 and the improvement concerned 21 companies out of 31.

With reference to productivity, the added value per employee grows for 20 enterprises out of 28.

Finally, debt sustainability improves, since Ebitda/Gross interest ratio increases for 20 companies out of 30.

No material changes occur with reference to ROA, ROE, Liquidity ratio, Coverage of fixed assets, Financial debt/Equity.

Tables 4 and 5 show the results for the firms involved in “Contractual” business-networks. It is highlighted:

- an increase in sales both for the year n+1 (for 69% of the firms) and for the year n+2 (for 71% of the firms);
- an increase in Ebitda both for the year n+1 (for 56% of the firms) and for the year n+2 (for 58% of the firms);

- the fixed assets coverage index improve for 154/298 firms in the year n+1 and for 119/229 firms in the year n+2;
- the Ebitda / Gross Interest ratio indicates a greater sustainability of the debt after the signing of the contract both with reference to one year after and two years later: the enterprises for which debt sustainability improves are 55% (158/285) a year later and 60% (134/224) two years later.

As in the case of firms involved in business networks ‘with legal subjectivity’, no significant results are found with reference to the ROA, ROS, Liquidity ratio, Coverage of fixed assets, Financial debt/Equity. By the contrary, value added per employee increases for the firm belonging business networks ‘with legal subjectivity’, whilst no material change occurs in the case of firms involved in “Contractual” business-networks.

Table 2. Business networks ‘with legal subjectivity’: One-year lag test

Variables	p-value	N. firms	Median n-1	Median n+1	Average n-1	Average n+1	Performance n+1 versus performance n-1 – No. firms		
							Better	Worse	Unchanged
Profitability and growth									
ROA	0.221	64	1.67	1.80	-0.88	-0.17	28	36	-
ROS	0.874	55	2.14	2.61	2.79	4.29	29	26	-
ROE	0.315	60	3.21	4.70	7.80	9.41	27	32	1
Sales (thousand euros)	0.000** *	64	859	716	3,944	4,648	47	17	-
Ebitda (thousand euros)	0.159	64	53	61	273	308	35	27	2
Productivity									
Added value per employee (euros)	0.337	55	35,275	33,640	47,129	46,520	31	24	-
Capital structure and Liquidity									
Liquidity ratio	0.385	62	1.01	0.92	1.14	1.00	30	29	3
Coverage of fixed assets	0.132	62	1.12	1.13	1.67	2.47	36	23	3
Financial debt/Equity	0.946	42	0.67	0.66	2.10	5.08	19	18	5
Debt sustainability									
Ebitda/Gross Interest	0.321	55	7.07	11.29	289	432	33	22	-

Note: The grand total for each ratio can differ due to missing values.

*** p<0.01, ** p<0.05, * p<0.1

Table 3. Business networks ‘with legal subjectivity’: Two-year lag test

Variables	p-value	N. firms	Media n n-1	Media n n+2	Average n-1	Average n+2	Performance n+2 versus performance n-1 – No. firms		
							Better	Worse	Unchanged
Profitability and Growth									
ROA	0.299	31	1.67	3.45	-0.88	6.37	15	16	-
ROS	0.045**	26	2.14	3.19	2.79	4.67	18	8	-
ROE	0.837	30	3.21	7.80	7.80	10.86	14	15	1
Sales (thousand euros)	0.002**	31	859	1,514	3,944	7,341	24	7	-
Ebitda (thousand euros)	0.079*	31	53	106	273	452	21	10	-
Productivity									
Added value per employee (euros)	0.076*	28	35,275	49,850	47,129	59,761	20	8	-
Capital structure and Liquidity									
Liquidity ratio	0.440	31	1.01	1.02	1.14	1.38	18	12	1
Coverage of fixed assets	0.136	30	1.12	1.25	1.67	3.80	19	10	1
Financial debt/Equity	0.619	20	0.67	0.99	2.10	24.95	8	9	3
Debt sustainability									
Ebitda/Gross Interest	0.045**	30	7.07	10.97	289	3,970	20	10	-

Note: The grand total for each ratio can differ due to missing values.

*** p<0.01, ** p<0.05, * p<0.1

Table 4. “Contractual” business-networks: One-year lag test

Variables	p-value	N. firms	Media n n-1	Media n n+1	Average n-1	Average n+1	Performance n+1 versus performance n-1 – No. firms		
							Better	Worse	Unchanged
Profitability and Growth									
ROA	0.525	303	2.35	2.75	1.91	2.56	157	146	-
ROS	0.874	273	2.89	3.16	2.52	2.66	140	133	-
ROE	0.442	280	2.36	3.55	5.38	6.06	146	125	9
Sales (thousand euros)	0.000**	303	1,323	1,522	6,926	7,618	210	92	1
Ebitda (thousand euros)	0.002**	303	92	102	515	569	169	129	5
Productivity									
Added value per employee (euros)	0.709	261	36,030	37,000	54,556	52,656	130	131	-
Capital structure and Liquidity									

Liquidity ratio	0.183	297	0.87	0.90	1.02	1.08	160	133	4
Coverage of fixed assets	0.098*	298	1.05	1.13	2.15	2.67	154	140	4
Financial debt/Equity	0.750	230	0.67	0.69	1.77	2.47	109	96	25
Debt sustainability									
Ebitda/Gross Interest	0.085*	285	5.11	6.32	1,152	770	158	126	1

Note: The grand total for each ratio can differ due to missing values.

*** p<0.01, ** p<0.05, * p<0.1

Table 5. “Contractual” business-networks: Two-year lag test

Variables	p-value	N. firms	Media n n-1	Media n n+2	Average n-1	Average n+2	Performance n+2 versus performance n-1 – No. firms		
							Better	Worse	Unchanged
Profitability and Growth									
ROA	0.255	233	2.35	2.60	1.91	3.68	120	112	1
ROS	0.344	212	2.89	3.31	2.52	3.20	113	99	-
ROE	0.034*	216	2.36	4.17	5.38	7.98	119	90	7
Sales (thousand euros)	0.000**	233	1,323	1,800	6,926	7,942	166	66	1
Ebitda (thousand euros)	0.000**	233	92	131	515	623	135	96	2
Productivity									
Added value per employee (euros)	0.165	203	36,030	41,530	54,556	56,878	110	93	-
Capital structure and Liquidity									
Liquidity ratio	0.435	229	0.87	0.92	1.02	1.09	122	102	5
Coverage of fixed assets	0.098*	229	1.05	1.14	2.15	3.67	119	108	2
Financial debt/Equity	0.725	176	0.67	0.84	1.77	2.23	83	81	12
Debt sustainability									
Ebitda/Gross Interest	0.011*	224	5.11	7.01	1,152	326	134	90	-

Note: The grand total for each ratio can differ due to missing values.

*** p<0.01, ** p<0.05, * p<0.1

The analysis shows that the results found for the firms participating in “contractual” business-networks are in line with those of enterprises that participate in business networks ‘with legal subjectivity’. Moreover, in the case of the latter, the results are achieved after two years while there are no significant changes after only one year.

5. Conclusions

The Italian business network contract represents an innovative tool for competitive growth of SMEs, extremely flexible, able to adapt to the needs of companies of all sizes and sectors, integrating two concepts equally important, but among them apparently far: the collaboration of entrepreneurial shared programs and the guarantee of entrepreneurial autonomy.

This study has assessed the impact of participation in networks on firms' performances through the analysis of productivity and growth, profitability, capital structure, liquidity and debt sustainability.

Agri-food enterprises that participate in networks (both business networks 'with legal subjectivity' and "contractual" business-networks) have increased Sales and Ebitda, improved the capital structure (the balance between investments and sources of financing improves) and the debt sustainability (measured by the Ebitda/Gross interest ratio). This last indicator is however affected by endogenous factors of the companies, i.e. by monetary policies and fluctuations in interest rates.

This research is a preliminary study; thus, it has several limits that do not allow to generalize the obtained results. These latter, however, confirm, albeit in part, the research hypotheses, namely an improvement in performance linked to the participation in the networks even if not for all the selected indicators. Further empirical checks on a wider sample and observation period can improve the reliability of analysis.

Despite the aforesaid limits, this paper contributes to the literature by testing the impact of participation in business networks on agri-food firms' performance. The empirical tests indicate that the network contract can become one of the main instruments of industrial policy on priority areas of interest for the Italian economy, including the internationalization, the relaunch of the areas affected by crisis areas and the development of lagging areas of the country.

References

- Accetturo, A., Giunta, A., and Rossi, S. (2011) *Le imprese italiane tra crisi e nuova globalizzazione*. Bank of Italy-Questioni di Economia e Finanza (Occasional papers), No.86, January.
- Agostino, M., Giunta, A., Nugent, J.B, Scalera D., and Trivieri F. (2015) "The importance of being a capable supplier: Italian industrial firms in global value chains", *The International Small Business Journal*, Vol.33, No.7, pp.708-730.
- Alter, C., and Hage, J. (1993). *Organizations working together*, Sage Publications, London.
- Amado, C.A.F., Santos, S.P., and Serra, J.M.M., (2017) "Does partial privatisation improve performance? Evidence from a chain of hotels in Portugal", *Journal of Business Research* 73 (2017), pp. 9–19.
- Amstutz, M., Teubner, G., (2009), *Networks. Legal Issues of Multilateral Co-Operation*, Oxford-Hart Publishing
- Anderson, C., (2013) *Makers: The New Industrial Revolution*, Crown Business, New York
- Ansoff, H. I. 1987 'The Emerging Paradigm of Strategic Behaviour', *Strategic Management Journal*, Vol.8, No.6, pp.501–515.

- Axelrod, R., (1984) *The evolution of cooperation*, Harper Collins, New York, NY
- Baker, G., (1992) "Incentive contracts and performance measurement", *Journal of Political Economy*, Vol. 100, pp.598-614.
- Baker, G., (2000) 'The use of performance measures in incentive contracting', *American Economic Review*, Vol. 100, pp.415-420.
- Beamish, P. W. and Lupton, N C, (2009) "Managing joint ventures", *The Academy of Management Perspectives*, Vol. 23, No. 2, pp.75-94.
- Bentivogli, C., Quintiliani, F., Sabbatini, D., (2013) *Le reti di imprese. Questioni di Economia e Finanza - Occasional papers*, vol. 152. Banca d'Italia
- Brass, D. J., Galaskiewicz, J., Greve, H.R., and Tsai, W., (2004) "Taking stock of networks and organizations: A multilevel perspective", *Academy of Management Journal*, Vol.47, pp.795-817.
- Cafaggi, F. (2008), "Contractual Networks and the Small Business Act: Towards European Principles?", *European Review of Contract Law*, Vol.4, No.15, pp.493-539
- Cafaggi, F. (2011) *Contractual Networks, Inter-Firm Cooperation and Economic Growth*, Edward Elgar, London.
- Cantele, S., and Vernizzi, S., (2015) "The effect of network participation on firm performance: a matched-pairs analysis", 8th Annual Conference of the EuroMed Academy of Business "Innovation, Entrepreneurship and Sustainable Value Chain in a Dynamic Environment", Verona, September 16-18, 2015, Conference Readings Book Proceedings, pp.375-387
- Castaldi, L., Turi, C., Mazzoni, C., and Delli Paoli, A., (2015) "Antecedents and constituents of alliance management capability: the role of valuable alliance experience and governance mechanisms for learning", *Journal of Management and Governance*, Vol.19, No.4, pp.797-823.
- Caves, D. W., Christensen, L. R., and Diewert, D. E., (1982) "The economic theory of index numbers and the measurement of input, output, and productivity", *Econometrica*, 50, pp.1393-1414.
- Child, J, and Faulkner, D., (1998) *Strategies of Co-operation: Managing Alliances, Networks and Joint Ventures*, Oxford University Press, Oxford
- Censis - Confagricoltura (2012). *Dalle reti naturali alle reti strutturate. Innovazione e aggregazione per l'agricoltura di domani*. Available at: www.censis.it.
- Coase, R (1937), "The Nature of the Firm", *Economica*, Vol. 4, No.16. (Nov., 1937): 386-405.
- Compagnucci, L., Cavicchi, A., and Spigarelli, F., (2016) *L'efficacia del contratto di rete nel settore agroalimentare Italiano: una rassegna normativa e della letteratura*, *Economia Marche Journal of Applied Economics*, Vol.XXXV, No.2, pp.1-20.
- D'Arienzo, M.C. (2014a) *Le reti di impresa per la crescita e la competitività*. Confagricoltura, Roma.
- D'Arienzo, M. C. (2014b) *Lente di ingrandimento sulle reti d'impresa*. *Mondo Agricolo*, 5, pp.34-36.
- Dyer, J. H., and Singh. H., (1998) 'The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage.' *Academy of Management Review* , Vol.23, No.4, pp.660-79.
- Ecorys (2014), *Business Networks Final report*, Rotterdam, 27th of February 2014
- European Commission(2011), *State Aid n. 343/2010 - Support to set up companies networks (reti di impresa)*.
- Eurostat (2018a), *Agriculture, Forestry and Fishery Statistics 2018 Edition*, Luxembourg: Publications Office of the European Union, November.
- Eurostat (2018b), "Agricultural land prices and rents", *News Release n. 48/2018*, 21 March.

- Fjeldstad, O.D., Snow, C.C., Raymond, E.M., and Lettl, C., (2012), The architecture of collaboration. *Strategic Management Journal*, Vol.33, No.6, pp.734–750.
- Franco, M (2011) ‘Determining factors in the success of strategic alliances: an empirical study performed in Portuguese firms’, *European Journal of International Management*, Vol. 5, No. 6, pp. 608–632.
- Goerzen, A. and Beamish, P.W. (2005). The effect of alliance network diversity on multinational enterprise performance, *Strategic Management Journal*, Vol.26, pp.333–354
- Goerzen, A. (2007) ‘Alliance networks and firm performance: the impact of repeated partnerships’, *Strategic Management Journal*, Vol. 2, pp. 487 – 509.
- Gronum S., Verreyne, M. L. and Kastle, T. (2012). The role of networks in small and medium-sized enterprise innovation and firm performance, *Journal of Small Business Management*, Vol.50, No.2, pp.257-282.
- Gulati, R. (1995). Social structure and alliance formation patterns: A longitudinal analysis, *Administrative Science Quarterly*, Vol. 40, 619–652.
- Håkansson, H. - Snehota, I., (1995) *Developing relationships in business networks*, MA, Thompson Press, Boston.
- Hill, C.W.L., Hitt, M.A. and Hoskisson, R.E. (1992). Cooperative versus competitive structures in related and unrelated diversified firms, *Organization Science*, Vol.3, pp.501-521.
- Huxham, C., and Vangen, S., (2005) *Managing to Collaborate: the theory and practice of collaborative advantage*, Routledge.
- Ismea (2018), *Rapporto sulla competitività dell’agroalimentare italiano*, Roma
- Istat (2013), “Atti del 6° Censimento Generale dell’Agricoltura”, Roma
- Istat (2017). *Annuario Statistico Italiano 2017*, Roma.
- Istat (2018), *L’andamento dell’economia agricola anno 2017*, Statistiche Report, 17 maggio.
- Istat (2019), *The Economic Performance of Agriculture in Italy Report. Year 2018* (17 gennaio 2019).
- Geretto, E., and Zanin, F., (2017) *Aggregazione e reti di imprese. Teoria, metodi e strumenti per la strategia, la valutazione della performance e il rating assignment*. Giappichelli, Torino.
- ICE (2018), *L’agroalimentare in Italia. Produzione ed export*, Roma.
- Kawai, N (2012) ‘The influence of external network ties on organisational performance: evidence from Japanese manufacturing subsidiaries in Europe’, *European Journal of International Management*, Vol.6, n.2, 221 – 242.
- Koka B R and Prescott J E (2008) ‘Designing alliance networks: the influence of network position, environmental change, and strategy on firm performance’, *Strategic Management Journal*, Vol.29, pp.639-661.
- Laperche, B, and Liu, Z., (2013) “SMEs and knowledge-capital formation in innovation networks: a review of literature”, *Journal of Innovation and Entrepreneurship*, Vol.2, No.21.
- Massari, F.S., Riggio, M.T., Calace, D. (2015), *Legal and Managerial Implications of the Italian 'Contratto Di Rete'*, *Management*, Vol. 10, Issue 2, pp.131-148.
- Oxley, J.E., (1999) Institutional environment and the mechanisms of governance: the impact of intellectual property protection on the structure of inter-firm alliances, *Journal of Economic Behavior and Organization*, Vol.38, No.3, pp.283-309.
- Ponte, S., Cheyns, E. (2013), “Voluntary standards, expert knowledge and governance of sustainability networks’ *Global Networks*, pp. 459–477.
- Powell, W.W., Koput, K. W. and Doerr-Smith L., (1996) ‘Interorganizational Collaboration and the Locus of Collaboration’ *Administrative Science Quarterly* 41, pp.116–45.
- Provan, K.G., Fish, A., and Sydow, J., (2007) “Interorganizational networks at the network level: A review of the empirical literature on whole networks”, *Journal of Management*, Vol.33, No.3, pp.479-516.

- Psillaki, M., Tsolas, I., and Margaritis, D., (2010) "Evaluation of credit risk based on firm performance", *European Journal of Operational Research*, 201, pp.873–881.
- RetImpresa (2013). Il management delle reti d'impresa dalla costituzione alla gestione operativa. Available at: <http://www.pv.camcom.it/>.
- Ricciardi, A. (2003). *Le reti di imprese. Vantaggi competitivi e pianificazione strategica*. Franco Angeli, Milano
- Ricciardi, A. (2010). Strategie di cooperazione tra aziende e mitigazione del rischio operativo: i vantaggi competitivi delle reti di imprese. In Airolidi, G., Brunetti, G., Corbetta, G., and Invernizzi, G. (Eds.), *Economia Aziendale and Management: scritti in onore di Vittorio Coda*. Egea, Milano:
- Ricciardi, A. (2013). 'I distretti industriali italiani: recenti tendenze evolutive', *Sinergie*, rivista di studi e ricerche, no. 91, pp.21–58.
- Ricciardi, A., Ingarozza, M.F., (2018) "Organizzarsi in rete per migliorare il rating e ridurre il costo dei finanziamenti" *Amministrazione & Finanza*, vol.33
- Ricciardi, A., Cardoni, A., and Tiacchi, L., (2014), Strategic Context, Organizational Features and Network Performances: A Survey on Collaborative Networked Organizations of Italian SMEs, in Amarinha-Matos, L.M., and Afsarmanesh H. (eds.), *Collaborative Systems for Smart Networked Environments*, Springer Berlin Heidelberg, Vol. 434, pp.534-545.
- Russo, L., (2015) "Il contratto di rete in agricoltura", *Rivista di Diritto Civile*, Vol.1, pp.181–208.
- Sabel, C.F., Zeitlin, J., (2004) "Neither Modularity nor Relational Contracting: Inter-Firm Collaboration in the New Economy", *Enterprise and Society*, Vol.5, No.03, pp.388-403.
- Storper, M., and Harrison, B., (1991) Flexibility, hierarchy and regional development: the changing structure of industrial production systems and their form of Governance. *Research Policy*, 20, pp.407-422.
- Todeva, E., (2006) *Business Networks: Strategy & Structure*, Taylor & Francis, New York.
- Thanassoulis, E., Boussofiane, A., and Dyson, R. D. (1996) "A comparison of data envelopment analysis and ratio analysis as tools for performance assessment", *Omega*, 24(3), pp. 229–244.
- Wilcoxon, F., (1945) Individual comparisons by ranking methods. *Biometrics Bulletin*, Vol.1, No.6, pp.80–83.
- Williamson, O. E., (1975), *Markets and Hierarchies: Analysis and Antitrust Implications (A Study in the Economics of Internal Organization)*, Free Press, New York
- Williamson O.E. (1996), *The Mechanism Of Governance*, Oxford University Press, Oxford-New York
- Wubben E.F.M., Bremmers, H.J., Ingenbleek, P.T.M., Wals, A.E.J. (2013) "Governance of differential stakeholder interests in supply chain and networks", *Journal on Chain and Network Science*, Vol.13, No.2, pp.99-105.
- Zaheer, A., McEvily, B., and Perrone, V., (1998), Does Trust Matter? Exploring the Effects of Interorganizational and Interpersonal Trust on Performance, *Organization Science*, Vol.9, No.2, pp.141-159.
- Zazzaro, A., (2011) *Reti d'impresa e territorio*, Il Mulino, Bologna.

The Intangible Assets into the Wine Business Sector: a Structured Literature Review

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Abstract

Wine is one of the most traditional products with high symbolic value and for some countries in the world is a carrier of community knowledge, embodying immaterial and intangible assets. Furthermore it generates income, employment, economic and social value. Through a review of the various contributions of the research strands, this work aims to highlight what have been, over the years, the most discussed issues, the research areas most investigated and those that have aroused less interest, so that any gaps may emerge in the current academic scenario.

To comply the paper aim, a literature searches on Scopus has been conducted, using a set of selected keywords. This work uses a structured literature review (SLR) method proposed by Massaro et al. (2016) as was adapted by Paoloni and Demartini (2016). This paper contributes to extend the international literature through the construction of a comprehensive framework on the wine sector that, starting from the state of the art, highlights the contribution of intangible resources to the sector, as provides different input for future researches and analysis.

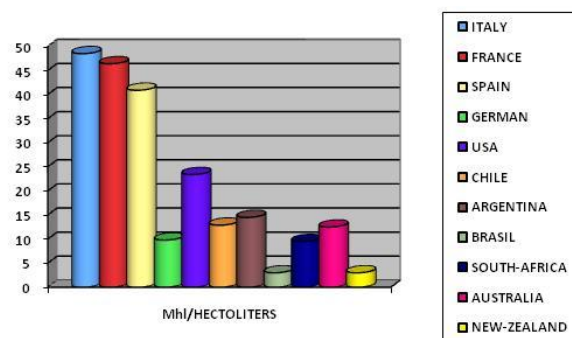
Keywords – Wine business, intangible assets, intangible heritage

Paper type – Academic Research Paper

1 Introduction

Wine is one of the most traditional products with high symbolic value for some countries in the world. It can be included into the "foodways" for the cultural, social and economic practices relating to the production and the consumption – as pervasive elements of each culture and means of expression of personal and common identity.

The last year 2017 will be remembered, worldwide, as one of the poorest years of the last twenty years in wine production, on the contrary, 2018, among the best and most abundant.



Data source OIV (International Organisation of Vine and Wine - www.oiv.int)

Fig. 1 Wine production trend (2018). The most country makers in the world.

These numbers referred to wine production, represent also the reason why “Wine” is a topic of research that involves a wide plethora of different interests.

Through a review of the various contributions of the research strands, this work aims to highlight what have been, over the years, the most discussed issues, the research areas most investigated and those that have aroused less interest, so that any gaps many emerge in the current scenario of field academic. In fact, the theme of the wine business lends itself to a multi-dimensional survey that we will discuss in this paper focusing on the topic of “Business, Management and Accounting” (BMA).

Above all in wine sector, it is more and more studied the highly context-specific and how a combination of tangible and intangible firms’ resources. That’s the reason why, according us, this linking is more interesting.

To comply the paper aim, a literature searches on Scopus has been conducted, using a set of selected keywords. Scopus has been used as it allows us to be confident on the quality of publications. Selected papers have been analyzed and classified them, in an attempt to identify main topics and results obtained thanks to research and analysis carried out so far.

This work uses a SLR method proposed by Massaro et al. (2016) as was adapted by Paoloni and Demartini (2016) limited to such part that are compatible with the different focus of this paper. Adopting it, we asked the following research questions:

RQ1: what is the focus of the wine literature?

RQ2: how is research on intangible heritage in wine sector developing in leading journals in the fields?

In answering our questions, this paper contributes to extend the international literature through the construction of a comprehensive framework on the wine sector by analysing the researches published over the period 2009-2019, which, starting from the analysis of the state of the art, intends on the one hand to highlight the contribution of intangible resources to the sector, on the other provide different input for future research and analysis. Our analysis shows the lack of interest from the scholars for the topic of intangible assets applied to the wine sector and offers interesting hints to launch new lines of research.

2 Research Methodology

This work uses a structured literature review (SLR) method proposed by Massaro et al. (2016) as was adapted by Paoloni and Demartini (2016). A SLR *“is a method for studying a corpus of scholarly literature, to develop insights, critical reflections, future research paths and research questions”* (Massaro et al. 2016:767). As Paoloni and Demartini point out (2016:2), a SLR uses a rigorous methodology through which it *“selects and evaluates contributions, analyses and synthesizes data, and finally it reports the research evidence with transparency, comprehensiveness and reproducibility”*. The literature that recognizes the usefulness of a rigorous SLR is extensive (Tranfield et al., 2003; Scandura and Williams, 2000; Littell et al., 2008) and the awareness of the usefulness of an SLR has increased in recent years and *“a research synthesis methods has changed rapidly to become more methodologically inclusive”* (Tsakalerou and Katsavounis, 2015:24).

According with the three first steps proposed by Massaro et al. (2016), we began our work by investigating the topics most frequently dealt with in the wine literature published from 2009 to present in the Scopus (search was made on March 2019). Our analysis aims to find article, title and key words of various documents such as articles, books, and book chapters.

More specifically, we adopt the framework developed by Paoloni and Demartini (2016:3) on based on Guthrie et al.'s (2012:71) previous work. To make the model more suited to our research topic, we have made some changes to the “A category” (article focus) by inserting the specific focuses of the prevailing literature in the field of “wine and intangible”, and we adapted the others to specific findings of our SLR. Furthermore, we followed several steps in order to no limit our area of investigation, and we described the process followed step by step (Broadbent and Guthrie, 2008). Finally, after reading titles and abstracts of the selected papers, we handed-pick some categories to identify the special focus of the papers and classify them in a way more useful to our work aims.

The classification system arising from Paoloni-Demartini (2016) framework is based on the identification of four categories of documents in which are included different and appropriate sub-classification of them. As underlined before, we adopted it whenever it is

possible and, in any case, we follow the Paoloni-Demartini (2016) approach to classify the detected and selected documents, introducing some integrations to develop a system more suitable to our RQs.

To establish literature review reliability and test its validity (Massaro et al., 2016:772), it was necessary an in dept reading of the selected papers, and it is disclosed us, on the one hand not every documents selected on the basis of the keywords were useful to the aim of our study and, on the other, some works excluded from the area of research (since classified by the data set in other subject areas, for example Decision Science) were instead fully relevant.

As Paoloni and Demartini point out (2016:2), “*the structured literature review is an iterative process in which the taxonomy of research themes and issues is developed and refined throughout the review and writing process*”. On base on this vein, in order to answer to RQ2, we extended the analytic framework to include each research area that revealed the key words “wine and intangible” irrespective of the research area.

3 The state of art in the field of “Wine and Intangible”

3.1 Selection of articles

According with the three first steps proposed by Massaro et al. (2016) we began our work by investigating the topics most frequently dealt with in the wine literature published from 2009 to present in the Scopus. Differentemente dal modello Paoloni-Demartini (2016), in una prima fase abbiamo preferito non selezionare alcun journal o specifiche parole chiave poiché il nostro obiettivo di ricerca era quello di individuare i temi maggiormente trattati in the field of wine (RQ1) e, in un secondo step, individuare la letteratura on intangible heritage in wine sector developing in the fields (RQ2).

At first, we found 28,119 documents results publish in 2009 to present of very heterogeneous content referred to term “wine”.

Fig. 1 - documents on wine by subject area 2009 (www.scopus.com)

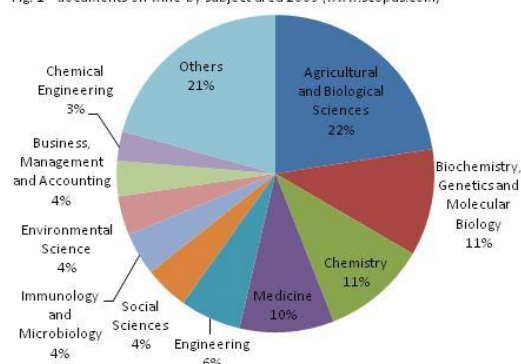


Fig. 1 shows us that only 4% of them focus on the topics of our research area “BMA” (RQ1) with 1,819 articles.

Even in our specific field of study (BMA), a high level of heterogeneity remains in the topics covered (fig. 2). There is also a reduced number of contributions focused on the theme "intangible / intellectual capital" (RQ2) with only 5 works in the analyzed period (www.scopus.com). This result prompted us to extend our research to the other Subject areas.

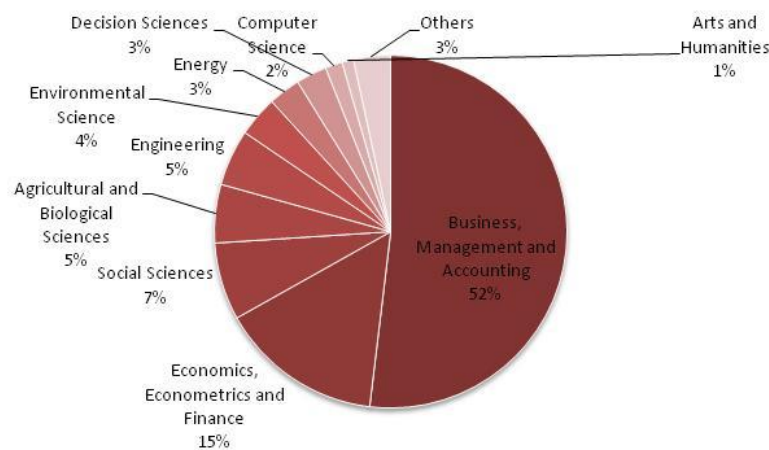


Fig. 2 – documents on wine by subject area (focus on BMA)

As can be seen in Fig. 3, the number of articles published, which link “wine and intangible” without restricted subject area, increased over the last years, although the number is not so high (34 papers in ten years) and the topics are very heterogeneous (fig. 4).

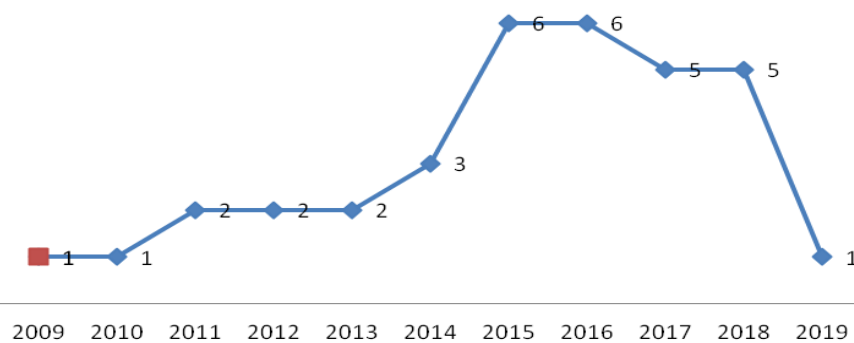


Fig. 3 – number of article selected for keywords “wine and intangible”

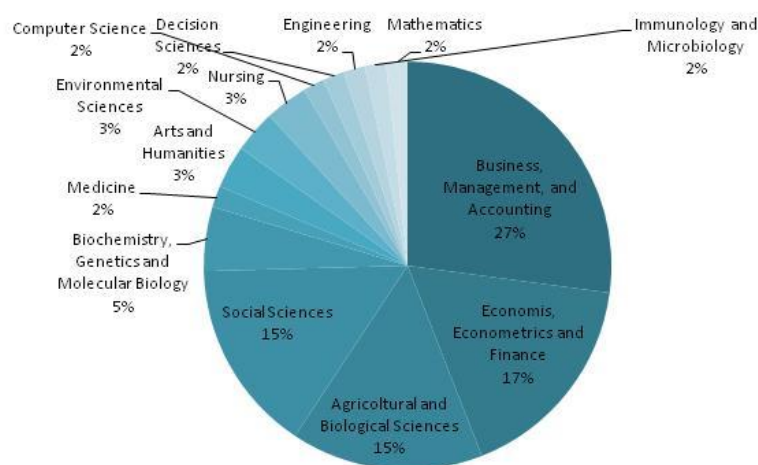


Fig. 4 – subject area according to Scopus – our elaboration

The documents used for the SRL are shown in the fig. 5 and classified by year, relevance and scientific impact (number of citations).the tab. 5 indicates the papers used in the SRL.

Fig.5 – articles used in SRL

Year	Articles	Articles relevant	Articles not relevant	Cited by
2009	1	1	-	-
2010	1	1	-	21
2011	2	2	-	13
2012	2	1	1	3
2013	2	-	2	-
2014	3	2	1	10
2015	6	5	1	4
2016	6	3	3	21
2017	5	2	3	-
2018	5	3	2	-
2019	1	1	-	-
Total	34	21	13	72

3.2 Defining the analytic framework

As Paoloni and Demartini point out, the SLR “is an iterative process in which the taxonomy of research themes and issues is developed and refined throughout the review and writing process” (2016:2). To comply the paper aims, we adopt the framework developed by Paoloni and Demartini (2016:3) nevertheless, to make the model more suited to our research topic, it was necessary to made some changes at the categories proposed by them. The adjustments are the following.

The category “A” aims to seek the focus of the works in order to reveal the most significant aspects covered by the scholars or practitioners. Inside it, we inserted the specific items draw out of the prevailing literature in the field of “wine and intangible”.

The category “B” is used to classify articles. the research field was defined based on the reading of the abstracts of the selected papers. We decided not to use the classification system used by Scopus but to adopt more specific macro-areas that could more quickly connect each work to the field of intangible assets.

The category C aims the geographical area in which the research took place, regardless of the author's nationality. Furthermore, comparative researches are planned by comparing more nations.

The category D specifies which research methodology is adopted. In category “Other” are included those documents such as special issues, editorials, or proceedings, or other generic categories not framed in any of those provided.

The review process returned us the categories into the Tab. 3.

Tab. 3 – documents classification

Article focus	Research area
A1. Intangible Assets	B1. Management
A2. Internationalization strategy	B2. Economics
A3. Wine tourism	B3. Economic History
A4. Sustainable Development	B4. Linguistic
A5. Intangible and performance	B5. Medicine and Biological
A6. Cultural Heritage	B6. Other
A7. Health benefits	
A8. Consumer behaviour	
A9. Accounting	
A10. Other	
Geographical area	Research method
C1. Northern Europe	D1. Literature review
C2. Southern Europe	D2. Qualitative
C3. Asia	D3. Quantitative
C4. Comparative Study	D4. Mixed method
C5. Not specified	D5. Other

3.2.1 Article Focus

In the article focus category we have highlighted the specific theme of each article examined, in order to identify already existing research topics (RQ1) and, among these, identify those that could be better explored in the future. All papers (except the other category) deal with aspects directly or indirectly related to our RQ2.

A1 Intangible Assets: These studies focus on intangible resource endowment (reputation, family history and brand equity, local factors, other different capabilities as innovation) as a source of competitive advantage in the development of international strategies.

A2 Internationalization strategy: to identify what are the important practical implications for managers or owners who can improve their firm's export performance by assessing their internal resources (tangible or intangible) before considering which export

channel to choose. This is important to discover the vital opportunities to internationalization.

A3 Wine Tourism: these articles focused the element both tangible factors (as wine or typical food or other) and intangible factors (as history, wine family's brand, and other, regional value elements, or other) to develop the competitiveness.

A4 Sustainable Development: the increased trend for organic products and the concept of sustainable development, firms must invest in valuable and unique resources (tangible or intangible) to achieve long-term success and gain competitive advantages.

A5 Intangible and performance: this category concerns studies that investigate the effects on the financial performances of specific activities (as intangibles)

A6 Cultural Heritage: this category includes studies that analyze the contribution of traditional foods (such as wine) to the heritage of humanity.

A7 Health Benefits: it is included all studies on the health benefits of some foods in the Mediterranean diet, such as wine.

A8 Consumer Behaviour: this category includes studies that investigate consumer behavior on particular topics, for example on experiences of "creative" tourism or luxury choices and others factors

A9 Accounting: it includes one paper refers to financial report.

A10 Other: this category includes all documents on which it was impossible to group in the previous, for example they are conference proceedings or other where it is not possible identify them specifically.

3.2.2 Research Area

In this category we have identified six different research areas and focusing on the following areas:

B1 Management: management studies, organization, marketing.

B2 Economics: international policies.

B3 Economic History: historic studies.

B4 Linguistic: linguistic translations.

B5 Medicine and Biological.

B6 Other: studies which it is not specified the field of research or present only once and then have little relevance for statistical purpose.

3.2.3 Geographical Area

In this category we have identified mainly European countries, with some studies on Asian Continent.

C1. Northern Europe: France, Germany, Czech Republic.

C2 Southern Europe: Greece, Italy, Spain, Portugal.

C3 Asia: Georgia, China, Japan.

C4 Comparative Study: comparative research among countries.

C5 Other: it was not possible to identify the geographical area on which studies referring.

3.2.4 Research Method

In this category we specified the various types of research methods.

D1 Literature Review

D2 Qualitative Research

D3 Quantitative Research

D4 Research Mix (in case of mixed method of research)

D5 Other (other research methods or not identified methods).

3.3. Results

3.3.1. Article Focus

Fig. 4 – article focus

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
A1	1		1	1			1	1	1	1		7
A2						2	1	1	1	1	1	7
A3				1			2	1				4
A4							1			1		2
A5		1	1									2
A6								1				1
A7					2	1	1					4
A8								1	2	2		5
A9									1			1
A10								1				1
Total	1	1	2	2	2	3	6	6	5	5	1	34

After analyzing all studies published in the last 10 years, which deal the theme of wine & intangible, fig. 4 shows us how there is an extreme heterogeneity of the topics covered, in accordance with what appeared from the beginning.

3.3.2. Research Area

Fig. 5 – research area

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Management	1		2	1			4	2	3	3		16
Economics		1				2	1	1	1	1	1	8
Economic History										1		1
Linguistic									1			1
Medicine& Biological					2	1	1	2				6
Other				1				1				2
Total	1	1	2	2	2	3	6	6	5	5	1	34

The Fig. 5 shows us that most of studies are in the Management area (47% of the total).

3.3.3. Geographical Area

Fig. 6 – geographical area

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Northern Europe		1	1	1					1	2		6
Southern Europe	1		1			2	5	3	1			13
Asia								1		2		3
Comparative Study										1	1	2
Not specified				1	2	1	1	2	3			10
Total	1	1	2	2	2	3	6	6	5	5	1	34

The Fig. 6 reveals that 38% of the articles analyze case studies related to Southern Europe, while 29% of them do not specify any specific geographical area.

3.3.4. Research Method

Fig. 7 – research method

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Literature Review												
Qualitative Research	1	1	1	2		2	4	4		5	1	21
Quantitative Research			1		2	1	1	1	3	1		10
Research Mix							1					1
Other								1	1			2
Total	1	1	2	2	2	3	6	6	4	6	1	34

The Fig. 7 shows that about 62% of studies use qualitative research methods, while only 29% use quantitative analysis. It emerge that there is not even study who adopt the literature review method.

3.3 Testing literature review validity

In the SLR, an important step is to test the validity of the literature review (Massaro et al., 2016). Therefore, we reviewed the 34 papers in the appendix to exclude those that are not relevant or not relevant to our area of research (Business Administration).

Fig. 8 shows that in the selected studies by Scopus, the 62% of them focus the theme of wine & intangible strictly related to our research topic. The remaining 38% are unrelated (e.g. health, cultural heritage and so on).

Fig. 8 – article focus per relevant papers

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
A1	1		1	1			1	1	1	1		7
A2						2	1	1	1	1	1	7
A3							2	1				3
A4							1			1		2
A5		1	1									2
Total	1	1	2	1		2	5	3	2	3	1	21

3.4 Measure article impact

According to Massaro et al. (2016) the focus point of the SLR is the identification of the impact of the articles surveyed.

In fig. 9 only the articles that had had at least one citation are reported, reclassified by number of citations, year of publication and research area. The restatement was made only for items useful for the purposes of RQ2 (see fig. 8).

Fig. 9 - Number of quotations per Research Area

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
A1			8	3				6				17
A2						6+4	4	3				43
A3								12				12
A5		21	5									
Total		21	13	3		10	4	21				72

Generally, there is a low number of citations: just one study have more than 20 citations and another with 12. Then, the scientific impact of the document is not relevant.

4 Discussions

The SLR was very useful for defining the themes most dealt with in the literature on wine & intangible in the last decade and answer to RQ2. The documents closely related to the research topic (A1) are very interesting and, with an incidence of 20.5%, focus on intangible resource endowment. However they do not have a strong scientific impact because the most cited documents belong to the research area A2 to which 21% of the documents belong and an incidence of 20.5% on the total of the articles relevant to our research area.

The category A1, Intangible Assets, includes the studies focus on intangible resource endowment (reputation, family history and brand equity, local factors, other different capabilities as innovation) as a source of competitive advantage in the development of international strategies. The topics with the greatest scientific impact, measured in terms of the highest number of citations (Massaro et al., 2016; Schinel, 2011; Dumay, 2014) are focused on which of the intangible resources possessed by companies from *viticulture* sector can serve as a source of competitive advantage in the development of their international strategies as, for example, the family-owned or non family-owned character of the viticultural companies (Fuentes-Lombardo et al. 2011). Vidoli et al. (2016) estimate the efficiency of a representative sample of Italian wine producers following a spatial stochastic frontier framework that allows to evaluate the role of intangible local factors (first of all, local business climate and development of local learning) in influencing the economic performance of firms. Šperková, Hejmalová (2012) investigate the rivalry among existing competitors in the wine-making branch and show that individual companies use all their tangible and intangible means in order to extend their share and attract new clients.

The category A2, internationalization strategy, identifies what are the important practical implications for managers or owners who can improve their firm's export performance by assessing their internal resources (tangible or intangible) before considering which export channel to choose. The topics with the greatest scientific impact, as underlined before, is the analysis of the effects of the intangible resources, product quality, firm size, and international experience on the probabilities of some decisions about the export channel (Fernández-Olmos, Díez-Vial 2014). Furthermore in another work Fernández-Olmos, Díez-Vial (2015) demonstrate that firms improve their export performance when considering internal resources (humans included) and the export channel. Other scholars (Bertazzoli et al. 2014; Iannone 2015) identify and evaluate the competitive strategies of niche enterprises selling traditional protected designation of origin wine in domestic and international markets, for example seeking to successfully exploit the ability to manage intangible resources that have a strong emotional component differentiating the enterprise from similar ones. Pellicanò and De Luca (2016) demonstrate how a combination of tangible and intangible firms' resources in interaction with home-based external conditions plays a crucial role in the internationalization process.

The category A3, Wine Tourism, focuses on the element both tangible factors (as wine or typical food or other) and intangible factors (as history, wine family's brand, and other, regional value elements, or other) to develop the competitiveness. In this category, which includes about 9% of the contributions on the subject, we find the interesting work of Bregoli et al. (2016) one of the most quoted paper (17% of the total quotations). They analyze how wine and tourism operators understand the concept of a "wine route", to determine the impact that definition can have on wine production, tourism, food and hospitality.

The category A4, Sustainable Development, holds only about 6% of the contributions on the subject but none of them has received quotations so far. The topic treated are the increased trend for organic products and the concept of sustainable development, firms must invest in valuable and unique resources (tangible or intangible) to achieve long-term success and gain competitive advantages (Iannone 2015; Fanasch, 2018).

Finally the category A5, Intangible and performance, holds only about 6% of the contributions on the subject, as the latter, but includes the most cited papers (Amadiou, Viviani, 2010; 2011) that obtain the 30%, more or less, of quotations. The topics is addressed to investigate what extent intangible investments have a positive impact on wine companies' financial performance.

The in dept review of the documents covered in the other categories (from A6 to A10) revealed us that the topics are include documents not relevant for the paper aim. This result offers interesting insights for future insights of research.

5 Conclusion

This article contributes to the existing literature because it is the first work on the subject of wine and intangibles that carries out a systematic review of literature (Fig. 7)

offering interesting ideas to scholars so that their scientific contribution can contribute to the development of such an important sector for the economy of many countries and spread a greater awareness of the value created by the intangible assets in the wine sector.

The SLR on Wine (RQ1) and on Wine & Intangible (RQ2) shows that there is space to deepen all the topics related to the topic. Today there is an extreme variety of contents, but a reduced scientific impact of the current works, so much can be done by scholars to explore different interesting aspects and contribute to the existing literature.

Moreover, despite the vast literature on the wine business (1819 works published in the last 10 years), scholars have paid little attention to the theme of intangible assets. Our review of the literature underlines the topic analyzed as an emerging issue, which gives us the possibility of identifying new trends and future directions for both researchers and mainly studied actors: wine entrepreneurs.

Further steps in our research include a quantitative analysis through case studies, to highlight the link between intangible assets - territory and made in Italy, as one of the most important intangible assets, to create business value. Another line of research that we aim to analyze is the female contribution to the creation of intangible assets in the wine sector. In fact, not even a document on this interesting topic emerged from the SLR. This last aspect is an interesting topic of research if we consider the profound evolution in this sector: for centuries the wine sector was represented by men, but after the new contribution of women in agriculture and especially in entrepreneurship, women entrepreneurs are becoming an interesting new research topic.

Another important contribution of this paper is to have refined the classification criteria used by the Scopus algorithm, making them more detailed and allowing scholars to identify the most treated and the least discussed topics, on which it is therefore appropriate to offer a contribution.

The limitations of this paper are that they used only the Scopus database for SLR, which is certainly one of the most relevant sources of scientific literature, but it is not the only one. Our results could be improved by extending the analysis to data sets taken from other sources such as Google Scholar, SCImago Journal and Country Rank, Web, WOS-Web of Science.

Finally this study can be integrated by classifying the results by Journal distinguishing them by relevance and number of documents published on the "wine" topics.

References

- Amadiou P., Viviani J.-L., (2010), Intangible effort and performance: The case of the French wine industry, *Agribusiness*, 26(2), pp. 280-306.
- Amadiou P., Viviani J.L., (2011), Intangible expenses: A solution to increase the French wine industry performance, *European Review of Agricultural Economics*, 38(2), pp. 237-258.
- Bertazzoli A., Ghelfi R., Rivaroli S., (2014), Competitive drivers in Marsala's wineries *Agribusiness*, 30(4), pp. 456-469.
- Bregoli I., Hingley M., Del Chiappa G., Sodano V., (2016), Challenges in Italian wine routes: managing stakeholder networks, *Qualitative Market Research* 19(2), pp. 204-224.

- Broadbent, J., & Guthrie, J. (2008). Public sector to public services: 20 years of “contextual” accounting research. *Accounting, Auditing & Accountability Journal*, 21(2), 129-169.
- Dumay, J. (2014). 15 years of the journal of intellectual capital and counting: a manifesto for transformational IC research. *Journal of Intellectual Capital*, 15(1), 2-37.
- Fanasch P., (2018), Survival of the fittest: The impact of eco-certification and reputation on firm performance, *Business Strategy and the Environment*, 5 (1), pp. 30-37.
- Fernández-Olmos M., Díez-Vial I., (2014), The direct or indirect exporting decision in agri-food firms *Agribusiness*, 30(2), pp. 148-164.
- Fernández-Olmos M., Díez-Vial I., (2015), Intangible resources, export channel and performance: is there any fit, *Journal of Business Economics and Management*, 16(5), pp. 1013-1033.
- Fuentes-Lombardo G., Fernandez-Ortiz R., Cano-Rubio M., (2011), Intangible assets in the internationalization of Spanish wineries: Directive and compared perception between family and non family businesses [Intangibles en la internacionalización de las bodegas españolas: Percepción directiva y comparada entre empresas familiares y no familiares], *Intangible Capital*, 7(2), pp. 428-473.
- Guthrie, J., Ricceri, F., & Dumay, J. (2012). Reflections and projections: a decade of intellectual capital accounting research. *The british accounting review*, 44(2), 68-82.
- Iannone B., (2015), Sustainability to improve knowledge values and intangible capital: A case study in wine sector, *Proceedings of the European Conference on Knowledge Management, ECKM*, pp. 367-374.
- Littell, J. H., Corcoran, J., & Pillai, V. (2008). *Systematic reviews and meta-analysis*. Oxford University Press.
- Massaro, M., Dumay, J., & Guthrie, J. (2016). On the shoulders of giants: undertaking a structured literature review in accounting. *Accounting, Auditing & Accountability Journal*, 29(5), 767-801.
- Paoloni, P., & Demartini, P. (2016). *Women in management: Perspectives on a decade of research (2005–2015)*. Palgrave Communications, 2(1), 16094.
- Pellicanò A., De Luca A.I., (2016), Dynamics, motivations and barriers in internationalisation processes of wineries in Calabria, *International Journal of Wine Business Research*, 27 (1), pp. 40-60.
- Scandura, T. A., & Williams, E. A. (2000). Research methodology in management: Current practices, trends, and implications for future research. *Academy of Management journal*, 43(6), 1248-1264.
- Schimmel, J. (2012). *Writing science: how to write papers that get cited and proposals that get funded*. Oxford University Press USA.
- Šperková R., Hejmalová H., (2012), Intensity of rivalry among existing competitors in the wine-making branch *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 60(2), pp. 429-436.
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British journal of management*, 14(3), 207-222.
- Tsakalerou, M., & Katsavounis, S. (2015). Systematic reviews and metastudies: A meta-analysis framework. *International Journal of Science and Advanced Technology*, 5(1), 23-26.
- Vidoli F., Cardillo C., Fusco E., Canello J., (2016), Spatial non stationarity in the stochastic frontier model: An application to the Italian wine industry, *J. Product. Anal.*, 43 (3), pp. 307-326
- References
- Amadiou P., Viviani J.-L., (2010), Intangible effort and performance: The case of the French wine industry, *Agribusiness*, 26(2), pp. 280-306.

- Amadiou P., Viviani J.L., (2011), Intangible expenses: A solution to increase the French wine industry performance, *European Review of Agricultural Economics*, 38(2), pp. 237-258.
- Bertazzoli A., Ghelfi R., Rivaroli S., (2014), Competitive drivers in Marsala's wineries *Agribusiness*, 30(4), pp. 456-469.
- Bregoli I., Hingley M., Del Chiappa G., Sodano V., (2016), Challenges in Italian wine routes: managing stakeholder networks, *Qualitative Market Research* 19(2), pp. 204-224.
- Broadbent, J., & Guthrie, J. (2008). Public sector to public services: 20 years of “contextual” accounting research. *Accounting, Auditing & Accountability Journal*, 21(2), 129-169.
- Dumay, J. (2014). 15 years of the journal of intellectual capital and counting: a manifesto for transformational IC research. *Journal of Intellectual Capital*, 15(1), 2-37.
- Fanasch P., (2018), Survival of the fittest: The impact of eco-certification and reputation on firm performance, *Business Strategy and the Environment*, 5 (1), pp. 30-37.
- Fernández-Olmos M., Díez-Vial I., (2014), The direct or indirect exporting decision in agri-food firms *Agribusiness*, 30(2), pp. 148-164.
- Fernández-Olmos M., Díez-Vial I., (2015), Intangible resources, export channel and performance: is there any fit, *Journal of Business Economics and Management*, 16(5), pp. 1013-1033.
- Fuentes-Lombardo G., Fernandez-Ortiz R., Cano-Rubio M., (2011), Intangible assets in the internationalization of Spanish wineries: Directive and compared perception between family and non family businesses [Intangibles en la internacionalización de las bodegas españolas: Percepción directiva y comparada entre empresas familiares y no familiares], *Intangible Capital*, 7(2), pp. 428-473.
- Guthrie, J., Ricceri, F., & Dumay, J. (2012). Reflections and projections: a decade of intellectual capital accounting research. *The british accounting review*, 44(2), 68-82.
- Iannone B., (2015), Sustainability to improve knowledge values and intangible capital: A case study in wine sector, *Proceedings of the European Conference on Knowledge Management, ECKM*, pp. 367-374.
- Littell, J. H., Corcoran, J., & Pillai, V. (2008). *Systematic reviews and meta-analysis*. Oxford University Press.
- Massaro, M., Dumay, J., & Guthrie, J. (2016). On the shoulders of giants: undertaking a structured literature review in accounting. *Accounting, Auditing & Accountability Journal*, 29(5), 767-801.
- Paoloni, P., & Demartini, P. (2016). Women in management: Perspectives on a decade of research (2005–2015). *Palgrave Communications*, 2(1), 16094.
- Pellicanò A., De Luca A.I., (2016), Dynamics, motivations and barriers in internationalisation processes of wineries in Calabria, *International Journal of Wine Business Research*, 27 (1), pp. 40-60.
- Scandura, T. A., & Williams, E. A. (2000). Research methodology in management: Current practices, trends, and implications for future research. *Academy of Management journal*, 43(6), 1248-1264.
- Schimel, J. (2012). *Writing science: how to write papers that get cited and proposals that get funded*. Oxford University Press USA.
- Šperková R., Hejmalová H., (2012), Intensity of rivalry among existing competitors in the wine-making branch *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 60(2), pp. 429-436.

- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British journal of management*, 14(3), 207-222.
- Tsakalerou, M., & Katsavounis, S. (2015). Systematic reviews and metastudies: A meta-analysis framework. *International Journal of Science and Advanced Technology*, 5(1), 23-26.
- Vidoli F., Cardillo C., Fusco E., Canello J., (2016), Spatial non stationarity in the stochastic frontier model: An application to the Italian wine industry, *J. Product. Anal.*, 43 (3), pp. 307-326

Value Creation in the User-Centric Personal Information Ecosystem

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Abstract

The emerging user-centric personal information ecosystem within the data-driven economy offers new opportunities and poses new challenges to organizations that base their business on the collection and use of personal information. In the user-centric ecosystem, the control over personal information is given back to the individuals who, as the information owners, can decide whether, under what conditions and in change for what to disclose their data to trusted counterparts. In this new scenario, organizations should revise their relationship with individuals to make them willing to disclose the information they need. Based on evidences from the economics and psychology of privacy literature, the paper argues that this could be done by involving individuals as coproducers in the value-generating processes that use personal information. Under this strategy, besides economic compensation and personalized services, organizations can leverage the ‘psychological’ benefits deriving from the coproduction experience as further incentives that can enhance the individuals’ willingness to disclose their personal information.

Keywords –Value creation, Coproduction, Personal information, Privacy, User-centric ecosystem.

Paper type – Academic Research Paper

1 Introduction

People using low cost and high processing capacity devices produce every day huge amounts of information that, by being generated by individuals, directly or indirectly pertains to them and should thus be considered as personal information (Kang, 1998). Acquisti, Taylor and Wagman (2016, p. 444) observe that “individuals’ traits and attributes (such as a person’s age, address, gender, income, preferences, and reservation prices — but also her clickthroughs, comments posted online, photos uploaded to social media, and so forth) are increasingly regarded as business assets that can be used to target services or offers, to provide relevant advertising, or to be traded with other parties”. This explains why personal information is increasingly being considered as a fundamental economic asset, the new ‘oil’ of the 21st century (WEF, 2011), an important currency in the new millennium to which also a relevant monetary value can be associated (Thaler &

Tucker, 2013). However, while a remarkable value resides in personal information, it often remains untapped and this raises the problem of how to unlock that value.

According to (WEF, 2013), the empowerment of individuals as the ‘owners’ of personal information represents a fundamental condition for unlocking its value. In the traditional organization-centric personal information ecosystem (O-CPIE), an asymmetry of power exists between organizations and individuals, due to an asymmetry in the amount of information about individuals held by organizations and the individuals’ lack of knowledge and ability to control how, by whom and in exchange for what information pertaining to them is used (Haynes & Nguyen, 2014; Solove, 2006; WEF, 2011). Giving back to people the control (if not ownership) over personal information means rebalancing the relationship among the various stakeholders influencing the personal information ecosystem.

The continuous technological evolution that makes personal information management tools available to individuals and the coming into force of new and more user-oriented personal information protection legislations (such as the EU General Data Protection Regulation) are creating the conditions for the emergence of a new user-centric personal information ecosystem (U-CPIE). In the U-CPIE, individuals are the ‘owners’ of the information they generate and should be allowed to decide whether to disclose their data to trusted counterparts to receive some benefits from them.

Organizations that collect and use personal information tend to adopt strategies based on economic compensation, free access to services or the delivery of better and more personalized services to obtain the individuals’ consent to the treatment of their information. While these strategies appear effective in many cases, their success depends on the exploitation of the information asymmetry between individuals and organizations. In fact, when individuals are requested to provide personal information in exchange for some form of material compensation, they may not be able to act as economically rational agents. On the one hand, individuals normally are not aware of the value their personal information can have for the organizations that use it and this makes it impossible for them to define a fair exchange value for their personal information. On the other hand, when they are made aware of the use that organizations will do of their personal information, individuals tend to over-estimate that value. For these reasons, compensation-based strategies that are effective in the O-CPIE could be less effective in the emerging U-CPIE. This rises the research question the paper intends to address, i.e. “What strategies, besides compensation, organizations can implement in the U-CPIE to make individuals more willing to share their personal information?”

The paper argues that to answer this question it is necessary to overcome a purely economic valuation of personal information and to consider other dimensions of value that appear to motivate the disclosure behaviours of individuals in contexts in which there is no material compensation, as in the case of online social networks. The individuals’ disclosure behaviour on social networks appears paradoxical since, despite their worries about privacy, they share a lot of personal information, including highly sensitive information (Awad & Krishnan, 2006; Norberg, Horne, & Horne, 2007).

Many studies have highlighted that the reasons that lead people to share their information on social networks are more related to the social and psychological dimensions of value than to self-interest. The paper argues that to unlock the value of personal information within the U-CPIE, organizations can leverage these non-economic dimensions of value by implementing an interaction strategy with the personal information owners (PIOs, henceforth) that: (i) considers them as information providers; (ii) involves them as coproducers in the value-producing processes that use personal information; and (iii) empowers them through an iterative, dynamic and dialogic interplay.

Methodologically, the paper is based on a conceptual research approach (Meredith, 1993) and refers to sources from different literature domains. On the one hand, sources from the economics and psychology of privacy are considered to explain the privacy paradox and its consequences. On the other hand, sources from the marketing literature are considered to identify strategies for involving the PIOs as coproducers in the value-producing processes that use personal information as a resource.

The paper is organized as follows. Section 2 introduces the concept of U-CPIE and considers some conditions that would allow to unlock the value of personal information within it. Section 3 discusses the privacy paradox to show how the individuals' disclosure behaviours can be explained with reference to the concept of psychological ownership. Section 4 argues for a valuation of personal information based on social and psychological factors that cannot be measured in monetary terms. Section 5 suggests considering coproduction as a strategy organizations can implement to redefine their relationship with individuals within the U-CPIE and discusses some implications that would follow. Finally, the last section draws some conclusions and suggests further research development paths

2 The User-Centric Personal Information Ecosystem

Defining personal information is not an easy matter since, due to the laws protecting the privacy of individuals, the scope of the definition constrains heavily the use of certain classes of information pertaining to individuals. In (WEF, 2011), a quite general definition of personal information is given as digital data 'created by' and 'about' people that strictly resembles the one given by Kang (1998) who defines personal information as data authored by an individual, describe an individual, or can be mapped to an individual. Definitions like these, that define personal information as personally identifiable information, pose several critical questions. On the one hand, as pointed out by Van Kleek, and O'Hara (2014), what does identifiable mean? Identifiable by whom? Using what methods? On the other hand, the technological evolution, the diffusion of data analytics tools and the emergence of powerful re-identification algorithms have made the identifiability concept obsolete in the definition of personal information since even anonymized data could have significant privacy consequences (Narayanan & Smatkov, 2010; Tene, 2011).

The definition of personal information based on the identifiability concept is strictly related to the idea of privacy as ‘the right to be let alone’, as defined by Warren and Brandeis in 1890 (Kang, 1998; Solove, 2006). Influential as it has been, this definition becomes more and more problematic in the highly interconnected world of today in which individuals are embedded in complex networks of relationships. An alternative view of privacy has been advocated by Westin (1967) who defines privacy as “the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others” (p. 7). Privacy can then be defined in terms of the control we have over information about ourselves or, more generally, in terms of the “control over transactions between person(s) and other(s), the ultimate aim of which is to enhance autonomy and/or to minimize vulnerability” (Margulis, 1977, p. 10). Based on this definition of privacy, an alternative view of personal information emerges as “the information over which a person has some interest or control, in order to negotiate their environment or order their lives” (Van Kleek & Ohara, 2014, p. 8).

Defining personal information as information over which the subject has control means giving individuals the responsibility over the management of their information and, hence, their privacy. As Whitley (2009, p. 158) points out, the “control over personal data is no longer something that is managed by organizations beneficently on behalf of individuals, instead individuals (about whom the data relates) have the opportunity to take an active role in the control and management of their personal data”. This entails a shift from the traditional O-CPIE model for personal information management to the U-CPIE.

In the U-CPIE, individuals considered as PIOs (although property rights can be hard to assign when considering personal information) can exert a higher control over their information and decide whether to disclose that information to trusted organizations in order to receive some benefits from them. However, allowing individuals to exert control is a condition which is necessary, but not sufficient, to unlock the value of personal information in the U-CPIE.

The World Economic Forum identified three conditions that need to be considered to unlock the value of personal information: deliver meaningful transparency, strengthen accountability and empower individuals. Deliver meaningful transparency means to make transparency practices more meaningful, actionable and relevant for individuals by simplifying the ways in which organizations communicate them how personal information is being used. Strengthen accountability means linking accountability to the impact of different data uses on individuals and distributing privacy risks equitably among all the stakeholders. Empower individuals means giving them a say in how their information is used, giving them the capacities to use it for their own purposes, and engaging them in understanding (and managing) the intended impact of information usage.

According to (WEF, 2014) meaningful transparency, strengthened accountability and empowered individuals are the conditions that enable trusted flows of information between the PIOs and organizations within the U-CPIE that amount to transactions in which a value is exchanged between them. Hence, to be effective, measures to foster

transparency, accountability and empowerment should be devised based on an appreciation of how PIOs value and use their personal information. To this end, the next section discusses the individual disclosure behaviours on social media to understand why individuals are willing to disclose personal information on them, despite their privacy concerns. Although the relationship among individuals on social media is radically different from the relationship between individuals and organizations, the disclosure behaviours on social media can give interesting insights on what elements organizations can leverage to enhance the PIOs' willingness to disclose their information in the U-CPIE.

3 Why people disclose their personal information: the privacy paradox

Although individuals express high levels of concerns about their privacy, they often disclose a lot of personal information, especially on social media, including sensitive information (Chang & Heo, 2014). Many authors have observed this incongruence between what individuals declare and how they behave and refer to it as the 'privacy paradox' (Awad & Krishnan, 2006; Norberg et al., 2007). Even when they have been made aware of the privacy risks, individuals often do not adopt privacy protecting measures and tools mainly because their costs are considered too high or because the benefits expected from information disclosure are perceived (or even rationally evaluated) as outweighing the risks for privacy.

Empirical researches show that when it comes to personal privacy, the individuals' decision-making processes are characterized by psychological biases, bounded rationality and incomplete information, which prevent them from acting as economically rational agents (Acquisti, 2004; Kokolakis, 2017; Norberg, Horne, & Horne, 2009). This weakens sensibly the argument that personal information disclosure is based on a risk-benefit trade-off evaluation and makes it interesting to consider why individuals disclose their personal information on social media, where there is no material compensation for information disclosure.

In a study of students' disclosure behaviour on Facebook, Chang and Heo (2014) found that the expected benefits seem to have effect on the willingness to disclose personal information only in case of 'basic information' (e.g., language(s) spoken, gender, college/university, current city of residence, a short personal description, hometown, and personal website/blog URL) and some 'sensitive' information (e.g., e-mail, profile picture, work experience, birthday, networks the participants join, and instant messenger screen name(s)). Instead, the disclosure of 'highly sensitive' information (for instance, mobile phone number, other phone number(s), religious views, political views, address, relationship status, family members, and interests in men or women) is not affected by how much users perceive benefits.

Chang and Heo's conclusion is in line with the findings of Lee Park and Kim (2013) that found that information disclosure on social media is related to self-clarification, social validation, relationship development, social control, and self-representation, with relationship development being the most frequently stated motivation for disclosure.

Similarly, Kokolakis (2017) observes that since social networking is a way of gaining social capital, individuals disclose personal information on social media to earn social capital.

The relationship between the individuals' behaviour on social networks, social capital, community building and collaborative identity construction has been widely explored within the literature (Ellison, Steinfield, & Lampe, 2007; Ellison, Vitak, Steinfield, Gray, & Lampe, 2011; Valenzuela, Park, & Kee, 2009) that highlights how the individuals' disclosure behaviour on social networks cannot be explained in terms of direct utilitarian benefits, such as those assumed to be at the basis of the rational risk/benefit privacy calculation. When they decide to disclose personal information, "individuals take risks in sharing parts of the 'self' with others, as the other parties can use the shared information in unexpected and/or undesirable ways" (Norberg et al., 2009, p. 502). Hence, a fundamental psychological dimension is at play in personal information disclosure on social media.

The psychological dimension of privacy has been highlighted in some recent studies that show how the sense of 'psychological ownership' represents an important driver, maybe the most important one, of personal information valuation over and above information sensitivity and privacy concerns (Cichy, Salge, & Kohli, 2014; Spiekermann & Korunovska, 2017). Psychological ownership (Jussila, Tarkiainen, Sarstedt, & Hair, 2015; Pierce, Kostova, & Dirks, 2003) concerns the individuals' perceptions of property toward tangible and intangible goods, irrespective of whether they also legally own those goods. Quite unsurprisingly, the development of a sense of psychological ownership has been found to influence negatively the individuals' willingness to disclose their data and to motivate people to retain their personal information (Cichy et al., 2014). If we assume that the willingness to disclose personal information relates to how individuals value it, then psychological ownership can be considered as one of the determinants of the value of personal information, as seen from the PIOs' perspective. In fact, the higher the sense of psychological ownership, the lesser is the willingness to disclose personal information, which means that the amount of money an individual will possibly accept for disclosing his information grows sensibly, and the higher is the individuals' willingness to pay to protect their data from being deleted or sold (Spiekermann & Korunovska, 2017). Moreover, quite interestingly, it has also been found that incentives appealing to the motives of psychological ownership are more effective than compensatory payments in attenuating the negative relationship between the PIOs' sense of psychological ownership and their willingness to disclose their information. Put it differently, the willingness to disclose personal information increases if individuals perceive this as a way to "express themselves, enhance their self-efficacy or contribute to their self-identity by supporting a greater good as a direct consequence of disclosing their personal data" (Cichy et al., 2014, p. 5).

As observed above, individuals are supposed to perform a risk-benefit evaluation to decide whether to disclose their personal information: they disclose their information because the benefits of doing outweigh the cost or risks.

The discussion in this section shows that the PIOs' disclosure behaviours can be influenced by the possible psychological benefits (related to the determinants of psychological ownership) that can derive from disclosure. This is what happens when personal information is shared on social media. However, they can also represent elements that, besides material compensations, organizations can leverage to implement an interaction strategy with PIOs that can enhance their willingness to disclose personal information in the U-CPIE.

4 PIOs as data providers: unlocking the value of personal information through coproduction

Firms collect and use personal information to create value through the execution of value-producing processes. Since these processes use personal information as a resource, the individuals that information pertains to should be considered as involved in them, playing a role like that played by customers who collaborate with firms to coproduce value. As observed in (Norberg et al., 2009, p. 499), "the input of information from consumers in economic terms can be conceived as a type of coproduction, since the consumer contributes this information, like a raw material, toward the production of other goods and services".

Customers' involvement as coproducers has been studied quite extensively within the marketing and service literature (Lusch & Vargo, 2006; Prahalad & Ramaswamy, 2004; Vargo & Lusch, 2004), also with respect to the psychological implications of coproduction (Bendapudi & Leone, 2003; Etgar, 2008). Fuchs, Prandelli and Schreier (2010) found that customers involved as coproducers experience higher levels of psychological ownership than customers who do not participate in the production and delivery processes. Moreover, Etgar (2008, p. 102) observes that the "very act of participation and performance of the relevant tasks can yield experiences that provide psychological benefits independently of the nature of the goods or services created in the process".

As observed in (Cichy et al., 2014), tailored incentive design that underpin psychological ownership can be highly effective in mitigating negative effects on the individuals' willingness to disclose personal information on social media. This suggests the possibility of exploiting the psychological benefits that can derive from coproduction as incentives that, together with material compensations, can influence the PIOs' disclosure decisions. From this point of view, it seems reasonable to expect that, within the U-CPIE, a strategy based on coproduction that helps establishing a positive relationship with the PIOs, could enhance their willingness to share with organizations a resource they need for their value-producing processes.

In the U-CPIE, coproduction is an almost unavoidable strategy for organizations that want to compete in the digital and data-driven economy. Once the control over personal information is given back to the PIOs, the potential economic value embedded in personal information will remain untapped if their owners do not consent to its use. Hence, the implementation of strategies for unlocking that value could represent a significant

element of competitive advantage in the data-driven economy. According to the World Economic Forum such strategies should satisfy three critical conditions: deliver meaningful transparency, strengthen accountability and empower individuals (WEF, 2013, 2014). Quite interestingly, a strategy based on coproduction satisfies these conditions.

In describing the conditions that could facilitate value cocreation experiences, Prahalad and Ramaswamy (2004) identify Dialogue, Access, Risk-benefits assessment, and Transparency (the so-called DART framework) as the basis for the interaction between consumers and firms. Dialogue implies interaction, deep engagement, and the firms' willingness to avoid opportunistic behaviours and to recognize an active role to the consumers. Access implies that consumers should be allowed direct access to the relevant information, which could require making available to them tools (mainly technological ones) enabling informed decision-making. Risk-benefit assessment is based on dialogue, access and transparency that allow consumers to acquire more information about potential risks of goods and services, which is the basis for sharing the risks and assume more responsibility for dealing with them. Finally, transparency implies reducing the information asymmetry, which is the basis for building trust between firms and consumers. What makes the reference to the DART framework relevant for the present discussion is the fact that the four dimensions it encompasses cover the three conditions for unlocking the value of personal information identified by the World Economic Forum.

When organizations avoid using (opportunistically) personal information in ways that are unimagined and unwanted by the PIOs, open dialogue, interactivity and transparency allow them, as coproducers, to get a clear understanding of how their personal information is collected and used. This allows overcoming many of the problems related to the most common practices of informed consent, which are mainly based on long, complex and generic documents, and strengthen meaningful transparency through information sharing. Access is the condition that enables the empowerment of PIOs and allows them to assume responsibility on the disclosure of personal information and to share with organizations the risks involved in the use of their information. Giving individuals direct access to the relevant information concerning the use of their personal information can be done by providing them with tools that allow tracking it, which is a fundamental aspect of the individuals' control over personal information. Pursuing transparency is a way to reduce the information asymmetry between individuals and the organizations that collect and use personal information. Through transparency, individuals can be made aware of not only how and by whom their personal information is used, but also of what value firms generate by using that information. By reducing information asymmetry, individuals can make more informed decisions on whether to disclose their personal information, and in exchange for what. This is the basis for strengthening accountability on both sides of the personal information value chain.

Based on the observations above, it can thus be concluded that the PIOs' involvement as coproducers in value-generating processes can represent a viable strategy organizations can implement to enhance their willingness to share personal information. Although many critical aspects need to be considered to give further support to this conclusion,

preliminary as it is, the discussion in this section nevertheless shows that coproduction can play a relevant role to enable value creation from personal information in the data-driven economy.

5. Conclusions, limitations and further research

Personal information represents a fundamental asset in the digital society to which a remarkable economic value can be associated. However, this value often remains untapped and this raises the problem of how to unlock it to generate further value in the data-driven economy. While it has been suggested that giving back to individuals the control over their personal information could ease the flow of information, it is not clear why and in exchange for what individuals would be willing to disclose their personal information to organizations that will use it to produce value.

Researches in the economics and psychology of privacy show that individuals do not value their personal information simply in economic terms. The peculiar relationship of personal information to the self makes the sense of psychological ownership a fundamental aspect of its value as seen from the PIOs point of view. Leveraging the determinants of psychological ownership can thus represent a possible strategy that, together with the more traditional compensation mechanisms, organizations can implement to free the flow of personal information within the U-CPIE.

The main contribution of the paper has been to show that this could be done by involving PIOs as coproducers in the organizations' value-producing processes that use personal information as a resource. However, this possibility has been discussed at a very preliminary level and without considering in depth how the coproduction concept has been developed within the management and the marketing literature, especially with respect to the conditions that can make individuals willing to coproduce. Hence, more research is needed to develop further and to test the hypothesis formulated in the paper also based on empirical data. Moreover, in the paper no distinction has been made among different types of personal information that can be associated to different types and levels of perceived risks. This represents a further limitation of the present study that needs to be overcome to identify the incentive mechanisms that can be most effective in the different cases.

However, preliminary as they are, the results of the discussion in this paper show how some well-known concepts from the management and marketing literature, conveniently reviewed, can help organizations to devise strategies for dealing with the new challenges posed by the emerging user-centric personal information ecosystem.

References

- Acquisti, A. (2004, 05/17/2004). *Privacy in electronic commerce and the economics of immediate gratification*. Proceedings of the 5th ACM Conference on Electronic Commerce, New York.
- Acquisti, A., Taylor, C., & Wagman, L. (2016). The Economics of Privacy. *Journal of Economic Literature*, 54(2), 442-492.

- Awad, N. F., & Krishnan, M. S. (2006). The Personalization Privacy Paradox: An Empirical Evaluation of Information Transparency and the Willingness to Be Profiled Online for Personalization. *MIS Quarterly*, 30(1), 13-28.
- Bendapudi, N., & Leone, R. P. (2003). Psychological Implications of Customer Participation in Co-Production. *Journal of Marketing*, 67(1), 14-28.
- Chang, C.-W., & Heo, J. (2014). Visiting theories that predict college students' self-disclosure on Facebook. *Computers in Human Behavior*, 30, 79-86.
- Cichy, P., Salge, T.-O., & Kohli, R. (2014). *Extending the Privacy Calculus: The Role of Psychological Ownership*. ICIS 2014, Auckland, New Zealand.
- Ellison, N. B., Steinfield, C., & Lampe, C. (2007). The Benefits of Facebook "Friends:" Social Capital and College Students' Use of Online Social Network Sites. *Journal of Computer-Mediated Communication*, 12(4), 1143-1168.
- Ellison, N. B., Vitak, J., Steinfield, C., Gray, R., & Lampe, C. (2011). Negotiating Privacy Concerns and Social Capital Needs in a Social Media Environment. In S. Treppe & L. Reinecke (Eds.), *Privacy Online: Perspectives on Privacy and Self-Disclosure in the Social Web* (pp. 19-32). Berlin: Springer.
- Etgar, M. (2008). A descriptive model of the consumer co-production process. *Journal of the Academy of Marketing Science*, 36(1), 97-108.
- Fuchs, C., Prandelli, E., & Schreier, M. (2010). The Psychological Effects of Empowerment Strategies on Consumers' Product Demand. *Journal of Marketing*, 74(1), 65-79.
- Haynes, P., & Nguyen, C., M-H. (2014). Rebalancing Socioeconomic Asymmetry in a Data-Driven Economy. In B. Bilbao-Osorio, S. Dutta & B. Lanvin (Eds.), *The Global Information Technology Report* (pp. 67-72). Geneva: World Economic Forum.
- Jussila, I., Tarkiainen, A., Sarstedt, M., & Hair, J. F. (2015). Individual Psychological Ownership: Concepts, Evidence, and Implications for Research in Marketing. *Journal of Marketing Theory and Practice*, 23(2), 121-139.
- Kang, J. (1998). Information Privacy in Cyberspace Transactions. *Stanford Law Review*, 50, 1193-1294.
- Kokolakis, S. (2017). Privacy attitudes and privacy behaviour: A review of current research on the privacy paradox phenomenon. *Computers & Security*, 64, 122-134.
- Lee, H., Park, H., & Kim, J. (2013). Why do people share their context information on Social Network Services? A qualitative study and an experimental study on users' behavior of balancing perceived benefit and risk. *International Journal of Human-Computer Studies*, 71(9), 862-877.
- Lusch, R. F., & Vargo, S. L. (2006). Service-dominant logic: reactions, reflections and refinements. *Marketing Theory*, 6(3), 281-288.
- Margulis, S. T. (1977). Conceptions of Privacy: Current Status and Next Steps. *Journal of Social Issues*, 33(3), 5-21.
- Narayanan, A., & Smatkov, V. (2010). Myths and fallacies of "Personally Identifiable Information". *Communications of the ACM*, 53(6), 24-26.
- Norberg, P. A., Horne, D. A., & Horne, D. R. (2009). Standing in the Footprint: Including the Self in the Privacy Debate and Policy Development. *Journal of Consumer Affairs*, 43(3), 495-515.
- Norberg, P. A., Horne, D. R., & Horne, D. A. (2007). The Privacy Paradox: Personal Information Disclosure Intentions versus Behaviors. *Journal of Consumer Affairs*, 41(1), 100-126.
- Pierce, J. L., Kostova, T., & Dirks, K. T. (2003). The state of psychological ownership: Integrating and extending a century of research. *Review of General Psychology*, 7(1), 84-107.
- Prahalad, C. K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. *Journal of Interactive Marketing*, 18(3), 5-14.

- Solove, D., J. (2006). A Taxonomy of Privacy. *University of Pennsylvania Law Review*, 154(3), 447-560.
- Spiekermann, S., & Korunovska, J. (2017). Towards a value theory for personal data. *Journal of Information Technology*, 32(1), 62-84.
- Tene, O. (2011). Privacy: The new generations. *International Data Privacy Law*, 1(1), 15-27.
- Thaler, R. H., & Tucker, W. (2013). Smarter information, smarter consumers. *Harvard Business Review*, January-February, 45-54.
- Valenzuela, S., Park, N., & Kee, K. F. (2009). Is There Social Capital in a Social Network Site?: Facebook Use and College Students' Life Satisfaction, Trust, and Participation1. *Journal of Computer-Mediated Communication*, 14(4), 875-901.
- Van Kleek, M., & Ohara, K. (2014). The Future of Social Is Personal: The Potential of the Personal Data Store. In D. Miorandi, V. Maltese, M. Rovatsos, A. Nijholt & J. Stewart (Eds.), *Social Collective Intelligence: Combining the Powers of Humans and Machines to Build a Smarter Society* (pp. 125-158). Cham: Springer.
- Vargo, S. L., & Lusch, R. F. (2004). Evolving to a New Dominant Logic for Marketing. *Journal of Marketing*, 68(1), 1-17.
- WEF. (2011). *Personal Data: The Emergence of a New Asset Class*. Geneva: World Economic Forum.
- WEF. (2013). *Unlocking the Value of Personal Data: From Collection to Usage*. Geneva: World Economic Forum.
- WEF. (2014). *Rethinking Personal Data: A New Lens for Strengthening Trust*. Geneva: World Economic Forum.
- Westin, A., F. (1967). *Privacy and Freedom*. New York: Athenaum.
- Whitley, E. A. (2009). Informational privacy, consent and the “control” of personal data. *Information Security Technical Report*, 14(3), 154-159.

Networks for Regional Sustainability: a Case Study Approach

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Abstract

Climate change is the biggest social challenge facing the globalised world. The aim of this paper is to investigate the requirements for governance structures in regional sustainability programmes against climate change.

The study is an explorative case study. It is based on a literature review and expert interviews. It also involves the participatory observation of working groups meetings, and a design thinking workshop.

In spite of their enormous importance, little is known about the institutional conditions of the regional governance of climate change projects in Germany.

For this reason, the research project focuses on the important aspect of networking and governance structures. Consequently, the investigation will contribute to answering the question of which institutional framework conditions can raise the likelihood of climate change projects having a sustainable effect.

The outcomes of the application

This research has not only practical implications for the single case. The exploration of the critical factors of success also offers other regions important food for thought in shaping their governance structures. In particular, the design thinking process and the business network in the District of Steinfurt offer valuable points of reference.

Keywords - Regional sustainability, Governance, Climate change, Design thinking, Social ecosystems

1 Introduction

The negative effects of the unchecked consumption of resources was described as early as in the Club of Rome's 1972 report "The Limits to Growth". The prophecy described in the report matches the climate change crisis facing us today.

Since the 1980s, the issue of climate change has increasingly been the subject of public discourse. In order to combat climate change, the sustainable use of resources is called for.

In the Brundtland Commission report, the term "sustainability" is transferred to socio-economic processes. The following line of action is stated in this report: "*Sustainable development is development that meets the needs of the present without compromising the*

ability of future generations to meet their own needs. (World Commission on Environment and Development 1987, p. 41).

For this reason, many cities, as well as regions, have made climate change one of their key political objectives. There are numerous party programmes, master plans, voluntary commitments, smart city initiatives, etc.

Most of the programmes target the following measures (Bierwirth and Schüle 2012):

- Climate-friendly mobility
- Switching to regenerative energies
- Food and consumption
- Waste prevention
- Landscape conservation
- Reduction of energy consumption, e.g. in the residential sector.

In the area of conflict between ecological, technical, economic and social requirements, many cities and regions are struggling to strike a suitable balance between conflicting interests (Auffhammer 2018; Kabisch et al. 2017; Batisha and Thomas 2015). In so doing, many experts argue that the energy transition is more a social than a technical challenge (Wittmayer and Loorbach 2016).

With most people, awareness of activities that harm the environment and the realisation that changes in behaviour are essential do not usually increase the likelihood that they will actually change their behaviour. The same applies to consumers, representatives of business, and politicians, just to name a few of the biggest stakeholder groups (Thaler and Sunstein 2008; Kahneman 2012; Pettman and Zabel 2005; Bang et al. 2000).

The core question is therefore: how can cities and regions stimulate and perpetuate sustainable behaviour? Global sustainability problems require a multiscale approach that can zoom in and out from the macro- to the meso- to the microlevel, and vice versa (Loorbach and Shiroyama 2016).

To enable cooperation between these different levels, it is essential to develop network and governance structures (Cadman et al. 2015; Davidson and Lockwood 2008; Loorbach and Shiroyama 2016; Orenstein and Shach-Pinsley 2017; Schmitter 2010; Sol et al. 2018). It is much easier to implement climate change projects at the city level than at the regional level (Dierwechter 2017; Ehnert et al. 2018; Frantzeskaki et al. 2017; Gatrell et al. 2016).

The particular challenge facing regions is that they can only lay down guidelines to their municipalities to a very limited extent. This means that a region's municipalities will usually pursue climate action initiatives on a voluntary basis.

Collaborative and participative modes of governing are advocated to address sustainable development problems that cross geographical and political boundaries and whose solution requires the coordination and integration of the activities of disparate sectors and actors, as well as the participation of all those affected. (Davidson and Lockwood 2008).

Brand/Warsewa (Stablo and Ruppert-Winkel 2017) developed key success factors for regional governance processes. According to the authors, it is fundamentally important to

gain the support of the highest administrative level and of charismatic leading figures (Ruppert-Winkel 2018; Orenstein and Shach-Pinsley 2017). It has also proven beneficial to ensure that projects are linked to concrete municipal problems, and that solutions can be expected. To achieve this, it is helpful for appealing lead projects, possibly involving local celebrities, to be effectively communicated to the public.

Ideally, an administrative unit acts as an organisational hub, which provides a service-oriented platform for cooperation, ensuring efficient process management, including controlling (Stablo and Ruppert-Winkel 2017).

2 The case study

In a bid to explore the specific conditions for successful regional sustainability programmes, a local authority, which can be regarded as a regional alliance, was selected as the case study. The district of Steinfurt in North Rhine-Westphalia, a predominantly rural district in northwest Germany with a population of 434,000, has 24 towns/cities and municipalities¹.

The Agenda 21 process was launched in the district of Steinfurt in 1999. As early as ten years ago, the *Kreistag* (district council) decided unanimously to adopt the goal of becoming energy self-sufficient by the year 2050 in the context of a climate change project. As a result, the implementation of the concept enjoyed official political legitimacy and was established at the highest level.

As one out of nineteen local authorities, Steinfurt was chosen by the Federal Ministry for the Environment to prove whether it is possible to reduce greenhouse gas emissions by ninety-five percent by 2050 and to cut in half final energy consumption².

To achieve the institutional anchoring of this goal, the Agenda 21 Office was transformed into the Office for Climate Protection and Sustainability in 2013. It has since become a nationally respected player in climate (Stablo and Ruppert-Winkel 2017).

The tasks of the Office for Climate Protection and Sustainability include³:

- Climate protection and climate change
- Development of renewable energies and energy efficiency
- Reinforcement of regional added value, regional marketing
- Development of rural areas
- Promotion of citizen responsibility.

In the District of Steinfurt, the goal of becoming energy self-sufficient is operationalised as follows: by 2050, all the energy required in the district is to be produced carbon-free and consumed locally, whilst reducing energy consumption by half.

¹ District of Steinfurt https://www.kreis-steinfurt.de/kv_steinfurt/Kreisportrait/St%C3%A4dte%20&%20Gemeinden/, 10 January 2019

² District of Steinfurt, Office for Climate Protection and Sustainability, https://www.kreis-steinfurt.de/kv_steinfurt/Kreisverwaltung/%C3%84mter/Amt%20f%C3%BCr%20Klimaschutz%20und%20Nachhaltigkeit/, 10 January 2019.

³ District of Steinfurt, Office for Climate Protection and Sustainability, https://www.kreis-steinfurt.de/kv_steinfurt/Kreisverwaltung/%C3%84mter/Amt%20f%C3%BCr%20Klimaschutz%20und%20Nachhaltigkeit/, accessed on 3 April 2019

In this way, the money spent on heat, fuel and electricity should remain in the region and create a “regional added value”.

On the way to becoming a climate-neutral district, the innovative capacity of the regional economy is to be improved at the same time, reinforcing the structural change. The climate change mitigation targets serve the further purpose of creating a distinct profile for the district, aspiring to set an example for “ethically responsible social life”.

The 100% Climate Protection Master Plan¹ represents an important conceptual foundation. This master plan, drawn up in 2013, was the result of cooperative teamwork between the Office for Climate Protection and Sustainability, climate change stakeholders from local authorities and regional utility companies, experts from Münster University of Applied Sciences, and external climate experts.

The climate change policy objectives were elaborated upon in the master plan:

- Induce change by launching exemplary climate change projects that are visible and tangible to the local population, and turn the experience gained from model projects into application-oriented principles.
- Gradually improve networking and the targeted management of all climate change stakeholders and projects in the district, and organise structures to enable stakeholders to learn from each other.
- Strengthen the options for action and the initiative of civil society in the district by providing appropriate input, and enable companies, associations and citizens to achieve their own goals and implement their own projects relating to climate change and sustainability.

3 Governance structures in the District of Steinfurt

Seeking to achieve these climate change goals, structures and networks have evolved comprising bodies such as work groups, round tables, committees and associations. Most of the coordination is undertaken by the Office for Climate Protection and Sustainability.

Due to its lack of authority over regional networks, when it came to climate issues, the District of Steinfurt immediately recognised the importance of participation, and was quick to involve local authorities, citizens and companies in the region’s energy transition.

3.1 Community wind farms

A higher-than-average number of wind turbines have been installed in the District of Steinfurt over the last 20 years. Whereas in other regions, the development of wind farms met with strong resistance from citizens and residents, the District of Steinfurt attached importance to early grassroots participation. Public participation explicitly includes citizens’ investment in the turbines, enabling them to benefit financially from renewable energies.

¹ The 100% Climate Protection Master Plan, https://www.kreis-steinfurt.de/kv_steinfurt/Kreisverwaltung/%C3%84mter/Amt%20f%C3%BCr%20Klimaschutz%20und%20Nachhaltigkeit/energieland2050%20e.V./Service/Informationsmaterial/Masterplanbericht_Langfassung%20.pdf, accessed on 8 April 2019

After intensive networking, the Office set up a Wind Energy Service Station, specifically for the purpose of mediating in case of conflict.

3.2 Participation portal

Climate change projects run by the district and participating local authorities can be presented and discussed on a GIS-based participation portal. Online maps enable users to view where and when certain projects or events are being planned, and how they can get involved¹.

3.3 Company network

On the corporate side, an alliance of more than sixty companies from the region evolved, known as the company network². Thematically, the network focuses on developing renewable energies and on increasing energy efficiency, covering the areas of electricity, heat and mobility. In the process, the company network seeks to involve as many actors as possible along the various value chains.

3.4 The “energieland2050” association

In the context of network management, particular importance is placed on the energieland2050 association, founded by the District of Steinfurt in 2017.

This network consists of representatives from the political sector, industry, academia, municipal utilities, civil society and the 24 cities and municipalities belonging to the district. Considerable importance is attached to public participation³.

The “energieland2050” association is directed at three main target groups:

- Municipalities
- Companies
- Citizens/consumers.

The company network finances half of the association, which now has nine employees. This public-private partnership is another cornerstone of the district’s governance strategy.

All 24 local authorities belonging to the district are supported by the “energieland2050” association by undertaking activities such as:

- Preparing joint campaigns
- Collecting data and undertaking potentials studies
- Fundraising
- Linking and qualifying municipal climate officers.

The district’s service-oriented networking activities also enable smaller local authorities to undertake local climate change projects, increasing the measures’ leverage.

¹ Participation portal of energieland2050, <https://energieland2050-dialog.de/>, accessed on 3 April 2019

² District of Steinfurt Company Network, https://www.kreis-steinfurt.de/kv_steinfurt/Kreisverwaltung/Ämter/Amt%20für%20Klimaschutz%20und%20Nachhaltigkeit/energieland2050%20e.V./Für%20Unternehmen/Unternehmernetzwerk/, accessed on 3 April 2019

³ <https://energieland2050-dialog.de/>, accessed 10 January 2019

A qualified advisory service is being established for companies and citizens under the name “energieland2050 consultants”. Freelance energy consultants who meet predefined quality criteria are permitted to use the trademarked name “energieland2050 Consultant”. The aim of introducing the “energieland2050” consulting brand is for the district to boost the role and profile of the region’s diverse consulting expertise for the region¹. Besides developing networks and implementing specific climate change projects, considerable importance is attached to public relations.

In order to motivate a region’s stakeholders to participate in governance processes, their interests and expectations of benefit need to be analysed in detail. Team spirit and coherent action can also be built by recognisable and identity-shaping communication that exerts an internal and an external effect. This is usually achieved with the use of an umbrella brand. The lack of official authority means that people must be motivated by symbolically communicating a common vision, and projects seeking to realise this vision.

There is a consensus that the better network partners’ needs have been analysed, the more likely it is that their behaviour can be influenced. In this context, the design thinking method offers new potential insights. Inspired by lifestyle research, this method focuses on developing representatives of certain target groups, referred to as personae, in an attempt to explore and extrapolate their behaviour.

3.5 Design thinking

As the term “design” suggests, design thinking was originally an innovation method for designing technical devices and user interfaces. However, large software companies such as Google, Apple and SAP are increasingly establishing design thinking as a method for systematically approaching complex problems from all walks of life. As such, the method takes the content and scope of the classic term “design” much further (Grots and Creuznacher 2016; Reinecke 2016; Plattner et al. 2018).

3.6 Principles

Unlike with technology-based methods of innovation, attention is centred on the user in this case (human-centred approach). The user’s needs and behaviour are the starting point and point of reference for the entire process (Schallmo 2017).

Another important characteristic is work in multidisciplinary teams. Unlike with many methods that foster creativity, which often occur within an unstructured process, design thinking pursues clearly defined process levels, sometimes involving strict time management. One important characteristic of the method is its use of iterative loops, i.e. the multiple repetition of stages to achieve a solution step by step (Plattner et al. 2011).

The work process involves several methods commonly used in innovation and creativity management, with the difference being that emphasis is placed on visualisation techniques (Poguntke 2016).

¹ energieland2050 consultants, https://www.kreis-steinfurt.de/kv_steinfurt/Kreisverwaltung/Ämter/Amt%20für%20Klimaschutz%20und%20Nachhaltigkeit/energieland2050%20e.V./Themen%20und%20Projekte/energieland2050%20Berater/, accessed on 3 April 2019

3.7 Process stages

The number of stages varies depending on the model; the six-stage process model based on Hasso Plattner Institute's School of Design Thinking is in widespread use.

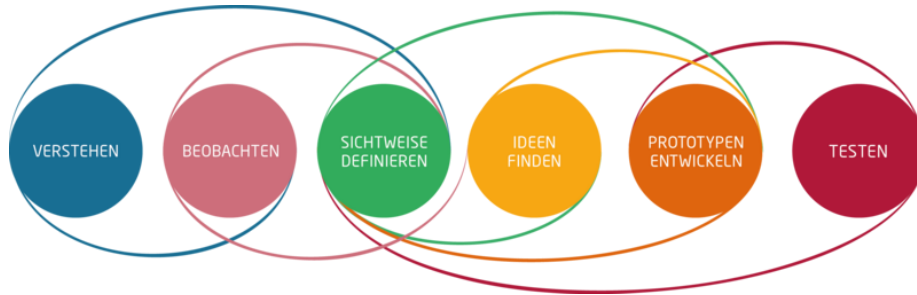


Figure 1. The design thinking stage model, Hasso Plattner Institute

At the first stage (“Verstehen”: “Understand”), the phenomenon to be addressed is described in detail. This description defines the framework for formulating a common understanding of the issue at hand. Another important goal at this stage is team building (Plattner et al. 2011).

At the second stage (“Beobachten”: “Observe”), teams view the matter under consideration from the perspective of the relevant user or person concerned. This stage involves “creating” what is referred to as a persona, who acts as a kind of representative for a certain target group. It is important to describe each persona in as much detail as possible: name, age, family situation, level of education, profession, interests, values and hobbies. Less tangible emotional aspects such as the persona’s dreams, unmet needs and problems are also described and visualised.

This approach enables players to “delve” emotionally into the individual’s lifeworld, seeing things from his or her perspective. The insights gained enable products and services to be created in such a way that best meets customers’ needs.

At the third stage (“Sichtweise definieren”: Define point of view”), the insights gained are gathered, structured and condensed to form a specific issue.

The fourth stage (“Ideen finden”: “Ideate”) involves the actual creative process. Participants switch from the “problem domain to the solution domain”, using various creativity techniques to generate as many ideas as possible.

The aim of subsequent prototyping (“Prototyp”: “Prototype”) is to visualise and materialise the idea, with the purpose of making it clearer and emotionally more comprehensible. Prototyping can be performed in very different ways: using drawings, Lego objects, card models or role play, to name a few.

At the last stage (“Test”), the prototype is tested to see whether it suits the relevant customer/user; it can then be adapted as required.

Principles of this method have already been used in urban planning for some time under the term “urban design thinking”, which involves the user-centred design of areas and districts (cf. for example (Dovey 2016; van Eijck et al. 2017). The City of Mannheim,

for instance, uses urban design thinking in its “Migrants4Cities” project to stimulate urban innovation by highly qualified migrants in a bid to achieve sustainable urban development.

3.8 Design thinking in the District of Steinfurt

As many studies have shown (cf. as representatives for many others: (Deffner et al. 2012; Ernst et al. 2016; Bang et al. 2000; Institut für Sozial-Ökologische Forschung 2010; Pettman and Zabel 2005), stakeholders from the Office for Climate Protection and Sustainability also assumed that the issue of climate change is too abstract for many people, bearing little relation to their personal daily lives.

For this reason, differentiated target group analyses are an essential prerequisite to identifying who is receptive to certain offers and solutions, and which problems they face. The Office for Climate Protection and Sustainability therefore decided to implement a design thinking process in 2015.

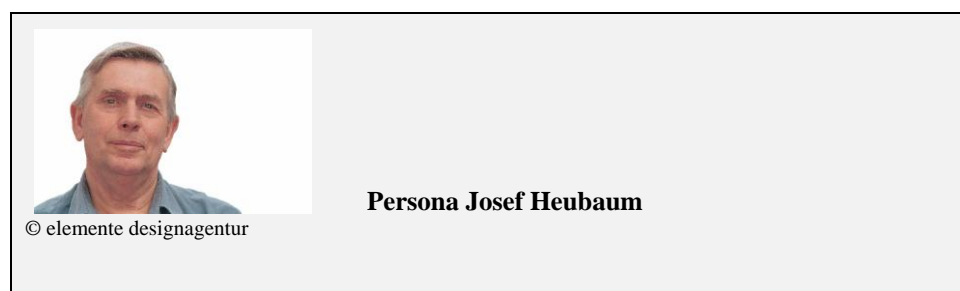
The situation analysis at the start of the process revealed that “energieland2050” was indeed known to experts as a vision of the future, but not to individuals in the region, apart from the closest network partners. Most were unaware of the added value that may be generated by participating in the project.

To gain a better understanding of the target groups, six design thinking workshops were held with different target groups¹.

The following six personae were selected and addressed:

- Climate officer / municipality
- Entrepreneur / energy industry
- Entrepreneur / craft industry
- Citizen / young person
- Citizen / woman with children
- Citizen / senior citizen 60+

One persona is presented as an example below. The persona Josef Heubaum was created in one design thinking workshop to represent the target group of craft industry entrepreneurs.



¹ The author participated in two of these workshops as an observer.

Characteristics:

Josef Heubaum is a 55-year-old craft entrepreneur. He is married, with three children. The master carpenter runs his own business and has 15 employees.

The following values are important to him in life:

- Tradition
- Thrift
- Home region
- Family
- Quality.

His work-related problems include:

- A latent fear of losing his livelihood, despite having full order books
- Fear of big competitors (IKEA, Finke etc.)
- Uncertainty caused by continuous change processes.

In his company, Josef Heubaum places great importance on quality. All the same, he is not a committed environmental activist.

The following goal was formulated: to persuade him to seek support from an energieland2050 Consultant in making his company more environmentally friendly.

This could include the following measures:

- Having a photovoltaic system installed on the roof
- Purchasing vehicles with emissions in mind
- Purchasing/supplying regionally.

The following communication goal was formulated: to persuade him to be an “energieland2050 ambassador” so that he would share his experience within his networks and spread his knowledge.

In order to achieve these goals, the participants first looked at what had so far prevented him from participating in the “energieland2050” network.

The following reasons were elaborated during the workshops:

- A lack of time (it is not his core business)
- No legal obligation to behave green
- A lack of personnel
- A general feeling of scepticism towards the public sector (Office for Climate Protection and Sustainability)
- A lack of cost pressure
- The previous appeal was not direct enough
- A lack of information.

Building on this analysis, the workshop participants thought about the ideas and messages that could be used to reach the persona Josef Heubaum:

- “As a craftsman, you are part of the energy transition, and can earn money from it.”
- “From the region for the region.”
- “So that your grandchildren can have a good life here, too.”
- “Give something back to your home region”

It was also considered important to establish access to the networks and multipliers of the target group. If the associations and institutions to which Josef Heubaum belongs were involved in the project, this could increase his trust and confidence in the project. The company network would be the ideal connecting factor.

Similar analyses were conducted along the stages of the design thinking process for the other five personae, and ideas were developed. These ideas formed the basis for fleshing out concrete measures and developing an umbrella brand concept.

4 Conclusion

The success factors for regional governance projects mentioned at the beginning of the paper are applicable in essential respects to the District of Steinfurt. The early resolution by the *Kreistag* (2010) gave the work of the Office for Climate Protection and Sustainability political legitimacy, and established it at the highest level.

The Office for Climate Protection and Sustainability acts as a coordinating office that helps network partners to achieve their own goals and reach their target groups, increasing the measures' leverage. In addition, impetus is continuously provided to support the partners' self-organisation and to transform loose networks into permanent entities, as was the case with the launch of the "energieland2050" association as a public private partnership.

According to the initiators¹ and the participants², the design thinking method was classed as appropriate for developing target group-oriented activities and an umbrella term concept.

Many of the projects build on local projects, and are designed to be participatory from the very beginning. As a result, they theoretically encourage the involvement of a wide range of actors. However, citizens are still largely unaware of the "energieland2050" brand. One reason for this is the difficulty in communicating measures to a predominantly rural administrative district³.

Communication about the umbrella brand declined substantially after the funding ended, meaning that there was no longer sufficient accompanying communication about the initiative. This is particularly due to the fact that the local authorities make no or little use of the umbrella brand in their communication activities.

An important research issue for the future is to determine whether the structures that have now been created (energieland2050, company network, etc.) suffice in order to ensure the work of the climate projects in the long term, or whether the Office for Climate Protection and Sustainability will need to continue providing support.

The actual question of whether local citizens' behaviour has changed due to the activities outlined would have to be evaluated in the context of an extensive empirical analysis, which has yet to be undertaken.

References

- Auffhammer, Maximilian (2018): Quantifying Economic Damages from Climate Change. In *Journal of Economic Perspectives* 32 (4), pp. 33–52. DOI: 10.1257/jep.32.4.33.
- Bang, Hae-Kyong; Ellinger, Alexander E.; Hadjimarcou, John; Traichal, Patrick A. (2000): Consumer concern, knowledge, belief, and attitude toward renewable energy: An application of the reasoned action theory. In *Psychol. Mark.* 17 (6), pp. 449–468. DOI: 10.1002/(SICI)1520-6793(200006)17:6<449::AID-MAR2>3.0.CO;2-8.

¹ Interview with an employee of the Office for Climate Protection and Sustainability (2016).

² Interview with the external process facilitator (2015).

³ Interview with an employee of the Office for Climate Protection and Sustainability (2017).

- Batisha, Ayman; Thomas, Ken D. (Eds.) (2015): Handbook of Research on Sustainable Development and Economics: IGI Global (Practice, Progress, and Proficiency in Sustainability).
- Bierwirth, Anja; Schüle, Ralf (2012): Kommunaler Klimaschutz : ein Konzept ist nicht genug! In Raumplanung (162), pp. 15–18.
- Cadman, Tim; Hume, Margee; Maraseni, Tek; Lopez-Casero, Federico (2015): Developing Sustainable Governance Systems at the Regional Level. The case of emissions trading. In Ayman Batisha, Ken D. Thomas (Eds.): Handbook of Research on Sustainable Development and Economics, vol. 2: IGI Global (Practice, Progress, and Proficiency in Sustainability), pp. 248–266.
- Davidson, Julie; Lockwood, Michael (2008): Partnerships as Instruments of Good Regional Governance: Innovation for Sustainability in Tasmania? In Regional Studies 42 (5), pp. 641–656. DOI: 10.1080/00343400701543165.
- Deffner, Jutta; Stieß, Immanuel; Reisenauer, Sylke (2012): Neue Wege in der Kommunikation energetischer Sanierung für Eigenheimbesitzer/innen. Konzeptbausteine für eine integrierte Kommunikations- Marketingstrategie mit dem Schwerpunkt auf dialogischen Maßnahmen. Institut für Sozial-Ökologische Forschung. Frankfurt am Main (ISOE-Studientexte, Nr. 19).
- Dierwechter, Yonn (2017): Urban sustainability through smart growth. Intercurrence, planning, and geographies of regional development across Greater Seattle. Cham: Springer (The urban book series).
- Dovey, Kim (2016): Urban design thinking. A conceptual toolkit. London, Oxford, New York, New Delhi, Sydney: Bloomsbury Academic.
- Ehnert, Franziska; Frantzeskaki, Niki; Barnes, Jake; Borgström, Sara; Gorissen, Leen; Kern, Florian et al. (2018): The Acceleration of Urban Sustainability Transitions: A Comparison of Brighton, Budapest, Dresden, Genk, and Stockholm. In Sustainability 10 (3), p. 612. DOI: 10.3390/su10030612.
- Ernst, Andreas; Hunecke, Marcel; Rennings, Klaus; Stieß, Immanuel; Briegel, Ramón; David, Martin; Kassel University Press GmbH (2016): Individuelles Umwelthandeln und Klimaschutz (IndUK) – Sach und Schlussbericht : Ergebnisintegration und transdisziplinäre Verwertung von Erkenntnissen aus der SÖF-Forschung zu den sozialen Dimensionen von Klimaschutz und Klimawandel : Projektlaufzeit: 01.04.2014-31.12.2014. Kassel: University Press (CESR-Paper).
- Frantzeskaki, Niki; Borgström, Sara; Gorissen, Leen; Egermann, Markus; Ehnert, Franziska (2017): Nature-Based Solutions Accelerating Urban Sustainability Transitions in Cities: Lessons from Dresden, Genk and Stockholm Cities. In Nadja Kabisch, Horst Korn, Jutta Stadler, Aletta Bonn (Eds.): Nature-based Solutions to Climate Change Adaptation in Urban Areas. Linkages between Science, Policy and Practice, vol. 51. Cham: Springer International Publishing; Springer Open (Theory and Practice of Urban Sustainability Transitions), pp. 65–88.
- Gatrell, Jay D.; Jensen, Ryan R.; Patterson, Mark W.; Hoalst-Pullen, Nancy (Eds.) (2016): Urban Sustainability: Policy and Praxis. 1st ed. 2016. Cham: Springer (Geotechnologies and the Environment, 14). Available online at <http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&AN=1175147>.
- Grots, Alexander; Creuznacher, Isabel (2016): Design Thinking: Process or Culture? A Method for Organizational Change. In Walter Brenner, Falk Uebernickel (Eds.): Design Thinking for Innovation. Research and Practice. 1st ed. 2016. Cham, s.l.: Springer International Publishing, pp. 183–191.
- Institut für Sozial-Ökologische Forschung (2010): Handlungsmotive, -hemmnisse und Zielgruppen für eine energetische Gebäudesanierung : Ergebnisse einer standardisierten Befragung von Eigenheimsanierern. Frankfurt am Main: Technische Informationsbibliothek u. Universitätsbibliothek.

- Kabisch, Nadja; Korn, Horst; Stadler, Jutta; Bonn, Aletta (Eds.) (2017): *Nature-based Solutions to Climate Change Adaptation in Urban Areas. Linkages between Science, Policy and Practice*. Cham: Springer International Publishing; Springer Open (Theory and Practice of Urban Sustainability Transitions). Available online at <http://dx.doi.org/10.1007/978-3-319-56091-5>.
- Kahneman, Daniel (2012): *Thinking, fast and slow*. London: Penguin Books.
- Loorbach, Derk; Shiroyama (2016): *The Challenge of Sustainable Urban Development and Transforming Cities*. In Derk Loorbach, Julia M. Wittmayer, Hideaki Shiroyama, Junichi Fujino, Satoru Mizuguchi (Eds.): *Governance of urban sustainability transitions. European and Asian experiences*. Tokyo, Heidelberg, New York, Dordrecht, London: Springer (Theory and Practice of Urban Sustainability Transitions), pp. 3–25.
- Orenstein, Daniel E.; Shach-Pinsley, Dalit (2017): *A Comparative Framework for Assessing Sustainability Initiatives at the Regional Scale*. In *World Development* 98, pp. 245–256. DOI: 10.1016/j.worlddev.2017.04.030.
- Pettman, Barrie; Zabel, Hans-Ulrich (2005): *A model of human behaviour for sustainability*. In *International Journal of Social Economics* 32 (8), pp. 717–734. DOI: 10.1108/03068290510608228.
- Plattner, Hasso; Meinel, Christoph; Leifer, Larry (Eds.) (2018): *Design Thinking Research. Making Distinctions: Collaboration versus Cooperation*. Cham: Springer International Publishing (Understanding Innovation). Available online at <http://dx.doi.org/10.1007/978-3-319-60967-6>.
- Plattner, Hasso; Meinel, Christoph; Weinberg, Ulrich (2011): *Design Thinking. Innovation lernen - Ideenwelten öffnen*. Nachdr. München: mi-Wirtschaftsbuch.
- Poguntke, Sven (2016): *Corporate Think Tanks. Zukunftsforen, Innovation Center, Design Sprints, Kreativsessions & Co. 2., überarbeitete und erweiterte Auflage*. Wiesbaden: Springer Gabler.
- Reinecke, Sven (2016): *What is it that Design Thinking and Marketing Management can learn from each other?* In Walter Brenner, Falk Uebernickel (Eds.): *Design Thinking for Innovation. Research and Practice*. 1st ed. 2016. Cham, s.l.: Springer International Publishing, pp. 151–162.
- Ruppert-Winkel, Chantal (2018): *Leaders, networks and the social context: A relational leadership approach to regional renewable energy self-sufficiency*. In *Journal of Cleaner Production* 193, pp. 811–832. DOI: 10.1016/j.jclepro.2018.05.001.
- Schallmo, Daniel R.A. (2017): *Design Thinking erfolgreich anwenden. So entwickeln Sie in 7 Phasen kundenorientierte Produkte und Dienstleistungen*. Wiesbaden: Springer Fachmedien.
- Schmitter, Philippe C. (2010): *Governance arrangements for sustainability: a regional perspective*. In *Corporate Governance* 10 (1), pp. 85–96. DOI: 10.1108/14720701011021139.
- Sol, Jifke; van der Wal, Merel M.; Beers, Pieter Jelle; Wals, Arjen E.J. (2018): *Reframing the future: the role of reflexivity in governance networks in sustainability transitions*. In *Environmental Education Research* 24 (9), pp. 1383–1405. DOI: 10.1080/13504622.2017.1402171.
- Stablo, Järmo; Ruppert-Winkel, Chantal (2017): *Mit Good Regional Governance zur nachhaltigen Energiewende? Das Beispiel des Kreises Steinfurt in Deutschland*. In Jana Rückert-John, Martina Schäfer (Eds.): *Governance für eine Gesellschaftstransformation. Herausforderungen des Wandels in Richtung nachhaltige Entwicklung*. Wiesbaden: Springer VS (Innovation und Gesellschaft), pp. 161–188.
- Thaler, Richard H.; Sunstein, Cass R. (2008): *Improving decisions about health, wealth and happiness*. Illustrated ed. New Haven: Yale University Press; [distributor] John Wiley and Sons Ltd.
- van Eijck, Guido; Kums, Marieke; Lofvers, Willemijn; Naafs, Saskia; van Spaandonk, Thijs; Steketee, Ady; Ziegler, Franz (2017): *Urban challenges, resilient solutions. Design thinking*

for the future of urban regions. English edition. Edited by Tijs van den Boomen, Eric Frijters, Sandra van Assen, Marco Broekman. [Haarlem]: TrancityxValiz.

Wittmayer, Julia M.; Loorbach, Derk (2016): Fostering Alternative Ideas, Practices, and Social Relations Through Transition Management. In Derk Loorbach, Julia M. Wittmayer, Hideaki Shiroyama, Junichi Fujino, Satoru Mizuguchi (Eds.): Governance of urban sustainability transitions. European and Asian experiences. Tokyo, Heidelberg, New York, Dordrecht, London: Springer (Theory and Practice of Urban Sustainability Transitions), pp. 13–32.

Internet resources

District of Steinfurt https://www.kreis-steinfurt.de/kv_steinfurt/Kreisportrait/St%C3%A4dte%20&%20Gemeinden/, 10 January 2019

District of Steinfurt, Office for Climate Protection and Sustainability, https://www.kreis-steinfurt.de/kv_steinfurt/Kreisverwaltung/%C3%84mter/Amt%20f%C3%BCr%20Klimaschutz%20und%20Nachhaltigkeit/, 10 January 2019.

District of Steinfurt, Office for Climate Protection and Sustainability, https://www.kreis-steinfurt.de/kv_steinfurt/Kreisverwaltung/Ämter/Amt%20für%20Klimaschutz%20und%20Nachhaltigkeit/, accessed on 3 April 2019

The 100% Climate Protection Master Plan, https://www.kreis-steinfurt.de/kv_steinfurt/Kreisverwaltung/%C3%84mter/Amt%20f%C3%BCr%20Klimaschutz%20und%20Nachhaltigkeit/energieland2050%20e.V./Service/Informationsmaterial/Masterplanbericht_Langfassung%20.pdf, accessed on 8 April 2019

Participation portal of energieland2050, <https://energieland2050-dialog.de/>, accessed on 3 April 2019

District of Steinfurt, Company Network, https://www.kreis-steinfurt.de/kv_steinfurt/Kreisverwaltung/Ämter/Amt%20für%20Klimaschutz%20und%20Nachhaltigkeit/energieland2050%20e.V./Für%20Unternehmen/Unternehmernetzwerk/, accessed on 3 April 2019

District of Steinfurt, energieland2050 consultants, https://www.kreis-steinfurt.de/kv_steinfurt/Kreisverwaltung/Ämter/Amt%20für%20Klimaschutz%20und%20Nachhaltigkeit/energieland2050%20e.V./Themen%20und%20Projekte/energieland2050%20Berater/, accessed on 3 April 2019

Stakeholders' Voices. Knowledge Transfer towards Public Administration

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Abstract

Knowledge is a strategic tool for public administration. Therefore, knowledge management would affect organizational effectiveness. In the context of the new approaches of public management, especially considering the public value management point of view, knowledge transfer with stakeholders should be the norm. The present study identified a gap in the academic literature in relation to stakeholder management practices and how do public bodies involve their stakeholders in the decision-making processes. The paper proposes several lines of mapping the interactions between public administration and its stakeholders by considering the value attributed to stakeholders, the awareness of their needs and desires, as well as the degree of involvement into the decision-making processes.

Keywords – knowledge management, knowledge transfer, stakeholder management, stakeholder mapping, public administration

Paper type – Academic Research Paper

1 Introduction

Knowledge management in public administration has been the aim of increasingly more academic papers in the past decades (see for instance some of the recent literature reviews undergone by Biswas, Khan and Biswas, 2017; Massaro, Dumay and Garlatti, 2015; McEvoy, Ragab and Arisha, 2017; Laihonon and Mäntylä, 2018). A relatively large

amount of the literature in the field is dedicated to knowledge transfer (Amayah, 2013; Chen and Hsieh, 2015; Pee and Kankanhalli, 2016; Sandhu, Jain and Ahmad, 2011; Tangaraja et al., 2015). Knowledge transfer, both inside and outside a public organization, is stimulated by the new approaches in public management, which make these organizations not only more transparent and accountable, but also more connected to its stakeholders and eager to cooperate for the benefit of the communities it serves.

Public organizations adopt a multi-actor perspective (Osborne, 2010), leading to setting up dynamic networks aiming a wide common welfare. When we consider smart cities, the relevance of knowledge and the need of knowledge sharing – both ways from and towards public organizations – is even more evident (Pinzaru, Zbucnea and Vitelar, 2018). In the context of knowledge management and new public management approaches, stakeholders are increasingly more relevant (Bingham, Nabatchi and O'Leary, 2005; Riege and Lindsay, 2006). By involving stakeholders, the new public management strategies lead to co-creation, more effective programs and better impact in the communities (see for instance Black and Gallan, 2015; Bovaird and Loeffler, 2012; Bryson, Sancino, Benington and Sørensen, 2017; Osborne, Radnor and Strokosch, 2016). Another relevant aspect is the facilitation of knowledge transfer from stakeholders to public administration. Having this in mind, the literature in knowledge management focuses in a significant degree on stakeholder management (see, for instance, Bourgon, 2007; Butler et al., 2008; Richards and Duxbury, 2014; Riege and Lindsay, 2006).

Investigating the literature in the field of public management, one observes, that even the importance of its stakeholders is recognized, the studies focusing primarily on stakeholder management are lacking. Therefore, the present study aims to contribute to covering part of the gap by understanding how does public administration involve stakeholders in its decision-making processes. By scrutinizing the literature, we develop hypothesis to be tested in subsequent research.

2 Understanding the role of public administration within society

Today, managing complexity does not rely any more exclusively on virtues of public management but requires that all stakeholders are able to promote exchange, collaboration and cooperation building social, knowledge-oriented and public value-driven networks within social ecosystems. Public organizations should follow the public value view to shape strategy and action within ecosystems by engaging stakeholders and involving civil society as a proactive actor in constructing governance within public-private networks for shared and common partnerships. Creating and maintaining public value relies on sustaining a networked governance that supports multilateral cooperation to cope with changing contexts (Hartley, 2005).

Public value is created in relationships in which the public is involved to act for and benefit of value creation (Meynardt, 2009). Increasingly, value creation is emerging within service networks because customer participation supports mutual relationship with a provider as a condition to unlock the potential of value co-creation (Black and Gallan, 2015). Public administration should adopt a public value management view to value

creation process within society (Stoker, 2006) meeting public needs and promoting the public interest as the result of a dialogue, developing policies as an issue of collaborative processes that contribute to designing trust-based relationships and planning successful action in long-terms (Denhardt and Denhardt, 2000).

Creating public value relies on reinforcing networks of social ties where public administration interacts with stakeholders within community in order to facilitate public wealth (Borgonovi, 2001) and contribute to services delivery by sustaining the relationships with multiple inter-dependent actors, inform the policy making systems promoting multiple processes (Osborne, 2006). In public service delivery, strengthening cooperation and partnerships facilitates trust and conflict reduction in relational exchange, helps reveal both transformational approach to service improvement and distinctive competencies (Entwistle and Martin, 2005). Public administration should face uncertainty by engaging with external stakeholders looking at an ecosystem perspective in order to better support public governance (Dumay, Guthrie and Farneti, 2010; Osborne, 2006).

In following a public value management view, public administration should consider the relationships as dominant focus because «government activity is interconnected and interdependent and, as such, may require more collaborative effort in the pursuit of public value» (O'Flynn, 2007, p. 361). Value creation relies on following a multi-actor perspective that implies to interpret differences among actors, levels, spheres and logics and to consider how to develop capacity and agreement about co-producing public value by obtaining authorization and legitimation (Bryson, Benington, Sancino and Sørensen, 2017). Public administration should strengthen collaboration with citizens as partners as related to «active, bidirectional act of participation, involvement, and unification of forces between two (or more) parties» (Vigoda, 2002, p. 527). Public administration should serve the public interest engaging stakeholders in sustaining information and knowledge sharing to develop successful cooperation enhancing responsiveness within society (Bryer, 2006). Sustaining governance helps dialogue between stakeholders and public organizations as key source to construct transparent processes that enable effective two-way knowledge transfer and lead to sustainable policy solutions (Riege and Lindsay, 2006).

H1: The more public administration values its stakeholders, the more their input is incorporated in its policies and actions.

3 Stakeholder management within public administration

3.1 The relevance of stakeholder management in public organizations

Public administration is operating for the benefit of the wider public, its stakeholders. Therefore, the success of the implemented strategies and projects should be evaluated by these stakeholders. Nevertheless, this process is not simple considering the variety of stakeholders, and their various relationships with the public body. For better management, stakeholders should be understood. They should be analyzed and mapped.

The stakeholders' theory is still evolving, with different aspects to be developed: despite attempts in proposing stakeholder homogeneity and independence models (Fassin, 2008, 2009), there is no robust stakeholder theory model to be generally recognized (Wagner Mainardes, Alves and Raposo, 2011). Moreover, there is a body of work to be done on practical aspects of the stakeholders mapping approaches, from the inherent conflicts (and how to deal with them), to the direct relationship between the stakeholders' management and the organizational efficiency (Wagner Mainardes, Alves and Raposo, 2011).

Identifying, mapping and managing stakeholders of the public administration are activities discussed mainly from the perspective of efficiency (Bryson, 2004; Meynhardt, 2009), of large scale programs involving different institutions (Heikkila and Gerlak, 2005), of the change management strategies and techniques (Rainey and Fernandez, 2006) and of the knowledge management paradigm (Riege and Lindsay, 2006). Stakeholder management is understood as a part of the strategic management in the case of the public organizations that develop performance management strategies (Isaac Mwitta, 2000; Verbeteen, 2008), and evidence from practice highlights the complexity of stakeholders' understanding and mapping (McAdam, Hazlett and Casey 2005; Bovaird, 2005; Williams & Lewis, 2008).

As for the practice, the human resources paradigm provides managers from the public institutions with four major dimensions to understand and map stakeholders: the functional role (the position of the individual stakeholder), his/her interests, the means of action at its disposal and the justifying principle (Ferrary, 2005). The most recent discussions on the topic are developed from the perspective of collaborative projects (Bryson et al., 2013), pointing out the need to design flexible inclusive processes in which stakeholders can be involved, as well as the need of a flexible power dynamics' management (Bryson et al., 2013). Even if there is an academic trend to model the usage of technology, more specifically of the digital one in all aspects of management - the one of the public administration included -, it should be seen more like a tool to efficiently manage specific activities such as communicating with stakeholders and boosting their engagement (Bryson et al., 2013).

H2: The more public administration is aware of its stakeholders, the more efficient it is.

3.2 Involving stakeholders in the decision-making processes of public administration

Knowledge transfer is a relevant subject for knowledge management in public administration, which determined a relatively high segment of the studies in the field - around 15% - being dedicated to it (McEvoy, Ragab, and Arisha, 2017). These studies present a complex image of knowledge sharing within and outside the public administration, considering both internal and external factors, both human and organizational ones (Pinzaru, Zbucnea and Vitelar, 2018, p.701).

A prerequisite for involving stakeholders in the decision-making processes would be to encourage knowledge transfer and cooperation across the boundaries of the public body (Wiig, 2002). Designing an "Intelligent Organizational Behavior" also facilitates it.

This leads to implementing an active KM strategy, encompassing the development of a learning organization, knowledge acquisition and packaging, organization architecture and process redesign (Wiig, 2002). Therefore, knowledge transfer is not a simple state of mind; it involves a certain strategical organizational framework. It also needs organizational capabilities and infrastructure.

Knowledge transfer in public organizations is also influenced by their senior managers (Currie, Waring and Finn, 2008; Dawes, Cresswell and Pardo, 2009; Handzic, 2011; Pee and Kankanhalli, 2016). The impact of senior management could be either formalized in a shared vision, processes and actions, or could be less formal, based on example and encouragement of knowledge transfer.

H3a: Strong leadership support for knowledge transfer enhances the reception and use of stakeholders' inputs in the decision-making processes of public administration.

Knowledge Management is strongly influenced in public organizations by the organizational culture (Riege and Lindsay, 2006). Therefore, best practices of involving stakeholders into the decision-making processes should be associated with a knowledge management – connected organizational culture. A mediating factor seems to be the accountability and transparency culture (Riege and Lindsay, 2006, p.26). The need to involve stakeholders into the decision-making processes is acknowledged (Rod, 2006; Rybakovas, 2007). Nevertheless, it is not necessary the norm.

We also stress that the transfer of knowledge between public bodies and their stakeholders is a two-ways process and tacit knowledge is at the core of this process (Riege and Lindsay, 2006, pp.27-28).

H3b: Organizations with stronger awareness of their stakeholders involve them more in the decision-making processes.

4 Conclusions

There is a limited body of literature helping public administration better involve stakeholders in the decision-making processes (Riege and Lindsay, 2006, p.37), although this is a trendy recommendation in the public administration management theory. In the same time, public managers should also be cautious and consider the limits and risks associated to involving citizens and other stakeholders into the decision-making processes (Irvin and Stansbury, 2004).

Involving stakeholders in public administration strategies and projects leads to co-creation and increased public value, possibly to social innovation. Also, the effectiveness of the activity of a public body would increase by stakeholders' involvement and by considering their voice in the decision-making process. In this way, the needs and desires of the public would be, theoretically, better addressed and the beneficiaries would be more satisfied. In practice, the processes of stakeholder management and involvement are not so smooth.

Knowledge transfer between public administration and its stakeholders depends on many different factors. Previous studies suggest that the stronger the awareness of their

stakeholders, the more public administration takes them as points of reference, considers them as partners and involves them into the decision-making processes. This process is in a wide degree influenced by the attitude of the senior leadership.

References

- Amayah, A.T., (2013) "Determinants of knowledge sharing in a public sector organization", *Journal of Knowledge Management*, Vol. 17, No. 3, pp. 454-471.
- Bingham, L. B., Nabatchi, T., and O'Leary, R., (2005) "The new governance: Practices and processes for stakeholder and citizen participation in the work of government", *Public Administration Review*, Vol. 65, No.5, pp. 547-558.
- Biswas, S., Khan, A. and Biswas, S.K., (2017) "The prospect of adopting knowledge management in public service organisations: evidence from a developing country", *European Journal of Research and Reflection in Management Sciences*, Vol 5, No. 3, pp. 51-68.
- Black, H.G. and Gallan, A.S., (2015) "Transformative service networks: cocreated value as well-being", *Service Industries Journal*, Vol. 35, No. 15-16, pp. 826-845.
- Borgonovi, E., (2001) "Il Concetto di Valore Pubblico", *Azienda Pubblica*, Vol. 14, pp. 185-188.
- Bourgon, J., (2007) "Responsive, responsible and respected government: towards a New Public Administration theory", *International Review of Administrative Sciences*, Vol 73, No. 1, pp. 7-26.
- Bovaird, T., (2005) "Public governance: balancing stakeholder power in a network society", *International Review of Administrative Sciences*, Vol.71, No.2, pp. 217-228.
- Bovaird, T. and Loeffler, E., (2012) "From Engagement to Co-production: The Contribution of Users and Communities to Outcomes and Public Value", *Voluntas*, Vol. 23, No. 4, pp. 1119-1138.
- Bryer, T.A., (2006) "Toward a Relevant Agenda for a Responsive Public Administration", *Journal of Public Administration Research and Theory*, Vol. 17, No. 3, pp. 479-500.
- Bryson, J.M., (2004) "What to do when stakeholders matter: stakeholder identification and analysis techniques", *Public Management Review*, Vol.6, No.1, pp. 21-53.
- Bryson, J., Benington, J., Sancino, A. and Sørensen, E., (2017) "Towards a Multi-Actor Theory of Public Value Co-Creation", *Public Management Review*, Vol. 19, No. 5, pp. 640-654.
- Bryson, J., Sancino, A., Benington, J., and Sørensen, E., (2017). "Towards a multi-actor theory of public value co-creation", *Public Management Review*, Vol.19, No.5, pp. 640-654.
- Bryson, J.M., Quick, K.S., Slotterback, C.S. and Crosby, B.C., (2013) "Designing public participation processes", *Public Administration Review*, Vol.73, No.1, pp. 23-34.
- Butler, T., Feller, J., Pope, A., Emerson, B., and Murphy, C., (2008) "Designing a core IT artefact for Knowledge Management Systems using participatory action research in a government and a non-government organisation", *Journal of Strategic Information Systems*, Vol 17, No. 4, pp. 249-267.
- Chen, C.A. and Hsieh, C.W., (2015) "Knowledge sharing motivation in the public sector: the role of public service motivation", *International Review of Administrative Sciences*, Vol 81, No. 4, pp. 812-832.
- Currie, G., Waring, J., and Finn, R., (2008) "The Limits of Knowledge Management for UK Public Services Modernization: The Case of Patient Safety and Service Quality", *Public Administration*, Vol.86, No.2, pp. 363-385.
- Dawes, S.S., Cresswell, A.M., and Pardo, T.A., (2009) "From "Need to Know" to "Need to Share": Tangled Problems, Information Boundaries, and the Building of Public Sector Knowledge Networks", *Public Administration Review*, Vol.69, No.3, pp. 392-402.

- Denhardt, R.B. and Denhardt, J.V., (2000) "The New Public Service: Serving Rather than Steering", *Public Administration Review*, Vol. 60, No. 6, pp. 549-559.
- Dumay, J., Guthrie, J. and Farneti, F., (2010) "GRI Sustainability Reporting Guidelines for Public and Third Sector Organizations. A critical review", *Public Administration Review*, Vol. 12, No. 4, pp. 531-548.
- Entwistle, T. and Martin, S., (2005) "From Competition to Collaboration in Public Service Delivery; a New Agenda for Research", *Public Administration*, Vol. 83, No. 1, pp. 233-242.
- Fassin, Y., (2008) "Imperfections and shortcomings of the stakeholder model's graphical representation", *Journal of Business Ethics*, Vol. 80, No. 1, pp. 879-888.
- Fassin, Y., (2009) "The stakeholder model refined", *Journal of Business Ethics*, Vol. 84, No. 1, pp. 113-135.
- Ferrary, M., (2005) A stakeholder perspective of human resource management, in *Stakeholder Theory*, Palgrave Macmillan, London, pp. 104-124
- Handzic, M., (2011) "Integrated Socio-Technical Knowledge Management Model: An Empirical Evaluation", *Journal of Knowledge Management*, Vol.15, No.2, pp. 198-211.
- Hartley, J., (2005) "Innovation in Governance and Public Services: Past and Present", *Public Money and Management*, Vol. 25, No. 1, pp. 27-34.
- Heikkilä, T. and Gerlak, A.K., (2005) "The formation of large-scale collaborative resource management institutions: Clarifying the roles of stakeholders, science, and institutions", *Policy Studies Journal*, Vol.33, No.4, pp. 583-612.
- Irvin, R.A. and Stansbury, J., (2004) "Citizen participation in decision making: is it worth the effort?", *Public Administration Review*, Vol.64, No.1, pp. 55-65.
- Isaac Mwita, J., (2000) "Performance management model: A systems-based approach to public service quality", *International Journal of Public Sector Management*, Vol.13, No.1, pp. 19-37.
- Laihonen, H. and Mäntylä, S., (2018) "Strategic knowledge management and evolving local government", *Journal of Knowledge Management*, Vol. 22, No.1, pp. 219-234.
- Massaro, M., Dumay, J. and Garlatti, A., (2015) "Public sector knowledge management: A structured literature review", *Journal of Knowledge Management*, Vol 19, No 3, pp. 530-558.
- McAdam, R., Hazlett, S. A., & Casey, C., (2005) "Performance management in the UK public sector: addressing multiple stakeholder complexity", *International Journal of Public Sector Management*, Vol.18, No.3, pp. 256-273.
- McEvoy, P., Ragab, M. and Arisha, A., (2017) "Review on the KM Applications in Public Organisations", *Electronic Journal of Knowledge Management*, Vol 15, No 1, pp. 37-48.
- Metaxiotis, K. and Ergazakis, K., (2008) "Exploring stakeholder knowledge partnerships in a knowledge city: a conceptual model", *Journal of Knowledge Management*, Vol. 12, No. 5, pp. 137-150.
- Meynardt, T., (2009) "Public Value Inside: What is Public Value Creation?", *International Journal of Public Administration*, Vol. 32, No. 3-4, pp. 192-219.
- O'Flynn, J., (2007) "From New Public Management to Public Value: Paradigmatic Change and Managerial Implications", *Australian Journal of Public Administration*, Vol. 66, No. 3, pp. 353-356.
- Osborne, S.P., (2006) "The New Public Governance", *Public Management Review*, Vol. 8, No. 3, pp. 377-387.
- Osborne, S.P., (2010) "Delivering public services: Time for a new theory?", *Public Management Review*, Vol 12 No. 1, pp. 1-10.
- Osborne, S.P., Radnor, Z. and Strokosch, K., (2016) "Co-Production and the Co-Creation of Value in Public Services: A suitable case for treatment?", *Public Management Review*, Vol. 18, No. 5, pp. 639-653.

- Pee, L.G. and Kankanhalli, A., (2016) "Interactions among factors influencing knowledge management in public-sector organizations: A resource-based view", *Government Information Quarterly*, Vol 33, No.1, pp. 188-199.
- Pinzaru, F., Zbucnea, A. and Vitelar, A., (2018). Knowledge transfer from business to public administration in Smart City Development, in *Proceedings of the 19th European Conference on Knowledge Management*, University of Padua, Italy, 6-7 September 2018, eds. E. Bolisani et al., ACPI, pp. 700-707.
- Rainey, H.G. and Fernandez, S., (2006) "Managing successful organizational change in the public sector". *Public Administration Review*, March/April, 168-177.
- Richards, G. S., and Duxbury, L., (2014) "Work-group knowledge acquisition in knowledge intensive public-sector organizations: An exploratory study", *Journal of Public Administration Research and Theory*, Vol.25, No.4, pp. 1247-1277.
- Riege, A., and Lindsay, N., (2006) "Knowledge management in the public sector: stakeholder partnerships in the public policy development", *Journal of Knowledge Management*, Vol.10, No.3, pp. 24-39.
- Rod, M., (2006) "Multi-party, multi-sector knowledge creation: maximising outcomes through stakeholder collaboration", *Journal of Information and Knowledge Management*, Vol. 5, No. 4, pp. 259-267.
- Rybakovas, E., (2007) "A Model of stakeholder interest based regional development", *Socialiniai mokslai*, Vol.58, No.4, pp. 28-36.
- Sandhu, M.S., Jain, K.K. and Ahmad, I.U.K.B., (2011) "Knowledge sharing among public sector employees: evidence from Malaysia", *International Journal of Public Sector Management*, Vol 24, pp. 206-226.
- Stoker, G., (2006) "Public Value Management. A New Narrative for Networked Governance?", *American Review of Public Administration*, Vol. 36, No. 1, pp. 41-57.
- Tangaraja, G. et al., (2015) "Fostering knowledge sharing behaviour among public sector managers: a proposed model for the Malaysian public service", *Journal of Knowledge Management*, Vol 19, No. 1, pp. 121-140.
- Verbeeten, F.H., (2008) "Performance management practices in public sector organizations: Impact on performance", *Accounting, Auditing & Accountability Journal*, Vol.21, No.3, pp. 427-454.
- Vigoda, E., (2002) "From Responsiveness to Collaboration: Governance, Citizens, and the Next Generation of Public Administration", *Public Administration Review*, Vol. 62, No. 5, pp. 527-540.
- Wagner Mainardes, E., Alves, H. and Raposo, M., (2011) "Stakeholder theory: issues to resolve". *Management Decision*, Vol.49, No.2, pp. 226-252.
- Wiig, K.M., (2002) "Knowledge management in public administration", *Journal of Knowledge Management*, Vol. 6, No.3, pp. 224-239.
- Williams, W. and Lewis, D., (2008) "Strategic management tools and public sector management: the challenge of context specificity", *Public Management Review*, Vol.10, No.5, pp. 653-671.

Patient Value Creation in Health Knowledge Ecosystems: Evidence from a Field Study

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Abstract

Knowledge ecosystems offer an important perspective in studying knowledge management, innovation and value creation across large and holistic communities. Health communities could be defined as such because of their complexity, representation of multiple stakeholder groups, varieties of knowledge, and also individuals, where the ultimate goal is health, as a consequence of patient value creation. The community approach serves the main goal of patient value creation, as it responds to the need for a systematic approach in encouraging patients to play a more active role in health. It is important to integrate patient engagement strategies into all efforts to improve the effectiveness and efficiency of care. Patient value creation includes much more than the clinical communication, and the knowledge domains extend far beyond clinical knowledge. We need to answer, how ecosystems create and deliver value in sustained way (Levit et al., 2013). Based on this problem formulation, with this paper we aim at answering the following research questions: how to manage holistic knowledge across health knowledge ecosystems? what are the main barriers for knowledge sharing and integration for patient value creation? In order to answer these questions, we apply knowledge creating community approach (Paavola, et al 2004), where various stakeholders create and share knowledge of clinical, and social domain, that all together contribute to patient value creation. In order to understand the complex nature of knowledge flows in the health ecosystem, (collection, mapping of knowledge flows, and identification of preconditions for knowledge exchanges and co-creation) we have applied phenomenological approach. We have applied case study method with the research base at Lithuanian Health Science University Hospital, Department of Obstetrics and Gynecology and associated communities. The research on knowledge creating communities in health from the patient perspective has indicated important tendencies, and knowledge management implications in the field. Qualitative empirical study has revealed a specific knowledge development pattern from the patient perspective - knowledge socialisation and development starts within very close and trusted community members. Trust, validity, reliability and responsibility of knowledge has

emerged as a full mediators for knowledge absorption. Thus, health communities and knowledge ecosystems need safe places for “unverified” knowledge in order to ensure that the important trends and unresolved questions are not missed.

Keywords – knowledge ecosystem; health ecosystem; innovation communities; patient value; knowledge management

Paper type – Academic Research Paper

1 Introduction

Knowledge ecosystems offer an important perspective in studying knowledge management, innovation and value creation across large and holistic communities. Health communities could be defined as such because of their complexity, representation of multiple stakeholder groups, varieties of knowledge, and also individuals, where the ultimate goal is health, as a consequence of patient value creation. Knowledge ecosystems are defined as a unique set of actors and interactions and thereby evolves in its own manner (Valkokari, 2015). They also represent environments that trigger intellectual interactions and innovative productions (Bahrami & Evans, 2005). Knowledge ecosystems can be seen as “organizations comprising diverse actors bound together by a joint search for valuable knowledge while having independent agency also beyond the knowledge ecosystem” (Järvi et al., 2018). Knowledge ecosystems focus on the generation of new knowledge, where research institutes and innovators, such as technology entrepreneurs, play a central role in business and innovation ecosystems (Valkokari, 2015). As we address knowledge ecosystems in health domain, we see few gaps within the existing literature. First, health knowledge ecosystems extend far beyond business and innovation community domains, as it also involves stakeholders from various society groups, and institutions. Second, knowledge circulated across the ecosystem is of various nature, novelty, and follows different validation procedures (academic validation, industrial validation, community validation and so on). Third, knowledge interactions, exchanges and new knowledge creation across actors are multilevel and complex. Last, but not least, the integration of various knowledge in patient value creation carry collective, but also individual character, and thus its integration for health decision making is always embedded in situations and contexts of knowledge application.

Still, the majority of knowledge management efforts in health care are focused on the use of information and communication technologies (Nicolini et al., 2008). Despite the recognition of healthcare as a knowledge driven process, and the importance of knowledge management tools in health sector (Bordoloi & Islam, 2012), it often applies static context and does not support knowledge development and sharing between the actors. Knowledge ecosystems approach thus offers much broader perspective on health knowledge management, especially in relation to patient value creation within health

communities. Communities can vary in format (virtual vs face to face) (Kothari et al., 2011), or have different underlying structures, such as domain (knowledge and expertise held by members); community (relationships and sense of belonging among members); practice (the common set of frameworks, ideas, and tools members share in their work context) (Chua, 2006), and thus knowledge management provides positive results in terms of building connection between people and organizations, and also creation, dissemination, collaboration, innovation and acquisition of knowledge for value creation. Flexible structures within communities urge people to create new ideas and share their tacit knowledge (Akram et al., 2011). Therefore, the community approach serves the main goal of patient value creation, as it responds to the need for a systematic approach in encouraging patients to play a more active role in health. It is important to integrate patient engagement strategies into all efforts to improve the effectiveness and efficiency of care. Innovative delivery systems are including patients as part of the solution, recognizing that high-quality care should help patients gain the skills, confidence, and knowledge they need to manage their health (Hibbard & Greene, 2013). In practical terms, it means effective patient-clinician communication and shared decision making as the key components of patient-centered care. These components require that informed, activated, and participatory patients and family members interact with a patient-centered care team that has effective communication skills and is supported by an accessible, well-organized, and responsive health care system (Epstein & Street, 2007). However, patient value creation includes much more than the clinical communication, and the knowledge domains extend far beyond clinical knowledge. The specific contingencies of the environment and knowledge flows needs to be studied in order to understand how and when they affect patient value creation. More importantly, we need to answer, how ecosystems create and deliver value in sustained way (Levit et al., 2013).

Based on this problem formulation, with this paper we aim at answering the following research questions: how to manage holistic knowledge across health knowledge ecosystems? What are the main barriers for knowledge sharing and integration or patient value creation? In order to answer these questions, we apply knowledge creating community approach (Paavola et al, 2004), where various stakeholders create and share knowledge of clinical, and social domain, that all together contribute to patient value creation.

In the first part of the paper, we discuss the various types of knowledge, shared across health knowledge ecosystems, look at the mechanisms of knowledge integration, and also discuss the barriers and facilitators of knowledge creation from the literature perspective, which is later tested via qualitative study.

2 Knowledge shared across health knowledge ecosystems - barriers and facilitators of knowledge creation

From the knowledge management theory perspective we know, that the standard knowledge management processes encompass multiply activities, such as knowledge search, recognition, transfer, sharing, absorption, and knowledge creation. These activities

are always embedded in the knowledge context, such as knowledge artefacts, specific languages involved, institutional and cultural norms, defining formal and embedded knowledge sharing standards, the distinction between tacit and explicit knowledge, and also, knowledge environments (Nonaka, 1998). Abide (2008) highlighted the types of knowledge relevant to the functioning of the health ecosystem, such as patient, practice, medical, resource, process, organizational, relationship and metric knowledge, which creates an overall system. The study also discussed knowledge management modules such as management of explicit and tacit knowledge, clinical experiences and culture of errors, collaborative problem solving, practice of medical practices and protocols, educational resources for doctors and patients, social knowledge, communities of practice, expertise and interests, and data enriched by observations and medical records analytics. Osterlund (2007) has outlined areas of cooperation for the exchange of knowledge between different healthcare communities. These and other works created the basics for the research on health communities, knowledge creation and development through the knowledge exchange and learning environments in both the virtual and real world.

At the moment health communities are increasingly pursuing data. Informatics and managers are trying to create data storages and management strategies to balance costs and accessibility for this amount of the data (Jiang et al, 2016) . However, usually this kind of storages means, that only clinical data is recorded and could be re-used for solving future health issues. Of course databases can represent abstracts of the commonly used data in a structured format and help to optimize common use cases. According to Rosenbloom et al. these efforts have largely focused on supporting data models that can facilitate exchange for clinical use and research. Results of these efforts and early research evaluating the use of these novel models are beginning to appear in the biomedical literature. But integration community based knowledge and learning sources still stands outside of conventional medical investigation domain. Creating supportive, caring environments for patients is a basic principle of holistic healthcare practice and an increasingly important aspect of today's health care delivery system. Building on patient-centered comparative effectiveness research would allow populations in the world to share their data not only for research, but to use it for the daily health issues. Creating such a knowledge sharing model would provide evidence for patients and their families to make informed medical decisions, and to engage patients and families directly (PCORI, 2017). Community empowerment and integration of various sources of knowledge in health innovation and co-creation processes becomes critically important for the future success of health systems worldwide (Petraite et al., 2018).

It is already known that a patient-controlled health-record infrastructure can support the development of highly desirable health system qualities. Firstly, to allow a patient to effectively become a health information exchange of one. As members of health decisions team, patients could obtain and share their data with their medical professionals or other members (Mandl & Kohane, 2016). But important challenges in achieving common goal of using data to develop knowledge that helps promote health related to efficacy, accuracy, utility, safety, privacy, and security can be met. When models for health

information technology will open up the point of care for innovation and connect patients at home to their healthcare data, using additional information about health issues could meet unexpected results, so that's why is important to explore presumptive difficulties or barriers before feasible actions (Mandl, Mandel & Kohane, 2015). Firstly, technical challenges can meet issues as a longitudinal clinical data or having information on care provided outside their health system (Fleurence et al, 2014; Hersh et al, 2013). If every member of a team, can be informational source, it is important to make a decision, how this information turns into based knowledge for others. Problems could be associated with the design of appropriate clinical studies, informing prospective participants, and obtaining permissions in a manner that protects human rights (Trinidad et al, 2011). Clinicians are more likely to adopt and use measures that enhance the clinician's ability to deliver high-quality care, they often see disease-specific measures, as more relevant than general measures of overall functional status (McGlynn et al, 2014).

Attention to security and privacy is critical to develop and sustain patient trust and encourage participation (Daugherty, Wahbe & Fleurence, 2014). As example, informatics community can be an important partner to patients, clinicians, administrators, and researchers in health services, but first comes patient safety and privacy – security issues must be ensured. Challenges can be met when dealing how to successfully supporting patients through a variety of governance structures and setting policies, patients' willingness to provide this information depends on their belief that the data will be used in practice (McGlynn et al, 2014). Of course, also it's important to synergize efforts to avoid duplication and waste of resources (Ohno-Machado, 2014) and to harmonize data through efficient cross-networking (Ogunyemi et al, 2013). Also

Organizational challenges can be faced associated with the rapid development of a national resource, populations served, health systems included and many other characteristics. Such a models success and long-term sustainability will also depend on communicating with health system leaders and providing them with evidence of the benefits of conducting high-quality, efficient research as part of the routine delivery of care (Daugherty, Wahbe & Fleurence, 2014).

After all it still one of the major challenges is lack access to high quality health system data for development and validation (Taylor and Mandl, 2015) and patient involvement as an equal member.

Patient value creation – defines the framework for performance improvement in health care. Strict measurement and improvement of value is the way to drive progress. Yet value in health care remains still misunderstood (Porter, 2010). In the service management discourse the patient is seen as a customer, who actively makes choices, seeks information and creates values (Nordgren, 2009). Generally, value creation involves a process that increases a customer's well-being, in that the customer becomes 'better off' in some approach (Grönroos and Voima, 2013). In a well-functioning health care system, value should always be defined around the patient and should determine the rewards for all other actors in the system. In health care system value is measured by the outcomes achieved, not the volume of services delivered (Porter, 2010). This is important if we consider that patient engagement can occur at varying levels (micro-, meso-, and macro-)

(Hardyman et al, 2015). This is of importance to health care given the multiplicity of providers that can be involved in a single health care encounter.

Value co-creation already defined as “benefit realized from integration of resources through activities and interactions with collaborators in the customer’s service network” (McColl-Kennedy et al, 2012). Every stakeholder value propositions are also viewed as having a key role in co-creation of value ‘between stakeholders’. These propositions, being central in aligning value, may then be reflected within organizations services (Fyrberg Yngfalk 2013; Frow & Payne 2011; Osborne, Radnor & Nasi 2013). Patients are seen as wishing to be part of their value creating. But this has particular relevance in health care, where there is potential to cause harm. This has implications given that the responsibilities and tasks of health care professionals are regulated and institutionalized, which cannot necessarily be delegated to patients (Nordgren, 2008). That means that could be one of the possible barriers when creating well-performed health ecosystem. It should be noted that not all patients will have the same motivations when engaging in value co-creation. Some individuals may see greater value in engaging in certain activities than others (Shau et al, 2009). Well-defined, organised and practically checked co-creation through patient engagement could create highest value when creating health.

As we can see in any field, improvement of the system depends on having a shared goal that unites the interests and activities of all stakeholders. In health care, however, stakeholders have many, often conflicting goals, including access to services, profitability, high quality, cost containment, safety, convenience, patient-centeredness, and satisfaction. When there is lack of clarity about goals, it is leading to slow progress in performance improvement. Achieving high value for patients must become the goal of health care delivery - if value improves, patients, payers, providers, and suppliers can all benefit while the economic sustainability of the health care system increases (Porter, 2010).

Public health improvement is an ultimate goal to everyone as health care user or provider. Already identified, or some new barriers can reduce co-creation process or harm even created values. Areas for further analysis and empirical to patient engagement and value co-creation in health care also must be identified in the future. Creation of health knowledge ecosystem is a complicated process, however, after anticipating and evaluating potential barriers, removing them and using facilitators - maximum results can be achieved.

3 Materials and methods

In order to understand the complex nature of knowledge flows in the health ecosystem, (collection, mapping of knowledge flows, and identification of preconditions for knowledge exchanges and co-creation) we have applied phenomenological approach. Phenomenological approach (Creswell, 2007) is widely applied while investigating commonalities in different experiences of individuals, when they face the phenomenon. According to Wilson (2002), entire approach allows us to get closer to the experiences of the participants of the research object, and also to reveal the essence of the object and its

structure through the framework of the experience of the participants (Wilson, 2002). We have applied case study method with the research base at Lithuanian Health Science University Hospital, Department of Obstetrics and Gynecology and associated communities.

The qualitative research method chosen allows us to have an in depth view on opportunities and barriers associated with the new approach to the health knowledge management within communities. The analysis of health community knowledge flows is based on the patient centric approach, and draws on qualitative, semi-structured interviews with 10 pregnant women from Kaunas Clinics of Lithuanian Health Science University. Interviews were semi-structured and typically lasted half to one hour, and were conducted in September 2018. Interviews were recorded, transcribed, and coded and analysed inductively to trace themes arising from the data. Participants were recruited through pregnancy and prenatal courses support groups and social media through snowball sampling. The research questions examined the health topics and knowledge sources that are addressed on social networking sites related to pregnancy, and other sources.

4 Results

Qualitative empirical study has revealed a specific knowledge development pattern from the patient perspective - knowledge socialisation and development starts within very close and trusted community members, such as doctors, providing immediate care *“If something is not clear to me, I usually go to the doctor to check and consult additionally”, „But there may be some situations, when I am not sure, if my situation is so serious that I need to go to a hospital. I just want to ask some professional’s opinion“, “I usually refer to my acquaintance obstetrician and she can give me an advice if some feelings or processes happen are normal for me, or I should contact the doctor. Recently, I felt pains, and she advised me to go to the hospital. So I did.”* or friends and families: *„I have a friend who is knowledgeable in questions of healthcare, so I ask her. Because I do not want to disturb a doctor each time.”; “Usually I refer to my acquaintance who is obstetrician and she gives me advices if some feelings or processes happening are normal for me, or I should contact the doctor”*. In addition, hospital facilitated communities of practice also are considered as a trustworthy source of knowledge and learning, where important elements of knowledge are being created. Still, the novelty, timeliness and scientific validation of knowledge being shared is critically important for successful combination and externalisation activities *“I think, doctors who are older, than retirement age, must leave, it is time to have a rest. Because they do not feel any need to be interested in the newest knowledge, scientific research, findings, but rely exclusively on their experience, comparing to younger doctors have fresh knowledge gained recently in the universities. I think, it is good that they know a lot, but being categoric decreases my trust. That is why I value opinions of different doctors“, “I am looking for sources where doctor’s name is written, and authorship is provided. Those must be journal articles, based on scientific research. Or written by trustworthy doctors or medical specialists.”*

Therefore, web based communities of much wider scope and coverage are not participating in valuable knowledge creation that later would be combined and internationalise exactly because of the lack of validation and trust *“I will never take a medicine, because it is written online. I don’t want to risk. I always listen to the opinion of professional”*. Still, these types of communities can be an important source of problems identification that still need valid solutions, *“Looking for an information in the internet, forums reading stories of other women, helps me to decide if smth may be really serious. But I never rely on a single source of information. But, reading the internet information, you can evaluate, understand, if that is a signal when you must seek for a medical help, or it is not so scary as it seems at a first sight”* and yet are not addressed by the professional health care system stakeholders and validated community *“Because different women have different experiences. Everything is individual and may not fit to my situation. I don’t like those forums, because they may provide you with subjective, misleading information.”*

Third, trust, validity, reliability, and responsibility of knowledge has emerged as a full mediators for knowledge absorption. Lack of responsibility, and also the professional knowledge validation might have negative impacts on the overall condition and wellbeing of the patient, primarily because of causing stress and also being emotionally harmful - *“So I am trying not to go to the Internet to avoid stressing situations”*; *“You know, I was afraid to search it [information]. Because, I know I will read a lot of info, paraphrase it in my thoughts, compose it differently: “It is so bad... what if it is bad?”*, *“If you will read about medical issues from the Internet, it might seem to you that you are going to die. It is nonsense to read about unborn child’s organs development, being pregnant. I have tried, but my husband forbids me to do that.”* The issue of reliability and responsibility might prevent new knowledge to be accepted at the ecosystem even though it could provide important ideas and novelties, and help identify problems. Thus, health communities and knowledge ecosystems need safe places for “unverified” knowledge in order to ensure that the important trends and unresolved questions are not missed. Still, the internet based sources, including communities, serve as a first though not trusted knowledge source that shapes behaviors of patients, and at the certain level influences next steps of actions. *“Sometimes it [e-sources] helps, but I still contact the professionals, because I don’t want to risk my baby’s health”*; *“ I still trust doctors more. Anyway, they know more, than friends and mamas [pregnant women], so I am more inclined to follow the doctor’s advices. They are graduated specialists, experienced”*. The need of individually adjusted knowledge is also very high, and yet not satisfied by the internet communities. Thus, a need for trusted, explicit, and reliable knowledge on the web is fundamental in order to facilitate community knowledge creation for patient value creation.

5 Discussion

The research on knowledge creating communities in health from the patient perspective has indicated important tendencies, and knowledge management implications in the field.

Conceptually designed model of health knowledge ecosystem, that encompasses wide range of stakeholders suggests the application of organisational knowledge management practices, and is based on the ontology of knowledge creation between individuals, groups, and organisations. In order to address the complex phenomena of knowledge development, sharing, transfer and absorption between health communities, we have developed a systematic model for knowledge integration that includes various stakeholders (see Figure 1).

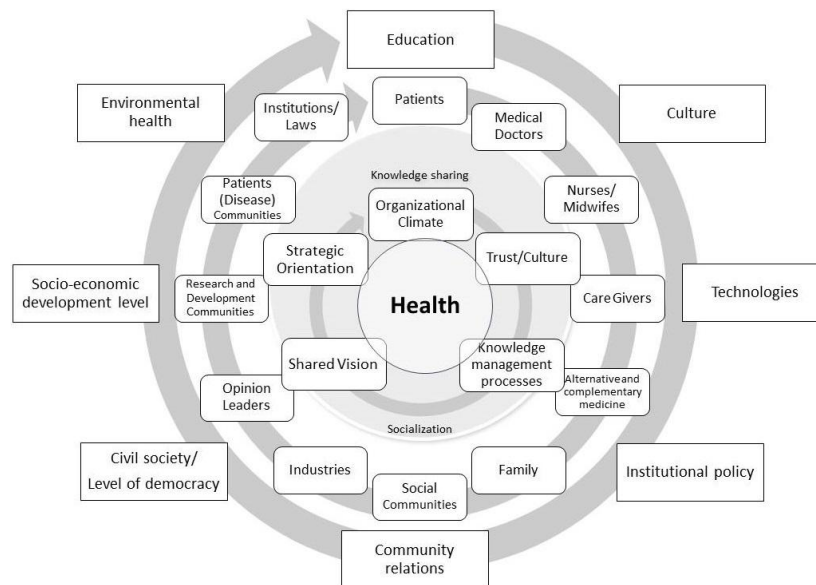


Figure 1 Knowledge Management Model for Communities Creating Health: a Systemic Perspective

Healthcare, based on value creation for public health issues, focuses on patient-centered approach. The traditional attitude that the patient is in the middle of the system as a client getting services no longer is meaningful. It is limited in its ability to improve value from the patient perspective. According to Kamal (2018) “shared decision making is a collaborative decision-making approach that can be broadly defined as a process by which a patient and a physician collaborate to mutually reach a health care decision that is best aligned with patient preferences”. By changing the paradigm from disease treatment in to saving and staying healthy, patients are interested in their own health, thus becoming a participant in improving health. Collaborative decision-making is becoming a key focus for achieving a sustainable health system and a decent service. Such services compatible with patients preferences, improves not only emotional but also economic indicators – the faster health indicators are achieved, the less expensive treatments are used. The culture of health gives opportunities to take care own health, to share valid and trustworthy informational and also take part in community healthcare improvement. Such co-creation of knowledge allows to manage personalized information, not only clinical data. And this is how patient can bring the value not only in own health decisions, but also into community, where trustworthy, explicit, and reliable knowledge is fundamental need in

order to facilitate community knowledge creation and level of a community health. Defining, measuring, and implementing creation value-based health care at the patient level, with consideration for patient preferences and engagements, is a more improving health care approach.

6 Conclusions

Value creation is already well defined approach, but health sector is always more specific and sensitive, when it requires any changes. Every possible change can equally improve or harm both, systematically or individually. Knowledge management tools in health sector it often applies static context and does not support knowledge development, but patient value creation includes much more than just recording clinical data. Knowledge co-creation across large and holistic communities involves stakeholders from various groups and environments. Health communities could be defined as such because of their complexity, representation of multiple stakeholder groups, varieties of knowledge, and also individuals, where the ultimate goal is health, as a consequence of patient value creation. To understand how and when they affect patient value creation, firstly components of knowledge flows must be indicated. It is still remains a question how ecosystems create and deliver value in sustained way. However, first steps are made to indicate what could affect an integration of successful knowledge co-creation, when a patient is acting like an equal member of health care team. Considered that patient acting as a value creator, as an informed, active, responsible participant and could occur at varying levels. That is how single health care encounter may affect positively all the holistic community. Though, integration of different actors or knowledge for health decision making is always embedded contexts of knowledge application. In this article main barriers defined why integration community based knowledge and learning sources still stands outside of conventional medical investigation domain.

Firstly, amount of clinical data, and also, just the clinical data is recorded and could be re-used in future healthcare decisions. This includes also management strategies to balance cost, but knowledge sharing model would provide evidence for patients to make informed medical decisions. From this approach also we need to add that organizational challenges can be faced associated with. Long-term success depends on health system leaders and their attitudes to efficient research as part of the routine delivery of care.

Secondly, allowing a patient to become a part of health information exchange may meet one more challenge – quality of information and also patient safety. Patients could obtain and share their data with their medical professionals or other members, but also they can use their possibilities to change, hide or add information, that does not respond to reality. Also there comes and patient safety of personal data issues – how many other persons can see or use it for other unrelated purposes. Also this includes and technical challenges with issues as a longitudinal clinical data or having information on care provided outside their health system. Attention to security and privacy is critical to develop and sustain patient trust and encourage participation in such as knowledge co-creation model.

The issue of trust, validity, reliability, and might prevent new knowledge to be accepted at the ecosystem even though it could provide important ideas and novelties. The application of health centric patient-value approach in designing knowledge management systems may help identify and solve problems faster. Thus, health communities and knowledge ecosystems need safe knowledge sharing and learning environments for “unverified” knowledge in order to ensure that the important trends and unresolved questions are not missed.

References

- Akram, Kashif & Siddiqui, Sulaman & Nawaz, Muhammad Atif & Ghauri, Tauqir & Cheema, A.K.H.. (2011). Role of knowledge management to bring innovation: An integrated approach. *International Bulletin of Business Administration*. 11. 121-134.
- Bahrami H, Evans JS. *Super-flexibility for Knowledge Enterprises*. Springer, 2005.
- Bordoloi P, Islam N. Knowledge Management practices and healthcare delivery: A contingency framework. *The Electronic Journal of Knowledge Management*. 2012;10(2):110–120.
- Chua AYK: The Rise and Fall of a Community of practice: A Descriptive Case Study. *Knowledge and Process Management*. 2006, 13 (2): 120-128. 10.1002/kpm.239.
- Clarysse B, Wright M, Bruneel J, Mahajan A. Creating value in ecosystems: crossing the chasm between knowledge and business ecosystems *Res. Policy*, 43 (2014), pp. 1164-1176
- Creswell JW. *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). 2nd ed. ed. Thousand Oaks: CA: Sage; 2007.
- Daugherty, S. E., Wahba, S., & Fleurence, R. (2014). Patient-powered research networks: building capacity for conducting patient-centered clinical outcomes research. *Journal of the American Medical Informatics Association : JAMIA*, 21(4), 583–586. doi:10.1136/amiajnl-2014-002758
- Epstein RM, Street RL Jr. Patient-centered communication in cancer care: Promoting healing and reducing suffering. National Cancer Institute; 2007. NIH Publication No. 07-6225
- Fleurence, R. L., Curtis, L. H., Califf, R. M., Platt, R., Selby, J. V., & Brown, J. S. (2014). Launching PCORnet, a national patient-centered clinical research network. *Journal of the American Medical Informatics Association : JAMIA*, 21(4), 578–582. doi:10.1136/amiajnl-2014-002747
- Frow, P., and A. Payne. 2011. “A Stakeholder Perspective of the Value Proposition Concept.” *European Journal of Marketing* 45 (1): 223–240
- Fyrberg Yngfalk, A. 2013. “It’s Not Us, It’s Them!” – Rethinking Value Co-Creation Among Multiple Actors.” *Journal of Marketing Management* 29 (9–10): 1163–1181
- Gronroos, C ; Voima, P. (2013) Critical service logic: making sense of value creation and co-creation *JOURNAL OF THE ACADEMY OF MARKETING SCIENCE*; Volume: 41, Issue: 2, Pages: 133-150, DOI: 10.1007/s11747-012-0308-3
- Hardyman W., Kate L. Daunt, Kitchener M. (2015) Value Co-Creation through Patient Engagement in Health Care: A micro-level approach and research agenda, *Public Management Review*, 17:1, 90-107, DOI: 10.1080/14719037.2014.881539
- Hersh WR, Weiner MG, Embi PJ, et al. Caveats for the use of operational electronic health record data in comparative effectiveness research. *Med Care* 2013; 51(8 Suppl 3):S30–7
- Hibbard JH, Greene J. What The Evidence Shows About Patient Activation: Better Health Outcomes And Care Experiences; Fewer Data On Costs. *Health Affairs* 2013 32:2, 207-214
- Institute of Medicine (US). *Evidence-Based Medicine and the Changing Nature of Healthcare: 2007 IOM Annual Meeting Summary*. Washington (DC): National Academies Press (US); 2008.

- 7, Policy Changes to Improve the Value We Need from Health Care. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK52830/>
- Järvi K, Almpantopoulou A, Ritala P. Organization of knowledge ecosystems: Prefigurative and partial forms, *Research Policy*, Volume 47, Issue 8, 2018, Pages 1523-1537, ISSN 0048-7333
- Jiang G, Evans J, Endle CM, Solbrig HR, Chute CG. Using Semantic Web technologies for the generation of domain-specific templates to support clinical study metadata standards. *J Biomed Semant.* 2016;07:10.
- Kamal Robin N., Sarah E. Lindsay, Sara L. Eppler Patients Should Define Value in Health Care: A Conceptual Framework *The Journal of Hand Surgery*, Volume 43, Issue 11, Pages 1030-1034
- Kothari A., Hovanec N., Hastie R. & Sibbald, S. (2011). Lessons from the business sector for successful knowledge management in health care: a systematic review. *BMC health services research*, 11, 173. doi:10.1186/1472-6963-11-173
- Levit L, Balogh E, Nass S, et al., editors. *Delivering High-Quality Cancer Care: Charting a New Course for a System in Crisis*. Washington (DC): National Academies Press (US); 2013 Dec 27. 3, Patient-Centered Communication and Shared Decision Making. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK202146/>
- Mandl, K. D., Mandel, J. C., & Kohane, I. S. (2015). Driving Innovation in Health Systems through an Apps-Based Information Economy. *Cell systems*, 1(1), 8–13. doi:10.1016/j.cels.2015.05.001
- Mandl, K. D., & Kohane, I. S. (2016). Time for a patient-driven health information economy? *N Engl J Med*, 374(3), 205-208. DOI: 10.1056/NEJMp1512142
- McColl-Kennedy, J. R., Vargo, S. L., Dagger, T. S., Sweeney, J. C., & Kasteren, Y. van. (2012). Health Care Customer Value Cocreation Practice Styles. *Journal of Service Research*, 15(4), 370–389. <https://doi.org/10.1177/1094670512442806>
- McGlynn, E. A., Lieu, T. A., Durham, M. L., Bauck, A., Laws, R., Go, A. S., ... Kahn, M. G. (2014). Developing a data infrastructure for a learning health system: the PORTAL network. *Journal of the American Medical Informatics Association : JAMIA*, 21(4), 596–601. doi:10.1136/amiajnl-2014-002746
- Nicolini D, Powell J, Conville P, Martinez-Solano L. Managing knowledge in the healthcare sector. A review. *International Journal of Management Reviews*. 2008;10(3):245–263. doi: 10.1111/j.1468-2370.2007.00219.x.
- Nordgren, L. (2009). Value creation in healthcare services – developing service productivity. Experiences from Sweden. *International Journal of Public Sector Management*, 22, 114–127
- Ohno-Machado L. (2014). Networking the country to promote health and scientific discovery. *Journal of the American Medical Informatics Association : JAMIA*, 21(4), 575. doi:10.1136/amiajnl-2014-003005
- Ogunyemi OI, Meeker D, Kim HE, et al. Identifying appropriate reference data models for comparative effectiveness research (CER) studies based on data from clinical information systems. *Med Care* 2013;51(8 Suppl 3):S45–52 [PubMed] [Google Scholar]
- Osborne, S. P., Z. Radnor, and G. Nasi. 2013. “A New Theory for Public Service Management? Toward a (Public) Service-Dominant Approach.” *The American Review of Public Administration* 43: 135–158.
- Paavola, S., Lipponen, L., & Hakkarainen, K. (2004). Models of Innovative Knowledge Communities and Three Metaphors of Learning. *Review of Educational Research*, 74(4), 557–576. <https://doi.org/10.3102/00346543074004557>
- PCORI (2017) *Compilation of Patient Protection and Affordable Care Act Extracted sections concerning Patient-Centered Outcomes Research and the Authorization of the Patient-Centered Outcomes Research Institute (PCORI)*. Available from: http://www.pcori.org/sites/default/files/PCORI_Authorizing_Legislation.pdf

- Porter, M. E. (2010). What is value in health care? *N Engl J Med*, 363(26), 2477-2481.
- Rosenbloom, S. T., Carroll, R. J., Warner, J. L., Matheny, M. E., & Denny, J. C. (2017). Representing Knowledge Consistently Across Health Systems. *Yearbook of medical informatics*, 26(1), 139–147. doi:10.15265/IY-2017-018
- Schau, Hope J., Muniz, Albert A., Arnould, Eric J. (2009), “How Brand Community Practices Create Value,” *Journal of Marketing*, 73 (September), 30–51.
- Taylor PL, Mandl KD. *Harvard Health Policy Review*. 2015;14:18–21.
- Trinidad SB, Fullerton SM, Ludman EJ, et al. Research ethics. Research practice and participant preferences: the growing gulf. *Science* 2011;331:287–8
- van der Borgh, Michel and Cloodt, Myriam and Romme, A. Georges L., Value Creation by Knowledge-Based Ecosystems: Evidence from a Field Study (March 2012). *R&D Management*, Vol. 42, Issue 2, pp. 150-169, 2012. Available at: <http://dx.doi.org/10.1111/j.1467-9310.2011.00673.x>
- Valkokari K. Technology Business, Innovation, and Knowledge Ecosystems: How They Differ and How to Survive and Thrive within Them. *Innovation Management Review* August 2015 (Volume 5, Issue 8) www.timreview.ca
- Wilson A. Phenomenology and Research Methodology for Information Behaviour Research. *The New Review of Information Behaviour Research* 2002;3:71-81.

Budgeting Control System and e-Procurement: an Integrated Tool for Limiting Misconducts in Healthcare Purchasing Procedure

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Abstract

*Corruption and misconducts, “the abuse of entrusted power for private gain” (Pope, 2008), are pervasive virus that negatively affects the public lives of many Countries. Given that the 9% of the worldwide GDP on average is represented by health expenditure, healthcare is particularly vulnerable to corruption (Petkov and Cohen, 2016; EU, 2017). Due to the large number of services delivered, Public Hospitals and Local Health Authorities undergo a high risk of misconducts, which could bring not only to a waste of public resources, but also to undermine access to the services, impoverishing their quality and the possibility for sustainable development of countries (Braithwaite, 2013; Neu et al., 2013). Corrupt practices and fraud affect up to 25% of expenditure on medical and non-medical goods (Sorenson and Kanavos, 2011); these increase inequality and determine substantial well-being and value losses (Porter, 2010). Corruption can be expressed by the Klitgaard's equation (1998): **Monopoly** plus **Discretion** minus **Accountability**. Hence, to limit corruption phenomena an efficient way seems to be increase accountability and transparency by strengthening of internal controls (Christensen and Skærbæk 2007; Fadda et al, 2017).*

Accordingly, e-Procurement in the public domain can be seen as a tool to support the delivery of public purchasing process, improving efficiency and transparency of transactions (Carayannis and Popescu, 2005; Croom and Brandon-Jones, 2005); Budgeting control system is a powerful tool to align strategies and plans with operational decisions (Garrison et al, 2010), suitable for simultaneous controls in daily management and purchasing decisions (Provenzali, 1991).

Therefore, the goal of this work is to understand if it is possible to integrate the simultaneous budgeting-based control system with the e-Procurement procedures (through an ERP software), and how this integration could potentially limit misconducts in healthcare purchases.

After a theoretical background about themes of Corruption, e-Procurement and Budget, a single pilot qualitative case study (Yin, 2014) has been conducted. In particular, we developed a qualitative inquiry (Patton, 2002) based on face to face interviews (Said et. al, 2017) with two high-qualified SAP® developer-providers.

This contribution attempts to clarify how internal controls impact on the “responsibility chain” (roles, responsibility, transparency degrees of discretion) of procurement process in public healthcare, by increasing level of accountability.

This paper fosters debate about relationship between corruption and level of internal control system of Healthcare Organization. This would have considerable consequence also for practitioners involved in ERP software development.

Keywords – Budget, e-Procurement, Corruption, Internal Control, Healthcare.

Paper type – Academic Research Paper

1 Introduction

Corruption and misconducts are a pervasive virus that negatively affects the public lives of many countries around the world. Corruption, in particular, could be considered as “the greatest obstacle to economic and social development” (Braithwaite 2013, Neu et al 2013).

Many definitions of this phenomenon have been provided over time (Bardhan 1997, Liu 2016). Although a unique definition of corruption has not been provided yet, on the other hand one of the most commonly shared definition is the “the abuse of entrusted power for private gain” Pope (2008).

Given that the 9% of Gross Domestic Product on average for Organization for Economic Co-operation and Development Countries is represented by health expenditure, there is a shared agreement that Health facilities are particularly vulnerable to corruption, especially regarding procurement procedures (Petkov and Cohen, 2016; EU, 2017).

Health organization are currently facing a growing demand for health services. This phenomenon is affected by the health status of the community, progress in medical technologies, costs and patients’ preferences (WHO, 2014). Accordingly, purchases of drugs, medical devices, machineries and common consumables represent those operative inputs that can potentially improve population health, access to care and quality of life by providing an effective healthcare service. However, due to the large number of services delivered and the amount of financial resources managed, Public Hospitals and Local

Health Authorities undergo a high risk of conducting misleading behaviours, which could undermine access to the services and their quality. Misleading behaviours triggered events are represented by the possibility to alter a fair economic price, clinical efficacy, maintenance needs, usage of technologies for pursuing private gains. Therefore, damages generated by corruption lead not only to a waste of public resources but also undermine the possibility for sustainable development of countries, increase inequality and determine substantial well-being losses. With regard to procurement process, opportunistic behaviours are strongly encouraged by unstoppable interactions between public and private sectors, which involve various stakeholders with different perspectives concerning the value added by health technologies (Drummond et al., 2013). Corrupt practices and fraud affect up to 25% of expenditure on medical and non-medical goods (Sorenson and Kanavos, 2011). Implications of corruption in the procurement of health technology are mainly represented by the acquisition of low quality and ineffective products, which are not aligned with health needs (Petkov and Cohen, 2016).

The owners of public hospitals, indeed, are citizens who cannot nominate or oversight managers directly. Hence, the separation between formulation of policy and administrative action has been considered the way to improve the efficiency and effectiveness of Public Administration, to contain opportunistic behaviours and, thus a pre-requisite for a sustainable development (Barberis, 1998; Osborne, 2006).

Structure, culture and tradition design the essence of how public administrations work: the legal setting largely determines what can be done or not and which solutions pursue or not. Governance mechanisms have a great role in determining internal control systems and their reliability and, at last, how much it easy for the corruption finds its pathway into organizations (Zahra et al., 1995). In other terms, the triangle: 1) public administration, 2) internal control systems and 3) corporate governance mechanisms represent the spectrum where the corruption could take its dangerous role (Di Pietra and Melis, 2015).

Corruption can be expressed with the following equation: monopoly plus discretion minus accountability (Klitgaard 1998). Monopoly and discretion (by bringing low transparency) are positively related with the level of corruption within a Country, while accountability negatively. Although this equation is generally valid, it seems particularly suitable for the healthcare context; this field has the following peculiarities, which makes it vulnerable to corruption:

- High discretion of clinical decision;
- High information asymmetry between clinicians and patients;
- Monopolistic power of public health providers in many specialized healthcare services.

Consequently, the aim of the public organization reforms has been to underpin performance management and increase the transparency and accountability of health organizations in order to increase as well responsibility of managers and decision-makers. Accordingly, the introduction of e-procurement goes in this direction by promoting fair competition and low “cost-effective” prices (Cohen et al, 2002).

Ex-ante better design of governance mechanisms, internal system controls and performance management tools as a whole, is felt even more in the public sector: this is essential for preventing opportunistic behaviours and avoiding information losses (Christensen and Skærbæk, 2007)

Hence, to limit corruption phenomena an efficient way seems to be the strengthening of internal controls (Fadda et al, 2017, Palozzi et al, 2018). Accordingly, the budgeting control system would be a powerful tool to align strategies and plans with operational decisions. Budget is suitable not only for planning activities, but also for simultaneous controls in daily management and purchasing decision. (Provenzali, 1991).

Starting from these preconditions the aim of this work is to answer to the following research questions:

“Within the Healthcare Public Providers context, could Budgeting Control System be integrated with the e-Procurement process in order to verify consistency between plans and purchases? And, could this integration be effective in limiting potential decision-makers misconducts in health procurement?”

In other words, this contribution attempts to understand which features of Budgeting Control System increase awareness and accountability in the e-procurement process.

Based on an Enterprise Resource Planning (ERP) software, the integration between Budget and eProcurement allows intervening on all the variables of the corruption equation: Budget increases public hospitals' responsibility and transparency in financial resource employment (Kassel, 2008; Barret, 2014), e-Procurement promotes traceability of purchasing process.

Thus, this contribution attempts to clarify if it is possible to practically formalize the “responsibility chain” in the procurement process within the electronic market. Responsibility chain expresses relationships between roles, responsibility, accountability, degrees of transparency of decision-making process which bring to approve (or not) a health furniture, without opportunistic pressures and in coherence with the value-based healthcare principles (Porter, 2010).

To achieve its purpose, this paper follows the following outline: after this brief introduction, the second section reports a background addressed to the issues of corruption, e-procurement and Budgeting. The third section explains how the interview-based qualitative pilot case study (Patton, 2002; Yin, 2014) intercepts opinions of two SAP® developers/providers in order to understand the real feasibility of an ERP integration between Budget and e-Procurement. The fourth presents findings of the inquiry. The last section discusses results obtained and provides some consideration about the potential impact of such control tool on misconducts, in relation of the procurement phase within Healthcare Organization context.

2 Background

As recognized, corruption negatively affects public lives of many countries around the world, whose damages lead both to waste public resources and to undermine the

possibility for a steady and fair growth of countries, increasing inequality and determining huge well-being losses

Referring the issue to the health sector implies an investigation about how much misconducts affect the creation of public value and, thus, wealth of people. However, healthcare professionals do not always understand what is the corruption range and how it impacts on their daily operations; conversely, anti-corruption specialists often are not able to really understand the complexity of the healthcare system (Petkov and Cohen, 2016); the result is a continuous providing of anti-corruption rules and structured procedures, often disconnected from the clinical practice needs.

Potential structural malfunctions could be observed at the NHS-hospital or Region-hospital level (Beerli and Navot, 2012), where healthcare providing is strongly influenced by scientific and technological advancement, which affects expenditure of both current supplies and strategical assets. Hence, the procurement process seems to be particularly vulnerable to opportunistic behaviours of decision-makers, which could result in corruptive conducts aimed at private gains.

European Union (2017) defined six typologies of corruption in healthcare:

1. bribery in medical service delivery;
2. procurement corruption;
3. improper marketing relations;
4. misuse of (high) level positions;
5. undue reimbursement claims;
6. fraud and embezzlement of medicine and medical devices.

All these distorted practices could lead both to waste resources and to decrease the access to healthcare services and treatments.

Referring with the procurement process, corruption appears into the possibility to alter fair economic purchases within manipulated negotiations; this, potentially, means: higher price supplies, overestimation of supply volumes, falsification of maintenance needs, not appropriateness health technologies employment, etc.

In this scenario, the higher the ineffective managerial structures and control mechanisms, the higher the possibility of observing corruption (European Union, 2017).

Accordingly, since the introduction of New Public Management (Hood, 1991; Dunleavy and Hood, 1994; Barberis, 1998), and its evolution to the paradigm of Public Governance (Osborne, 2006; Bovaird et al., 2009), the separation between Policy and Administration has been considered the way to contain opportunistic behaviours within Public Administrations in order to improve their efficiency and effectiveness. In this direction, many jurisdictions' reforms have attempted to contain misconducts through the improvement of rules aimed at regulating corporate governance mechanisms and internal control tools (Cooper et al, 2013). Within these reforms, we can find the introduction of new procurement process for Public Organization built on centralized and electronic (e-) markets.

With the term e-business we consider information exchange, commercial transactions and knowledge sharing between organizations (Croom, 2005) by using an information

technology interface completely integrated with the organization's processes (Graham and Hardaker, 2000), in coherence with the broader organizational strategy.

In particular, e-procurement is the mirroring of procurement activities on the internet (Croom and Johnston, 2003), which deals both with all the "technology solutions" that facilitates procuring goods and services (Presutti, 2003) and with the automation of the procurement process (Vaidyanathan and Devaraj, 2008); it also includes the activities of purchase request, authorization, ordering, delivery and payment supplier (Chaffey, 2007). E-procurement can be defined as the use of information technologies to facilitate B2B purchase transactions (Wu et al., 2003), which enables firms to more efficiently and accurately capture and aggregate the value of "how much" they are spending.

E-procurement in the public domain can be seen as a tool to support the delivery of public procurement policy, improving efficiency and transparency of transactions (Carayannis and Popescu, 2005; Croom and Brandon-Jones, 2005).

Benefits can have a twofold nature (Garrido, 2008; Dai and Kauffman 2004):

- financial (quantitatively and monetary measurable);
- organizational (qualitatively measured)

Starting from the financial benefits, e-procurement allows increased efficiency in the organizational structure, especially in the reduction of purchasing department size, levels and number of functional areas involved in the purchasing process. It implies gains in the administrative process and procurement costs.

Moreover, e-Procurement prevents single users or buyers from purchasing outside the negotiated contracts and from different sources. Maverick buying is considered a relevant cause of internal inefficiency and increase in the total cost of ownership of the purchased goods and services. Accordingly, Barratt and Rosdahl (2002) claimed that it improves transparency of prices and in the relations with suppliers (contractual conditions, time and terms of each order, order tracking and tracing), that brings to higher accountability of operation-purchasing processes (Puschmann and Alt, 2005, Currie, 2000).

In particular, referring with the transparency in public sector, positive impacts of e-procurement can be summarized as follows:

- better control and maverick-buying reduction (Croom and Johnston, 2003);
- attracting more new suppliers to do business with government (Rotchanakitumnuai, 2013)
- reducing corruption between purchasing officers and suppliers (Panayiotou et al., 2004)
- preventing from information asymmetry (Croom and Brandon-Jones, 2007)
- traceability of information and all the daily operations (Belisari et al, 2019)
- reinforcing user compliance (Belisari et al, 2019)
- reducing opportunities for corruption in public procurement process (Neupane et al, 2014)

Following Figure 1 illustrate the process flow of public procurement:

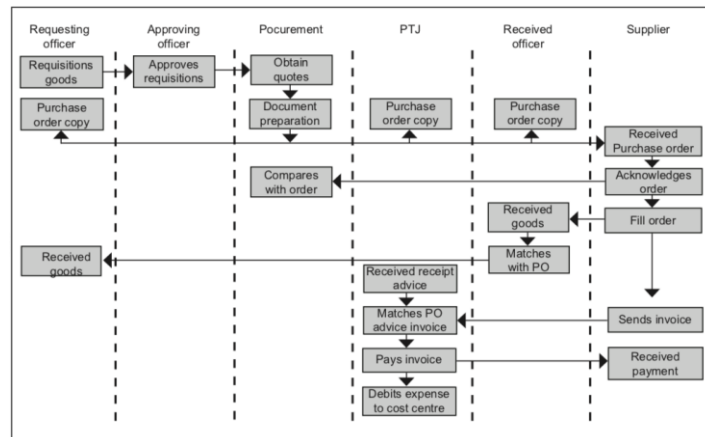


Figure 1: The procurement process for the public Procurement. Source: Said et al 2017.

Within this process three are the stages identified as highly vulnerable to corruption: 1) the need of assessment; 2) during the selection of supplier; 3) monitoring of services. (Said et al, 2017).

In Italian context, according with Raffa and Esposito (2006) the procurement code over regulates the use of the public procurement procedures, so that the purchasing process is often paralyzed. Moreover, the Italian government concentrated in the hands of a state-led agency (CONSIP) the power of negotiating big contracts aimed at buying standard goods. With exception of special equipment, the most of purchasing of details of such auction contracts and the availability of goods, firms operating in the public sector have to surf CONSIP's electronic catalogues. In healthcare field, the process starts with defining both the items and the rules that would be followed during the bidding. Usually, the price is the key determinant for awarding the contract. Figure 2 describes the auction process in the Italian public health care system. The auction may take advantage of multiple criteria of assessment (Bichler, 2000)

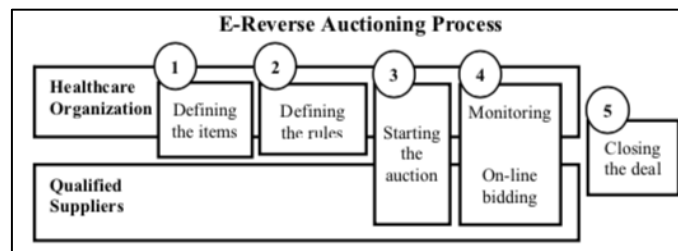


Figure 2: e-Reverse Auctioning Process. Source: Raffa, L., & Esposito, G. (2006).

Said et al (2017) have analyzed the process of public purchasing through the e-Procurement; the activities are listed in the following Table 1.

Table 1: The activities of e-Procurement

N	Activity
1	User requests to purchase goods or services.
2	Procurement officer checks the availability of funds in the financial system
3	Procurement officer chooses potential suppliers based on the selected registered code in the system
4	Successful supplier would be chosen based on the goods services provided in addition to the exact specifications requested by the users.
5	Once the supplier is selected, the procurement officer would send the proposal to the authorized personnel for approval.
6	Procurement officer generate the purchase requisition through the system and sent it to the successful supplier
7	At the time of delivery of good, supplier include invoice and delivery notes.
8	The store keeper verifies the supply received and generates a receipt note in the system
9	The payment process would proceed, after all reconciliation process with the order were completed.

Source: Authors' elaboration inspired by Said et al (2017)

Across this e-procurement process (in particular for activities from 1 to 6), it would be possible to compare what is the amount of financial resource licensed by the Healthcare Organization Budget with the actual purchases for the different kind of goods and services.

Budget is a quantitative plan for acquiring and using resources over a specified time (Garrison et al, 2010). It is used for two distinct purposes:

- *Planning*, that is “how developing goals” and preparing various budgets to achieve those goals.
- *Control*, that regards the action taken by management to increase the integration of all parts of the organization in working together in order to achieve the goals fixed at previous stage.

Budget is strictly connected to Responsibility Accounting, whose basic idea is that a manager should be held responsible for those items that he/her can effectively control to a significant extent. This implicates a personalization of accounting information and assignments to individuals, who will be responsible for revenues, costs and performance of the operational Unit they govern.

In particular, for an organization as a whole, the master budget consists of a number of separate, but interdependent, budgets that formally lay out the company's sales, production and financial goals. Among these budgets, the production one (composed by direct materials, labour, and service budgets) details the resource that must be purchased to fulfill the expected production as contrasted to expected sales. In the context of a healthcare organization is production budget where the use of consumable components (e.g. prothesis, medical device, drugs, etc.) or new capital equipment employment are authorized.

However, a static planning budget is inappropriate for evaluating how well resource consumption is controlled. If the actual level of expense differs from what was planned, this should be kept into account in terms of impact on costs: if this difference is negative, the spending variance (difference between how much a cost should have been and its

actual amount) should be immediately highlighted and labeled as unfavorable (or vice versa).

Budget, as said, should be suitable for simultaneous controls of daily management activities (Provenzali, 1991). By verifying the consistency between actual and planned costs, it could give indication about the cost-effectiveness of resource employed, identifying also the responsible of the purchasing of those resources used. In this perspective, in accordance with Casati (2000) budget becomes a comprehensive tool able to:

1. map goals,
2. count resources for their achievement,
3. to set control parameters able to trigger, in case, corrective actions.

Moreover, in a Healthcare Organization budget is a “bridge” between business administration and clinical management aimed to formalize strategic plans into practical actions, which brings to “more efficient use of hospital resources” (Barr, 2005).

In this perspective, Budget has stopping to be a tool aimed at the mere authorization of expenses on the base of a check of funds availability. It should evolve into a formal validation of the appropriateness of the resource employed, able to connect the responsibility of who promotes the purchase with the results obtained.

Accordingly, by increasing the level of ERP-based internal controls, budget could surely contribute to fight misconduct within procurement within Healthcare Institution (Fadda et al., 2017)

2.1 Research Problem

In the context of Healthcare Organizations, what happen if the amount of the actual cost of a specific supply is considerably higher than how much it should have been, as licensed in the planning budget? Who has been held responsible? Which are the potential corrective actions?

The attempt to answer these questions is the very engine of this work: understand if it is possible to integrate the simultaneous budgeting-based control system with the e-Procurement procedures (within the electronic market) through the use of an ERP software.

Our expectation is to understand if the presence of procedural mechanisms of control are able to monitor the responsibility chain of procurement process in case of significative variance among planned and actual purchases.

Variance can be:

- i) quantitative, if the purchase differs in term of financial resources or in terms of quantity of goods (or services)
- ii) qualitative, if the purchase differs in term of composition of expenditure.

Potentially, this check should hold responsible those who promote the purchase, increasing accountability and thus limiting their misconduct or opportunistic behaviours.

3 Method

To get this goal, we ran single pilot case study (an “empirical inquiry that investigates a contemporary phenomenon within its real-life context”, Yin 2014), with the purpose to intercept some insights from information-rich key informants.

In particular, we developed a qualitative inquiry (Patton 2002) based on face to face interviews (Said et. al, 2017) with two SAP® developer-providers. The interviewees hold the following apical job-position within their organization:

1. The Chief Executive Officer at Technis Blu Company (SAP® Partner)
2. The IVE Services Industries Director at SAP® Italy

The framework for the analysis includes the following main topics:

- A. Acceptance of Budget as a Managerial Control Tool
- B. Functional Interaction between budget and procurement
- C. Employment of an ERP software as support of procurement
- D. Accountability
- E. Transparency
- F. Abuse of discretion
- G. Functional Integration between an ERP software and Public Electronic Market

On the base of their professional experience (Scapens, 2004) we asked participants to talk about such open topics. Interviews, in Italian language and integrally recoded, were transcribed and coded them for each of the seven topics. We used sentences to analyse the data on the basis of such portions of text. Once the coding process was carried out, we sorted and analysed all the portions of text coded. Then, we analyzed data by generating a large quantity of codes by assigning labels to sections of text that have some distinct meaning in order to categorizes, organize and interpret them.

4 Results

In relation to our interviews, we derived around 80 raw concepts, included in approximately 30 pages. Based on interviewees’ experience on SAP® development, this selection process was finalized to build and refine categories into more specific concepts, clustered per topic. Interviewees’ opinions are included in the following Table 2. After each statement, a code is shown in order to distinguish the interviewee who agrees with the assertion: K1, K2 (where K1 represents the Key Informant 1 and so on).

Table 2: Findings form interviews

A. Acceptance of Budget as a Managerial Control Tool <ul style="list-style-type: none">• Internal control is the keystone to fight misleading and opportunistic behaviours. (K1, K2)• Always more frequently, in the field of Managerial Control in Healthcare is used to use the Budget as an operating control, and not only as a planning support. (K1, K2)• Budget have to be considered a tool for: i) ex ante, ii) simultaneous, iii) ex post controls, provided by different forms and features. (K1)
B. Functional Interaction between budget and procurement <ul style="list-style-type: none">• In the Healthcare context, the budgeting process is commodity-related; this means that its connection with procurement procedures has to be tailored with the kind of goods or services purchased (K1); for instance:

<ul style="list-style-type: none"> ○ in case of drugs purchasing, budget has the role of monitoring the transactions; but, due to clinical safety reasons, it could never stop the supply; ○ in case of medical devices purchasing, budget has the role to verify the fund availability; moreover, for special equipment which need staff training, budget tool has to be integrated with the SAP® “project management” tool. • During the procurement process, an ERP software provides a simultaneous control of the consistency between funds earmarked for a specific supply and funds actually employed. (K2) • Higher risks of misconducts are during the sourcing phase of suppliers, goods and service; during the procurement procedure, these risks are reduced. However, if an anomaly was observed, it is possible to locate who has held the responsibility; this both discourages misleading behaviour and potentially triggers penalty mechanisms. (K2)
<p>C. Employment of an ERP software as support of procurement</p> <ul style="list-style-type: none"> • An ERP software would allow users to standardize procurement procedures; however, due to the necessity of healthcare field, often it is not suitable to define replicable procedures valid for different kinds of purchase. (K1) • An ERP software would reduce the common risks of anomalies in procurement process (K1): <ul style="list-style-type: none"> ○ Invoicing is automatically connected with the order; ○ The choice of supplier could be integrated with the electronic market in case of common goods searching (otherwise, in case of customized supplies, this choice cannot be automated). • In the case of SAP®, it supports the purchasing process through two tools: Material Management as support for accounting and Ariba as support for the cash outflows cycle. (K1). • Through these tools SAP® encourages budget-based controls both for (K2): <ul style="list-style-type: none"> ○ Funds availability; ○ Appropriateness of purchases as compared with those planned. • Budget, within ERP System, is still employed as a control tool in healthcare organizations. (K1, K2)
<p>D. Accountability</p> <ul style="list-style-type: none"> • During procurement transactions, it should be always identified the responsible of Cost Center who promote the purchase. (K2) • The responsible of procurement should have a mere technical role aimed at the issuing of purchasing order; actually, he/her holds the responsibility (and the power) of the whole procurement process (K2) • In a Healthcare Organization, the procurement process should involve different individuals with very heterogeneous competences: clinicians, responsible of procurement, Ethic Committee, Scientific Committee, HTA units. (K1) • Supervision of appropriateness of purchases should be due to Ethic and Scientific Committees; while, the Head of a Cost Center should have the responsibility of the Budget of his/her department. (K1) • For example, SAP® is based on rules and responsibilities; by a personal logon (user and password) is always possible to verify “who were” that “does something”. (K1) • The only solution to risks of misleading behaviour is the fragmentation of purchasing process in different activities, whose responsibility is held by different independent subject, interconnected among each other (K2).
<p>E. Transparency</p> <ul style="list-style-type: none"> • Transparency derives from the possibility to historicise information. (K1, K2) • For example: <ul style="list-style-type: none"> ○ SAP® improves traceability of transactions by a drilldown approach applied to the procurement process. (K1) ○ SAP® verifies the whole purchasing chain: by the login (user and password), it traces “who” is interested the advancement of an order. (K1) • Transparency is scaring. Higher is the transparency of a process, more evident will be its inefficiencies (attributable to a specific responsible). (K2)
<p>F. Abuse of discretion</p> <ul style="list-style-type: none"> • An ERP system can never judge clinical discretion and choices. (K1) • The budgeting controls could limit the abuse of discretion (maverick behaviour) in purchasing process. (K1, K2) • Multiple authorization workflows decrease risks of abuse of discretion. (K1, K2) • Rigid approval procedures for specific purchases (previously defined) contain abuse of discretion. (K1, K2)
<p>G. Functional Integration between an ERP software and Public Electronic Market</p> <ul style="list-style-type: none"> • From a technical point of view, an ERP software (such as SAP®), can be easily integrated with the Public Electronic Market. This can be particularly suitable to reduce misconducts in supplier choice.

(K1, K2)

- The integration would make possible to automatically identify within the Electronic Market those suppliers who own the features to satisfy the demand of those goods and services looked for. (K1, K2)

Source: Authors' elaboration

5 Discussion and Conclusion

“Within the Healthcare Public Providers context, could Budgeting Control System be integrated with the e-Procurement process in order to verify consistency between plans and purchases? And, could this integration be effective in limiting potential decision-makers misconducts in health procurement?”

As answer to the research questions, this study could affirm that a functional integration, through an ERP software, between Planning Budget and e-Procurement is possible and easily achievable from a technical point of view. In particular, the Budgeting system is still considered as a managerial tool for simultaneous control of operational activities provided by healthcare organizations. Its integration within e-Procurement logics, moreover, allows a continual check of resource employment from the responsible of the Cost Center within the organization.

With the exclusion of drugs, whose procurement can never be stopped due to obvious clinical reasons, integration between Budget and e-Procurement becomes a tool that potentially allows to verify the operational appropriateness of purchases, by overcoming the mere checking of the fair employment of financial funds. In some cases, this involves authorizing information materials coming from Ethic Committee, HTA Unit or Scientific Direction of Organization.

Even if managerial control tools cannot deal with decision of the clinical practice, they allow to map those who hold the responsibility of any phase of purchasing process, by locating also those officials who have authorized purchases that significantly differs from what budgeted.

In this sense, integration between Budget and e-Procurement magnifies the control possibilities that are owned, separately, by each of the tools. Hence, this integration strategy verifies the contingency between planned and actual purchases; this extends the “responsibility chain” from operational needs planning to the actual delivery of goods or services purchased. Accordingly, the choice of a supplier becomes the outcome of an objective process, which is parametrized on operational necessities and not on subjective propensities of Procurement Officers. This potential change involves the Principal-Agent Theory (Eisenhardt, 1989; Jensen and Mecklinig, 1976; Whipple and Roh, 2010) in term of relation between buyer and supplier.

Moreover, according to Kramer (2012), the improper selection of suppliers by approving higher price, accepting low quality goods and engaging unnecessary service or consultations probably has driven by corruption in public procurement (Said et al, 2017).

Thus, segmentation of procurement process in many sub-phases makes possible to isolate who hold responsibility of each sub-phase and his/her relationship with the supplier, since the planning of supply. In addition, the possibility to historicize

information increase the traceability of transaction and, then, the transparency of the entire procurement process.

Give the above, the continual control of financial resource employment has a positive impact on Accountability of purchasing process in healthcare. Sure enough, the integration between Budget and e-Procurement:

- individuates those who hold responsibility of each stage of procurement process;
- decreases subjectivism in supplier choice;
- triggers a justification mechanism (also clinical, if necessary) when actual expenses were too much different from those applied (both per amount and per operational composition).

These three endpoints should have the results to decrease misconducts and maverick behaviours, with the endpoint to prevent corruption activities during the procurement process (Said et al, 2017).

As simultaneous control tool for the operational management, the study demonstrates how Budgeting System increases the makings of e-Procurement to fight potential corruptive behaviour from public Officers, by triggering authorization mechanisms, which make more transparent the purchasing, process.

In particular, this study has referred with the combination of the following three elements:

- A. Managerial ERP software based on a rules and responsibilities for users;
- B. Variance analysis potentialities of Budgeting system;
- C. Fairness of a “step-by-step” on-line purchasing pathway, structured a priori, and form a Third Part.

This way, according with Christensen and Skærbæk (2007), it is possible to create conditions to decrease the abuse of discretion in procurement process, which would become more transparent, with the result of Accountability increasing.

However, the introduction of a high structured procurement process could be affected by resistance to change by those employees (both clinical and administrative) involved.

In this regard, a statement belonging to the Key Informant 2 has been extremely meaningful; K2 argued that:

“The increasing of Transparency could upset the whole Organization”.

With this sentence the interviewed has intended to underline two main aspect related to the improvement of internal managerial control system within healthcare organizations:

1. Increasing Accountability is scaring; it highlights internal inefficiencies (both aware and unintentional) and individuates the responsible of inappropriateness employment of resource.
2. No one wants to hold too much responsibilities in his/her job (often without additional benefits which justify these duties). Thus, employees ask for rigid procedures (in order to discharge part of own responsibility on the procedure itself); this behaviour brings to drastically slow down decision-making and operative processes.

Probably this is the reason why, as stated by the K1, just few Public Hospital and Local Health Authorities in Italy have decided to use a comprehensive internal ERP, such

as SAP[®], for managing and monitoring all the processes of healthcare delivery and those resources their related.

For sure, results of our enquiry confirm that, all the organizational level, the only “mechanical” method to reduce misconducts during procurement process is to intervene on the “responsibility chain”, by strengthening it. As stated by Fadda et al (2017), by increasing the level of integrated internal control system is possible to increase the organization Accountability. According to the Klitgaard’s equation (1998), corruption decreases.

Clearly, this study and its findings are not free from limitations; firstly, the sample of interviewees is too small. Although the key informants are two high skilled managers that operate in the field of ERP implementation within MCs since 90s, their points of view should be partial and limited to their own experiences and to their involvement with SAP[®] supply. Hence, extending the sample to other key informants with different background would be advisable.

Secondly, the literature background about interrelationships among the huge topics of corruption, e-Procurement and Budget deserves to be better explored and clarified, in order to classify which levers of controls positively impact on misconducts.

Both these two major limitations lay the foundation for further detailed enquiries whose aim, as that one presented in this paper, is fostering debate about relationship between misconducts and level of internal control systems (Di Pietra and Melis, 2015), in the context of Healthcare Organizations.

By the way, in the lens of healthcare sustainability, the present work surely highlights the necessity to look for technical ERP solutions able to support “managerial-rational” approaches in clinical practice, which continually involve decision-makers, form the planning process to the procurement procedures.

References

- Barberis, P. (1998) “The New Public Management and a New Accountability”. *Public Adm.*, 76, 451–470.
- Bardhan, P. (1997) “Corruption and Development: A Review of Issues”. *J. Econ. Lit.*, 35, 1320–1346.
- Barr, P. (2005) “Flexing Your Budget, Modern Healthcare”, September 12, pp. 24–26
- Barratt, M. and Rosdahl, K. (2002) “Exploring business-to- business market sites”, *European Journal of Purchasing and Supply Management*, Vol. 8 No. 2, pp. 111-22.
- Barrett, P. (2014) “New Development: Financial Reform and Good Governance”. *Public Money Manag.*, 34, 59–66.
- Beerli, I. and Navot, D. (2012) “Local Political Corruption: Potential structural malfunctions at the central–local, local–local and intra-local levels”, *Public Management Review*, 15, 5, 712–739.
- Belisari, S., Appolloni, A. and Cerruti, C. (2019) “Positive and negative impacts of the adoption of e-procurement solutions: the Italian market case”. *International Journal of Procurement Management*, 12(2), 219-241.
- Bichler, M. (2000) “An Experimental Analysis of Multi-Attribute Auctions”. *Decision Support Systems*, 19: 249-268.

- Bovaird, A.G., Bovaird, T. and Löffler E. (edited by) (2009) *Public Management and Governance*, 2nd Edition. Taylor & Francis.
- Braithwaite, J. (2013) "Flipping markets to virtue with qui tam and restorative justice". *Account. Org. Soc.*, 38, 458–468.
- Carayannis, E.G. and Popescu, D. (2005) "Profiling a methodology for economic growth and convergence: learning from the EU e-procurement experience for central and eastern European countries", *Technovation*, Vol. 25, pp. 1-14.
- Casati, G. (Ed.) (2000) *Programmazione e controllo di gestione nelle aziende sanitarie*. McGraw-Hill.
- Chaffey, D. (2007) *E-business and E-commerce Management: Strategy, Adoption and Practice*, Pearson Education, Harlow, Essex, England.
- Christensen, M. and Skærbæk, P. (2007) "Framing and Overflowing of Public Sector Accountability Innovations". *Accounting, Auditing & Accountability Journal*, 20, 1, 101-132.
- Cohen, J. C., Cercone J. A., and Macaya, R., (2002) Improving transparency in pharmaceutical systems: strengthening critical decision points against corruption.
- Cooper, D. J., Dacin, T. and Palmer, D. (2013) "Fraud in accounting, organizations and society. Accounting", *Organizations and Society*, 38, 6–7, 440–457.
- Croom, S. (2005) "The impact of e-business on supply chain management – an empirical study of key developments", *International Journal of Operations & Production Management*, Vol. 25, pp. 55-73.
- Croom, S. and Brandon-Jones, A. (2005) "Key issues in e-procurement: procurement implementation and operation in the public sector", *Journal of Public Procurement*, Vol. 5, pp. 367-87.
- Croom, S., and Johnston, R. (2003) "E-service: enhancing internal customer service through e-procurement". *International Journal of Service Industry Management*, 14(5), 539-555.
- Currie, W. (2000) *The Global Information Society*, Wiley, New York, NY.
- Dai, Q. and Kauffman, R.J. (2004) "To be or not to b2b? An evaluative model for e-procurement channel adoption". *Information Technology and Management* 7 (2), 109–130.
- Di Pietra, R. and Melis, A. (2015) "Governance and corruption: is history repeating itself? Fostering a debate and inviting contributions from a multidisciplinary perspective". *Journal of Management and Governance*, 20, 4, 689-701
- Drummond, M., Tarricone, R. and Torbica, A. (2013) "Assessing the Added Value of Health Technologies: Reconciling Different Perspectives". *Value Health*, 16, 7–13. 100
- Dunleavy, P., Hood, C. (1994) "From Old Public Administration to New Public Management". *Public Money Manage*, 14, 9-16.
- Eisenhardt, K. (1989) "Agency theory: An assessment and review", *Academy of Management Review*, 14(1) 57-74.
- European Union (2017) "Updated Study on Corruption in the Healthcare Sector. Final Report". Luxembourg: Publications Office of the European Union.
- Fadda, I., Paglietti, P., Reginato, E. and Pavan, A., (2017) "Analysing Corruption: Effects on the Transparency of Public Administrations" *Outcome-Based Dynamics for Performance Management book series*, 251-267.
- Garrido, M.J. (2008) "Organizational and economic consequences of business e-procurement intensity". *Technovation* 28 (9), 615.
- Garrison, R. H., Noreen, E. W. and Brewer, P. C. (2010). *Managerial accounting* 13th edition.
- Graham, G. and Hardaker, G. (2000) "Supply chain management across the internet", *International Journal of Physical Distribution & Logistics Management*, Vol. 30, pp. 286-96.
- Hood C. (1991) "A Public Management for All Seasons". *Public Administration*, 69, 3-19.

- Jensen, M.C. and Meckling, W.H. (1976) "Theory of the firm: Managerial behavior, agency costs and ownership structure", *Journal Of Financial Economics*, 3(4) 305-60.
- Kassel, D.S. (2008) "Performance, Accountability, and the Debate over Rules". *Public Adm. Rev.*, 68, 241–252.
- Klitgaard, R. (1998) "International Cooperation Against". *Finance & Development*, 35(1).
- Kramer, W. M. (2012) "The most common procurement fraud schemes and their primary red flags". Retrieved 18 May 2015, from: <http://iacrc.org/procurement-fraud/the-most-common-procurement-fraud-schemes-and-their-primary-red-flags/>.
- Liu, E. (2016) "A historical review of the control of corruption on economic crime in China". *J. Financ. Crime*, 23, 4–21.
- Neu, D., Everett, J., Rahaman, A.S. and Martinez, D. (2013) "Accounting and networks of corruption". *Account. Org. Soc.*, 38, 505–524.
- Neupane, A., Soar, J. and Vaidya, K. (2014) "An empirical evaluation of the potential of public e-procurement to reduce corruption". *Australasian Journal of Information Systems*, 18(2).
- Organisation for Economic Co-operation and Development (OECD) (2008) "Corruption: Glossary of International Criminal Standards"; OECD Publishing: Paris, France; Available online: <http://www.oecd.org/corruption/corruptionglossaryofinternationalcriminalstandards.htm> (accessed on 24 July 2018).
- Osborne, S.P. (2006) "The New Public Governance?" *Public Manag. Rev.*, 8, 377–387.
- Palozzi G., Brunelli S. and Falivena C., (2018) "Higher Sustainability and Lower Opportunistic Behaviour in Healthcare: A New Framework for Performing Hospital-Based Health Technology Assessment", *Sustainability* 10, 3550.
- Panayiotou, N.A., Gayialis, S.P. and Tatsiopoulos, I.P. (2004) "An e-procurement system for governmental purchasing", *International Journal of Production Economics*, Vol. 90, No. 1, pp.79–102.
- Patton, M. Q. (2002) *Qualitative evaluation and research methods*. SAGE Publications, Inc. Thousand Oaks.
- Petkov, M., Cohen, D. (2016) "Diagnosing Corruption in Healthcare"; Transparency International: London, UK, October.
- Pope, J. (2008) "National Integrity Systems: The key to building sustainable, just and honest government. In *Promoting Integrity. Evaluating and Improving Public Institutions*"; Head, B.W., Brown, A.J., Connors, C., Eds.; Ashgate Publishing: Aldershot, UK; pp. 28–29.
- Porter, M. E. (2010) "What is value in health care?" *New England Journal of Medicine*, 363(26), 2477-2481.
- Presutti, W. (2003), "Supply management and e-procurement: creating value added in the supply chain", *Industrial Marketing Management*, Vol. 32, pp. 219-27.
- Provenzali P., (1991) *Il Budget*, Trieste Ebc.
- Puschmann, T. and Alt, R. (2005) "Successful use of e-procurement in supply chains", *Supply Chain Management: An International Journal*, Vol. 10 No. 2, pp. 122-33.
- Raffa, L. and Esposito, G. (2006) "The implementation of an E-reverse auction system in an italian health care organization". *Journal of Public Procurement*, 6(1/2), 46-69.
- Rotchanakitumnuai, S. (2013) "The governance evidence of e-government procurement". *Transforming Government: People, Process and Policy*, 7(3), 309-321.
- Said, J., Ishak, M. W., & Omar, N. (2017) "The effectiveness of e-procurement system in reducing lobbyist involvement in public procurement". *Asia-Pacific Management Accounting Journal*, 12(1).
- Scapens, R. W. (2004) *Doing case study research*. In *The real life guide to accounting research* (pp. 257-279). Elsevier.

- Sorenson, C., Kanavos, P. (2011) "Medical technology procurement in Europe: A cross-country comparison of current practice and policy". *Health Policy*, 100, 43–50.
- Vaidyanathan, G. and Devaraj, S. (2008) "The role of quality in e-procurement performance: an empirical analysis", *Journal of Operations Management*, Vol. 26, No. 3, pp.407–425.
- Whipple, J.M. & Roh, J. (2010) "Agency theory and quality fade in buyer-supplier relationships", *International Journal of Logistics Management*, 21(3) 338-52.
- World Health Organization (2014) "WHO Compendium of Innovative Health Technologies for Low Resource settings, 2011-2014. Assistive devices, eHealth solutions, Medical devices, Other technologies, Technologies for outbreaks. Available online": http://www.who.int/medical_devices/innovation/compendium/en/.
- Wu, F., Mahajan, V. and Balasubramanian, S. (2003) "An analysis of e-business adoption and its impact on business performance", *Journal of the Academy of Marketing Science*, Vol. 31, No. 4, pp.425–447.
- Yin, K. R. (2014) *Case Study Research: Design and Methods* (V Edition): Sage publications Ltd, London.
- Zahra, S. A., Priem, R. L., and Rasheed, A. A. (1995), "The antecedents and consequences of top management fraud", *Journal of Management*, 31, 6, 803–828

Public Organisations as Sustainable Communities

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Abstract

Public organisations should contribute to value creation moving towards sustainability as a vision for strategy and action, redesigning trust-based relationships with stakeholders and sustaining governance networks within ecosystems. As organisations seeking sustainability, public organisations should evolve as communities developing strategic, managerial and technological sources to enable and facilitate public value creation within society. Public organisations should achieve sustainability and develop the community adopting a logic service view as strategic choice, strengthening transformational and ethical features of public managers as leaders, and developing the potential of information technology by driving the transition from using technology in government to developing digital, smart, lean and open platforms for value creation, innovation and networking as sources that enable public organisations as sustainable communities.

Keywords – public organisations, sustainability, value creation, community.

Paper type – Academic Research Paper

1 Introduction

Today, public organisations should rethink how to approach the sustainability as a vision for change to drive public decision-making, management and governance (Goodsell, 2006; Fiorino, 2010), to rediscover the community as a source that enables networks to develop and contribute to public value creation, promoting social interaction between public and private spheres. Public organisations should serve the public interest as the result of dialogue with citizens (Denhardt and Denhardt, 2000), promoting collaborative processes that involve private, public and no profit organisations in order to achieve policy objectives within a community (Bourgon, 2007). Creating public value relies on sustaining networked governance and multilateral cooperation to cope with changing contexts. Public organisations evolve as communities following the public value and service logic views to shape strategy using technology and strengthening public managers as leaders that engage stakeholders involving civil society in constructing governance networks and shared partnerships (Hartley, 2005).

It is time to rethink the role of public organisation that contribute to facilitating value creation promoting multilateral relationships between public and private actors within society. Public organisations should develop as a community and intermediary network between public sphere and private sphere, enhancing enhances shared values within ecosystems. Public organisations should act as enablers of social and public value creation. Technologies open up to digital and smart ecosystems. Public managers as agents of change should exercise leadership in interacting within organisations and with external stakeholders. Following a service logic view for value creation, public organisations should develop managerial and technological sources to enhance processes that enable civil society and stakeholders to engage in public-private partnerships and drive public, digital and open ecosystems that support dialogue, knowledge and information sharing, social exchanges, interaction and citizen-centred services effectiveness (Osborne, 2018; Dumay, Guthrie and Farneti, 2010; Stoker, 2006; O'Flynn, 2007; Moore, 1995).

The aim of this study is to elucidate how public organisations evolve as communities and contribute to facilitating value creation identifying a pathway towards sustainability developing strategic, managerial and technological capabilities within ecosystems. As organisations that achieve sustainability through public value co-creation, public organisations should adopt a service logic view enabling the service users to actively contribute to value creation (Osborne, 2018). Information and communication technologies (ICTs) help public organisations to work through networks that involve private and public actors, developing knowledge and capabilities in the pursuit of public goals (Janowski, Pardo and Davies, 2012). ICTs help strengthen collaboration and support the exchange between governments and civil society for service innovation, governance, administration effectiveness and support to institutional reform (Lips, 2012). ICTs are driving public organisations as digital and smart communities to support public value creation within open ecosystems (Larsson and Grönlund, 2014; Granier and Kudo, 2016). Creating public value relies on accountable public managers that helps construct

community shared values, interacting with citizens and proactively to support networks (Bryson, Crosby and Bloomberg, 2014).

The paper is structured in six sections. Following the introduction and methodological section, in the third paragraph, the theoretical background relies on rediscovering sustainability within public organisations as a source for strategy and action, as a vision for change and innovation. Public organisations as communities should follow a logic service view as a service strategy oriented to sustainability within ecosystems. In the fourth paragraph, it is explained how public organisations evolve as communities within ecosystems managing strategic, managerial and technologic capabilities. In particular, public organisations are moving from being organisations to becoming communities adopting a service logic view to value co-creation processes, strengthening the role of public managers as ethical and transformational leaders and agents of change within and between organisation and society, and promoting digital and smart platforms and open ecosystems. In the fifth paragraph, the discussion is presented. Finally, conclusions are set out.

2 Methodological section

The study is theoretical and relies on a literature review relating to public organisations that proceed towards sustainability developing strategic, managerial and technological sources that drive public organisations to evolve as a community that contributes to value creation and encourages efforts and cooperation for public wealth. The selected contributions are interpreted in a narrative synthesis in order to elucidate new perspectives and advance theoretical frameworks on emerging issues (Denyer and Tranfield, 2006; Dixon-Woods, Agarwall, Young, Jones and Sutton, 2004).

3 Towards public organisations as communities oriented to sustainability within ecosystems

After the promises of New public management about efficiency and effectiveness, public organisations should serve the public interest adopting a public value management view as a vision (Stoker, 2006; O'Flynn, 2007), moving towards an ecosystem and community perspective where public administration, business, no profit organisations, civil society, individuals and groups contribute to sustaining knowledge and public value creation within society (Osborne, 2010). Public organisations should rethink how to adopt a sustainability-oriented approach because «they are embedded in society, producing not only benefits (and obligations) for individuals but also providing public goods and services, establishing collective efficiency, and creating collective rules and purposes» (Hartley, 2005, p. 34). Public administration should develop bottom-up policies involving the civil society to provide and input and contribute, encouraging civic engagement and collaborative citizen-centred public management as means to provide benefits for the community (Cooper, Bryer and Meek, 2006). Public organisations should achieve

sustainability as a vision for managing *res publica* within communities and creating value within ecosystems (Fiorino, 2010; Goodsell, 2006; Dumay, Guthrie and Farneti, 2010), redesigning trust-based relationships with stakeholders, citizens and where the public is involved (Meynardt, 2009). Public organisations should serve the public interest as result of dialogue with citizens (Denhardt and Denhardt, 2000) and consider the role of civil society and governance networks following a public value management view (Stoker, 2006), involving the stakeholders to take part in public policy, decision-making and work government (Bingham, Nabatchi and O’Leary, 2005), and promoting social and urban development by interacting with stakeholders within ecosystems (Zbucnea and Romanelli, 2018). Public organisations should contribute to expressing the values of a community facilitating public discussion, integration and citizen participation for services design and delivery, to achieve policy objectives (Bourgon, 2007). Sustaining networked coproduction of public services by virtual communities helps support a community approach to public service support (Meijer, 2011). Users and community contribute to services co-production «where all the parties make substantial resource contributions» (Bovaird, 2007, p. 847). Public organisations should identify a pathway for sustainability looking at an ecosystem perspective (Dumay, Guthrie and Farneti, 2010) interacting with their stakeholders, sustaining multiple relationships with interdependent actors and promoting co-construction and co-innovation where the locus of co-production is the service system (Osborne, 2006; Osborne, Radnor and Strokosch, 2016). Following a service logic view to public value creation (Osborne, 2018), public organisations should identify a strategic pathway for sustainability that relies on public managers acting to realize rights and responsibilities, meeting citizen preferences and interacting with community (Stoker, 2006; O’Flynn, 2007; Moore, 1995). The advent of interactive and digital technology helps public organisations to adopt and strengthen a community/citizen and smart approach in order to support public-private partnerships, involving citizens in policy-making for sustaining public values, equity and development (Larsson and Grönlund, 2014; Dunleavy, Margetts, Bastow and Tinkler, 2005).

4 How public organisations evolve as sustainable communities

Public organisations should contribute to public value creation promoting dialogue, cooperation and social exchange within ecosystems. In becoming sustainable communities, public organisations should proceed towards sustainability as a source for strategy, action and change (Fiorino, 2010), managing strategic, managerial and technological capabilities. As sustainable organisations, public organisations should develop knowledge sources to achieve social and policy issues (Leon, 2013) building inter-organisational relationships within ecosystems (Osborne, 2010, Hartley, 2005). Public organisations should adopt a service logic view in order to facilitate value co-creation by the service users, rediscovering the public manager as a leader and agent of change, and using technology to drive public organisations as digital platforms and ecosystems (Osborne, 2018; Bryson, Crosby and Bloomberg, 2014; Harrison, Pardo and Cook, 2012).

4.1 Rethinking service logic-oriented public organisations

Public organisations should rediscover a service logic view by interacting with citizens as services users and co-producers of value, developing collaboration with stakeholders. Public organisations should facilitate value creation processes, enabling the service users to contribute to production, design, innovation and value of public services (Osborne, 2018). Citizens, clients and governmental organisations should be active co-producers of public value (Moore, 1995). «PSOs do not create value for citizens – they can only make a public service offering. It is how the citizen uses this offering and how it interacts with his/her own life experiences that creates value» (Osborne, 2018, p. 228) whilst «co-production assumes a process where the PSO is dominant and where the logic is linear and based upon product-dominant conceptions of production» (Osborne, 2018, p. 225). Value creation relies on public organisations sustaining multiple relationships promoting co-construction and co-innovation where the locus of co-production is the service system (Osborne, 2006; Osborne, Radnor and Strokosch, 2016). Public organisations should rethink a pathway for public value co-creation that «assumes an interactive and dynamic relationship where value is created at the nexus of interaction» (Osborne, 2018, p. 225).

Public organisations should consider the public service delivery as a relational and process-based phenomenon supported by digital technologies that help public organisations to ensure services efficiency, quality and sustainability adopting an end user-driven (Osborne, Zoe, Radnor, Kinder and Vidal, 2015). Public organisations should enable the users to create value because «it is the citizen and/or service user who creates the performance and value of a public service, with the PSO acting as a facilitator of this process» (Osborne, 2018, p. 229). As organisations achieving sustainability coherently with a service logic view, public organisations should promote collaborative, long terms and trust-based relationships enabling the citizens and/or service users as the actors with their needs, personal abilities and experiences that actively drive value creation (Osborne, 2018).

Proposition 1: Public organisations as communities should adopt a service logic view in designing services and processes in order to facilitate value co-creation where the service users contribute to creating the performance of value.

4.2 Rediscovering public managers as leaders between organisation and society

While managers utilise and control human resources, leaders should motivate people, inspire, develop and innovate (Bennis, 1989). Managers should strategically develop human resources in order to achieve organisational objectives and act as leaders that exert influence on public service motivation of employees in order to support them to contribute to public service value (Park and Rainey, 2008). Successful changes rely on rediscovering public managers as leaders that implement programs, support the employees that feel to contribute to public services, interact with citizens and exercise multiple accountability within society. Public managers should attend to community

values helping networks, enhancing effectiveness and accountability within society (Bryson, Crosby and Bloomberg, 2014).

Public managers should also exercise an ethical guide in order to support employee commitment and job satisfaction, and to improve the absenteeism reduction. Public managers as ethical leaders help face and solve ethical questions that exert positive influence on employees' behaviours and attitudes at work (Hassan, Wright and Yukl, 2014). Administrative leadership relies on public management capabilities playing a key role in driving the organisations to achieving the objectives (Van Wart, 2013). Thereby, political instability can exert influence on strategic reform strategies and on the stability of the roles of public managers that feel less identified within organisational goals and less motivated to lead the employees (Dutton, Dukerich and Harquail, 1994). Political instability and uncertainty contribute to decreasing the motivation to lead for public management and exerting high level of dissatisfaction at work denying to public managers the need to lead followers (Weick and Sutcliffe, 2011; Chan and Drasgow, 2001). Public management should exercise leadership and plan strategic activities that contribute to driving processes of change, leveraging on the personal characteristics of the individuals. In particular, public managers should behave as transformational leaders driving the employees to better work and believe in public service in a context of change, paying attention to people, identity and relationships in order to motivate the employees in performing the task within organisations (Van der Voet, 2014; Karp and Helgø, 2008). Transformational leadership helps support public service motivation and enhance the commitments to public mission, fostering job satisfaction, work performance and quality (Moynihan, Pandey and Wright, 2009; Park and Rainey, 2008).

Proposition 2: Public organisations should ensure stability and reduce uncertainty in order to drive public managers as agents of change, train and develop transformational and ethical leaders that support public service motivation of employees that feel to contribute to public services systems.

4.3 Developing technology within public organisations living within ecosystems

Public organisations should drive digital evolution that helps redefine relationships with government stakeholders building communities within society. ICTs help support the building of networks and enhance the relationships between public organisations and civil society facilitating knowledge sharing, social exchange and partnerships to achieve public value issues, to promote openness, leadership, integrated service delivery and management within ecosystems (Janowski, Pardo and Davies, 2012; Lips, 2012). Public organisations are embracing ICTs to connect with networks, to drive change in democratic processes, and to create new governance structures that enable change, enhance government effectiveness, support public sector reform, and strengthen citizen engagement and relationships between civil society and government agencies (Bannister and Connolly, 2012). Digital government relies on creating a digital ecosystem for public value creation by strengthening cooperation, ensuring openness, inclusiveness, engagement and participation in policy-making and service design, opening to a data-driven culture and strategy in order to better serve citizens and business that access to

social and informative exchange (Oecd, 2014). Technology enables the relationships between citizens and public organisations towards a community/citizen centred approach as oriented to a public service design (Dunleavy, Margetts, Bastow and Tinkler, 2005; Meijer, 2011). Technology helps empower the citizen as responsible partner in delivering public services (Linders, 2012). The future of public services delivery and design relies on building digital platforms and spaces that contribute to services co-production and value co-creation (Fishenden and Thompson, 2013) leading to open, public and networked ecosystems that help promote innovation and transparency, support citizen engagement, knowledge and information sharing (Harrison, Pardo and Cook, 2012). ICTs enable public organisations to proceed towards sustainability moving from transformation to contextualisation by promoting policy driven e-governance platforms (Janowski, 2015). ICTs contribute to enhancing social and knowledge-based interaction between public and private sphere as a source for value creation and services co-production. Digital technologies are leading sustainable public organisations to encourage private-public collaborations, to evolve as smart communities that rely on proactive citizen participation, and help drive smart culture in government, empowering citizens as co-designers and co-producers of public services and leading to innovation and knowledge development (Larsson and Grönlund, 2014; Gil-Garcia, Zhang and Puron-Cid, 2016).

Proposition 3: Public organisations as communities should develop the potential of technology in order to advance digital, smart and open communities as spaces and platforms that help encourage partnerships and collaboration among private and public actors within ecosystems.

5 Discussion

In coping with an increasing complexity and uncertainty, public organisations should contribute to facilitating value (co-)creation processes, proceeding towards sustainability as a vision for action and change in order to drive the wealth of communities and advance the progress of society. As sustainability-oriented institutions, public organisations should develop and integrate strategic, managerial and technological capabilities in order to evolve as communities that play a key role for services co-production and value (co-)creation within ecosystems, defining policy choices and interacting with civil society to propose better policy solutions and services design. Public service organisations should promote collaboration encouraging inter-organisational and long-terms relationships, where multiple inter-dependent actors and processes contribute to public services delivery and help policy making. As shown in figure 1, the main contribution of this study is to identify some pathways that enable public sector and services organisations as value creation-oriented and sustainable communities within ecosystems.

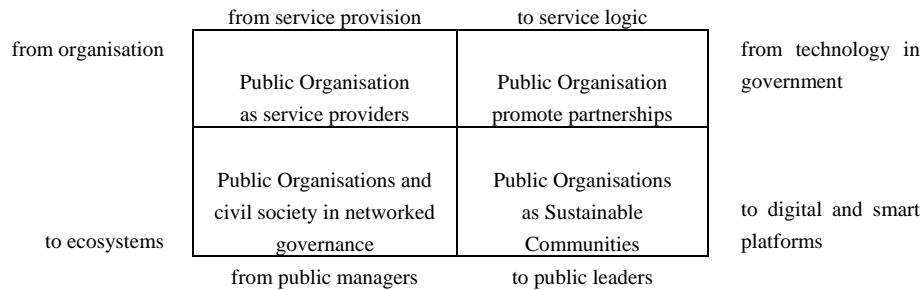


Figure 1 – Towards public organisations as sustainable communities

As services providers, public organisations contribute to service provision following an organisational view in order to serve the public interest, strengthening the role of public manager and driving e-government processes. As organisations embedded within social and economic ecosystems that merely contribute to service provision, public organisations should use the potential of digital and smart government and platforms in order to involve civil society within networked governance where public managers attend to value community and interact with citizens to build shared partnerships.

As institutions oriented to public value and service logic view, public managers behave as agents of change exercising administrative, transformational and ethical leadership to drive public organisations to promote cooperation, dialogue and partnerships by using and developing technology. Public organisations become sustainable communities following a service logic view to public service delivery and design, strengthening public managers as effective and ethical leaders within and between organisation and society, and developing smart and lean platforms and communities within ecosystems. Thereby, public managers should play a key role to drive change and support innovation process in order to feel themselves more identified within organisational goals, being motivated to lead employees in their work and commitment. Public organisations as communities should consider the sustainability as a source that helps value creation processes and enables the wealth of people and business ensuring social, financial, economic and democratic performances.

6 Conclusion

In this study, there are theoretical, managerial and organisational key implications. Public organisations as communities promote value co-creation sustaining the dialogue and supporting cooperation among private and public actors as the result of multilateral relationships, social exchanges and shared values. Public organisations as communities tend to follow a service logic view as strategic approach to public service systems, sustaining the potential of technology to drive smart, lean and open communities within

ecosystems, and empowering public managers as accountable, ethical and transformational leaders in front of the society.

Public organisations should select a sustainability and community-oriented pathway adopting a logic service view as strategic choice (proposition 1), strengthening transformational and ethical features of public managers as leaders (proposition 2), and developing the potential of information technology in order to drive the transition from use of technology in government to drive digital, smart, lean and open ecosystems for value creation, innovation and networking (proposition 3) as sources that drive public organisations as sustainable communities.

In this study, there are some limitations. This study identifies some theoretical propositions and provides a framework of analysis in order to drive public organisations as sustainable communities. Thereby, any empirical research and case studies are provided in the analysis because public organisations are still in infancy in dealing with sustainability as a source for change and innovation in governance and services design within ecosystems.

Further research perspectives and investigations will consider how the hypothesized propositions can be applied within local autonomies and be translated in managerial and leadership programs, human resources policies and practices, technological advancements and digital platforms that contribute to enhancing the community development within public organisations that interact with civil society in order to develop knowledge sources, organisational frameworks, strategies, value-oriented processes, and shared culture within social and economic ecosystems.

References

- Bannister, F. and Connolly, R., (2012) "Defining E-Governance", *e-Service Journal: A Journal of Electronic Services in the Public and Private Sectors*, Vol. 8, No. 2, pp. 3-25.
- Bennis, W.G., (1989) *On Becoming a Leader*, Addison-Wesley, Reading MA.
- Bingham, L.B., Nabatchi, T. and O'Leary, R., (2005) "The New Governance: Practices and Processes for Stakeholder and Citizen Participation in the Work of Government", *Public Administration Review*, Vol. 65, No. 5, pp. 547-558.
- Bourgon, J., (2007) "Responsive, Responsible and Respected Government: Towards a New Public Administration Theory", *International Review of Administrative Sciences*, Vol. 73, No. 1, pp. 7-26.
- Bovaird, T., (2007) "Beyond Engagement and Participation: User and Community Coproduction of Public Services", *Public Administration Review*, Vol. 67, No. 5, pp. 846-860.
- Bryson, J.M., Crosby, B.C. and Bloomberg, L., (2014) "Public Value Governance: Moving Beyond Traditional Public Administration and the New Public Management", *Public Administration Review*, Vol. 74, No. 4, pp. 445-456.
- Chan, K.Y. and Drasgow, F., (2001) "Toward a Theory of Individual Differences and Leadership: Understanding the Motivation to Lead", *Journal of Applied Psychology*, Vol. 86, No. 3, pp. 481-498.
- Cooper, T.L., Bryer, T.A. and Meek, J.W., (2006) "Citizen-Centered Collaborative Public Management", *Public Administration Review*, Vol. 66, pp. 78-88.
- Denhardt, R.B. and Denhardt, J.V. (2000) "The New Public Service: Serving Rather than Steering", *Public Administration Review*, Vol. 60, No. 6, pp. 549-559.

- Denyer, D. and Tranfield, D., (2006) "Using Qualitative Research Synthesis to Build an Actionable Knowledge Base", *Management Decision*, Vol. 24, pp. 213-227.
- Dixon-Woods, M., Agarwall, S., Young, B., Jones, D. and Sutton, A., (2004) *Integrative Approaches to Qualitative and Quantitative Evidence*, Health Development Agency, London, available at www.hda.nhs.uk
- Dumay, J., Guthrie, J. and Farneti, F., (2010) "GRI Sustainability Reporting Guidelines for Public and Third Sector Organizations. A critical review", *Public Administration Review*, Vol. 12, No. 4, pp. 531-548.
- Dunleavy, P., Margetts, H., Bastow, S. and Tinkler, J., (2005) "New Public Management is Dead-Long Live Digital-Era Governance", *Journal of Public Administration Research and Theory*, Vol. 16, No. 3, pp. 467-494.
- Dutton, J.E., Dukerich, J.M. and Harquail, C.V., (1994) "Organizational Images and Member Identification", *Administrative Science Quarterly*, Vol. 39, No. 2, pp. 239-263.
- Fiorino, D.J. (2010) "Sustainability as a Conceptual Focus for Public Administration", *Public Administration Review*, Vol. 70, pp. S78-S87.
- Fishenden, J. and Thompson, M., (2013) "Digital Government, Open Architecture, and Innovation: Why Public Sector IT Will Never Be the Same Again", *Journal of Public Administration Research and Theory*, Vol. 23, No. 4, pp. 977-1004.
- Gil-Garcia, J. R., Zhang, J. and Puron-Cid, G., (2016) "Conceptualizing Smartness in Government: An Integrative and Multi-Dimensional View", *Government Information Quarterly*, Vol. 33, No. 3, pp. 524-534.
- Goodsell, C.T. (2006) "A New Vision for Public Administration", *Public Administration Review*, Vol. 66, No. 4, pp. 623-635.
- Granier, B. and Kudo, H., (2016) "How Are Citizens Involved in Smart Cities? Analysing Citizen Participation in Japanese 'Smart Communities'", *Information Polity*, Vol. 21, No. 1, pp. 61-76.
- Harrison, T.H., Pardo, T.A. and Cook, M., (2012) "Creating Open Government Ecosystems: A Research and Development Agenda", *Future Internet*, Vol. 4, No. 4, pp. 900-927.
- Hassan, S., Wright, B.E. and Yukl, G., (2014) "Does Ethical Leadership Matter in Government? Effects on Organizational Commitment, Absenteeism, and Willingness to Report Ethical Problems", *Public Administration Review*, Vol. 74, No. 3, pp. 333-343.
- Janowski, T., (2015) "Digital Government Evolution: From Transformation to Contextualization", *Government Information Quarterly*, Vol. 32, No. 3, pp. 221-236.
- Janowski, T., Pardo, T.A. and Davies, J., (2012) "Government Information Networks – Mapping Electronic Governance Cases Through Public Administration Concepts", *Government Information Quarterly*, Vol. 29, pp. S1-S10.
- Karp, T. and Helgø, T., (2008) "The Future of Leadership: The Art of Leading People in a "Post-Managerial" Environment", *Foresight*, Vol. 10, No. 2, pp. 30-37.
- Larsson, H. and Grönlund Å., (2014) "Future-oriented eGovernance: The Sustainability Concept in eGov Research, and Ways Forward", *Government Information Quarterly*, Vol. 31, pp. 137-149.
- Leon, R.D., (2013) "From the Sustainable Organization to Sustainable Knowledge-Based Organization", *Economic Insights-Trends & Challenges*, Vol. 65, No. 2, pp. 63-73.
- Linders, D., (2012) "From E-government to We-Government: Defining a Typology for Citizen Coproduction in The Age of Social Media", *Government Information Quarterly*, Vol. 29, No. 4, pp. 446-454.
- Lips, M., (2012) "E-Government Is Dead: Long Live Public Administration 2.0", *Information Polity* Vol. 17, No. 3-4, pp. 239-250.

- Meijer, A.J., (2011) "Networked Coproduction of Public Services in Virtual Communities: From a Government-Centric to a Community Approach to Public Service Support", *Public Administration Review* Vol. 71, No. 4, pp. 598-607.
- Meynardt, T., (2009) "Public Value Inside: What is Public Value Creation?", *International Journal of Public Administration*, Vol. 32, No. 3-4, pp. 192-219.
- Moynihan, D.P., Pandey, S.K. and Wright, B.E., (2009) "Pulling the Levers: Leadership, Public Service Motivation and Mission Valence", *International Public Service Motivation Research Conference*, June 7-9, Bloomington, IN.
- Moore, M.H., (1995) *Creating Public Value. Strategic Management in Government*, Harvard Business Press, Cambridge.
- OECD (2014) *Recommendation of the Council on Digital Government Strategies*, Public Governance and Territorial Development Directorate.
- O'Flynn, J., (2007) "From New Public Management to Public Value: Paradigmatic Change and Managerial Implications", *Australian Journal of Public Administration*, Vol. 66, No. 3, pp. 353-356.
- Osborne, S.P., (2018) "From Public Service-Dominant Logic to Public Service Logic: Are Public Service Organizations Capable of Co-Production and value Co-Creation?", *Public Management Review*, Vol. 20, No. 2, pp. 225-231.
- Osborne, S.P., (2010) Introduction. *The (New) Public Governance: A Suitable Case for Treatment?*, in Osborne S.P. (ed.), *The New Public Governance? Emerging Perspectives on the Theory and Practice of Public Governance*, Routledge, London and New York.
- Osborne, S.P., Radnor, Z. and Stokosch, K., (2016) "Co-production and The Co-Creation of Value in Public Services: A Suitable Case for Treatment?", *Public Management Review*, Vol. 18, No. 5, pp. 639-653.
- Osborne, S.P., (2006) "The New Public Governance", *Public Management Review*, Vol. 8, No. 3, pp. 377-387.
- Park, S.M. and Rainey, H.G., (2008) "Leadership and Public Service Motivation in US federal agencies", *International Public Management Journal*, Vol. 11 No. 1, pp. 109-142.
- Stoker, G. (2006) "Public Value Management. A New Narrative for Networked Governance?", *American Review of Public Administration* Vol. 36, No. 1, pp. 41-57.
- Van der Voet, J., (2014) "The Effectiveness and Specificity of Change Management in a Public Organization: Transformational Leadership and a Bureaucratic Organizational Structure", *European Management Journal*, Vol. 32, No. 3, pp. 373-382.
- Van Wart, M., (2013) "Lessons from Leadership Theory and the Contemporary Challenges of Leaders", *Public Administration Review*, Vol. 73 No. 4, pp. 553-565.
- Weick, K.E. and Sutcliffe, K.M., (2011) *Managing the Unexpected: Resilient Performance in an Age of Uncertainty*. John Wiley & Sons.
- Zbucnea, A. and Romanelli, M., (2018) "The Role of NGOs in Urban Development", in H. van der Meer, G. Enthoven and G. Schiuma (eds.), *Societal Impact of Knowledge and Design* (pp. 637-648), *Proceedings IFKAD 2018*.

Towards Sustainable Communities within Urban Ecosystems

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Abstract

Cities of tomorrow should evolve as sustainable communities that promote social and economic growth and development, and contribute to creating public value within urban services ecosystems. The aim of the study is to elucidate how cities can identify some pathways to develop the city as sustainable urban community. Cities as sustainable and smart communities should promote continuous innovation within knowledge-based, technological-enabled and learning-oriented society. Cities should select a pathway for sustainability promoting smartness as strategic and cultural vision that helps design and production of citizen-centred services, driving urban organisational networks and cooperation to develop knowledge management and innovation systems. As sustainable communities, cities should select a sustainability-oriented pathway to develop the community, enabling all the stakeholders to actively play a key role to support innovation and urban value creation. Cities should use technology in order to design a human-centered and community-oriented urban strategy for growth and development engaging urban stakeholders in innovation processes and systems, investing in urban intelligence as engines of sustainable development.

Keywords – sustainable cities, smart cities, smart communities, urban ecosystems, innovation.

Paper type – Academic Research Paper

1 Introduction

Rethinking cities of tomorrow relies on rediscovering sustainable and urban communities that promote social and economic growth. Cities contribute to engendering social and public value within urban ecosystems (European Commission, 2017). As engines and drivers of social and economic change, cities should become communities that develop and implement continuous innovation to drive sustainable competitiveness of urban service ecosystems and to improve the quality of life (Begg, 1999; Gómez-Baggethun and Barton, 2013). As ecosystems that create value and develop open innovation, adopting a knowledge-based approach to local urban growth (Newman and Jennings, 2008; Evans, Joas, Thundback and Theobald, 2005; Paskaleva, 2011; Knight, 1995), sustainable cities support strong growth as inclusive, smart and urban communities

that promote environmentally responsible behaviours (Deakin *et al.*, 2012). The future and sustainability of cities relies on urban communities that acquire intellectual capital fostering knowledge-based processes and infrastructures developing sources for innovation (Eger, 2005; Deakin, 2014). As smart and sustainable communities, cities should identify the smart approach as a vision that enables the city as a knowledge-based and technology-enabled engine that is able to design and implement urban development and sustainability of urban ecosystems (Lindskog, 2004; Gómez-Baggethun and Barton, 2013; Leydesdorff and Deakin, 2011).

The aim of the study is to elucidate how cities identify a pathway to evolve as sustainable and urban communities. Cities should select a pathway for sustainability promoting smartness as a human-centred vision to ensure citizen-centred services and drive urban organisational networks and cooperation in order to develop knowledge management and innovation systems and sources. Within knowledge-based, technological-enabled and learning-oriented society, cities should develop as sustainable and smart communities that promote continuous innovation within services ecosystems.

The paper is structured in six sections. Following the introduction and methodological section, in the third section, cities should be considered as sustainable and smart communities that evolve by developing technology-enabled innovation, knowledge sources and constructing the community as an organisational framework for innovation in order to drive growth in urban landscape. In the fourth section, it is elucidated how to drive cities as sustainable and smart communities that proceed towards sustainability, become smart cities and use technology in order to promote innovation. In the fifth section, a framework of analysis is presented in order to elucidate how cities can identify some pathways that are oriented to lead cities to becoming sustainable and urban communities. Finally, conclusions are outlined.

2 Methodological section

The study is theoretical and relies on a review of the literature that is related to understanding the concepts of sustainable city, smart city and smart community as drivers that enable urban stakeholders to design services and develop innovation driving the cities to proceed and evolve as sustainable and urban communities. Smartness, sustainability and community are the key words and values that help cities to rethink strategy and action about future urban development. The selected contributions are interpreted in a narrative synthesis in order to elucidate new perspectives and advance theoretical frameworks on emerging issues (Denyer and Tranfield, 2006; Dixon-Woods, Agarwall, Young, Jones and Sutton, 2004).

3 Cities as sustainable and smart communities

There are many definitions about what a city is. Cities as organisations rely on citizens as human resources and contribute to exercising social, economic, productive and cultural functions and performing task in order to create social and public value within

ecosystems. «Cities are complex entities and play multiple and complex economic and social roles» (Marceau, 2008, p. 126). According to Clark (2004) «cities are economic and social systems in space. They are a product of deep-seated and persistent processes which enable and encourage people to amass in large numbers in small areas» (p. 3). Cities should evolve as smart-driven and sustainability-oriented communities in order to build urban future development. As smart communities, cities should adopt a smart vision, select both knowledge-based and innovation-oriented strategies in order to achieve sustainability as a source that helps to design and implement urban development, social and economic growth within urban ecosystems (Eger, 2005; Gómez-Baggethun and Barton, 2013; Knight, 1995; Leydesdorff and Deakin, 2011; Lindskog, 2004; Zygiaris, 2013). Sustaining smart growth relies on revitalizing economic growth in urban areas by developing smart cities and communities that contribute to promoting innovation processes (European Commission, 2012). Cities as communities are made of people: their lives and beliefs influence their actions and thoughts driving history, values and beliefs of their cities (Carrillo, 2004). Developing cities as sustainable communities relies on strengthening social capital (Bridger and Luloff, 2001), making the cities as socially inclusive communities (Deakin *et al.*, 2012) and empowering citizens to actively play a key role in urban value creation in order to contribute to achieving urban sustainability (Haapio, 2012). Cities of tomorrow should sustain the competitiveness of urban ecosystems, enabling people, organizations and business to work and live in knowledge-based and global society (Begg, 1999). Cities as learning and knowledge-oriented systems support creative and morphogenetic processes over time (Camagni, 1996). Sustaining smart city and community development by information technology helps to empower individuals and groups to use skills and information for promoting change within communities and sharing data, information and knowledge for problem solving (Stratigeia, 2012; Chourabi *et al.*, 2012).

As sustainable and knowledge-based organizations, cities as communities should drive value creation in short, medium and long time dealing with knowledge and selecting a knowledge-based strategy in order to develop urban social and economic growth, and achieve social and environmental issues (Knight, 1995; Leon, 2013; Leon, 2018), using technology as a catalyst to transform the economy of an urban community by knowledge sources in order to drive sustainable growth (Eger, 2005; Eger, 2009). Cities should adopt a sustainability-oriented horizon in order to survive as successful urban communities because «cities live and die» (Schnore, 1971, p. 34). Cities as sustainable ecosystems and engines of economic and social growth are social incubators of change and innovation within urban communities (Newman and Jennings, 2008; Evans, Joas, Thundback and Theobald, 2005). Cities should design sustainable urban forms in order to rediscover the city as a community by shaping the urban ecosystem as open space and community-oriented environment (Jabareen, 2006). Sustainable urban development relies on promoting change urban management for urban growth (Mieg, 2012). Cities as smart communities proceed in a significant and positive way becoming spaces, places and platforms that enable to rediscover the opportunities offered by strategic collaboration, dialogue and cooperation between all the stakeholders or *helices* of urban environment

(government, industry, university and civil society) (Lindskog, 2004; Eger, 2005). Sustainable urban development relies on making the city as a system of innovation in order to solve the problems of sustainable development (Johnson, 2008). Cities as communities contribute to developing social and business networks that involve private and public actors to share skills, values and knowledge sources to drive social and urban development (Zbucheá and Romanelli, 2018). Smarter cities should develop innovation to promote governance and community development (Allwinckle and Cruickshank, 2011) sustaining collaborative organizational forms that benefit the urban services, business and social ecosystems (Deakin, 2014; Gómez-Baggethun and Barton, 2013; Lombardi, Giordano, Farouh and Yousef, 2011; Leydesdorff and Deakin, 2011).

4 How to drive cities to become sustainable communities

As evolving and social organisms, cities should design and aliment dynamic processes that involve all the urban stakeholders to develop and manage knowledge, assume values and ideals, select actions that contribute to making the city as a sustainable community. Cities should follow a smart approach as a vision to service innovation by technology. Cities should identify a pathway for sustainability as a vision that supports urban growth and learning in long-terms. They should evolve as a communities and engines of social and economic innovation that involve all the urban stakeholders. Sustainable cities as smart urban communities contribute to creating social, economic, cultural and public value, developing knowledge sources to achieve social and policy issues and to build innovation-oriented and knowledge-driven inter-organisational relationships (Knight, 1995; Paskaelva, 2011; Leon, 2013).

4.1 Towards sustainable cities

Cities of tomorrow should design and implement an inclusive, open and cohesive city developing creativity, diversity and social innovation (European Union, 2011). Sustainable cities «have strong economic growth, are socially inclusive in their growth, and are environmentally responsible» (Deakin *at al.*, 2012, p. 8). Building urban sustainability relies on strengthening the community, empowering citizens to play a key role in constructing development and values of the city, and promoting the construction of social capital as a source for achieving sustainability within social ecosystems (Carrillo, 2004; Bridger and Luloff, 2001; Haapio, 2012). Sustainable cities are socially inclusive and responsible in promoting urban growth (Deakin *at al.*, 2012, p. 8). Cities contribute to creating communities and learning systems that sustain creative processes over time (Camagni, 1996; Schnore, 1971). As places where most part of humanity is living (Newman and Jennings, 2008), cities are engines of economic and cultural growth in urban areas. Sustainable cities contribute to promoting social interaction and stimulating creativity by improving the wealth of people within community (Camagni, 1996).

Cities as meeting places and spaces contribute to sustaining learning and education. Cities are services providers and social incubators for driving change and innovation (Evans, Joas, Thundback and Theobald, 2005). Sustainable cities tend to improve

community-oriented and people-centered services (renewable energy, efficiency in use of water and electricity, green areas, fast public transportation and waste recycling systems) and contribute to building community by encouraging urban governance (planning and decentralization, civil and political rights), promoting social and economic development (education, green energy access, employment, green productive growth) and strengthening environmental management as drivers that help ensure better quality of life (UN, 2013). Cities help people, customers, enterprises and governments to support sustainable development (Satterthwaite, 1997) leading citizens to take everyday decisions (Haughton, 1997), driving change by achieving long-term horizons and successful issues (Czarniawska, 2002). Thereby, technology helps cities that aim at becoming sustainable. Cities select a pathway for sustainability using information and communication technologies (ICTs) to develop e-services through innovation and sustainable use of resources (Cocchia, 2014). ICTs contribute to sustaining smart strategy, improving services and quality of life towards sustainability (D'Auria, Tregua and Vallejo-Martos, 2018).

Cities as sustainable communities develop a framework to monitor system performance, help policy-making and facilitate feedback for individuals and business to build an intelligent urban system (Innes and Booher, 2000). Building sustainable urban development relies on improving the quality of life for people in a city in terms of ecological, cultural, political, institutional, social and economic elements without a burden can occur on the future generations. A sustainable city should be able to reform the way by which the city can interact with global economy and environment (Haughton, 1997). Sustainable cities contribute to promoting sustainable urban development improving and extending the wealth of people within a community (Trindade, Hinning, da Costa, Marques, Bastos and Yigitcanlar, 2017). Sustainable cities pay attention to social changes and equity to support development dealing with resilience, managing decision-making processes Sustainable cities offer new approaches to services relying on human side of change looking at the future and achieving goals in a community-based view following long-time horizon (D'Auria, Tregua and Vallejo-Martos, 2018).

4.2 Cities develop a smart approach to drive urban growth

Cities become smart by investing in human and social capital and developing new communication (transports and technologies) infrastructures, promoting sustainable economic growth and participatory governance to ensure high quality of life (Caragliu, Del Bo and Nijkamp, 2011). Cities should select a smart approach and vision for driving growth, service and community development within urban ecosystems (Zygiaris, 2013; Stratigeia, 2012). Cities should promote smartness as a vision that enables the city as a smart community that is oriented to change (Deakin, 2011) in order to modernize urban services and infrastructures employing ICTs in order to rethink the city design and planning. According to Giffinger *et al.* (2007) smart cities use technology to develop smart industries and smart economies, promoting smart mobility, sustaining smart government, relying on smart people and enhancing smart living and smart environment. Technology helps cities to design a path for sustainability relying on adopting and

following a smart approach for development. «Increasingly cities are seeking to become ‘smarter’ in how they are managed and developed in order to become more sustainable» (Deakin *et al.*, 2012, p. 8). Promoting smartness makes cities as urban communities that embrace a change orientation for driving urban development (Deakin, 2011). Cities should promote smartness as both a human-centred vision to urban development and a source that enables the involvement of local stakeholders in planning, defining and driving the sources for urban transformation of the city (Lara, Da Costa, Furlan and Yigitcanlar, 2016). Cities should adopt a smart orientation to improve urban services and enhance urban values, cohesion and innovation because smart city comprise: land, technology, citizens and government. Technology helps businesses, public bodies and citizens to develop and improve services infrastructures to drive the urban development in geographical areas (Dameri, 2013). Smart cities as communities achieve long-term issues using information technology in order to promote and extend high quality of life in urban environments strengthening the connections between productivity, economic growth and human capital, enhancing service systems and capabilities in an urban network and ecosystem (Albino, Berardi and Dangelico, 2015; Shapiro, 2006). Cities should adopt a smart strategy for continuous and sustainable urban development over time in order «for improving the operational and managerial efficiency and the quality of life by building on advances in ICTs and infrastructures» (Nam and Pardo, 2011, p. 186). Smarter cities should develop innovation for application as social, cultural environmental platforms rediscovering governance and community (Allwinkle and Cruickshank, 2011).

4.3 Promoting smart communities for innovation

Chourabi *et al.* (2012) refer to smart communities as cities that interact with citizens ICTs sharing data, information and knowledge for problem solving. Smart communities help all the members of a community (local government, business, education, healthcare institutions and the public) to learn to work together rediscovering the potential of information technology to transform the community in a positive way (Lindskog, 2004). According to Concilio, Cullen and Tosoni (2019) urban innovation relies on organizational and partnerships structures, citizen empowerment, knowledge creation and exploitation, networks of knowledge and innovation, adaptability to change and resilience. Smart communities enable citizen participation in services co-production (Granier and Kudo, 2016). «The process of reinvention and renewal of an entire community involves all its citizens and its institutions. Government, industry, academy and the citizenry each must assume responsibility for the future of the region and must share in the governing process to prepare the community for the challenges of the global digital age» (Eger, 2005, p. 34). Cities should be *loci* of innovation and innovative milieus (Shearmur, 2012). «It is in cities that, for example, innovative partnerships between government, business and communities may be easiest to arrange since the organisations concerned are smaller than at national levels and in principle at least more permeable than higher levels of government, leading to faster problem-solving and greater room for policy experimentation» (Marceau, 2008, p. 138). Cities should rethink how to promote urban growth, innovation and development by embracing a triple helix

model and rediscovering the active role of civil society as critical stakeholder that contributes to innovation processes and systems driving cooperation that involves industries, government, university and citizens (Lombardi, Giordano, Farouh and Yousef, 2011; Leydesdorff and Deakin, 2011). Cities should drive economic growth and become the main actors that stimulate open innovation, encouraging multi-level private-public partnership and cooperation to co-create, co-design and co-implement innovative solutions and action, promoting innovation as a means for public governance and stakeholder involvement (European Commission, 2017). Cities investing in innovation, technology and knowledge sources become knowledge-oriented cities that drive urban development and support learning environment (Kominos, 2013). As «laboratories of knowledge development and knowledge and application» (Kunzmann, 2014, p. 18), cities should contribute to sustaining an open innovation approach linking technology, people and territory in order to develop knowledge sources and policies to reinforce the cohesion of urban communities (Paskaleva, 2011). Cities as smart communities should acquire intellectual capital attracting and retaining skilled and talent people sustaining innovation systems by reinforcing knowledge and intellectual infrastructures (Leydesdorff and Deakin, 2011; Knight, 1995), involving public and private actors in order to drive social and urban development (Zbucheá and Romanelli, 2018).

5 Discussion

Rethinking a pathway for driving cities as sustainable urban communities relies on reconsidering the strategic role of cities within knowledge-based, learning-oriented and urbanized societies. Cities as smart communities contribute to improving the quality of life and competitiveness in urban, local and global environments. Increasingly, cities become incubators and spaces that enhance social and economic sustainability and innovation.

As shown in figure 1, the main contribution of this study is to identify a framework of analysis to understand how cities tend to identify some trajectories of sustainable development within urban ecosystems ecosystems. The analysed framework is presented in order to elucidate how cities identify a pathway to drive urban communities to proceed towards sustainability as a source for action and vision for change within urban ecosystems.

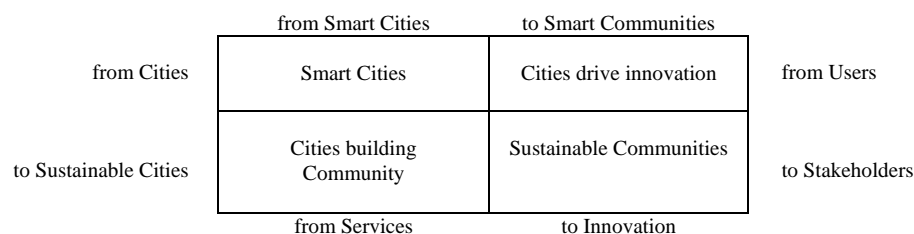


Figure 1 – Driving cities towards sustainable urban communities

Cities as communities design the future promoting sustainability and developing smartness as a strategic orientation that relies on technology-enabled services, managing knowledge for driving urban development and constructing organisational frameworks for innovation design that is oriented to collaboration and relies on enhancing innovation and social networks within urban ecosystems. Cities should develop innovation as a source that helps urban communities to drive social and economic growth and promote development by involving all the stakeholders of urban ecosystem, mobilizing organisational and managerial competences that enhance public value creation. As future-oriented communities oriented, cities should consider the sustainability as a condition that guides urban communities to assume behaviours and plan initiatives in urban planning in order to develop innovation-driven and community-oriented pathways. Smart and sustainable cities contribute to building the community as a value and source for development. Technology-enabled and services-oriented urban communities acquire human capital and develop knowledge sources helping organisational and individual learning in order to enable value creation within urban service and innovation ecosystems. As sustainable communities, cities should promote smart growth to develop the urban community and support a sustainability-oriented pathway moving from ensuring services to involving all the stakeholders to play a proactive role in the urban value co-creation process, rediscovering knowledge sources and promoting innovation in order to construct better policies for urban governance and entrepreneurship.

6 Conclusion

Cities of tomorrow should evolve as communities living in urban service and innovation ecosystems. Technology is a necessary but not sufficient source to enable cities to acquire, use and manage knowledge for breeding innovation and sustaining urban learning within ecosystems. Cities should use technology in order to plan a human-centered and community-oriented urban design for growth and development engaging with urban stakeholders and investing in human resources and urban intelligence as engines of sustainable, social and economic development. There are managerial, organizational and social implications. Cities should develop technological and knowledge sources to enable innovation processes that help drive sustainable growth in urban ecosystems. The study is conceptual and provides only a theoretical framework of analysis. It does not provide any empirical analysis. Future research perspectives imply to consider how cities use information technology to develop innovation in services, knowledge creation and governance as drivers of value creation within Italian local autonomies.

References

Albino, V., Berardi, U. and Dangelico, R.M., (2015) "Smart Cities: Definitions, dimensions, performance, and initiatives", *Journal of Urban Technology*, Vol. 22, No. 1, pp. 3-21.

- Allwinkle, S. and Cruickshank, P., (2011) "Creating Smart-er Cities: An Overview", *Journal of Urban Technology*, Vol. 18, No. 2, pp. 1-16.
- Begg, I., (1999) "Cities and Competitiveness", *Urban Studies*, Vol. 36, No. 5-6, pp. 795-809.
- Bridger, J.C. and Luloff, A.E., (2001) "Building the Sustainable Community: Is Social Capital the Answer?", *Sociology Inquiry*, Vol. 71, No. 4, pp. 458-472.
- Camagni, R., (1996) *Economia e Pianificazione della Città Sostenibile*, Il Mulino, Bologna
- Caragliu, A., Del Bo, C., and Nijkamp, P., (2011) "Smart cities in Europe", *Journal of Urban Technology*, Vol. 8, No. 2, pp. 65-82.
- Carrillo, F.J., (2004) "Capital Cities: a Taxonomy of Capital Accounts for Knowledge Cities", *Journal of Knowledge Management*, Vol. 8, No. 5, pp. 28-46.
- Chourabi, H., Gil-Garcia, J. R., Pardo, T.A., Nam, T., Mellouli, S., Scholl, H.J., Walker, S., and Nahon, K., (2012) "Understanding Smart Cities: An Integrative Framework", in 45th Hawaii International Conference on System Sciences(pp.2289-2297). IEEE.
- Clark, D., (2004) *Urban world/global city*, Routledge, London and New York.
- Cocchia, A., (2014) "Smart and Digital City: A Systematic Literature Review", in Dameri, R.P., and Rosenthal-Sabroux, C., *Smart City. How to Create Public and Economic Value with High Technology in Urban Space*(pp. 13-43), Progress in IS, Springer, Cham.
- Concilio, G., Cullen, J. and Tosoni, I. (2019) "Design Enabled Innovation in Urban Environments" in Concilio, G. and Tosoni, I. (eds.) *Innovation Capacity and the City*(pp. 85-101), Cham, Springer.
- Czarniawska, B., (2002) "Remembering while Forgetting: The Role of Automorphism in City Management in Warsaw", *Public Administration*, Vol. 62, No. 2, pp. 163-173.
- D'Auria, A., Tregua, M. and Vallejo-Martos, M.C., (2018) "Modern Conceptions of Cities as Smart and Sustainable and Their Commonalities", *Sustainability*, Vol. 10, No. 8, pp. 1-18.
- Dameri, R., (2013) "Searching for Smart City Definition: A Comprehensive Proposal", *International Journal of Computers & Technology*, Vol. 11, No. 5, pp. 2544-2551.
- Deakin, M., (2014) "Smart Cities: State-of-The-Art and Governance Challenge", *Triple Helix*, Vol. 1, No. 7, pp. 1-16.
- Deakin, M., (2011) "The Embedded Intelligence of Smart Cities", *Intelligent Buildings International*, Vol. 3, No. 3, pp. 189-197.
- Deakin, M., Hirst, P., Hummerstone, E., Webb, S., Karlsson, A.-K., Blin A.-S. and Duff, J., (2012), *JESSICA for Smart and Sustainable Cities*, European Investment Bank.
- Denyer, D. and Tranfield, D., (2006) "Using Qualitative Research Synthesis to Build an Actionable Knowledge Base", *Management Decision*, Vol. 24, pp. 213-227.
- Dixon-Woods, M., Agarwall, S., Young, B., Jones, D. and Sutton, A., (2004) *Integrative Approaches to Qualitative and Quantitative Evidence*, Health Development Agency, London, available at www.hda.nhs.uk
- Eger, J. M., (2005) "Smart Communities, Universities, and Globalization: Educating the workforce for tomorrow's economy", *Metropolitan Universities*, Vol. 16, No. 4, pp. 28-38.
- Eger, J.M., (2009) "Smart Growth, Smart Cities, and the Crisis at the Pump. A Worldwide Phenomenon", *I-Ways Journal of E-Government Policy and Regulation*, Vol. 32, No. 1, pp. 47-53.
- European Commission (2017) Report from the Commission to the Council on the Urban Agenda for the EU, COM(2017) 657 final, 20.11.2017
- European Commission (2012) *Smart Cities and Communities – European Innovation Partnership*, C(2012) 4701 final, Brussels, 10.7.2012.
- European Union (2011) *Cities of Tomorrow. Challenges, Visions, Ways Forward*. European Commission, Directorate General for Regional Policy, Bruxelles.

- Evans, B., Joas, S., Sundback, S. and Theobald, K., (2005) *Governing Sustainable Cities*, Earthscan, London.
- Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N. and Meijers, E., (2007) *Smart Cities: Ranking of European Medium-Sized Cities*. Vienna, Austria: Centre of Regional Science (SRF), Vienna University of Technology. Available from http://www.smart-cities.eu/download/smart_cities_final_report.pdf.
- Gómez-Baggethun, E. and Barton, D.N., (2013) "Classifying and Valuing Ecosystem Service for Urban Planning", *Ecological Economics*, Vol. 86, pp. 235-245.
- Granier, B. and Kudo, H., (2016) "How Are Citizens Involved in Smart Cities? Analysing Citizen Participation in Japanese 'Smart Communities'", *Information Polity*, Vol. 21, No. 1, pp. 61-76.
- Haapio, A., (2012) "Towards Sustainable Urban Communities", *Environmental Impact Assessment Review*, Vol. 322, pp. 165-169.
- Haughton, G., (1997) "Developing Sustainable Urban Development Models", *Cities*, Vol. 14, No. 4, pp. 189-195.
- Innes, J.E. and Booher, D.E., (2000) "Indicators for Sustainable Communities: A Strategy Building on Complexity Theory and Distributed Intelligence", *Planning Theory & Practice*, Vol. 1, No. 2, pp. 173-186.
- Jabareen, Y.R., (2006) "Sustainable Urban Forms: Their Typologies, Models, and Concepts", *Journal of Planning Education and Research*, Vol. 26, No. 1, pp. 38-52.
- Johnson, B., (2008) "Cities, Systems of Innovation and Economic Development", *Innovation: Management, Policy and Practice*, Vol. 10, No. 2-3, pp. 146-155.
- Knight, R.V., (1995) "Knowledge-based Development: Policy and Planning Implications for Cities", *Urban Studies*, Vol. 32, No. 2, pp. 225-260.
- Komninos, N., (2013) *Intelligent Cities: Innovation, Knowledge Systems and Digital Spaces*, Routledge, London.
- Kunzmann, K.R., (2014) "Smart Cities: A New Paradigm of Urban Development", *Crios*, Vol. 4, No. 1, pp. 9-20.
- Lara, A.P., Da Costa, E.M., Furlan, T.Z. and Yigitcanlar, T. (2016) "Smartness That Matters: Towards a Comprehensive and Human-Centred Characterisation of Smart Cities", *Journal of Open Innovation: Technology, Market and Complexity*, Vol. 2, No. 2, pp. 1-13.
- Leon, R.D., (2018) "Sustainable Knowledge Based Organizations. Definition and Characteristics", *Environmental Engineering and Management Journal*, Vol. 17, No. 6, pp. 1425-1437.
- Leon, R.D., (2013) "From the Sustainable Organization to Sustainable Knowledge-Based Organization", *Economic Insights – Trends and Challenges*, Vol. 65, No. 2, pp. 63-73.
- Leydesdorff, L. and Deakin, M., (2011) "The Triple-Helix Model of Smart Cities: A Neo-Evolutionary Perspective", *Journal of Urban Technology*, Vol. 18, No. 2, pp. 53-63.
- Lindskog, H., (2004) "Smart communities initiatives", in *Proceedings of the 3rd ISOneWorld Conference* (Vol. 16).
- Lombardi, P., Giordano, S., Farouh, H. and Wael, Y., (2011) "Modeling the Smart City Performance", *Innovation: The European Journal of Social Science Research*, Vol. 25, No. 2, pp. 137-149.
- Marceau, J. (2008) "Introduction. Innovation in the city and innovative cities", *Innovation*, Vol. 10, No. 2-3, pp. 136-145.
- Mieg, H.A., (2012) "Sustainability and Innovation in Urban Development: Concept and Case", *Sustainable Development*, Vol. 20, No. 4, pp. 251-263.
- Nam, T. and Pardo, T.A., (2011) "Smart City as Urban Innovation With Dimensions of Technology, People and Institutions", in *Proceedings of the 5th international conference on theory and practice of electronic governance*(pp. 185-194). ACM.

- Newman, P. and Jennings, J., (2008) *Cities as Sustainable Ecosystems. Principles and practices*, Washington DC, Island Press.
- Paskaleva, K.A., (2011) "The Smart City: A Nexus for Open Innovation?", *Intelligent Buildings International*, Vol. 3, No. 3, pp. 153-171.
- Satterthwaite, D., (1997) "Sustainable Cities or Cities that Contribute to Sustainable Development?", *Urban Studies*, Vol. 34, No. 10, pp. 1667-1691.
- Schnore, L.F., (1971) "The City as a Social Organism", in Bourne, L.S., *Internal Structure of the City. Readings on space and environment*(pp. 32-39), New York, Oxford University Press.
- Shapiro, J.M., (2006) "Smart Cities: Quality of Life, Productivity and the Growth. Effects of Human Capital", *The Review of Economics and Statistics*, Vol. 88, No. 2, pp. 324-335.
- Shearmur, R., (2012) "Are Cities the Font of Innovation? A Critical Review of the Literature on Cities and Innovation", *Cities* Vol. 29, pp. S9-S18.
- Stratigeia, A., (2012) "The Concept of 'Smart Cities'. Towards Community Development?" *Networks and Communication Studies*, Vol. 36, No. 3-4, pp. 375-388.
- Trindade, E.P., Hinnig, M.P.F., da Costa, E. M., Marques, J. S., Bastos, R. C. and Yigitcanlar, T., (2017) "Sustainable Development of Smart Cities: A Systematic Review of the Literature", *Journal of Open Innovation: Technology, Market, and Complexity*, Vol. 3, No. 1, pp. 1-14.
- United Nations (2013) *World Economic and Social Survey 2013. Sustainable Development Challenges*, Department of Economic and Social Affairs, New York.
- Zbuche, A. and Romanelli, M., (2018) "The Role of NGOs in Urban Development", in H. van der Meer, G. Enthoven and G. Schiuma (eds.), *Societal Impact of Knowledge and Design*(pp. 637-648), *Proceedings IFKAD 2018*.
- Zygiaris, S., (2013) "Smart City Reference Model: Assisting Planners to Conceptualize the Building of Smart City Innovation Ecosystems", *Journal of the Knowledge Economy*, Vol. 4, No. 2, pp. 217-231.

Exploration and Exploitation in the Local Development: Empirical Evidence from Italy

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Abstract

Exploitation and exploration are strongly complementary and both essential for successful innovation, organizational learning, and even organizational survival, although the simultaneous pursuit of both appears to be very difficult. In the literature, several studies focus on the issue of balancing exploration and exploitation at the firm level, while poor attention has been paid to firms' systems at the territorial level, such as geographical clusters. Based on this premise, the present paper tries to cover this gap by evaluating the effects of the exploration and exploitation on the economic and innovation performances of local systems of firms. An econometric analysis on the 103 Italian Provinces over the period 1999-2015 was performed. Main results show that Italian firms operating in the same province perform on average more exploration in unrelated technological domains than in the case of the same technological area. This behavior is not beneficial in terms of economic performance in the short run, but is conducive of innovation and employment. In the same technological domain, the exploitation of existing knowledge is prevailing among local systems of firms and affects negatively the employment. Finally, the paper aims to contribute theoretically and methodologically, to the scientific debate about the application of exploration-exploitation framework beyond the boundaries of single firms. In particular, results could support i) policy-makers in defining proper and customized initiatives and measures able to boost local economic and innovation growth; ii) academics and scholars in developing comparative studies

among diverse geographical contexts, benchmarking analysis and best practices identification at provincial, regional and national level.

Keywords: Exploration, Exploitation, Local development and growth, Econometric analysis

Paper type – Academic Research Paper

1 Introduction

Since the publication of March's (1991) pioneering article, the terms "exploration" and "exploitation" have increasingly come to dominate studies in the fields of innovation strategy, technology management, organizational learning and adaptation, and economic growth (e.g., Aghion and Howitt, 1992; Allen and McGlade, 1986; Benner and Tushman, 2003; Burgelman, 2002; Holmqvist, 2004; Katila and Ahuja, 2002; Levinthal and March, 1993; McGrath, 2001; Tushman and O'Reilly, 1996).

Exploration refers to learning gained through processes of concerted variation and planned experimentation (Baum et al., 2000). According to Benner and Tushman (2002) exploratory innovation involves a shift to a different technological trajectory. Along the same line, He and Wong (2004) defined exploratory innovation as technological innovation aimed at entering new product-market domains.

According to He and Wong (2004) exploitation strategies trigger learning processes aimed at improving the product-market domains. Therefore, exploitation refers to learning gained via local search, experiential refinement, and selection and reuse of existing routines domains (Baum et al., 2000). As a result, exploitative innovations involve improvements in existing components and build on the existing technological trajectory (Benner and Tushman, 2002).

Following March (1991), exploitation and exploration strategies are strongly complementary and both essential for successful organizational adaptation, technological innovation, organizational learning, and even organizational survival. However, although both exploration and exploitation are essential for assuring organizations' competitive advantages in the short and long-term, the simultaneous pursuit of both appears very difficult. First, they compete for scarce organizational resources, since more resources devoted to exploitation imply fewer resources left over for exploration, and vice versa. Second, both types of actions are iteratively self-reinforcing, as exploration often leads to more exploration, and exploitation to more exploitation (Cao et al., 2009). Finally, the mindsets and organizational routines needed for exploration are radically different from those needed for exploitation (Gupta et al., 2006).

Most of researches on the topic have highlighted the need for organizations to pursue strategies to balance exploration and exploitation, in order to achieve high performances in terms of learning, innovation and economic growth (Cao et al., 2009; He and Wong, 2004; Venkatraman et al., 2007). The dilemma between exploration and exploitation was therefore the object of particular attention in the field of organizational ambidexterity

(e.g. Junny et al., 2013). This rich line of studies has produced numerous researches at the level of the single company (e.g.:Raisch and Birkinshaw, 2009), dyadic collaborations (e.g., Lavie and Rosenkopf, 2006), strategic alliances (e.g: Lin et al., 2007). Little attention has been paid by the literature to the issue of balancing exploration and exploitation in the context of geographical firms' clusters. There is also a growing interest on the topic of how to reach the ambidexterity at the level of clusters or innovation networks (Bocquet and Mothe, 2015; Ferrary, 2011; Kauppila, 2007; Wolf et al., 2017), but the geographical dimension of the problem and the performances' implications at the territorial level are under-investigated (Wang et al., 2015). Thereby, this paper tries to cover this gap by evaluating the effects of the exploitation and exploration strategies on the economic and innovative performance of a local system of firms.

We believe our interest on the effects of the two strategies on a system of firms rather than on a single organization significantly contributes to the existing and growing literature (Ferrary, 2011, Kauppila, 2007). In fact, analyzing which of the two strategies is more conducive for the territorial development and growth, allows us to answer to an open question characterizing the studies in the field of economic growth and regional development, namely the relevance of heterogeneity in firms' competencies and capabilities for the competitive advantage of the local systems of firms (Boschma, 2005; Schampet al., 2004). Exploration strategies have been found to have a higher effect on the level of knowledge heterogeneity, because those strategies span on a wider range of technological knowledge. On the contrary, exploitation strategies involve an intensive search along an existing knowledge dimension, producing a lower diversity in the knowledge system (Quintana-Garcia and Benavides-Velasco, 2008). A fully understanding of the benefits and costs going along with the adoption of these distinct strategies at a territorial level still lacks, hence calling for further investigations.

To reach this aim, an empirical research has been conducted on the 103 Italian Provinces, by measuring for each Province both economic and innovative performance and indexes that capture the exploitation and exploration strategies. An econometric analysis on the 103 Italian Provinces over the period 1999-2015, controlling for an extensive set of control variables, is applied.

The remainder of the paper is organized as follows. Section 2 briefly introduces the exploration-exploitation framework and its relevance at the local level. Section 3 presents the research methodology, describing data, variables, and estimation method. Then, Section 4 reports the empirical results, while Section 5 concludes.

2 Background

The seminal paper of March of 1991 gave rise to a wide debate in various research fields (organizational learning, technological innovation, innovation strategy, etc.) on the need for organizations to search a trade-off between exploration and exploitation. Most of the studies on the subject have highlighted that exploration and exploitation are two distinct and complementary learning and innovation activities, both required to sustain survival, learning and innovation (Benner and Tushman, 2002). At the same time,

exploration and exploitation compete for scarce resources (Garcia et al., 2003) and refer to diverse time horizons in producing returns (March, 1991). March claims (1991, p. 73): “compared to returns from exploitation, returns from exploration are systematically less certain, more remote in time and organizationally more distant from the locus of action and adaptation”. Consequently, organizations naturally tend to focus on the refinement of existing knowledge and competences to gain efficiency and high returns in the short time, with the risk to experiment a competence trap and loose flexibility toward turbulent and changing environments (He and Wong, 2004). On the other side, pursuing exclusively exploration is associated with less efficiency in the short run and more uncertain returns (O’Reilly and Tushman, 2013).

Literature widely supports the idea that pursuing both exploration and exploitation, namely the ambidexterity strategy, is a key to successfully coping with the trade-off issue between exploration and exploitation at the single firm (Raisch et al., 2009) and strategic alliances’ levels (Lin et al., 2007). Numerous empirical studies (for an extensive review refer to Junny et al., 2013) have been conducted to test “the ambidexterity hypothesis” (He and Wong, 2004). Most of them find a positive relationship between the ability of an organization to follow an ambidexterity strategy and the performances implications, particularly when the domain of technological innovation is analyzed. These empirical studies mainly refer to established firms (e.g: Cao et al., 2009; Lubatkin et al., 2006) or to collaborations in strategic alliances between small and large firms (e.g: Lin et al., 2007). The applications of the exploration-exploitation framework to study innovation and growth of local systems of firms are very poor. There is a growing interest on this topic as demonstrated by the study of clusters’ ambidexterity. As stated by Wolf et al. (2017) “A cluster is ambidextrous if it manages to balance innovative activities that exploit existing competencies and is open to novel technological approaches by means of exploration”. According to Bocquet and Mothe (2015), a cluster can be ambidextrous if the firms inside the cluster are singularly ambidextrous, or if a portion of firms in the clusters perform exploration, while the remaining part is devoted to exploitation. Performances implications in terms of growth and innovation implications at the territorial level are taken for granted and not empirically investigated in these studies, that are mostly oriented to identify antecedents of ambidexterity, particularly by examining the role of governance structures or managerial orientation in this specific context. The present paper tries to explore more in depth whether and how exploration, exploitation and eventually both are pursued by a local system of firms placed in the same local area and tries to investigate performances implications at the level of Italian provinces.

3 Research Methodology

3.1 Data Sample

The dataset is represented by the 103 Italian Provinces. The idea to focus on provinces (NUTS3 classification) depends on the fact that little attention has been paid to the analysis of exploration and exploitation at such geographical level. From a

methodological point of view, this level of analysis lets to collect more detailed data and taking into account different industrial specializations inside a regional setting. From a policy perspective, this methodological choice appears to be relevant as results could support policy-makers in defining proper and effective economic and innovation measures at provincial rather than regional or national scale. The focus on Italy is justified by the traditional presence of diverse industrial geographical clusters and productive vocations within a same region/province, making interesting and relevant to investigate exploration and exploitation in this context. Indeed, to build our dataset we used different statistical sources: the Italian Office of National Statistics (ISTAT) databases; the European Patent Office (EPO) database; the Ministry of University and Research (MIUR) database, and the UNIONCAMERE database. Particularly, data on GDP, employment, population, and R&D investment come from ISTAT databases, data on university are extracted by the MIUR database, data on firms in two-digit and three-digit NACE codes come from the UNIONCAMERE database, and finally data on patents are provided by the EPO database. Data have been collected for each Province and refer to the period 1999-2015

3.2 Variables

3.2.1 Dependent variables

As the phenomenon under investigation is the development and growth of local areas, we used as dependent variable the number of patents developed in each province, as an indicator of the innovative performance (e.g. Jaffe and Trajtenberg, 2005; Acs et al., 2002), and the GDP, the employment rate (Employment-to-population ratio), and the unemployment rate as indicators of the economic performance.

They have been measured by:

$$Patent_p = \text{Number of patents registered in the province} \quad (1)$$

$$GDP_p = \left(\frac{GDP_{region}}{N.employees_{region}} \right) \times N.employees_{province} \quad (2)$$

$$Employment_rate = \frac{Employees}{population} \times 100 \quad (3)$$

$$Unemployment_rate = \frac{Unemployed_workers}{total_labour_force} \times 100 \quad (4)$$

These variables have been measured in a time period of seventeen years (1999-2015). Finally, in order to exclude endogeneity problems, the dependent variables are lagged of three years respect to the independent variable.

3.2.2 Independent variables

To capture the characteristics of the strategies carried out within the provinces, in terms of exploitation and exploration, the degree of a province's industrial heterogeneity has been measured by using the inverse Gini coefficient (Greunz, 2004; Paci and Usai, 1999; van der Panne and van Beers, 2006). The index aims at capturing the level of concentration of firms in a specific industrial sector and it has been measured over a period of seventeen years.

Specifically, focusing on the manufacturing sector, we use two different measures: 1) the inverse Gini coefficient of the distribution of firms by sector (two-digit level) in each province ($\text{invGini}_{\text{unrelated-sector}}$); 2) the inverse Gini coefficient of the distribution of firms within each two-digit sector in each province ($\text{invGini}_{\text{related-sector}}$). The $\text{invGini}_{\text{unrelated-sector}}$ measures the heterogeneity across unrelated manufacturing sectors, as those characterized by a greater technological diversity. Instead, $\text{invGini}_{\text{related-sector}}$ measures the heterogeneity across related manufacturing sectors, namely those characterized by a greater technological similarity. Following Frenken et al. (2007), we assume that the related manufacturing sectors are those that share the same 2-digit NACE code.

The Gini index is defined as follows:

$$\text{invGini} = 1 - \left(\frac{\sum_{i=1}^{n-1} (Q_i - P_i)}{\sum_{i=1}^{n-1} P_i} \right) \quad (5)$$

Where:

- i indexes the manufacturing sector ($i = 1 \dots n-1$), classified into the two-digit NACE code for the $\text{invGini}_{\text{unrelated-sector}}$ and into the three-digit codes that share the same 2-digit class for the $\text{invGini}_{\text{related-sector}}$;
- $Q_i = \frac{\sum_{j=1}^i F_j}{CF}$
- $\sum_{j=1}^i F_j$ is the cumulative sum of firms in each manufacturing sector, classified into 2-digit NACE code/ 3-digit code, when the sector is ordered in increasing order;
- CF is the total number of firms.
- $P_i = \frac{i}{n}$

The inverse Gini coefficient ranges from a minimum value of zero to a maximum of one. Values of the index close to zero indicate that the industrial system in the province is specialized into a very few sectors, while values of the inverse Gini coefficient close to one indicate that the province industry specialization is spread across the different manufacturing sectors. Therefore, we assume that values of $\text{invGini}_{\text{unrelated-sector}}$ close to

one reflect exploration strategies towards industries that are characterized by a greater technological diversity, while values of $\text{invGini}_{\text{related-sector}}$ close to one reveal exploration strategies towards industries technologically related. Values of the inverse Gini coefficient close to zero indicate exploitation strategies within the province.

3.2.3 Control variables

The analysis includes several control variables. First, in order to take into account the general economic conditions of the provinces, we use a polytomic variable for provinces localized in the Northern Italy, generally considered as a more advanced and developed area (Mariotti et al., 2008). Four other controls have been included that may affect the province innovative performance. Specifically, the first variable refers to the presence of universities within the province area, which are considered as sources of new knowledge (Benneworth and Hospers, 2007; Cooke and Piccaluga, 2004). The second variable measures the R&D expenditure in the area. The index is defined as follows:

$$R \& D_p = \left(\frac{R \& D_r}{F_r} \right) \times F_p$$

Where:

- $R \& D_p$ is the amount of R&D investments in region r where the province p is located.
- F_r is the total number of firms in region r .
- F_p is the total number of firms in province p .

R&D expenditure has been frequently used as a proxy for the local capability to generate new knowledge and innovation (Cohen and Klepper, 1991; 1992; Frenken, 2007).

Thirdly, we control also for the scale of local economic activity, measured by the total number of firms located in each province as a determinant of some type of cross-fertilization and economic advantages, usually called urbanization externalities (e.g. Lorenzen and Frederiksen, 2008). In other words, the number of firms in each province aims to measure the entrepreneurial system considered as a factor influencing the local economic growth (e.g. Bertinelli and Black, 2004; Hendersen, 1997; Lorenzen and Frederiksen, 2008). Indeed, the scale and/or the diversity of local economic activity outside the own industry, by involving an exchange of complementary knowledge between economic actors operating in diverse fields (Isard, 1956; Jacobs, 1969), could enable innovation and economic growth. As highlighted by Jacobs (1969), relevant sources of knowledge are often not necessarily found within, but rather outer the own industrial environment. Thereby, a more diversified industrial structure may provide

access to different and complementary technological knowledge and therefore boost innovative activities (Beaudry and Schiffauerova, 2009).

Finally, we control for the technological level of the local industry in each considered province (Head et al., 1995), by using a polytomic codified variable.

4. Results and discussions

4.1 Descriptive statistics

In order to estimate the relationship between the economic and innovative performance and exploitation and exploration strategies carried out within the province, proxied by the variables presented in Section 3, we apply a linear estimator. The reason for choosing such estimator is because a linear regression well-adapt to our model.

The descriptive statistics together with correlation matrix are shown in Table 1 and Table 2, respectively.

Table 1. Descriptive statistics

	Mean	St. Dev.	Min	Max	Obs
Patent (n.)	36,08	2,95	0	714,78	515
GDP _p (€)	23,06	0,034	21,18	25,67	515
Empl_rate	49,94	0,57	23,57	72,36	515
Unempl_rate	9,23	0,23	1,85	31,46	515
invG _{unrelated-sector}	0,42	0,004	0,15	0,73	515
invG _{related-sector}	0,34	0,002	0,11	0,48	515
R&D _p (€)	15,61	0,15	9,06	21,30	515
N _{university} (n.)	0,80	0,07	0	15	515
N _{firms} (n.)	35086,77	1800,12	2122	338010	515

Focusing on the results shown in Table 1, it is possible to note that Italian provinces, over the time, have not strongly invested in R&D activities; this result is confirmed by the average number of EPO patents at provincial level. The values of the two inverse Gini indexes show that Italian firms follow mainly exploitation strategies within the provinces as their values are more close to 0 than 1. Put differently, the industrial system is specialized into a very few sectors within each province. Moreover, being invGini_{unrelated-sector} slightly higher than invGini_{related-sector}, and its maximum value equal to 0,73 (Table 1), it is possible to conclude that some provinces realize exploration strategies towards industries that are characterized by a greater technological diversity.

Focusing on the analysis of the Maximum and Minimum values at provincial level we can claim that the best performing provinces are mainly located in the Northern Italy. In particular, Milan is the best performing province in terms of number of patents, GDP, activities, and number of firms, while the best Italian province in terms of employment rate is Parma. The lowest unemployment rate is up to Reggio Emilia. Roma is the best

province in terms of number of universities and investments in R&D activities. On the contrary, in the Southern Italy it is possible to find the worst provinces in terms of GDP (Isernia), employment rate (Vibo Valentia), unemployment rate (Crotone), and number of firms (Isernia). It is important to underline that such results are not shown in this paper, but they are available upon request.

Table 2 shows the correlation coefficients among variables. The correlation matrix shows that the variables are not significantly correlated: Pearson correlation coefficients are almost all lower than 0.5 at a p-value less than 0.05.

Furthermore, to understand whether multicollinearity exists between independent variables, the variance inflation factor (VIF) test has been performed. Accordingly, as a rule of thumb, a multicollinearity problem does not threaten the validity of models if VIF scores are less than 10. All independent variables got the value of VIF lower than 4 in this test. Therefore, multicollinearity does not bias the regression results. This result is confirmed also by R^2 very large in both regression analyses performed.

In the following sections, the results of the linear estimation are presented and discussed.

Table 2. Correlation matrix

	GDP	Patent	Empl_rate	Unempl_rate	invG _{unrelated-sector}	invG _{related-sector}	R&D _p	N _{university}	N _{firms}	Geographical Area	TECH_Level_Industry
GDP	1										
Patent	0,664	1									
Empl_rate	0,153	0,245	1								
Unempl_rate	-0,223	-0,308	-0,604	1							
invG _{unrelated-sector}	0,303	0,216	-0,628	0,234	1						
invG _{related-sector}	0,534	0,438	0,138	-0,330	0,447	1					
R&D _p	0,223	0,196	0,610	-0,454	-0,782	0,023	1				
N _{university}	0,710	0,684	0,328	-0,163	-0,148	0,280	0,549	1			
N _{firms}	0,568	0,448	0,054	-0,018	0,124	0,313	0,178	0,682	1		
Geographical Area	0,286	0,378	0,425	0,736	0,109	-0,439	0,102	0,072	-0,078	1	
TECH_Level_Industry	0,285	0,392	0,321	0,402	-0,108	0,331	0,157	0,154	0,030	0,538	1

Model Estimation

The results of linear estimation of effects of exploitation/exploration strategies on the economic and innovative performance for Italian provinces over the period 1999-2015 are reported in the Table 3 and Table 4.

In particular, Table 3 reports the effects of the exploration strategies across technologically unrelated industries on the economic and innovative performance of the Italian provinces. Table 4 reports the effects of the exploration strategies across technologically related industries on the economic and innovative performance of the Italian provinces.

Table 3. Linear estimation of the effect of exploration strategies across technologically unrelated industries on the economic and innovative performance (1999- 2015).

	GDP _p	Patent	Employ_ rate	Unemploy_ Rate
invGini _{unrelated}	-0,780* (0,462)	36,954 (47,890)	24,651*** (5,705)	-17,310*** (3,503)
R&D	0,138*** (0,015)	-2,625* (1,514)	2,133*** (0,180)	-0,430*** (0,111)
N _{firms}	0,000*** (0,000)	0,001*** (0,000)	0,000*** (0,000)	0,000*** (0,000)
N _{university}	0,021 (0,016)	-4,894** (1,630)	0,539** (0,194)	-0,193 (0,119)
Geo_area	-0,128*** (0,024)	-18,716*** (2,489)	-7,057*** (0,297)	4,138*** (0,182)
Tech_Industry	0,052 (0,043)	-15,720*** (4,423)	-0,010 (0,527)	-0,511 (0,323)

Numbers in parentheses are the standard errors

Asterisks denote the significance of the coefficient estimates: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Results show a positive and significant relation between the invGini_{unrelated} index and the Employment rate and, coherently, a negative and significant relation between the invGini_{unrelated} index and the Unemployment rate. Moreover, a negative and significant relationship exists between invGini_{unrelated} index and the GDP, that is a measure of the provincial economic performance. The existence of a negative and significant relation between invGini_{unrelated} index and the GDP is consistent with the literature, as investments in exploration strategies imply high costs for the systems performing them and more uncertain income, at least in the short period. Put differently, this means that there is a lost of efficiency in the short run with respect to the cases in which firms of the local system focus on the same technological domain.

As for the effect on the innovative performance of the province, measured by patents, we find a positive coefficient, in line with our expectation that exploration strategies may increase the likelihood that some innovative activity occurs, although not significant.

Table 4. Linear estimation of the effect of exploration strategies across technologically related industries on the economic and innovative performance (1999- 2015).

	GDP	Patent	Employ_ rate	Unemploy_ Rate
invGini _{related}	6,653*** (0,477)	132,301*** (49,421)	-46,195*** (5,887)	12,143*** (3,615)
R&D	0,138*** (0,015)	-2,625* (1,514)	2,133*** (0,180)	-0,430*** (0,111)
N _{firms}	0,000*** (0,000)	0,001*** (0,000)	0,000*** (0,000)	0,000*** (0,000)
N _{university}	0,021 (0,016)	-4,894*** (1,630)	0,539*** (0,194)	-0,193 (0,119)
Geo_area	-0,128*** (0,024)	-18,716*** (2,489)	-7,057*** (0,297)	4,138*** (0,182)
Tech_Industry	0,052 (0,043)	-15,720*** (4,423)	-0,010 (0,527)	-0,511 (0,323)

Numbers in parentheses are the standard errors

Asterisks denote the significance of the coefficient estimates: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Results reported in table 4 show a positive and significant relationship between the $invGini_{related}$ index and the GDP and the number of patent applications (a typical measure of the innovation outputs). Such a result suggests that exploration strategies across technologically related industries increase both the economic and innovative performance of the province.

On the contrary, we have a negative and significant relationship between exploration strategies across technologically similar industries and the Employment rate and, coherently, a positive and significant relation between the $invGini_{related}$ index and the Unemployment rate.

In general and taking into account data reported in Table 1, it is possible to claim that firms located in Italian provinces try to balance exploration-exploitation strategies (with a small preference for exploitation) when considering unrelated technological domains. This result is in line with the literature about the ambidexterity that underline the need for organization to pursue simultaneously both the strategies, although it is a very complicated task (Cao et al., 2009; Gupta et al., 2006; March, 1991).

On the contrary, Italian firms opt mainly for exploitation strategies when organizations share common technological expertise.

Finally, exploration strategies across diverse technological domains have a positive and significant impact on the innovation performances and on the employment in a local area, while the economic performance in the short run is negatively affected. On the contrary, exploration strategies in similar industries affect positively and significantly the GDP and the number of patent applications, whereas impacting negatively on the level of employment.

5 Conclusions

The paper aims to better analyze the impact of exploration and exploitation strategies on the local economic and innovation development. In other words, although a wide stream of literature focuses on the analysis of the balance of exploration-exploitation strategies at the firm level (e. g.: Cao et al., 2009; He and Wong, 2004; Lubatkin et al., 2006) and some contributions exist with respect to networks or clusters (e.g. Bocquet and Mothe, 2015; Ferrary, 2011), little attention has been paid by the literature to this issue in geographical contexts, such as the provincial level (Wolf et al., 2017).

According to this, the paper tries to address this issue by evaluating the effects of the exploitation and exploration strategies on the economic and innovation performances of local systems of firms in Italy.

Based on this premise, an econometric analysis on the 103 Italian Provinces over the period 1999-2015 has been performed.

Results show that Italian firms operating in the same province try to balance exploration-exploitation strategies with respect to unrelated technological domains (mean value of $invGini_{unrelated} = 0,42$), while they opt mostly for exploitation in related technological areas (mean value of $invGini_{related} = 0,36$).

Results also show that the impact of increasing exploration in a province, on the economic and innovation performances, depends on the way the exploration activities are performed. When exploration is devoted to cover differently technological domains, there are good results for the rate of employment and for innovation, but reduced economic performances. On the other side, when exploration is focused on similar technologies domains in a same technological area, then there is a benefit in terms of GDP, but not in terms of employment rate.

Thereby, we believe that our paper could contribute, theoretically and methodologically, to the scientific debate about the implications of pursuing ambidexterity strategies in geographical contexts. Specifically, the analysis of the impact of these two strategies on territorial development and growth, could support policy-makers in defining proper and customized initiatives and measures able to boost local economic and innovation growth.

Finally, this paper has also implications for academics and scholars. Specifically, we propose an interpretative and econometric model to analyze the impact of exploration-exploitation strategies in different geographic contexts both at European and International level. Such analyses could represent a crucial preparatory step to support comparisons among diverse contexts, benchmark analysis and identification of best practices at provincial, regional and national level.

References

- Acs, Z. J., Anselin, L., and Varga, A. (2002). Patents and innovation counts as measures of regional production of new knowledge. *Research policy*, 31(7), 1069-1085.
- Aghion, P., and Howitt, P., (1992), "A model of growth through creative destruction", *Econometrica*, 60(2), 323-351.
- Allen, P., and McGlade, J., (1986), "Dynamics of discovery and exploitation : the case of the scotian shelf groundfish fisheries", *Canadian Journal of Fishery and Aquatic Sciences*, 43, 1187-1200.
- Baum, J. A. C., Li, S. X., and Usher, J. M., (2000), "Making the next move: How experiential and vicarious learning shape the locations of chains' acquisitions", *Administrative Science Quarterly*, 45: 766-801.
- Beaudry, C., and Schiffauerova, A. (2009). Who's right, Marshall or Jacobs? The localization versus urbanization debate. *Research policy*, 38(2), 318-337.
- Benner, M. J., and Tushman, M. L., (2002), "Process management and technological innovation: A longitudinal study of the photography and paint industries", *Administrative Science Quarterly*, 47: 676-706.
- Benner, M. J., and Tushman, M. L., (2003), "Exploitation, exploration, and process management: The productivity dilemma revisited", *Academy of Management Review*, 28: 238-256.
- Bertinelli, L., and Black, D. (2004). Urbanization and growth. *Journal of Urban Economics*, 56(1), 80-96.
- Bocquet, R. and Mothe, C., 2015. Can a governance structure foster cluster ambidexterity through knowledge management? An empirical study of two French SME clusters. *Knowledge Management Research & Practice*, 13(3), 329-343.
- Boschma, R.A., (2005), "Proximity and innovation: a critical assessment", *Regional Studies*, 39: 61-74.

- Burgelman, R. A., (2002), "Strategy as vector and the inertia of coevolutionary lock-in", *Administrative Science Quarterly*, 47: 325–357.
- Cao, Q., Gedajlovic, E., and Zhang, H., (2009). Unpacking organizational ambidexterity: Dimensions, contingencies, and synergistic effects. *Organization Science*, 20(4), 781-796.
- Ferrary, M. (2011). Specialized organizations and ambidextrous clusters in the open innovation paradigm. *European management journal*, 29(3), 181-192.
- Garcia, R., Calantone, R. and Levine, R., (2003). The role of knowledge in resource allocation to exploration versus exploitation in technologically oriented organizations. *Decision sciences*, 34(2), 323-349.
- Gupta A. K., and Smith K. G., Shalley C. E., (2006), The interplay between exploration and exploitation. *Academy of Management Journal* 49(4), 693–706.
- Head, K, Ries, J and Swenson, D. (1995). Agglomeration benefits and location choice: Evidence from Japanese manufacturing investments in the United States. *Journal of International Economics*, 38(3–4): pp. 223–47.
- He, Z.-L., and Wong, P.-K., (2004), Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science*, 15: 481–494.
- Henderson, V. (1997). Externalities and industrial development. *Journal of urban economics*, 42(3), 449-470.
- Holmqvist, M., (2004). Experiential learning processes of exploitation and exploration within and between organizations: An empirical study of product development. *Organization Science*, 15: 70–81.
- Jacobs, J. (1969), *The Economy of Cities*, Random House, New York.
- Junni, P., Sarala, R. M., Taras, V., and Tarba, S. Y., (2013). Organizational ambidexterity and performance: A meta-analysis. *Academy of Management Perspectives*, 27(4), 299-312.
- Katila, R., and Ahuja, G., (2002), "Something old, something new: A longitudinal study of search behavior and new product introduction", *Academy of Management Journal*, 45: 1183–1194.
- Kauppila OP (2007) Towards a network model of ambidexterity. Working Paper 429, Helsinki School of Economics, May. Paper presented at the 17th Nordic Workshop on Interorganisational Research, 16–18 August.
- Isard, W. (1956). Regional science, the concept of region, and regional structure. *Papers in Regional Science*, 2(1), 13-26.
- Lavie D., and Rosenkopf L., (2006), Balancing exploration and exploitation in alliance formation. *Academy of Management Journal* 49(6), 797–818.
- Lazzeretti, L., and Tavoletti, E. (2005). Higher education excellence and local economic development: The case of the entrepreneurial university of Twente. *European Planning Studies*, 13(3), 475-493.
- Levinthal, D. A., and March, J. G. (1993). The myopia of learning. *Strategic Management Journal*, 14 (2), 95-112.
- Lin, Z., Yang, H. and Demirkan, I., (2007). The performance consequences of ambidexterity in strategic alliance formations: Empirical investigation and computational theorizing. *Management science*, 53(10), 1645-1658.
- Lorenzen, M., and Frederiksen, L. (2008). Why do cultural industries cluster? Localization, urbanization, products and projects. *Creative cities, cultural clusters and local economic development*, 155-179.
- Lubatkin, M.H., Simsek, Z., Ling, Y. and Veiga, J.F., (2006). Ambidexterity and performance in small-to medium-sized firms: The pivotal role of top management team behavioral integration. *Journal of management*, 32(5), 646-672.
- March, J. G., (1991), "Exploration and exploitation in organizational learning", *Organization Science*, 2: 71–87.

- McGrath, R. G., (2001), "Exploratory learning, innovative capacity, and managerial oversight", *Academy of Management Journal*, 44: 118–131.
- O'Reilly III, C.A. and Tushman, M.L., 2013. Organizational ambidexterity: Past, present, and future. *Academy of management Perspectives*, 27(4), 324-338.
- Quintana-Garcia, C. and Benavides-Velasco, C.A., (2008), "Innovative competence, exploration and exploitation: The influence of technological diversification", *Research Policy*, 37: 492–507.
- Raisch, S. and Birkinshaw, J., (2009), "Organizational ambidexterity: Antecedents, outcomes, and moderators", *Journal of management*, 34(3), pp.375–409.
- Raisch, S., Birkinshaw, J., Probst, G. and Tushman, M.L., (2009). Organizational ambidexterity: Balancing exploitation and exploration for sustained performance. *Organization science*, 20(4), 685-695.
- Schamp, E.W., and Rentmeister, B., Lo, V., (2004), "Dimensions of proximity in knowledge-based networks: the cases of investment banking and automobile design", *European Planning Studies*, 12: 607–624.
- Tushman, M.L. and O'Reilly, C.A., (1996). The ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review*, 38 (4), 8-30.
- Venkatraman, N., Lee, C.H. and Iyer, B., (2007). Strategic ambidexterity and sales growth: A longitudinal test in the software sector. In Unpublished Manuscript (earlier version presented at the Academy of Management Meetings, 2005).
- Wang, Y., Sutherland, D., Ning, L. and Pan, X., (2015). The evolving nature of China's regional innovation systems: Insights from an exploration–exploitation approach. *Technological Forecasting and Social Change*, 100, 140-152.
- Wolf, T., Cantner, U., Graf, H., and Rothgang, M. (2017). Cluster ambidexterity towards exploration and exploitation: Strategies and cluster management. *The Journal of Technology Transfer*, 1-27.

Migration and Diversity Potentials for Organisations

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Abstract

A successful integration of migrants in the labour market and in organisations is getting more important based on demographic changes. The central aim of the investigation is to deal with problem fields of the Human Resource Management, which arise by demographic changes regarding migration. Therefore, an explorative qualitative study with human resource managers and diversity representatives of the large DAX companies was conducted. The views of leaders and employees with and without an immigration background regarding diversity potentials in organisation are compared in this study. The results indicate that diversity is important for organisations. Employees have recognised the importance of diversity. Managers have not recognised the seriousness and urgency of cultural diversity and diversity actions. Human resource managers are not able to assess the additional stress of migrants correctly and to consider them in their day-to-day management and diversity actions.

Keywords: migration, diversity potentials, intercultural competence, human resource management

1 Introduction

The issue of diversity has high priority in Germany but also in other European countries. The process of globalisation as well as the European Integration increases the need for action of societies and organisations to adapt their structures and processes to demographic changes and diversity. Since the 19th century, the life expectation of people has doubled in Germany. (German Federal Statistical Office, 2015).

To ensure the employees' and leader's performance, organisations have to select suitable employees, who bring required diversity-competences like intercultural competence, social and digital competences, to address effectively the challenges of the 21st century. The interaction of people from different cultures is no longer an exception, but every day present (Fantini, 2009). People from different cultures are often discriminated in practice, although they are important potentials for organisations. Thus, organisations have to promote proactively, especially ageing employees, women and persons with an immigration background (Fuchs & Dörfler, 2005).

A successful Diversity Management is seen as indispensable for organisations in the long term. The strong interest of society and economy regarding Diversity Management

can be explained by the fact that the society has changed due to demographic processes and strong migration flows in the last two years, 2016 and 2017, in Europe. The result is a greater heterogeneity in societies and organisations.

More than 2.600 companies and institutions are signatories of the Diversity charter of German companies. However, by considering the national cross section of organisations in Germany, it is shown that around two thirds of the companies are not active regarding diversity and did not implement diversity management (KFW Research, 2017). Diversity has to be organised and consciously integrated in the respective organisation, when it should be used as a chance (e. g. Thomas, 2003; Franken, 2015). Migration delays the process of ageing society, but cannot solve it permanently (German Federal Statistical Office, 2016). So this article focuses on a more successful integration of diverse employees.

2 Diversity Management

Diversity Management describes the personnel diversity in organisations (Becker, 2006) and the commonalities and differences of individuals (Krell, 2003). It indicates both the obvious and barely perceived and salient characters like age, religion, sexual orientation, cultural values as well as barely obviously changing characters like language and competence (Miliken & Martin, 1996) and the values of equal opportunity and fairness.

Diversity Management aims to create diversity in organisations and to change the values, attitudes and behaviours of organisation and working groups (Ashikali & Groeneveld, 2015). The prerequisite for an organisation for the success of diversity is the appreciation of employees and their different individuality (Vedder, 2011). Persons should be treated equally, except of their cultural individual characteristics and should use their skills free from norms and stereotypes (Vedder, 2011).

Diversity of employees can have different effects in an organisation. It depends especially on the fact how diversity is respected. If the variety refers to status, negative effects for the organisation's performance are shown. If employees bring experiences, e. g. based on their different cultural background, it can have positive effects. An active promotion of this kind of diversity can contribute to an improvement of organisational results (Garib, 2013).

Diversity can be enriching for organisations and individuals, when they do a perspective change (Page, 2007). Studies pointed out that individuals with a pro-diversity belief describe multicultural groups as good, precisely by the fact of the group's diversity. People with a pro-diversity belief identify themselves stronger with the group (Van Dick et al., 2008). This accords to the social identity. Wolf and Van Dick (2008) illustrated in their study that people, who see migrants as an enrichment, have more contacts to them and express less racism than those, who do not see migrants as enrichment for the society. Stegman (2011) pointed out in his Meta-Analysis that pro-diversity beliefs as well as a positive diversity culture result in beneficial results for groups and individuals and increase job performance.

Different reasons exist about the organisation's reason and normative convictions of integrating diversity in their company strategy and culture (Ely & Thomas, 2001; Van der Zee & Otten, 2014). The first approach is the discrimination-and-fairness approach. The equal opportunity of everyone is of central importance. Quotes like anti-discrimination laws can be mentioned as examples. The second approach is the access-and-legitimacy-perspective. This approach understands diversity in the organisation as an access to new markets and is seen as an added value by the organisations (Van der Zee & Otten, 2014). The third approach is the integration-and-learning-perspective. Diversity is seen as a resource for learning, changing and renewal. Managers appreciate diversity on every level and encourage the exchange of different opinions. All three diversity's approaches are successful to motivate managers to diversify their staff. But only the integration-and-learning approach leads to reach sustainable advantages (Van der Zee & Otten, 2014).

Leaders take an important role in diversity management. They have an influence on the satisfaction, health and performance of employees (Franken, 2015). Managers take over different roles in their function as a leader and are between role model function and performance pressure (Franken, 2015). Especially, managers take over a central role by initiating diversity management (Wildermuth & Gray, 2005). Top managers take over the role of developing the diversity strategy. Leaders of the middle management implement the strategy. Therefore, the middle management plays a key role and demonstrates variety. They carry responsibility for a successful implementation of diversity management and are supporter of diversity competences (Thomas, 1990). The task of the leaders is to convince employees of the issue of variety (Dreas & Rastetter, 2016).

All studies have one in common. When organisations do not implement diversity actions in their company, the effects are negative and impair the working conditions for heterogeneous and homogeneous organisations.

It is shown that diversity is a competitive advantage, but at the same time, it can be a source of conflicts and counterproductive behaviour. A diversity fair personnel selection is important for organisations because it gives organisations flexibility and adaptation (Kersting & Ott, 2016).

3 Age and Migration as Diversity Categories

The employment of persons with an immigration background and ageing persons can have advantages for organisations, but can also lead to difficulties. Employees are confronted with different challenges by the international cooperation, which can lead to stress (Holmes & Rahe, 1967).

Thereby, immigration background is defined according to the typical definition of the German society: a person with migrant background has at least one parent without a German background that immigrated to Germany after. But in 2015 alone, around 4.7 million people have immigrated in the EU-states, whereby around 2.4 million people were from third countries. The highest level of immigration is recorded by Germany, followed by the United Kingdom, France, Spain and Italy. The consideration of the migrant population shows that around 35.1 million people, who were born outside of

Europe live in the EU. 19.3 million people, who were born in another EU-state, live in the EU (Eurostat, 2017). Romanians, Poles, Italians, Portuguese as well as Englishman belong to the five biggest groups of EU-citizens, who have lived before in other EU-state (Eurostat, 2017).

The research regarding migration has developed between the 1950 years and the 21st century. Following approaches were thereby considered: intercultural learning, stress approach, social identity as well as acculturation. All approaches were considered stronger in the research based on economic changes. Regarding diversity, the stress approach is predominantly in the research. The reason is that short-term and long-term interactions are characterised by stress.

In the context of migration, the perception of stress as well as the physical and psychological health was considered in the past (Eggerth & Flynn, 2013). The extent of the experienced burden is high, when the coping behaviour is ineffective or the number of appearing stressors is high (Eggerth & Flynn, 2013). Experienced discrimination, profound stress events as well as social isolation, e. g. by colleagues, can have an impact on the well-being of persons with an immigration background (Bozorgmehr & Razum, 2015). Discrimination cannot be made only by individuals but also by organisational processes and structures which makes it difficult for migrants to get access to the labour market and to work in their key qualification. This is called structural discrimination. Only a structural integration can support persons with an immigration background to work in their key qualification.

From the sociology perspective, the structural integration in the labour market is an important prerequisite to develop a national sense of belonging for persons with an immigration background.

In most of the organisations, a structural discrimination is found. This means that the labour market chances of persons with an immigration background are smaller compared to persons without an immigration background. The foreign graduation of persons with an immigration background is often not recognised and, therefore, they cannot work in their primarily qualification and work below their qualifications (Badura et al., 2010). Studies have shown that there is a negative relation between the education and the psychological integration. This phenomenon describes that higher educated migrants abandon from the host society (De Vroom & Verkuyten, 2015).

The so called glass ceiling effect is a phenomenon regarding gender and discrimination. The effect describes an invisible barrier that hinders a given ethical group from rising beyond the highest level in a hierarchy. Relating to big organisations, particular, it means the opportunities for qualified women to get into the top-management, which are much smaller than for men. This effect is stronger for persons with an immigration background. The frustration and the disappointed career expectation lead to a critical consideration of the host society.

The stress level increases through at the daily cooperation between people with and without an immigration background. The interpretation of unclear cultural patterns and the questioning of the organisational processes and structure cause many conflict situations.

Not only persons with an immigration background can feel stress, but also persons without an immigration background because habitual and firmly social established perspectives change. Persons with and without an immigration background have to adjust to new working methods and views (Asbrock et al., 2012).

This means for employees and managers to acquire intercultural competences to be able to work in multicultural teams and to fulfil the working challenges of the 21st century effectively.

In the research and in practice, it is always tried to determine whether direct positive effects of diversity management exist regarding the economic success. The results of the investigation are heterogeneous and depend strongly on the cultural specific relations (e. g. Genkova & Ringeisen, 2017).

The question about the advantages of diversity management for employees and companies is getting more and more important. The effects of diversity actions are often questioned in practice and fast quantifiable successes are expected. The research results determine that diversity sensitive attitudes are predictors for success. The change of attitudes of employees is carried out by top-down actions. This is examined by the research and practice. Thus, the role of the manager is mostly important for the implementation and acceptance of diversity actions (Dreas & Rastetter, 2016). This also applies for younger and ageing employees with and without an immigration background.

Finkelstein et al. (1995) has shown in a meta-analysis that younger persons evaluate the development potential of ageing employees less, compared to younger employees. The meta-analysis examined the work-related assessments of younger and ageing employees. At the same time, younger employees evaluated ageing employees as reliable. The Human Resource Management assesses inter alia ageing person, if they fit to the advertised position in the organisation. The appraisal of aptitude depends strongly on the attitude of human resource managers whether the position covers the role expectations about ageing persons (Diekman & Hirnisey, 2007). Bell et al. (2011) have shown in their meta-analysis that the diverse age base has no effects on the team performance. The advantages of a team with ageing members are that ageing employees have experiences and routine in cooperation with e. g. long-term customers. Furthermore, they can share their expertise with younger employees (Wei & Lau, 2012).

The role of top-down actions and leaders is seen as empirical verified regarding the implementation of diversity. The research questions of the study are as follows: Which context variables are seen as important?; Which stumbling blocks exist in the implementation?; Do managers and human resource managers see the problem fields? So this article focuses on the implementation of Diversity Management. It gives hints for a more successful integration of cultural diverse employees.

4 Methodology and Data

This study deals especially with the key issue of the Human Resource Management's challenges regarding the diversity. Persons with an immigration background as well as ageing people are important potentials for organisations. For this purpose, explorative

qualitative interviews were conducted. The aim was to analyse which role have managers regarding diversity and which competences are important to ensure equal opportunities in the personnel selection and to be diversity competent.

Therefore, 63 telephone interviews with managers (N = 17) and human resource managers (N = 13) as well as employees with (N = 18) and without an immigration background (N = 15) from different organisations were asked about the issue of equal opportunities, especially equal opportunities of persons with an immigration background and elderly employees. To answer the central questions of the study, following hypotheses were generated:

Explorative hypothesis: Managers and employees assess the need of diversity actions as equivalent.

Quantitative hypotheses: Hypothesis 1: Managers and employees differentiate regarding the expression of the stress level of employees with and without an immigration background.

Hypothesis 2: Managers and employees differentiate regarding the forms of the subjective assessment of the social competence.

There are rarely praxis-relevant and scientific results of diversity, especially cultural diversity and age diversity regarding managers and human resource managers. A qualitative interview was chosen as a survey method because it enables, compared to a quantitative questionnaire, to present the relationships and backgrounds of the topic diversity and the challenges of the Human Resource Management from the view of managers and human resource managers. Furthermore, conclusions for diversity potentials and stumbling blocks regarding the equal opportunities of persons with an immigration background and ageing people can be drawn. The interviews were conducted with a structured interview guideline.

Through qualitative interviews, non-concerned aspects can be figured out and, in turn, conclusions can be generated. In this case, which competences are important for diversity and to what extent diversity actions are necessary (Mayer, 2013). The questions of the interview guideline include the view of managers and human resource managers regarding the importance of diversity in organisations as well as the assessment of the subjective evaluation of lacking skills, e. g. intercultural competences. Therefore, it is examined to what extent stress has an impact on employees with and without an immigration background. The standardised interview is based on an interview guideline, which is designed deductive, theory-based (Mayer, 2013). The use of an interview guideline increases the structure of the questions as well as the comparability of data (Mayer, 2013).

In total, the interview guideline is based on open and closed questions, e. g. "How stressed are employees with an immigration background in your company at the moment, in your opinion?" The closed questions were answered on a 5-Point Likert Scale, e. g. 1= not at all stressed until 5 = very stressed. The combination of open and closed questions enables on the one hand to experience the individual views of managers and on the other hand to compare the interviews among each other.

The interview guideline includes different parts. One part deals with the questions regarding the issue of diversity as well as company-related questions like equal opportunities of employees with an immigration background in organisations. Another part deals with the aspects of social competence and the impact of cultural stereotypes and prejudices regarding the personnel selection. Further questions deal with the issue of leadership and stress. The aim is to experience whether employees with an immigration background have different stressors than employees without an immigration background. In the last part of the interviews, the respondents are asked about the issue of competence, inter alia which competences have the biggest impact on the equal opportunities in the personnel selection.

The interviews were analysed by the quantitative content analyses by Mayring (2015). The aim of the quantitative content analysis is to analyse the material of a communication (Mayring, 2015). The interviews were analysed by the frequency analysis with the aim to count the elements of the material and compare their frequency with other elements (Mayring, 2015). The transcribed, anonymised interviews were analysed with Excel.

The sample consists of 17 managers and 13 human resource managers. 17 of them are male and 13 female as well as 15 employees without an immigration background and 18 employees with an immigration background. 20 are female and 13 male. The age average of the managers and human resource managers is $M = 40.83$ years ($N = 29$; $SD = 9.30$). The age average of the employees with and without an immigration background is $M = 35.48$ years ($N = 33$; $SD = 9.99$).

5 Results

In the following, the results of the study will be presented. Explorative hypothesis: Managers and employees assess the need of diversity actions as equivalent. The results show that managers and employees assessed highly the diversity quotas, e. g. quota of women and migrants. These quotas are not usually legally consolidated by the view of managers and there is a lack of official guidelines. Managers claimed in the interviews that such quotas exist and are implemented as internal orientations in organisations. Further actions are a diversity department, equal opportunities officer, diversity representative, who apply actively the implementation of equal opportunities and diversity sensitization.

Most of diversity actions deal with the diversity aspects gender in Germany. Managers listed up different trainings, language courses and exchange programs, culture trainings which contribute to the implementation of diversity.

Human resource manager listed up trainings, joining the Diversity Charter of Germany Companies and the cooperation with the Federal Employment Agency. According to the statements of recruiters "individual intercultural competence trainings are offered for employees who would like to deal with intercultural competences and to analyse their own intercultural competence." The trainings include e. g. issues like "How to recruit internationally?", which aims at the intercultural difference at the recruiting." Further issues are "anti-prejudice [...] or emotional competences."

In contrast, employees with and without an immigration background mentioned that hardly or no diversity actions are implemented in the interviewed companies at all. This shows that employees with an immigration background assess the implementation of diversity actions as insufficient and are unsatisfied with that. Most of the diversity actions deal with the communication of diversity in companies like On- and Offline platforms, diversity departments and diversity committees. Both groups mentioned that trainings are offered in the organisations.

Most of the interviewed employees work in organisations that belong to the Diversity Charta of German companies and have implemented diversity in their company strategy. Employees figured out that the own professional development and the equal treatment at the personnel selection and development are important. Employees mentioned the following aspects as solutions: “Anonymous applications will not asserted. [...] Those, who have employee responsibilities and make personnel selections should do diversity competence training. They have to reflect themselves, if they are poised to hire someone, who is different than them. [...] I think that is actually the question and has to be answered by the human resource managers: Am I ready to hire somebody, who is different than I?” Following the statements of employees, also a form of benefit analysis can be helpful “[...] which hide the background of people as good as possible. So therefore, only the professional skills, social competence and media competences are measured without being influenced by the appearance of the person, e. g. gender etc.”

Both interviewed groups agree that openness, cultural interests are very important regarding the relevant competences. Social competences like tolerance and self-reflection are also important, followed by the intercultural competence and the cultural knowledge and awareness. At this point, a tendency is verified like in the previous results: the employees with and without an immigration background list up more competences and differentiate stronger regarding the promotion of intercultural competence.

Managers assess the tendency for the promotion of relevant competences for the future. They do not see the importance of the promotion of theses competences for the present. Therefore, managers do an external attribution. Interesting is, that managers mention risk tolerance as a relevant competence for diversity and associate them with risks. Furthermore, they mention emotional stability, intercultural flexibility, social identity, intercultural anti-prejudice as well as sensitisation for cultural differences. Employees mention instead empathy and openness, social competence, self-reflection, cultural knowledge and tolerance.

The research indicates that perspective change and experience exchange are stronger predictors for intercultural decision-making (e. g. Genkova & Ringeisen, 2017). The perspective change is a stronger predictor than empathy. Risk tolerance is not a relevant competence for diversity and the increasing of intercultural competence. This indicates that managers perceive diversity as a threat and assess the stress level for them as high because they are multipliers for diversity (see Table 1).

Table 1: Importance of Diversity

Managers/ Human Resource Managers	Employees with and without an immigration background
Seriousness and urgency of diversity is not clearly recognized	Seriousness and urgency of diversity is not clearly recognized by employees without an immigration background
Incorrect assessment of the stress of migrants	Good assessment of the stress level of migrants by employees without an immigration background
No consideration of the stress level of migrants in the day-to-day management	Risk of problematization of diversity

This shows that managers and employees consider the relevance of diversity measure as important. But it became obvious in the interviews that employees deal more with the issue of diversity than managers, based on the number of mentions and differentiation. Reasons for that can be that employees are more confronted with diversity and have more contact with it by colleagues and customers.

The citations indicate that there is a difference between self- and outside perception of managers and employees. Both groups attribute deficits and the need for diversity actions stronger to the other group. The research and practice shows that diversity processes proceeds top-down (Dreas & Raststetter, 2016). A further result of the present research and Best Practices is that top-down processes are only successful, when the expression of diversity sensitive competences is high (Dreas & Raststetter, 2016).

Hypothesis 1: Managers and employees differentiate regarding the expression of the stress level of employees with an immigration background.

The results of the hypothesis demonstrate that the assessment of the stress level of employees with an immigration background is the same of managers and employees ($T = .035$; $df\ 1; 49$; $p = .972$).

These results are supported by the qualitative analysis. The qualitative analysis showed that especially prejudices and the impatience of others based on eventually language problems as well as different work attitudes based on intercultural differences are stressing for employees with an immigration background. This is supported by statements of employees with an immigration background: "People with an immigration background have the feeling: I have to give more than 120 % than my German colleagues. This is one reason why migrants feel more stressed."

Hypothesis 2: Managers and employees differentiate regarding the forms of the subjective assessment of the social competence.

The results confirm that there is no significant difference between managers and employees regarding the subjective assessment of social competence ($T = -.489$; $df\ 2; 59$; $p = .628$). This can be an indication that both groups feel prepared for the challenges of diversity management. These results indicate that the need of increasing the competences is attributed to others. This is confirmed by the previous research.

6 Discussion and Conclusions

The results indicate significantly that the relevance of diversity is recognised by employees and managers. But it is determined that this tendency is stronger for

employees than for managers. Managers have often spoken about the importance of diversity measures for the organisation performance, justice and fairness for employees in the interviews. The managers have defined these aspects as important for the future and see no actual need. This means that managers deny the actual need of action and do not recognise or diagnose the stress level of employees with and without an immigration background enough, based on the diversity change. Managers have recognised the seriousness and urgency of diversity. But regarding cultural diversity and equal opportunities of persons with an immigration background, they do not see the urgency. Human resource managers are not able to assess the additional stress of migrants correctly and to consider them in their day-to-day management. The employees have recognised the importance of diversity. Regarding the equal opportunities of persons with an immigration background, employees without an immigration background do not see the importance in personnel actions, in contrast to employees with an immigration background.

Employees without an immigration background assess the stress level of employees with an immigration background well. In the interviews, employees have already spoken about the risk of problematization of diversity. The interviews have shown that in the western part of Germany, e. g. in the Ruhr area in Germany, such a concept would be superfluous because there is a high proportion of migrants and it is normal to work with different cultures together. An important diversity competence part is the intercultural and social competence. Empathy, tolerance and communicative competences, openness, self-reflection and emotional competences as well as cultural knowledge and awareness were also mentioned. Both groups have indicated the need to promote the competence by trainings and experiences abroad. This sounds partly contradictory to the results that both groups do not have significant differences regarding the subjective assessed social competence. The self-assessment is very high in addition, although the qualitative questionnaire classifies it as high.

In this study it can be positively highlighted that the sample of 63 managers and employees with and without an immigration background in total has a relative high diversification. Furthermore, the diversity aspects age and culture could be considered by different perspectives, by involved persons and managers, who develop diversity strategies for their companies and employees.

The interview guideline covers many issues of diversity management. The combination of closed and open questions increases the comparability of the interviews, compared to interviews with only open questions. But the results of structured interviews are less comparable, inter alia due to the open questions, whereby the analysis is more difficult. The results would have been more comparable, if a standardised, quantitative questionnaire was used and a higher sample could be asked. But the results would not have been so diverse like with the selected interviews. The topic diversity, especially equal opportunities of persons with an immigration background is hardly investigated. The qualitative investigation was used for generating hypotheses and delivers approaches that have to be examined in detail in the future.

There are some limitations of the study. The interview guideline deals partly superficial with some topics of diversity and does not question some parts in detail, e. g. which diversity actions are the most effective ones for elderly employees. However, other companies can differentiate from the sample due to other characteristics, e. g. size, structure, implementation of a diversity department. The interview guideline should be extended on the basis of the results of the study. Furthermore, it is necessary to investigate the category systems regarding their quality criteria.

The interviews pointed out that regional difference exist in Germany regarding the importance of diversity actions. Furthermore, the interviewed persons have answered the questions of the interviews differently in detail. Therefore, the results have to be considered critically. The interviews of the study were used for generating hypotheses for a quantitative questionnaire. Therefore, additional aspects regarding equal opportunities of persons with an immigration background could be measured. These aspects could not be asked in detail in conventional quantitative surveys. It was able to take a stronger focus regarding the urgency of diversity.

But there are some limitations regarding the sample: The results of the interviews give only approaches regarding the equal opportunities of persons with an immigration background and ageing people. To get a representative sample, a more comprehensive sample should be made with managers from different working fields, locations in Germany and other small, medium-sized and large organisations. The study could confirm that differences between employees with and without an immigration background exist regarding the importance of diversity concepts in personnel actions.

It has to be considered, whether the answers were given due to social desirability or deliberate misrepresentation because the survey method was an interview. A deliberate misinterpretation can be excluded because the respondents participated voluntarily and had not to expect any sanctions or other effects by specific statements. Social desirability could be minimised by the anonymisation of the data but it could still occur due to the social interaction during the interviews. This could lead to a distortion of the results because e. g. the individual responsibility or the skills of the own person were presented more positive.

To summarise: Diversity principles have to be more integrated in the company guidelines and manager guidelines. Apparently, leaders should be more sensitized, so that they are able to diagnose the present need of diversity correctly and are willing to implement the actions now and not in the future.

References

- Asbrock, F., Christ, O., Duckitt, J. & Sibley, C. G. (2012). Differential effects of intergroup contact for authoritarians and social dominators: A dual process model perspective. *Personality and Social Psychology Bulletin*, 38(4), 477-490.
- Ashikali, T. & Groeneveld, S. (2015). Diversity Management in Public Organizations and Its Effect on Employees' Affective Commitment: The Role of Transformational Leadership and the Inclusiveness of the Organizational Culture. *Review of Public Personnel Administration*, 35(2), 146-168.

- Becker, M. (2006). Wissenschaftstheoretische Grundlagen des Diversity Management. In M. Becker & A. Seidel. *Diversity Management – Unternehmens- und Personalpolitik der Vielfalt* (S. 3-48). Stuttgart: Poeschel.
- Bell, S. T., Villado, A. J., Lukasik, M. A., Belau, L., & Briggs, A. L. (2011). Getting specific about demographic diversity variable and team performance relationships: A meta-analysis. *Journal of Management*, 37, 709–743.
- Bozorgmehr, K. & Razum, O. (2015). Effect of Restricting Access to Health Care on Health Expenditures among Asylum-Seekers and Refugees: A Quasi-Experimental Study in Germany, 1994-2013. *PloSOne*, 10(7). DOI: 10.1371/journal.pone.0131483.
- Charta der Vielfalt & Ernst & Young GmbH (2016). *Diversity in Deutschland. Studie anlässlich des 10-jährigen Bestehens der Charta der Vielfalt*. Verfügbar unter: https://www.charta-der-vielfalt.de/fileadmin/user_upload/Studien_Publikationen_Charta/STUDIE_DIVERSITY_IN_DEUTSCHLAND_2016-11.pdf [Zugriff am 20.11.2017].
- De Vroom, T. & Verkuyten, M. (2015). Labour market participation and immigrants' acculturation. In S. Otten, K. van der Zee und M. B. Brewer (Hrsg.), *Towards Inclusive Organizations* (pp. 12-28). New York: Psychology Press.
- Diekmann, A. B., & Hirnisey, L. (2007). The effect of context on the silver ceiling: A role congruity perspective on prejudiced responses. *Personality and Social Psychology Bulletin*, 33(10), 1353–1366.
- Dreas, S. & Rastetter, D. (2016). Die Entwicklung von Diversity Kompetenz als Veränderungsprozess. In P. Genkova & T. Ringeisen (Hrsg.), *Handbuch Diversity Kompetenz. Band 1: Perspektiven und Anwendungsfelder* (S. 351-370). Wiesbaden: Springer.
- Eggert, D. E. & Flynn, M. A. (2013). Immigration: Implikationen für Stress und Gesundheit. In P. Genkova, T. Ringeisen & F. T. L. Leong (Hrsg.), *Handbuch Stress und Kultur. Interkulturelle und kulturvergleichende Perspektiven* (S. 343-359). Wiesbaden: Springer Fachmedien.
- Ely, R. & Thomas, D. (2001). Cultural diversity at work: The effects of diverse perspectives on work group processes and outcomes. *Administrative Science Quarterly*, 46, 229-273.
- Eurostat (2017). Statistiken zu Wanderungen und Migrantenbevölkerung. Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics/de [Accessed 06 February 2018].
- Fantini, A. E. (2009). Assessing intercultural competence: Issues and tools. In D. K. Deardorff (ed.), *The SAGE handbook of intercultural competence* (pp. 456-476). Thousand Oaks, CA: Sage.
- Finkelstein, L. M., Burke, M. J., & Raju, M. S. (1995). Age discrimination in simulated employment contexts: An integrative analysis. *Journal of Applied Psychology*, 80(6), 652–663.
- Franken, S. (2015). *Personal: Diversity Management* (6. Aufl.). Wiesbaden: Gabler.
- Fuchs, J. & Dörfler, K. (2005). Projektion des Arbeitsangebots bis 2050. Demografische Effekte sind nicht mehr zu bremsen. Den Betrieben stehen langfristig immer weniger und immer ältere Arbeitskräfte zur Verfügung –Die Zahl der Jungen sinkt dramatisch. IAB Kurzbericht, 11,1-5.
- Garib, G. (2013). Diversity is in the eye of the beholder: Diversity perceptions of managers. *The Psychologist-Manager Journal*, 16 (1), 18-32.
- Genkova, P. & Ringeisen, T. (2017). *Handbuch Diversity Kompetenz. Band 1: Perspektiven und Anwendungsfelder*. Wiesbaden: Springer Fachmedien.
- Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of psychosomatic research*, 11(2), 213-218.

- Kersting, M. & Ott, M. (2016). Diversity-gerechte Personalauswahl. In P. Genkova & T. Ringeisen (Hrsg.), *Handbuch Diversity Kompetenz. Band 1: Perspektiven und Anwendungsfelder* (S.679-692). Wiesbaden: Springer.
- KFW Research (2017). Migranten gründen häufiger und größer: mehr Wochenstunden, mehr Angestellte. Nr. 165, 4. April. Verfügbar unter: <https://www.kfw.de/PDF/Download-Center/Konzernthemen/Research/PDF-Dokumente-Fokus-Volkswirtschaft/Fokus-2017/Fokus-Nr.-165-April-2017-Migrantengr%C3%BCnder.pdf> [Zugriff am 17.10.2017].
- Krell, G. (2003). Personelle Vielfalt in Organisationen als Herausforderung für die Praxis. In H. Wächter, G. Vedder & M. Führung (Hrsg.). *Personelle Vielfalt in Organisationen*. München: Hampp.
- Kromm, W., Frank, G. & Gädinger, M. (2009). Sich tot arbeiten – und dabei gesund bleiben. In W. Kromm & G. Frank (Hrsg.), *Unternehmensressource Gesundheit . Weshalb die Folgen schlechter Führung kein Arzt heilen kann* (Die neue Führungskunst, S. 27-52). Düsseldorf: Symposium.
- Mayer, H.O. (2013). *Interview und schriftliche Befragung: Grundlagen und Methoden empirischer Sozialforschung* (6. Aufl.). München: Oldenbourg Wissenschaftsverlag GmbH.
- Mayring, P. (2015). *Qualitative Inhaltsanalyse. Grundlagen und Techniken* (12., überarb. Aufl.). Weinheim: Beltz.
- Page, S. E. (2007). *The difference: How the power of diversity creates better groups, firms, schools, and societies*. Princeton: Princeton University Press.
- Thomas, R. (1990). From affirmative action to affirmative diversity. *Harvard Business Review*, 68(2), 107–117.
- Thomas, A. (2003). *Kulturvergleichende Psychologie* (2. überarbeitete Auflage). Göttingen: Hogrefe.
- Van der Zee, K. & Otten, S. (2015). Organizational Perspectives on Diversity. In S. Otten, K. van Safdar, S., Struthers, W., & van Oudenhoven, J. P. (2009). Acculturation of Iranians in the United States, the United Kingdom, and the Netherlands. A test of the multidimensional individual difference acculturation (MIDA) model. *Journal of Cross-Cultural Psychology*, 40(3), 468-491.
- Van Dick, R., van Knippenberg, D., Hägele, S., Guillaume, Y. R. F., & Brodbeck, F. C. (2008). Group diversity and group identification: The moderating role of diversity beliefs. *Human Relations*, 61(10), 1463–1492.
- Vedder, G. (2011). Die Grundlagen von Diversity Management. In G. Vedder, E. Göbel & F. Krause (Hrsg.), *Fallstudien zum Diversity Management* (S. 1–17). München: Rainer Hampp.
- Wei, L., & Lau, C. (2012). Effective teamwork at the top: The evidence from China. *International Journal of Human Resource Management*, 23(9), 1853–1870.
- Wildermuth, C., & Gray, S. (2005). *Diversity training* (2. Aufl.). Alexandria/Virginia: ASTD Press.

Business Model innovation in Travel Industry: Implications for Integrated Bus Transportation Services

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Abstract

Innovations in Internet Technologies have radically changed the business in Travel industry. A variety of internet technologies, mobile and non (websites, portal, apps), enabled customers to plan and book complete travel solutions at the best available rates. Among the Internet Distribution Systems (IDS), that are web tools to support users from information collection to booking travel products, Dynamic Packaging (DP) is emerging as a key approach. DP, besides providing automated online travel packages, has a conceptual model of a great importance to reflect on the strategic issue of Travel industry: integration. How it emerges from our conceptual analysis of DP models (DPMs), effectiveness of DP depends from travel inter-system and intra-system integration. The first, affects DPM's capacity of create coherent travel packages, while the latter affects the capacity of providing efficiency in travel. This latter dimension of integration is deepened in this paper presenting a case study. Namely the case study demonstrate how DP conceptual model is effective to integrate independent, private Bus transportation services/providers, operating at the national scale. The relative technology platform is able to provide integrated, multicarrier travel tickets. By leveraging on DPM, then, improvements on the bus transportation services can be achieved, and impacts on the travellers marketing behaviours are expected, such as increasing the bus transport against the private car.

Keywords – Dynamic Packaging, Travel Industry, Business Model, Integrated Bus transport.

Paper type – Academic Research Paper

1 Introduction

A major innovation, occurred in last decades in travel industry, has been the pervasive penetration of internet. Internet took the central role, making the online distribution of hotel rooms, airline tickets, and other travel products, the most successful products sold

on the internet (Runfola, Rosati, and Guercini 2013). More in general, thanks to Internet and the related online technologies supported by both hardware and software innovations, a wide number of 'information-based' products, as travel ones, are almost exclusively sought and reserved online (Akoumianakis et al. 2011).

The process of planning and purchasing the travel has also changed considerably. Consumers approach the issue autonomously, the role of traditional travel agencies has been replaced by online 'agencies', the trip structure is broader and/or specialized due to higher customers' interests and needs.

In order to take advantage of the business opportunities offered by the Internet, and to pander the changes that have characterized the evolution of travel demand, a considerable number of online brokerage services, so-called "cybermediaries", have appeared in the business of travel (Cardoso and Lange 2007). Together with them, information systems and technology specialized in online intermediation have also been developed to facilitate the search and purchase of travel "elements" (travel products). All this internet-based tools designed to support the online sell/purchase of products are part of the large family of Internet Distribution Systems (Cardoso and Lange 2007; Järvelä et al. 1999; Runfola et al. 2013). It is interesting to underline the twofold key of investigation that the IDSs have determined in the literature, one Information Science-based, the other Business Management-based. With reference to the latter, the line of analysis of the Business Models incorporated by the IDS is relevant (Akoumianakis et al. 2011; Cardoso and Lange 2007; Henne 2014; Runfola et al. 2013).

Among the IDS, a relevant role is being acquired by the web systems able to offer integrated travel packages, called Dynamic Packages (Al-Dmour, Fouzia, and Sarayreh 2016; Cardoso 2006; Cardoso and Lange 2007; Järvelä et al. 1999; Runfola et al. 2013). They are information systems able to search, select, aggregate two or more travel products distributed online, and to configure a travel solution, that is travel configuration ad hoc for the customer requirement. DP enables users to automated search and booking of many travel products, from different providers, harmonized in one integrated travel ticket. There are two key elements of DPs that are catalysing the customers' attention: dynamic updating of prices and discounts (which follow the dynamic pricing policies of providers), the stipulation of a single transaction for the entire package with a single payment, and the accumulation of the discounts of the single travel products.

DP has, besides the business model, a significant conceptual model since it provides insights to reflect on the strategic issue of Travel industry: integration. How emerge from the original conceptual analysis of DPM hereinafter, operational performance of DPM depends by integration of travel products (TP) selected from the same travel system, and by the integration of TPs selected from different travel systems. We call this integration capacity of the DPM as travel "inter-system" and "intra-system" integration. The first one affects DPM's capacity of create coherent travel packages, the second one affects the capacity of providing efficiency in travel. This latter dimension of integration, that regards the single travel systems (transport, accommodation, subsistence, touristic offer), is deepened in this paper presenting a case study. Namely the case study demonstrate how DP conceptual model is effective to integrate autonomous, public Bus transportation

services/providers, at a national scale, and integrates bus travel products allowing integrated packaged tickets.

The Paper is structured as follows. Section 2 presents a brief review of developments and innovations in the Travel Industry. Section 3 analyses the DPM in its conceptual and business aspects. Section 4 presents a case study regarding a DP solution that intercept the business opportunities and challenges in the Integrated Bus Transportation market. The section 5 ends the paper addressing conclusions, implications, and limitations of this research.

2. Evolution and Innovations in Travel Industry

The internet technologies have radically changed the traditional processes of searching and booking travels operated by customers, as well as the distribution processes set up by providers of travel services. Internet and its related tools is a powerful distribution channel for many products, especially for *information-based* products as the travel ones are (Akoumianakis et al. 2011). If, on one hand, there are many advantages of online searching and booking of travel, like the saving of costs otherwise charged by agencies as commission, on the other hand it can be time consuming, since the booking of travel products over the internet needs additional time for non-specialized operators, and additional knowledge, expertise, experience, to achieve satisfying package configurations as the travel agency does (Cardoso and Lange 2007). In fact, many studies report about the problems and difficulties arising during the online travel organization and purchasing: from the need of phone calls to the provider for the reservation, to clearer or detailed information than those available on the internet, to the knowledge gap in understanding configuration principles and contractual rules (Cardoso and Lange 2007; Öörni 2003).

Because of this, some are sceptical about the efficiency of electronic markets, especially with regard to travel. Some scholars argued that at best as efficient, the electronic market of travel products is as efficient as their conventional counterparts (traditional travel agencies), mainly addressing this to poor availability of product information and a lack of systems integration (Öörni 2003).

Due to the advent of online distribution of travel products, however, the traditional Travel Agency services faced important changes in their Business models. Results of this changes are mainly consisting in reduced commission revenues, if not “commission free” (as already done by Airlines), opening to the e-providers of travel products.

In response to the mentioned problems the travel product providers improved their online distribution channel, including reservation system (hotel website, travel provider website or app, etc.), and third party providers, broadly defined as Internet Distribution Systems, or Online Travel Agencies (Runfola et al. 2013) entered and raised in the travel market. Online travel agencies gained consumer and provider preferences because of their competitive pricing, of the easy comparing of the prices, of the ability to market highly perishable products like hotel rooms (Runfola et al. 2013), or carrier’s seat. A particular IDS, or OTA, is represented today by DPM.

The Dynamic Packaging is emerging as an innovative approach able to support an innovative business model in Travel and Transportation market. DP is an online automated configuration and assembling of single, individual, autonomous travel products available on the internet, in the providers' webpages. The travel products are selected by the user to make selection, combination and reservation. Regardless to the origin of the inventory of travel products, the package that is created is treated as one operation, and implies just one payment by the customer (Cardoso and Lange 2007).

3 Dynamic Packaging. Concepts and Business Models

We define a *Travel Product* (TP) as any travel good or service, distributed online, that once combined with at least another TP, allow the creation of a *travel solution*. For instance, an hotel room, an airline travel, a bus travel, a car rental, a local tours, are usual TPs that are aggregated in order to have a feasible and satisfying travel solution. Type and amount of travel products to include in one travel solution depend on customers' wants and needs, such as purpose of the travel (business, leisure), interests, duration, and by travel constraints, like budget, Origin/Destination, available transportation systems. Any combination of travel products aimed at providing a travel solution for the customer's requirements, is a **travel configuration**. The process of combination of TPs is the so-called travel packaging.

DPs are online web solutions/technologies able to package, dynamically, travel products, to form dynamic travel configurations. They automate the process and elaborate providers' website data. Users of this DPM are both travel agencies (B2B) and travel customers (B2C).

More in detail DPMs are fully automated packaging online applications, which use of up-to-date travel product information. They apply a single price for the entire package, provide of guidance and support in the selection of travel products and packaging, by leveraging on products already selected by the customer in the past (Cardoso and Lange 2007). DP automates the process of configuration and assembling, through the internet, of packaged travel products for individual customers (Cardoso 2006). DP is performed by software platforms which dynamically retrieve, analyse, select, combine, on line available information of TPs, and return travel packages ready to be booked. It is important to stress that the results of DP are dynamic, this implies that they change continually over time, and that the payment is unique for all the TPs included in the package. The package is handled seamlessly as one transaction, hiding the pricing of individual components, within a one-to-one commercial relation between the DP provider and the travel customer (Cardoso and Lange 2007).

Due to the high level of autonomy and heterogeneity of TP's data - they belong to travel providers, are sourced by the DPM from online providers' internet channel - DPMs cannot be successfully developed by considering only syntactic and structural integration of data. A core problem of DP systems is then integration and interoperability with travel (or tourism) information systems (Cardoso 2006). The package that is created must be

seamless, require one single transaction, just one payment from the consumer, and then the hiding of the single products' prices.

Conceptually the travel package is obtained by grouping together TPs from one or more travel systems, and by grouping together two or more locations. We reduce the travel systems to: transportation, accommodation, subsistence, touristic offer.

According to the customers' requirements, DPs adopt two “pure” (or theoretical) grouping approaches to package any travel solution. Namely it employs: a “intra-system” packaging (that is the grouping of two or more TPs of the same travel system, like transportation services), an “inter-system” packaging (that is the combination of two or more TPs, from as many travel systems). Any customers' travel requirement can be seen as the combination of intra-system and/or intersystem packaging of TPs.

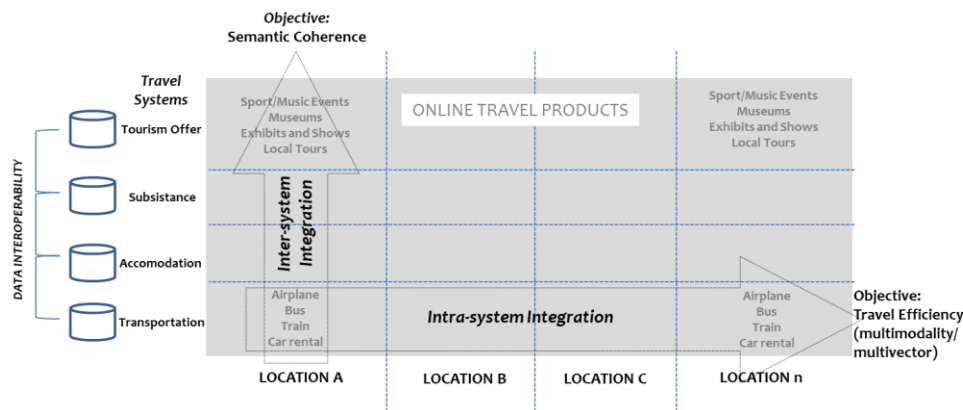


Fig. 1 – A conceptual model of DP.

2 Archetypes of DP applications can be identified: hard-coded, web services. By the mean of interfaces, the first type allows the interoperability of decentralized, autonomous, heterogeneous travel information systems. This kind of applications are limited in terms of dynamism because the diversity of the scopes, technologies and information structures makes the interoperability of information systems complex and stiff.

Web services, instead, duly combined with semantic tools, allow for a dynamic and flexible design of a travel package (Cardoso and Lange 2007).

On the basis of the DP conceptual model, any travel can be seen as a simple transportation from the location A to the location N, whose packaging would provide the best transportation solution (according to some performance: time, cost, accessibility, availability, etc.). Nonetheless the travel can pack a travel to just one location, involving products from all the other travel systems. Packaging is then reducible to a set of O&D, and to a set of diversified travel systems involved in the travel configuration.

In order to best perform this two dynamic packaging needs, recent advances in Semantics and Data systems interoperability can support an improvement of performances.

How emerges from the proposed conceptual analysis of DP model above, operational performance of DPM depends by the integration of TPs selected from the same travel system, and by the integration of TPs selected from different travel systems. We then argue to distinguish this integration capacity of the DPM in travel “inter-system” and “intra-system” integration. The first one affects DPM’s capacity of create coherent travel packages; this has impact mainly on the travel customers’ emotional satisfaction. The second one affects the efficiency of the travel; this impacts the physical satisfaction during the deployment of the travel. This latter dimension of integration, that regards the single travel systems (transport, accommodation, subsistence, touristic offer), is deepened in this paper presenting a case study.

Besides the conceptual model of DPs, it is important to review and understand the business model by which a DP solution provides service.

The Business Model is the basic mechanism by which a company, fulfilling customers’ demand of products or services, gain revenue, profits, competitiveness. It is the ‘how’ a firm delivers value to customers and converts payments into profits (Teece 2010). More practically it is a conceptual tool containing the most important objects, their relations with the objective, and the logic of a business. The business model describes the logic according to which an organization creates, distributes and captures value (Osterwalder and Pigneur 2010)

Three main aspects emerge from the extant literature with regard to BM: the type of services delivered, the degree of innovation in adopting new technologies and the revenue model (Järvelä et al. 1999). Following this characterization as mean of classification, four Business models can be identified for online TPs providers: *E-Booking Services*, *E-Travel Agent*, *E-marketplaces*, *Meta Booking Engines* (Järvelä et al. 1999).

E-Booking Services are online intermediaries operating through a ‘booking engine’, which allow customers to make reservations guaranteed by credit card. No payment is allowed online, instead the payment is due once received the service (i.e. check-out at the hotel). The revenue model is commission based. This services can be *multichannel* (combination of on and off-line transactions, i.e. Tui.com, Alpitourworld.com) or *pure player* (exclusively online, like Booking.com, Hrs.com, Laterooms.com) (Järvelä et al. 1999; Runfola et al. 2013)

E-Travel Agents are actually *E-Booking Services*, *multichannel* or *pure player*, having an e-commerce platform integrated to the booking engine. This model enable customers to finalise the transaction by charging a credit card. The revenue model is both commission-based or merchant (application of a *Mark-up*).

E-Marketplace is the Business model that characterizes the leading IDSs. This model pertains to those online operators which offer a wide range of TPs, by various providers, in most of the cases with a DP system, thereby selling travel package solutions. Also within this one, we find *multichannel* (e.g. Octopustravel.com) or *pure players* (e.g. Expedia.com, Lastminute.com).

Meta Booking Engines are websites that support the buying process with functionalities such as price comparison and review systems. User-generated content are of great importance for the full functionality of this model, thus tourism blog or websites

like tripadvisor.com and travepod.com are generally included (Runfola et al. 2013), as well as price charts showing a product's full price history, able to support customer in forecasting future prices.

It is interesting to stress that the *revenue model* has mainly shaped alternative classifications of business models, with regard to the merchant players (Jerath, Netessine, and Veeraraghavan 2010; Runfola et al. 2013). On the basis of the revenue model adopted four basic types can be identified (Jerath et al. 2010): *transparent sales*, *last minute/inventory control sales*, *opaque selling*, *flash/collective buying selling*. In the first one the regular price is displayed up-front (i.e. Expedia), and the customer can make comparisons with other retailers, or with the nominal price of the travel product provider itself. In the second, last minute pricing, the retailer sales a distressed inventory, late in the product's sales life cycle, before its expiration, at a significantly discounted price (i.e. Lastminute.com) (Runfola et al. 2013). The *inventory control sales*, in contrast to last minute, aims to reduce distressed inventory by offering a limited number of low-priced allocations far in advance of check-in, and reserving the lasting allocation for the late arrivals at a higher rate (Jiang 2007).

In order to prevent the distressed inventory (which arises both in the last minute model, due to the tendency of customer of postpone the purchase in order to get a further discount, and in the *inventory control sales* because of the possibility to not allocate the final over-rated allocations), retailers have adopted different solutions aimed at reducing the consumers inclination to price comparison and implementation of purchasing strategies and behaviours, often resulting in unsold inventory.

Opaque selling is the model in which the consumer before the purchase from the intermediary, doesn't know some of the product's attributes (i.e. the ultimate provider, the exact starting date of the service) (Jerath et al. 2010). The hidden attributes will be revealed only after the purchase (e.g. Hotwire.com, Priceline.com, Cheaptickets.com). Many advantages are addressed by the literature to this recent model, over the prevent of consumers' strategic behaviours and distressed inventory (Runfola et al. 2013). However, this formula is not free of any disadvantage or risk.

The raising of this *opaque selling* is encouraged by the so-called *private sales* or *flash sales* or *collective buying selling*. This model relies on virtual communities, which are emerging as important marketing channels for a variety of industries (Kim, Yang, and Kim 2009), and address to their members the offer of significant benefits. The main characteristic of this model is that the discounted *opaque* prices are visible and can be purchased for a very limited period of time only by members that have previously registered with the service (Runfola et al. 2013). This registration and related identification of the potential consumer is even more supported by the use of social media profiling (e.g. Facebook.com, Twitter.com), thus contributing to the wider phenomenon of 'social commerce'.

Differently from Järvelä et al., (Cardoso and Lange 2007) reduced the Business Models of DPs to the *agency model* and the *merchant model*. In the agency model the customer book a travel package, or just a product, using a travel agent. The consumer pays directly the travel product, and correspond a fee to the Agency, determined as a

percentage on the base price. This model is extinguishing according to recent data and trends, which are confirming that this model is no more appealing for companies, in contrast to simple flat booking reward, or commission-free.

About the merchant model it consists of a wholesale arrangement, with net rates and product/inventory availability with cut-off dates. Within this model a travel agency buys a set amount of the inventory, at a wholesaler price, then resell it to a consumer at a higher price, but anyway usually lower than the nominal price. This model particularly apply to hotel rooms.

According to the agency model the online travel agency passes the customers' reservations to the travel supplier, getting a commission. Under the merchant model the online travel agency books in advance a set amount of the inventory (or inventories, if the case of travel packages: hotel rooms, airline seats, event tickets, etc.) from the supplier, then proposes to the market its travel products/packages.

In this second case, the exposition to risk is higher but a higher financial performance is expected. Very important are in this case the capacity of interoperate with travel systems, in order to find and book convenient travel products (i.e. leveraging on suppliers' revenue management) and simultaneously to control risk by defining an optimal trade-off between variety of travel products, and set amount of booked products.

4. Dynamic Packaging of Bus Transportation travels. A Case study

4.1 The Case Study. Brief overview

This section presents and analyses the case of an innovative technological platform developed by an Italian company, ECHOPRESS an academic spin-off of the University of Calabria, based in Rende (Italy), specialized in web and mobile based solutions in the field of ICT services to transport and mobility companies.

The platform is under development, but represents a significant case of intra-system Dynamic Packaging. According to a case study methodology (Baxter and Jack 2008; Eisenhardt 1989; Yin 2003) then it is a *polar type* capable of explanatory power and theoretical significance (Mills, Durepos, and Wiebe 2010).

The technology platform aims to dynamically integrate TPs (bus transport services, per legs and networks), offered by participating transport companies, while providing on the demand side an aggregator of public transport products at national scale, in multimodality (Bus and Train), and multicarrier, with a single payment of the booked travel package.

The company currently already offers booking systems, e-ticketing, self-ticketing, helpdesk, for projects aimed at online booking and customer care. In particular, the company offers a software solution called SMARTBUS that offers fleet management, e-ticketing and remote controlling services to companies operating in the road transport sector.

4.2 The Context. Market and Regulatory opportunities

Italy is one of the European countries with the highest density of internal traffic that is distributed unevenly throughout its transport network which includes 278 ports, a railway network of 16,752 km, a road network (state roads, regional roads, provincial, municipal) of approximately 255,980, a highway network of 6,751 km (of which 5,724.4 km a toll) and 45 Enac certified airports (TTS Italia 2016). Due to morphology and demographic distribution, the main transportation system is the private car and the Bus.

The regulatory and strategic framework at the Italian level pushes and supports the interoperable electronic ticketing systems in the national territory. The relative Decree came into force on January 25, 2017 (Ministry of Infrastructure and Transport, Ministerial Decree No. 255 of 10/27/2016). The decree also highlights the importance of data standardization according to the Big Data paradigm, as the art. 7 (Monitoring) of the aforementioned regulation decrees that the data acquired through electronic ticketing systems, constitute a priority source for the population of the database of the National Observatory on local public transport policies.

4.3 The Business model

The business idea behind the DP platform is to make the public *Bus and Train* transport (local public transport services, national and international lines, tourism services) competitive. The extant offer of such services in Italy's market is very fragmented as far as buses are concerned, with many small and medium operators sharing the market for routes, according to the logic of optimizing revenues rather than customer service. In fact, the customer must research, plan, combine, and pay for the transport service by leg, one separately from the other, and not by Origin/Destination. Moreover, this fragmented transport system, reflects into long travel times, and relatively expensive rates. This is true both for multimodal transports and bus multicarrier.

The problem exacerbates in Italy, because of the short-medium transport routes: the potentially more competitive transport systems are the combinations bus-train, but the aforementioned market situation pushes the demand toward the private cars, generating further detriment of the public service.

This mechanism gradually weakens the bus transport system itself, whose operators periodically revise and optimize the services (routes, carriers, origin/destinations, fleet management, etc.) according to a cost recovery, which results in a further market detriment against the car.

4.4 The intra-system DP.

The platform is an innovative DP solution, which aims to aggregate the offer of transport and to innovate in the DP logic the process of purchasing a transport service (multimodal bus-train, or multi-carrier), by consumers or agencies of travel. On the supply side, some innovative tools for accessing and analysing historical data about the whole system of routes will be available, in order to improve the quality level of the offer.

Despite the growing demand for collective mobility services, there are still very few examples of technological platforms able to act as aggregators of information and services to support mobility and public transport services, with particular reference to multimodal transport (iron-rubber) and multi-vector.

On the demand side, the platform tends to offer the passenger support and assistance along all stages of the "life cycle" of customers' journey. Currently in the Italian panorama there is no single system able to aggregate all the information to plan trips within the national territory, using a combination of multimodal collective transports that also allows to purchase integrated travel solutions.

The platform is then an aggregator of data and information (stops, routes, polymetrics, schedules, fares, etc.) of local and national road and rail public transport, allowing the various participating operators to improve passenger handling processes with a triple purpose:

- provide potential customers with useful information to plan their trip regardless of the carrier and the means used, in order to provide flexible and seamless travel solutions;
- provide transport companies with a multimodal and shared web-based platform;
- create data exchange services (API, WIDGETS, WEB SERVICES) that allow operators in other sectors, such as tourism, to easily integrate the information and travel solutions produced by the platform.

The business principle on which the initiative is based is that of multi-side platforms. The platform is not limited to managing the DP, but wants to process and exploit the large amount of data to return strategic services to transport companies, such as dynamic pricing management, control and monitoring of company performance, CRM (to manage the customer relations).

The platform, thanks to the integration with geolocation technologies, is able to process and return to the traveller a quantity of dynamic data generated in real time (eg position and accumulated delay of vehicles, sales data, loading rates).

The analysis of static data, historical series and dynamic data will also offer the possibility of introducing dynamic pricing services. A Yield Management module will also be introduced, besides the implementation of social rewarding policies (reward for users' social activities), Social Customer Relationship Management (Social CRM) aimed at managing company-traveller relationships.

5 Conclusions

How emerged from the proposed conceptual analysis of DPMs, DPM's integration performance is a key element. It is determined by the integration of TPs selected from the same travel system, and by the integration of TPs selected from different travel systems. We supported the idea of distinguish this integration capacity of the DP in travel "inter-system" and "intra-system". The first, which affects DP's capacity of create coherent travel packages, has impact mainly on the travel customers' emotional satisfaction. The

second one, which in turn affects the efficiency of the travel, impacts the physical satisfaction during the deployment of the travel.

According then to the aim or nature of the travel (i.e. short business travel, long holiday travel) the DPMs can specialize to have high market performances, and customer satisfaction. They can be vertical integrator, or horizontal integrators, according to their travel specialization. This somehow suggest a market specialization of DPs, and address the identification of the main operational challenges of the two kinds of DP.

The case we analysed, emerges as a horizontal integrator, and represents a sample on the second kind of DPs, horizontal integrators.

Future developments of the research here tracked will involve the operational analysis of the sampled case, along with the analysis of a case study falling into the vertical DP integrators.

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References

- Akoumianakis, D., N. Vidakis, A. Akrivos, G. Milolidakis, D. Kotsalis, and G. Vellis. 2011. “Building ‘Flexible’ Vacation Packages Using Collaborative Assembly Toolkits and Dynamic Packaging: The Case Study of the EKoNES.” *Journal of Vacation Marketing* 17(1):17–30.
- Al-Dmour, F., M. Fouzia, and W. R. Sarayreh. 2016. “The Effect of Dynamic Packaging System Quality on Jordanian Tourist Satisfaction.” *International Journal of Humanities and Social Science* 6(2):150–61.
- Baxter, Pamela and Susan Jack. 2008. “Qualitative Case Study Methodology: Study Design and Implementation for Novice Researcher.” *The Qualitative Report* 13(4):544–59.
- Cardoso, J. 2006. “Developing Dynamic Packaging Systems Using Semantic Web Technologies.” *Transactions on Information Science and Applications* 3(4):729–36.
- Cardoso, J. and C. Lange. 2007. “A Framework for Assessing Strategies and Technologies for Dynamic Packaging Applications in E-Tourism.” *International Journal of Information Technology & Tourism* 9(1):27–44.
- Eisenhardt, K. M. 1989. “Building Theories from Case Study Research.” *Academy of Management Review* 14(4):532–50.
- Henne, J. 2014. “Business Model Dynamics in the Tourism Industry.” University of Twente, Enschede, The Netherlands.
- Järvelä, P., J. Loikkanen, M. Tinnilä, and V. K. Tuunainen. 1999. “Business Models for Electronic Commerce in the Travel Service.” *Information Technology & Tourism* 2(3–4):185–96.
- Jerath, K., S. Netessine, and S. K. Veeraraghavan. 2010. “Revenue Management with Strategic Customers: Last-Minute Selling and Opaque Selling.” *Management Science* 56(3):430–48.
- Jiang, Y. 2007. “Price Discrimination with Opaque Products.” *Journal of Revenue and Pricing Management* 6(2):118–34.
- Kim, S. H., K. H. Yang, and J. K. Kim. 2009. “Finding Critical Success Factors for Virtual

- Community Marketing.” *Service Business* 3(2):149–71.
- Mills, A. J., G. Durepos, and E. Wiebe, eds. 2010. *Encyclopedia of Case Study Research*. SAGE Publishing.
- Öörni, A. 2003. “Consumer Search in Electronic Markets: An Experimental Analysis of Travel Services.” *European Journal of Information Systems* 12(1):33–40.
- Runfola, A., M. Rosati, and S. Guercini. 2013. “New Business Models in Online Hotel Distribution: Emerging Private Sales versus Leading IDS.” *Service Business* 7(2):183–205.
- Teece, D. 2010. “Business Models, Business Strategy and Innovation.” *Long Range Planning* 43(2–3):172–94.
- TTS Italia, Associazione Italiana della Telematica per i Trasporti e la Sicurezza. 2016. *Il Mercato Dei Sistemi Intelligenti Di Trasporto in Italia: Quadro Attuale e Prospettive*.
- Yin, R. K. 2003. *Case Study Research: Design and Methods (3rd Ed.)*. Thousand Oaks, CA: Sage.

The Disclosure of Knowledge Transfer for Anchored Legitimacy: the Case of an Italian Public University

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Abstract

This paper sheds light on the disclosure of knowledge transfer (KT) and how disclosure impacts and is impacted by the stakeholders of a public university and its anchored legitimacy.

This is a qualitative case study that focuses on an Italian university. A mixed-method approach is adopted, triangulated from different sources. The methodologies used are drawn from active research and, in particular, our study relies on an interventionist approach.

KT disclosure is found to be more efficacious than KT reports in anchoring the legitimacy of an institution in its territory. This shows that the nature of the knowledge influences the transfer process. Disclosure must be smoothly adapted to formal or informal KT.

Research limitations/implications – In a single case study, our paper provides evidence for the implications of KT disclosure.

This study shows the potentiality of disclosure for KT in terms of unlocking and offering new opportunities for relations between universities and territories.

In an environment with few studies on the peculiar situation of a generalist university, the paper provides new insight into the importance of KT disclosure for strengthening links with the local community and enhancing legitimacy. This is essential for an anchored institution, and a novel concept of anchored legitimacy is presented.

Keywords – knowledge transfer, anchored legitimacy, generalist public university, anchor institution

Paper type – Academic Research Paper

1 Introduction

Universities, in performing their role as knowledge generators, must guide their programs according to societal value (Cesaroni and Piccaluga 2016). This implies that universities should become public leaders, galvanizing the interest of salient stakeholders, crafting strategies aimed at precise societal objectives (Mazzucato 2017). Brokering relationships of trust is a prerequisite for achieving any societal goal, as it is grounded on collective efforts, symbiotic partnerships and citizen engagement (Mazzucato 2018). In the past, public universities, were often small, elite institutions— known as “ivory towers.” Only recently have they become interested in discoursing with stakeholders (Geuna and Muscio, 2009). At the current time, they are digesting how essential trust is in confirming their social contract with stakeholders, and they are working on that trust by enhancing their commitment to disclose information.

Institutions periodically account for their activities in reports, and stakeholders are interested in the disclosure of crystal clear information, due to their idiosyncrasy, secrets, and obscure nature (Dumay 2016). For public universities, the emphasis is put on overreporting, because of the corporatization of public sector functions and the desired measurement of the performance of intellectual capital (IC) (Demartini and Paoloni 2013; Martin-Sardesai et al. 2017; Secundo et al. 2010). While the results achieved in the field of IC confirm the importance of disclosing precious information and its impact in financial terms (Guthrie et al., 2012; Dumay and Garanina, 2013), a generalist public university, as in case study presented here, may use disclosure to raise external funds, to build relationships of trust, and coordinate efforts towards enacting a precise direction for achieving societal relevance towards problem such as health, nutrition, quality of education, wellbeing (Laredo 2007; Philpott et al. 2011; Rolfo and Finardi 2014). The literature on IC in public sector has numerous case studies, little work has been done on the role of IC disclosure, reporting and media in universities (Dumay et al., 2015b).

Knowledge transfer (KT), a use of IC, is the motion of the results of research at a university from within it to a party or parties outside it, through formal or informal mechanisms, through harder or softer activities, whether commercially or not. In generalist public universities, KT depends on the academic knowledge created, as universities represent a unique context for knowledge management (Massaro et al., 2015). KT is part of the so-called third mission, and it is coming to be considered a strategic pillar for public universities (Parker 2013). Beyond teaching and research, third mission suggests universities to become “entrepreneurial” paying greater attention to aspects related to knowledge generation, implementation and exploitation (Elia et al., 2017).

Although legitimacy theory has already examined pragmatic, moral, and cognitive legitimacy in a variety of contexts (Bebbington et al., 2008; O’Dwyer et al., 2011; Dumay et al., 2015a), the nature of the relationships between public universities and their stakeholders requires an evolution of the theory toward anchored legitimacy, as public universities are effectively anchored institutions (Howard 2011). Their anchored legitimacy requires universities to bet on the risks and rewards from KT, disclosing salient information related to KT (Cesaroni and Piccaluga 2016; Etzkowitz and

Leydesdorff 1997). We understand anchored legitimacy as the legitimacy of an institution that is bounded within a territory, whose social contract it is not possible to break, and that cannot fail or leave its territory. A public university shapes a city and vice-versa (Garcia 2007). This new concept will be examined in the light of existing legitimacy theory; however, here, the first driver of the evolution of the public university, namely, the disclosure of salient information. This paper investigates how KT disclosure is implemented at a public university and how the disclosure impacts and is impacted by the stakeholders of the university, undermining that anchored legitimacy.

The paper proceeds as follows. Section 2 reviews prior studies on KT for universities and lays out KT in the light of anchored legitimacy. Section 3 briefly contextualizes the case and its materiality. The methodological section shows the triangulation and analysis of the data. The findings will be presented in section 4 and will be interpreted using legitimacy theory. Finally, the discussion, conclusions, and the limitations and prospects of this study, close the paper.

2 Literature review

The social contract between public universities and its stakeholders is grounded on the production, diffusion, and transfer of the high-quality knowledge needed to sustain the development of society and the upbringing of future generations. The disclosure of KT outcomes is becoming essential for public universities, beyond a simple reporting and accounting for those outputs.

The institutionalization of the third mission caused administrators of public universities to elevate KT to a strategic role, because it is grounded on a knowledge exchange between the university and community, including training and development (Gibbons et al., 1994; Gibb et al., 2013; Miller et al., 2016). With the lens of legitimacy theory, it is possible to see how universities pragmatically report to internal and external stakeholders and allow an evaluation of their performance and activities by them (Ntim et al., 2017). Morally, they started to voluntarily disclose various information on their mission, processes of value creation, and overall sustainability (Alonso-Almeida et al., 2014; Ceulemans et al., 2015b). This disclosure was done with the purpose of informing and educating their publics (Bebbington et al., 2008) and allow the administrative practices of public universities to come to light Lindblom (1994).

Sustainability, social and environmental, and IC reports are attempts to report information, but for various reasons they rarely focus on KT (Sangiorgi and Siboni 2017; Siboni et al. 2013). Little is known about KT disclosure, despite the attempt of measure KT keeping track of the number of patents issued, number of academic start-ups, and innumerable other items that are easier to account for. The focus on KT requires going beyond numbers and identifying the relationship between the generator and the receiver of knowledge. However, the question remains: what are the generators and receivers of knowledge, and what is the content of the transfer?

The literature identifies two forms of KT in universities: formal and informal KT, which coexist (C Grimpe and Hussinger 2013; Christoph Grimpe and Fier 2010). Hard

activities of KT are defined as those having tangible outputs and that are entrepreneurial in nature, such as spin-offs, patenting, and licensing. Softer activities remain important, however, and these are part of the traditional culture of academia, such as academic publishing, the production of qualified graduates or winning grants. The literature privileges the narration of the hard initiatives, as they are more easily measured and reported by numbers (Ratinho and Henriques 2010), while less attention is given to softer outputs (Abramo et al. 2009, 2011) in spite of the fact that they have a significant impact on economies (Cohen et al., 2002).

KT can also be categorized according to its formalism. The formal mechanisms of KT often embody or directly lead to legal instruments, such as patents or royalty agreements (Geuna and Muscio, 2009; Calcagnini and Favaretto, 2016), while KT's informal activities are the non-contractual interactions of the involved subjects (Agrawal 2001). Again, formal activities that take on legal forms can be easily identified and measured, as in the case of commercial and non-commercial KT (Landry et al. 2010), but informal knowledge exchanges are more difficult to track (Olmos-Peñuela et al., 2014b).

A public university following the Humboldtian definition creates academic knowledge in the forms of capital goods and final goods. The hard sciences typically produce capital goods, with their larger chances of appropriation and wider scope of application; the second case is more typical of the social sciences and humanities, the products of which have a more limited scope of appropriation and application but can directly affect the utility of stakeholders (Ankrah and AL-Tabbaa 2015).

Here, our question has been clarified. Why is it that KT disclosure grounds the anchored legitimacy of public universities?

The administrators of public universities, especially in generalist universities, must be able to draw a whole picture of all stakeholders (Freeman, 1984), as they in a sense represent them all (Leydesdorff 2012). However, thousand-year-old institutions may be deeply embedded in the DNA of their territories, representing norms, values, and beliefs. So-called anchored institutions, for instance civic universities, represent inner society and go beyond their missions, becoming deeply committed to the sustainable development of that areas (Goddard et al. 2016). Petruzzelli (2008) alone has taken account of how relational attributes can affect the KT between economic actors as is also treated here, although that study takes its data from a technical university, which is devoted to formal KT and does not consider informal KT, which pertains to departments of the social science and humanities more than to the more technical subjects. Moreover, Petruzzelli's study does not consider any implication in terms of legitimacy theory. Legitimacy theory, in its moral, cognitive, and pragmatic applications, does not provide an answer to the legitimacy problem of anchored institutions. While all organizations are driven by the search for legitimacy (Suchman, 1995, p. 574), anchored institutions already have secular social contract, which in the long run can be taken for granted, but must be supported by a communication policy (Dowling and Pfeffer 1975; Suchman 1995).

As anticipated by Dumay's work (Dumay and Guthrie 2017), despite the proliferation of IC reports (Agyemang and Broadbent, 2015; Ceulemans et al., 2015a; Sangiorgi and Siboni, 2017), the real decision points are found in the disclosure of information (Ferlie et

al., 2008): how to disclose and to whom. Our paper, which takes the University of Torino (UniTo) as its case will show the way in which disclosure adds value to anchored legitimacy.

3 Methodology

UniTo is taken as a case study, due to its particular features and its experience with KT. Using a qualitative methodological approach, the method of a case study allows the presentation of a situated examination of the problematic under investigation, with vivid illustrations from actually operating organizations and projects, offering insights into relations of cause and effect beyond what can be achieved from the quantitative analysis (Denzin and Lincoln 1994). Descriptions of meanings and relations are presented to understand how reality is put together, from the how events unfold of (Gephart, 2004). This methodology follows an accepted approach, in its design and execution (Yin 2003), involving the following: a criterion-sampling strategy, data collection from multiple sources, a strategy of analysis intended to obtain the greatest possible completeness of the targeted information (Patton and Appelbaum 2003). The rationale for this methodological choice are related to the exploratory nature of this study: UniTo is chosen as revelatory case of the generalist Italian public university, and the choice of a single-case study design is due to this method's capability of describing the existence of a phenomenon (Siggelkow 2007).

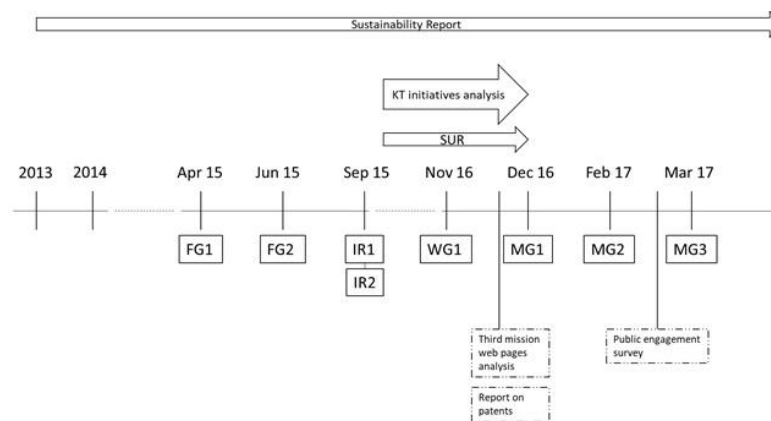
This case represents a unique opportunity to observe and interpret how a generalist public university addresses KT disclosure. UniTo is a large Italian public university, founded in 1440, and in addition to these historical roots, it has trained the winners of three Nobel Prizes and two presidents of Italy. Located in the Piedmont, UniTo is a city within the city of Torino, with 120 buildings in different areas of the city, as well as in key urban locations of the entire region. It includes a botanical garden and five university museums, and it is responsible for half of the medical services of the entire region through its university hospital. Nearly 75,000 students, professors, researchers, and staff members engage with UniTo each day. Teaching goes on in all of its 27 departments, and it does research in all academic fields (excluding engineering and architecture, which are taken by the local polytechnic university).

UniTo is a relevant case study, because it is one of the largest and most ancient Universities in Italy in 2018, 23 out of its 27 departments were officially lauded by the Ministry of Education as excellent departments and received additional funding, and in 2018, it was awarded first place in the public engagement ranking of the ministry.

The use of UniTo as a case study also granted the possibility of the use of primary data collected in a field where our participants had not been previously briefed on our study, allowing them to depict reality as it is, not as researchers may influence them to portray it. For most of the project, the researchers acted as impartial spectators, bearing in mind the methodologies used in active studies. Our work was interventionist to the extent that one researcher participating in the research group was the editor of the university sustainability report. We account for our approach by citing Dumay and Baard (Dumay

and Baard 2017), who affirm that “the knowledge of academics is useful in practice to enhance organizations and the way they operate rather than remaining in inaccessible ivory towers.” We firmly believe that our approach is justified as being part of interventionist research.

To address the complexity of the case of UniTo and to achieve a complete picture and a deeper understanding of the phenomenon, a mixed method was adopted for the collection of data (Johnson et al. 2007). This mixed method is largely qualitative and required active participation of the organization, taking place in meetings and focus groups (FGs), interviews, questionnaires, documentary reviews, and analyses of web pages. Data collection took place over a period of several years, allowing a longitudinal analysis. Data were been collected from April 2015 to March 2017 from the aforementioned sources and a review of internal and external information sources, such as documentation of the organization, internet sources, and publicly available studies and reports (see Appendix A). Appendix A shows the hermeneutic units and stakeholders involved in each stakeholder engagement event related to KT accountability and the input and the output of each event. All the events incorporate specific interesting features with regard to KT accountability related to its enhancement of university legitimacy. Figure 1 provides a timeline of events.



The recordings of meetings were transcribed and coded by two different researchers. Where there were inconsistencies, the researchers revised the transcripts, using with meeting notes, and reached consensus. Data analysis used open and axial coding techniques (Strauss and Corbin 1990) for the identification and linking of the data collected to the research question. Objective descriptive data and interpretative data based on perceptions were coded separately. Data were analyzed with different tools, both manual and software-aided ones, such as Gephi and QCMap.

The materials for interviews and focus groups were analyzed and triangulated with data collected through other sources. To assess the validity of our work, the data were triangulated through the connection of different kind of data, bearing on the same

phenomenon (Jick 1979). We connected data from multimedia sources, such as recording videos, photos, and minutes and notes of events. Finally, the case study was given written form through iteration of the concepts present in the theoretical framework.

4 Findings

4.1 Context of KT in UniTo

UniTo is considered bureaucratic. Departments have complete administrative autonomy, but the management of financial resources is centralized. As a result of the system of performance management that was imposed by the ministerial reform of 2010, UniTo began to publish budgets, a consolidated budget, financial statements, a consolidated financial statement, and a reclassification of the financial statement, according to ministerial guidelines (called missions and programs), as well as a performance plan (PP). The PP resembles an annual report of IC on the achievements of teaching, research, and the third mission. These documents were each 100 pages long, on average. All top administrators have access to a 24/7 online dashboard monitoring IC Key Performance Indicators (from university dropout rates to number of spin-offs created, number of foreign students and visiting professors attracted, and other indicators). The rector once began his speech at the ceremony inaugurating the academic year:

Italian Public Universities are one of the most controlled and transparent organization of the Italian market, which constantly make a great amount of data publicly available, even though external institutional stakeholders always ask to present UniTo again and again. (Rector, Convocation Address)

In his address, he expressed the frustrations of an anchored institution, wherein its legitimacy seems questioned. During the 2013/2014 academic year, a of mixed group of people, including professors, administrators, and students were given the task report information to external stakeholders in a more discursive and less bureaucratic manner. This was done to create a document able to report measures of performance and social, environmental, and economic sustainability to stakeholders. This strategy came about due to the increased perception among administrators that the university's grasp of local actors and the university was deteriorating, due to the intention of beginning a new discourse on sustainable development and the role of the university. Unfortunately, in spite of the adoption of the Global Reporting Initiative as a framework for reporting sustainability-related information, the report did not cover the main outcomes of the business model of the university. Despite this, during a meeting in April 2015 involving stakeholders of UniTo both internal and external, one professor judged the report to be "a nice stylistic effort that will not guarantee any extra funds to my research" (professor of philosophy, FG1).

Another meeting with multiple institutional stakeholders (FG2), UniTo was described as "nebulous" (municipal representative) an "ensemble" (association of public communicators) and a talented professor was described as training an "enormous number of students that need to be employed" (representative of an industrial association). This

image of vagueness and non-specificity emphasized a criticism of the legitimacy of the institution, not for its values or its rigor, but due to the lack of disclosure of its business models and the outcomes it derived. A manager said, “Compared to Torino Polytechnic, it is difficult to define UniTo, to engage it in a dialogue, to co-create policies. We have difficulty finding the right interlocutor, in knowing [your KT’s] exact firepower” (municipal manager, FG2). This how difficult it is for the institution to dialogue with stakeholders. This was largely due to the difference between the representatives of the university (whose behavior can be questioned) and the university itself (which is anchored). People were worried “about doing business with UniTo, as we have no clear perception of it. We perceive the name of a professor or an expert in a niche research field with more clarity, reading about his research output in the newspaper. The bonds we have with UniTo are personal, one to one” (company representative, FG1). The external stakeholders suggested that organizations like UniTo should not only be at the top of the rankings for research but must also be recognized as leader and a pioneer by the public at large, due to the coherent and coordinated communication of its affairs (environmental communicator, FG1).

4.2 KT reporting to KT disclosure

KT contents were drafted mostly to show existing relations between IC budget allocations. The greater part was missing, as information related to IC, such as the number of publications, research projects awarded, and external grants awarded, were silent about the impact of the third mission of the overall university, hidden in multiple different documents. At the organizational level, infrastructural disparities were found among departments, where certain department managers were able to account for their third-mission activities and department managers who completely ignored such practices. This point emerged from the results of a survey composed of 24 closed- and open-ended questions taken by the KT referent of each department. Each department’s feedback showed interest in the issue. The results of the survey depicted the university as a body with various animating spirits: for example, scientific departments tended to show more institutionalized and structured KT processes, while humanistic departments required deeper support in the development and disclosure of their KT, such as hiring professional experts in public engagement or in intellectual property rights and innovation. Most departments had adopted uncoded approaches (54.5%) or declarations of intent (27.3%), and only the scientific and medical departments had formal documentation. Almost all departments declared that they transferred to the outside (output) more knowledge than they received from the outside (input). This illustrated that the state of the art did not reflect the mission statement of the university, where it is characterized as a promoter of “scientific and technological KT to economic and social systems; the university supports the founding of new corporations or other entities, as well as sustaining new corporations able to exploit the results derived from research” (UniTo Statute, art. 5).

After this survey was complete, the Vice Rector of Public Relations created a taskforce framing the KT state of the art of KT in UniTo. The taskforce analyzed the

“third mission” web page created by each department, finding a great disparity between those that detailed all of the third mission activities undertaken and those with only a blank page containing no more than rhetoric.

It was thought that this was a consequence of the lack of a bureaucratic definition of KT. Furthermore, it also emerged a locus of the problem was to be found in the researchers “as primary source of data” (Director of the Research Department). After financial data and survey results were triangulated, our findings showed that in medical and hard sciences departments, KT and innovation generally coincided with the presence of formal research agreements (especially for legal and ethical motivations, such as privacy protection and the ethical implication of the experiments); for this reason, these agreements have been always considered more “research” than “third mission”. They raise greater amounts of money and they disclose less. Social sciences and humanities departments did not to formalization, especially concerning local SMEs, associations, and third sector partners, and they raised less money from local actors.

The outcomes of UniTo KT are shown in Table 1.

Table 1 Amounts of KT between department types in formal and informal activities, as well as external funds raised

<i>Areas</i>	<i>Formal KT</i>	<i>Informal KT</i>	<i>External funds raised</i>
Medical and hard sciences	90%	38%	95%
Social sciences and humanities	10%	62%	5%
Total	100%	100%	100%

Our findings suggest that formal KT occurred with less external engagement and more focused commitment and that it pays more. One hard science professor, during the internal roundtables (IRs) of September 2015, stated that:

We are trying to overcome the prejudice that we are not involved in the world. We work every day with people, we engage local communities, here and in developing countries, we engage with schools, but we must know if such arguments are of importance for people beyond the university (Professor, IR1).

Also during IR2, a social science professor stated that

The social sciences are often treated as second-level disciplines, and asking us to produce data on KT implies the prejudice that we are not really working (Professor, IR2).

These statements reported are essential for determining what KT disclosure is. Is KT disclosure just accounting of KT performances? Then the answer is not. Our findings suggest that KT disclosure means divulging the results derived from a scientific project, engaging citizens and in reasoning together about the findings of specific research and benefitting from it.

4.3 KT disclosure in practice

Disclosure of KT depends on the nature of the given KT. In 2016, a new institutional website, called FRidA, was launched, with the function of presenting the research of UniTo to the general public, using popular language; this tactic embodies informal KT. Each professors and researchers who wished could voluntarily share with the general public the results of their research by uploading a summary of her/his projects. The same database contains a description of more than 3,000 events of public engagement performed in 2011–2015. The most-used form of disclosure was found to be the participation of a researcher in a public event, such as a festival, science café, or fair. In public engagement, the researcher presents him- herself and his or her research without laying an emphasis on the role of the institution.

Taking a semantic analysis of the KT initiatives depicted by departmental representatives, our paper here presents a visual network. Figure 2 was created to visibly show the links between KT accountability and the content itself, giving the links between stakeholders, the topics of the KT, and UniTo departments.

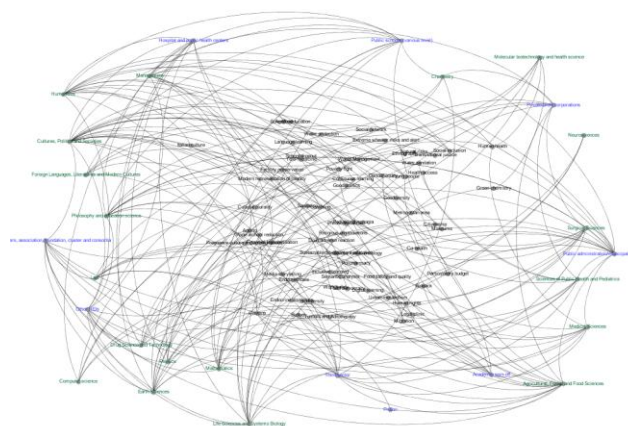


Figure 2: Social network-analysis of projects collected, departments involved, and stakeholders

Figure 2 was created using social network and semantic analysis of the project presentations collected by departments, where the blue represents the stakeholders involved, green nodes represent departments, and black nodes reflect project contents. Social sciences and humanities, hard sciences, life sciences, and health sciences are equally distributed in the top ten departments according to numbers of weighted nodes. Stakeholders are labelled in homogeneous categories. The most common categories are public administration departments, municipalities, and governments; third-sector

organizations; other research institutions and universities; public schools; and hospitals and public health centers. Our study found that projects covered a wide range: from water sanitation to innovative agricultural techniques in Saharan rural villages, from projects supporting vulnerable people (migrants, disabled, newly poor, addicts, and inmates) to financial literacy, from pregnancy care to the early diagnosis of rare diseases, dysphagia, endometriosis, and oncology related to DNA risk. The legitimacy obtained by educating people on such topics is priceless, overwhelming any business strategy that a public organization could put in place.

Formal KT on patents was located in five different databases, which were merged and controlled by researchers. The final results showed 175 patents (2011–2015), which should be considered far from final, because they accounted only for patents traced by university offices (excluding those created by researchers personally). We found more patents than those reported in notes to financial statements or IC reports. Further, our initial hypothesis about formal KT, that it pays more and means reduced external engagement, was overturned.

UniTo's legitimacy is anchored in the territory of the hard science departments. This was confirmed by an administrator, who said, "For us, it is relevant to have updated information on partners and the work that has been done, along with its territory" (representative of a hard science department, MG2). The problem of stolen legitimacy can be perceived in the words of a research director: "among the hard sciences, there is the challenge of marketing strategy and negotiation with private corporations. [Companies] start from the assumption that when they pay for something, it is then their property. We feel that our role is unbalanced role. They presume that the output of a public university could be privatized, but we must defend our role and territory" (director of central research department, MG3).

The problem of legitimation is closely linked with the production and transfer of knowledge. Our findings demonstrate that "the value of KT is a question of reputation: if UniTo presents itself in a certain way, then large corporations will concede it more space, to create a dialogue and to deal with favorable contractual duties. Companies, in general, consider us to be a supplier and not as a partner" (Professor 1, MG3).

However, at the organizational level, all tools examined in this project are institutionalized, and with emphasis placed on creating engagement events with the surrounding territory, not simply to ensure the role of the university as a researcher, but to affirm again UniTo's status quo. This is risky, but being anchored means that

"Innovation may come through the work of companies the university efforts: the desirable future of the economy and the society relies on the dialectic role more than on mechanical adjustment, as explained by supply and demand numbers" (vice rector, Strategic KT Report).

5 Discussion and conclusions

This study investigated KT disclosure at the university level and how these strategies influence and are influenced by stakeholders. Related with the theoretical framework presented earlier, UniTo illustrates the complexity of an anchor institution (Howard 2011) that perceived potential conflict undermining its legitimacy and the social contract with its stakeholders. As Dumay and Baard (2017) found, the problems of a university must be addressed and resolved using intervention strategies. This has been executed in UniTo through a protracted process of organizational and communication changes. Our study of how the development and implementation of the new strategy exhibits a new notion of anchored legitimacy. The complexity connected to the development of this new concept is especially apparent, given the long-term existence of the institution, rooted in its territory for centuries, subjected to a centralized public control influencing the implementation of changes.

One challenge linked to KT disclosure is from KT that may vary from the source field of knowledge and its inclination, relative to stakeholder interactions and communications. Opening the black box of generalist knowledge through public universities means disentangling various legitimacy issues that are interlinked. With the aim of educating and informing the external public (Lindblom 1994), the relation between the nature of knowledge and the generalist approach takes first place. The first proposition of our study is to consider the nature of knowledge when ministries are called to develop politics and incentives in terms of KT.

The second challenge relates to the hierarchy of needs. University managers are often more concerned with following the law than they are with ensuring the effective use of the data they produce. Universities as data factories are myopic, in that university managers do not recognize the importance of translating data into comprehensible information. In anchored legitimacy, the adhesion to the general norms and values of the larger society are taken for granted, while the disclosure of new, secret, and unknown information has the potential to reveal new aspects of an institution that everyone thinks they know (Dumay 2015; Ntim et al., 2017; Deegan, 2002). The second proposition is to apply anchored legitimacy to different knowledge intensive public institutions such as research centers, schools, museums, to understand similarities and differences in its generalization.

The third challenge, which may be more of a risk, is the disclosure of data and the communication of information that internal stakeholders do not approve. This disaffection might can birth to a legitimacy crisis (Ntim et al., 2017). KT disclosure is perceived to be individual-centric, deinstitutionalizing the university and its legitimacy for the benefit of personal legitimacy. Myopic managers and directors may come to take university legitimacy for granted (Suchman, 1995; Dumay et al., 2015a), focusing their attention more on the bureaucracy than on the message that is being communicated (Vagnoni and Cavicchi 2015). At third, anchored legitimacy should be framed by stakeholder management theory in understand how to engage internal stakeholder on KT.

Our study also suggests the importance of elevating third mission activities to a strategic level. To recognize KT means identifying the producer and receiver of KT, as well as having the ability to clearly communicate the outcome of research to the right stakeholder and to capitalize on them. This means to propose organizational changes such as creating a culture of public engagement where researchers have the soft skills to valorize the contribution of the social sciences and humanities, as well as giving a value to scientific and medical formal KT on the market. Adoption standardized procedures and the simplification of the institutionalized processes, as well as the timely answer given to external interlocutors, impact its external reputation, as when public universities performs well, companies legitimize them (Deegan 2002).

Finally, the attempt to implement KT generates an image of an anchored institution that is engaged and bonded among its central administration and departments, as well as the external public. Our study clearly revealed that large-scale spaces of public knowledge are composed by the constellation of competencies that generate internal KT coopetition (such as between the scientific and humanities departments), and disclosure managed at a central level can serve as tool to deflect donations from one area to another. This final proposition affects the area of anchored institution management.

This study showed the practical implications that reinforce the need for KT disclosure as a process of anchored legitimacy, using new communication strategies and media. This can result in clearer and more transparent external communication with the policy makers, who both govern higher education systems and may play the role of partners in triangulation among the university, private industry, and public government. Responding to the call of Dumay and Rooney (2011), our work emphasizes the literature on the disclosure of knowledge in public sector organizations. The social implications are many, and this study shows the potential for disclosing KT through unlocking and offering new relational opportunities between universities and territories (Massaro et al., 2015), by sharing goals and becoming a public leader in a territory. Continuous learning can contribute to reciprocal local development and reinforce the university as outstanding nationally and internationally. Due to exogenous pressure creating a changing role for universities in societies, this paper presents a broad framework for the adoption of disclosure of the KT as a strategy to ensure that the legitimacy of the institution is still anchored.

References are available upon request

Customer Portfolio Mapping. How to Identify Strategic and Tactical Customers and Evaluate the Customer Reciprocity Relationship

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Abstract

"Each company has the customers it deserves" said one day a Ceo to his management. This is a very strict statement that forces companies to question the reasons why they have a specific customer portfolio and to distinguish strategic customers from tactical ones.

The mapping of the customers, focus of this article, has the dual objective to measure objectively the level of "strategicity" of the customer portfolio and the level of business reciprocity between the company and its customers, in order to appropriately orient the decision processes of the company.

In order to achieve the aforementioned dual objective, three sets of information are required: the economic and financial quality of the client, the level of utility of the client for the company and the level of utility of the company for the client.

The combination of the two first set of information allows to evaluate the level of "strategicity" of each single customer, that is if the customer is strategic or tactical and why. The questions to be answered are: how much competitive are the strategic customers for the company? How many customers are at the same time competitive but tactical for the company? The company's goal is to select strategic customers that are at the same time competitive and useful for the company over time.

A second combination between the above strategic level of the customer and the level of utility of the company for the client allows to measure the degree of business reciprocity of the customer relationship. The questions to answer are: how much is strategic the company for the strategic customers? How many are the strategic customers for whom the company is considered tactical? The company's goal is to be strategic for strategic customers.

Each set of information is based on key performance indicators that allow not only to map the customer portfolio in terms of customer strategicity and business reciprocity of the customers, but above all to identify the priority business figures in terms of

management decisions and actions and therefore to plan and control the customer portfolio quality and through the latter the economic value creation.

Keywords – knowledge management tool, performance evaluation, customer portfolio mapping, strategic customers, Automotive Independent Aftermarket.

Paper type – Academic Research Paper

1 Introduction

How do you identify a competitive company? Which are the determinants that let the company gets and preserves the competitive advantage? The determinants of the competitive company are connected to the superior ability to operate with clients, suppliers, process, resources, know-how, markets, etc. each one useful for the business continuity (Krapfel et al., 1991; Turnbull and Zolkiewski, 1995; Kotler et al., 1996; Lars Grønholdt et al., 2015). In order to identify as strategical what is essential for the company, those previous determinants are detected as strategical dimensions.

There are many scientific contributions regarding the customer portfolio models or supplier portfolio models that suggest managerial decision tool to support the right customer portfolio composition (Fiocca, 1982; Campbell and Cunningham, 1983; Shapiro et al., 1987; Krapfel et al., 1991; Olsen and Ellram, 1997; Turnbull and Zolkiewski, 1997; Browne, 2000).

According with many papers regarding the study of the Customer Relationship Management (Park et al., 2003; Rado Kotorov, 2003; Chor-Beng Anthony Liew, 2008) and many theory of strategic relationship management (Donaldson and O'Toole, 2002; Klink and Sjöberg, 2003; Aihie Osarenkhoe and Az-Eddine Bennani, 2007) the aim of the company is to increase and maintain for a long time a profitable relation with the customer (Weinstein, 1994; Mulhern, 2003; Jonker et al., 2004).

The goal of this article is the quality measurement and, more precisely, the strategic level of the client's portfolio. It is based on an original model created by the authors, the so-called Customer Portfolio Mapping (CPM from now on). The added value of this approach is to provide company management with a clear tool in the logic and definition of the criteria that make it possible to distinguish strategic and tactical customers and evaluate the quality of customer business relationship. The entrepreneurs achieve this goal thanks to the integration of two knowledge: the methodology of university scientific research and the applicative one connected to the dynamics of the competitive context. The Customer Portfolio Mapping methodology is oriented to the companies with a business-to-business approach who believe that the good quality of the business relationship with the customer is an element of competitive advantage (Elliott, 1998; Conlon et al., 1987; Derrick 2006; Henry Lau et al., 2016). In particular, the management should be answer to these questions: which is the share of the revenues and of the operating profit realized by the company with the strategic clients? Which are the clients with whom the company has a non-strategic relationship of trade? Which are the

management area where the company can operate to improve the strategy relevance and the reciprocity of the revenue and the operating profit? (Porter, 1996; Bennett Stewart, 2013).

In 2009, the authors of the article created within the department of Management and Production Engineering (DIGEP) of the Politecnico di Torino, a research group with the aim of developing metrics for measuring economic, financial, competitive and strategic business performance and sharing it with the companies. Today the research group is recognized from many companies as a studies centre where to get knowledge to transfer to the management and where to find the competence to develop new management tools. The strong collaboration of the research team with companies operating in the sector of the Italian automotive independent aftermarket (IAM) (the research group is totally financed by the companies) allowed the realization of a model consistent with the dynamics of the business and understandable to those who make the decisions (McDonald et al., 1997) useful to create economic value for the company (Porter, 1980, 1985; Rappaport, 1998; Besanko et al., 2000; Guelfi, 2013). The Italian Automotive IAM is composed of Manufacture, Distributors and Spare Parts Dealers (in Italy almost 500 manufacturers, 150 distributors and 5.000 dealers).

2 Three set of integrated information and three set of key performance indicators

The methodologic path of the Customer Portfolio Mapping is based on three set of information which are continuously integrated and where each one of these set gets inputs from logical performance indicator already evaluated.

The first set of information is referred to the Customer's Company Quality (Guelfi et al., 2016): the goal is to measure the level of the economic/financial and competitive/strategic balance and where you it is possible distinguish the following methodologic steps:

1. identify the best key performance indicators (KPIs);
2. choose the criteria and the evaluation scale.

About the identification of the best key performance indicators, it is possible to determine:

- a. indicators about economic balance to highlight the attitude in realizing a good economic profit in their business (for example, the contribution margin's percentage, the level of operating gross margin or the added-value for each euro of internal and external labor cost);
- b. indicators about assets and liabilities balance in order to evaluate the attitude to operate in balanced conditions of use and procurement of capital (e.g. warehouse turnover rate, relationship between equity and net fixed assets, relationship between the days sales outstanding and the days purchases outstanding);
- c. indicators about financial balance to distinguish the attitude in generating correct cash-flow (e.g. the percentage of operative cash-flow generated by the revenues, the relationship between ebitda, earnings before interests taxes depreciation and amortization

and the variation of the operating net working capital and the relationship between new investments and current cash-flows);

d. indicators about competitive balance in order to highlight the attitude of managing the direction and the intensity of their own competitive risk (e.g. operating leverage, the intensity of competitive cost advantage and the level of concentration of the revenues in terms of clients and/or markets and/or products);

e. indicators of strategic balance to evaluate the coherence between strategic goals and resource and competence (e.g. relationship between the rate of revenue's growth and investments in process and/or product, development rate of investments in distinctive competences, company size and development rate).

In order to identify the criteria and the evaluation scale of each indicator, the next steps have to be followed:

a. the evaluation criteria are three: positivity or negativity, improving or worsening, stability or volatility. For each indicator, the comparable companies were chosen and therefore the related average value (median value, if the companies are far different) was calculated. These calculations have to be done in term of punctual value of the period, variation and volatility over the previous period.

b. the evaluation scales are five: far over the average (represented by the 15 percentile), over the average (between 15 and 40 percentile), average (between 40 and 60 percentile), under the average (between 60 and 84 percentile), far under the average (85 percentile and more).

In order to be as much synthetic as possible, the performance highlighted by an indicator is better evaluated as it is positive and has stable improving, all conditions being the same.

The economic/financial and competitive/strategic balance measurement is declined in five judgement states with decreasing positivity of the customer's company:

1. Strong;
2. Consistent;
3. Normal;
4. Mediocre;
5. Weak.

The second level of information deals with the Client's Level of Strategical Coherence for the mapped company: the goal is to objectively measure how much is the client strategic, using the most coherent indicators. The criteria and the measurement scale are the same as for the first level, while it can be distinguished a particularly difficult step and indicators linked with the company strategic goals. About the first step, in order to identify a strategic client, the company has to have clearly in mind which are his strategic goals and then build the client's strategic indicators. Strategic goals are synthetized as:

a. profitability: in this case the main goal is to get a consistent profit, implying that the more important indicators to qualify a client as strategic in both absolute value and percentage are those one related to client's profitability;

b. cash-flow: the logic is the same as point a) but focused on the client's cash-flow: indicators about the cash flows generated by the client are the best in order to define the latter's strategic level;

c. development: the logic behind is the same as point a) and b), and it can be split in terms of revenues, organization, processes, competences, diversification, relationship, etc. and how the client can be functional/coherent in the identified development strategy: indicators related to continuity and to client's dimension rather than to the level of territorial control and to the attention/trust degree about the mapped company;

The Client's Level of Strategic Coherence is declined in five judgement states with decreasing positivity in terms of strategic attitude of the client:

1. Vital client;
2. Valuable client;
3. Proper client;
4. Mediocre client,
5. Weak client.

The first three typologies (vital, precious and proper) allow the company to be in good health and improve, the last two clusters bring negativity to the company.

The third level is referred to the Strategic Coherence level of the Mapped Company for the Client: this analysis reverses the traditional point of view of the client's utility for the mapped company and has the goal of evaluating how much is the company strategic according the client's utility curve. The quality of the information is in function of how deep is the knowledge of the client, of its priorities and what leads his decisions in terms of suppliers. Also in this case:

- a. criteria and measurement scale are the same as the previous level of information;
- b. the indicators to select are those related to the client's strategic goals, also in terms of profitability, cash-flow and development: between all the indicators, there are some particularly relevant such as the substitution time of the mapped company with the competitors, the utility recognized by the client in terms of price/value relationship (reliability, responsiveness, service, etc.), the percentage of the mapped company's revenue over client's purchases, financial condition agreed with the client, etc (Campbell and Cunningham, 1983).

3 Strategic customer. Customer's Strategic Map

The second step of the methodologic path of Customer Portfolio Mapping is based on the integration of first two set of information: Customer's Company Quality and the Customer's Strategic Coherence Level. The result is the distinction between the strategical clients of first and second level, valuable, tactical and harmful. In particular, for the mapped company (fig.1):

1. the strong first level client, so the one who are in economic-financial and competitive-strategic balance, are strategic and vital/valuable for the company itself;
2. the consistent second level client are strategic and vital/precious for the company itself;

3. the normal clients are valuable and proper for the company itself;
4. the mediocre clients are tactical in terms of economic/financial and competitive/strategy and mediocre for the company itself;
5. the weak clients are harmful, that means that they are economic/financial and competitive/strategic unbalanced, and also harmful for the company itself.

Customer's Level of Strategic Coherence for the Mapped Company	Economic/Financial and Competitive/Strategic Customer's Profile				
	Strong	Consistent	Normal	Mediocre	Weak
Vital	Strategic 1	Strategic 2	Precious	Tactical	Harmful
Valuable	Strategic 1	Strategic 2	Precious	Tactical	Harmful
Proper	Precious	Precious	Precious	Tactical	Harmful
Mediocre	Tactical	Tactical	Tactical	Tactical	Harmful
Harmful	Harmful	Harmful	Harmful	Harmful	Harmful

Fig. 1 – Strategic Customer. Customer's Strategic Map

It's particularly interesting looking at two different combination about the harmful clients for the mapped company:

- a) the harmful client, even if they are strong, are dangerous because of the incoherence of strategic utility: those clients are healthy and competitive, but dystonic looking at the strategic goals of the mapped company;
- b) the harmful clients because they are weak in terms of economic/financial and competitive/strategic, but at the same time they are proper for the mapped company.

For the harmful clients like point a), the mapped company has the competitive duty and the economic convenience of understanding the reason why the strong clients are not strategically useful and it has to identify some operating solutions that can increase the strategic utility. As it was outlined before, this methodology requires a deep knowledge of the strong/harmful client's business model by the mapped company.

The harmful clients like point b) are different because the mapped company has not the right or the possibility to act in the economic/financial and competitive/strategic choices. This constraint implicates a particular fragility condition, because the client's revenue/profit is vital, precious and proper for the mapped company.

Customer's Portfolio Mapping allows to:

- a) quantify the punctual and the trend effect, in relation to the past, of the revenues and margin realized by the mapped company with different client's segment: strategic, valuable, proper, mediocre and harmful;
- b) identify in a strict way, for different client's segments, the more appropriate policies to improve the strategic quality of its customer's portfolio.

3.1 The strategic exchange relationship. Strategic Reciprocity/Equivalence Map

The third step of the methodologic path of the customer's portfolio mapping is based on the integration of the first map results (concerning the distinction between the Strategic/Precious/Tactical/Harmful Clients) with the third set of information (connected to the Strategic Coherence of the Mapped Company recognized by the Customer). The connected result is the exchange relationship's distinction based on positive coherence rather than negative incoherence as well as other possible combinations: the positivity of the former is contrasted by the negativity of the latter. Particularly, it is possible to distinguish for exchange relationships for the mapped company (fig.2):

1. positive coherences the ones that occur between strategic / valuable customers for the company that in turn recognize the company as strategic / valuable: the goal is to preserve and strengthen these relationships by operating appropriately on the rationales that feed them;
2. negative incoherences the ones that occur between tactical/harmful clients that recognizes the mapped company as strategic/valuable, as well as the relationship with the strategic/valuable clients, which recognize the mapped company as tactical/harmful: the goal is to change those harmful relationship towards a positive coherence;
3. useless coherence for those with tactical clients that recognize the mapped company as tactical and vice versa;
4. harmful coherence for those with harmful clients that recognize the mapped company as harmful as vice versa.

Strategic Coherence Level of the Mapped Company for the Customer	Customer's Strategic Level for the Mapped Company			
	Strategic	Valuable	Tactical	Harmful
Strategic	Positive Coherence	Positive Coherence	Negative Incoherence	Negative Incoherence
Valuable	Positive Coherence	Positive Coherence	Negative Incoherence	Negative Incoherence
Tactical	Negative Incoherence	Negative Incoherence	Useless Coherence	Useless Coherence
Harmful	Negative Incoherence	Negative Incoherence	Useless Coherence	Useless Coherence

Fig. 2 – The Strategic Exchange Relationship. Strategic Reciprocity/Equivalence Map

The positive coherence exchange's relationship of point 1) are the healthy one, where the mapped company and its clients are mutually strategic/valuable and the company's decisions/actions have the duty of preserve and reinforce them, after reaching that relationship level. The incoherence negative relationships of point 2) highlight two different company's policies:

a) when the company is tactical/harmful for the strategic/valuable clients is required that the mapped company has to modify its decisions/actions in order to improve the dispensed contents in that client's segment;

b) when the company is strategic/valuable for the tactical/harmful clients, it is always the mapped company that has to modify decisions/actions, in order to reduce the dispensed contents to the tactical/harmful clients or increasing the gained advantage (e.g. prices, profitability) or deciding to stop serving that client.

The useless coherence exchange's relationships are not interesting for the competitive company that has only two choices: increase the two-strategic level from the tactical condition to the valuable one or increase, in a short-term vision, the gained advantage becoming harmful for a tactical customer.

The harmful coherence exchange's relationships have only one possible way, identify the most convenient exit strategy.

The under-discussion mapping allows to:

a) measure, in punctual and trend terms, the percentage of revenues and profit realized in a reciprocity/equivalence strategic condition;

b) highlight, for every client's strategic level for the mapped company, the positive coherence's or negative incoherence's degree, referring to the strategic/valuable clients. Highlight the negative incoherence's and useless coherence's degree, referring to the tactical clients. Highlight the harmful incoherence's degree, referring to the harmful clients;

c) objectively distinguish the strategic reciprocity level of the exchange relationship for each client, in punctual and trend terms;

d) accurately identify, for every client's segment, the more appropriate policies in order to improve the customer's portfolio strategic quality;

e) increase the knowledge of the customer's business model and to ask oneself on what are the determinants of their economic value creation in order to build a competitive price/value offer different from the competitor's one (Homburg, 2002).

4 Conclusions

To conclude, the Customer Portfolio Mapping model allows the competitive company to, by using the appropriate key performance indicators, to objectively measure the strategic level of its customer portfolio and the reciprocity/equivalence strategic level of the exchange relationship with their own customers.

How much are the revenues and the strategic profit of the mapped company? Is the mapped company strategic for the strategic customers? With which client and for what reasons are there imbalances in the exchange relationship? The information derived by the structured and methodical analysis of the customer's portfolio quality are essential conditions in terms of awareness, development and managerial communication and they all operate as a real distinctive competitive leverage in order to drive the company towards its strategic goals.

References

- Aihie Osarenkhoe and Az-Eddine Bennani, (2007) "An exploratory study of implementation of customer relationship management strategy", *Business Process Management Journal*, Vol. 13 Issue: 1, pp.139-164, <https://doi.org/10.1108/14637150710721177>
- Bennett Stewart, G. III, (2013) *The quest for value*, Harper Collins, New York.
- Besanko, D., Dranove, D. and Shanley, M. (2000), *Economics of Strategy*, 2nd ed., John Wiley & Sons, New York, NY.
- Browne, S. (2000), "Risk-constrained dynamic active portfolio management", working paper, Columbia University, New York, NY, June.
- Campbell, N.G. and Cunningham, M.T. (1983), "Customer analysis for strategy development in industrial marketing", *Strategic Management Journal*, Vol. 4, pp. 369-80.
- Chor-Beng Anthony Liew, (2008), "Strategic integration of knowledge management and customer relationship management", *Journal of Knowledge Management*, Vol. 12 Iss: 4 pp. 131 – 146. <http://dx.doi.org/10.1108/13673270810884309>
- Conlon, G., Napolitano, L. and Pusateri, M.A. (Eds) (1997), *Unlocking Profits: The Strategic Advantage of Key Account Management*, Strategic Account Management Association, Chicago, IL.
- Derrick Philippe Gosselin, Guy André Bauwen, (2006) "Strategic account management: customer value creation through customer alignment", *Journal of Business & Industrial Marketing*, Vol. 21 Issue: 6, pp.376-385, <https://doi.org/10.1108/08858620610690137>
- Donaldson, B. and O'Toole, T. (2002), *Strategic Market Relationships: From Strategy to Implementation*, Wiley, Chichester.
- Elliott, G. and Glynn, W. (1998), "Segmenting financial services markets for customer relationships: a portfolio-based approach", *The Service Industries Journal*, Vol. 18 No. 3, pp. 38-54.
- Fiocca, R. (1982), "Account portfolio analysis for strategy development", *Industrial Marketing Management*, Vol. 11, pp. 53-62.
- Guelfi S. (2013). Mapping of the Strategic Positioning and Sequencing through the Integrated Value Creation Model: The Wholesale Spare Parts Distribution in the Italian Automotive Independent After Market in the 2008-2011 Period. *International Journal of Business Administration* Vol. 4, No. 4; 2013. doi:10.5430/ijba.v4n4p
- Guelfi S., Norese M.F., Saluto P. (2016). An integration of theoretical knowledge, day by day experience and multicriteria methods to support the entrepreneurial learning process. *Measuring Business Excellence*. doi: 10.1108/MBE-12-2015-0056.
- Henry Lau, Dilupa Nakandala, Premaratne Samaranayake, Paul K. Shum, (2016) "BPM for supporting customer relationship and profit decision", *Business Process Management Journal*, Vol. 22 Issue: 1, pp.231-255, <https://doi.org/10.1108/BPMJ-04-2015-0039>
- Homburg, C., Workman, J.P. and Jensen, O. (2002), "A configurational perspective on key account management", *Journal of Marketing*, Vol. 66 No. 2, pp. 38-60.
- Jonker, J. J., Piersma, N., & Poel, D. V. (2004). Joint optimization of customer segmentation and marketing policy to maximize long term profitability. *Expert Systems with Applications*, 27(2), 159–168.
- Klink, M.B. and Sjöberg, U. (2003), "Towards a comprehensive SCP-model for analysing strategic networks/alliances", *International Journal of Physical Distribution & Logistics Management*, Vol. 33 No. 5, pp. 408-26.
- Krapfel, R., Salmond, D. and Spekman, R. (1991), "A strategic approach to managing buyer-seller relationships", *European Journal of Marketing*, Vol. 25 No. 9, pp. 22-37.

- Kotler, P., Armstrong, G., Saunders, J. and Wong, V. (1996), *Principles of Marketing*, Prentice-Hall, London.
- Lars Grønholdt, Anne Martensen, Stig Jørgensen, Peter Jensen, (2015) "Customer experience management and business performance", *International Journal of Quality and Service Sciences*, Vol. 7 Issue: 1, pp.90-106, <https://doi.org/10.1108/IJQSS-01-2015-0008>.
- McDonald, M., Millman, T. and Rogers, B. (1997), "Key account management: theory, practice and challenges", *Journal of Marketing Management*, Vol. 13 No. 8, pp. 737-57.
- Mulhern, F. J. (2003). *Customer profitability and diagnosing a customer portfolio*. Kellogg on integrated marketing. New York: Wiley.
- Olsen, R.F. and Ellram, L.M. (1997), "A portfolio approach to supplier relationships", *Industrial Marketing Management*, Vol. 26, pp. 101-13.
- Park, C. H., & Kim, Y. G. (2003). A framework of dynamic CRM: Linking marketing with information strategy. *Business Process Management Journal*, 9(5), 652–671.
- Porter, M.E. (1980), *Competitive Strategies: Techniques for Analysing Industries and Competitors*, The Free Press, New York, NY.
- Porter, M.E. (1985), *Competitive Strategy: Creating and Sustaining Superior Performance*, The Free Press, New York, NY.
- Porter, M.E. (1996), "What is strategy?", *Harvard Business Review*, Vol. 74 No. 6, pp. 61-78.
- Rappaport A. (1998). *Creating Shareholder Value. The New Standard for Business Performance*. New York, The Free Press.
- Rado Kotorov, (2003) "Customer relationship management: strategic lessons and future directions", *Business Process Management Journal*, Vol. 9 Issue: 5, pp.566-571, <https://doi.org/10.1108/14637150310496686>.
- Shapiro, B.P., Rangan, V.K., Moriarty, R.T. and Ross, E.B. (1987), "Manage customers for profits (not just sales)", *Harvard Business Review*, September-October, pp. 101-8.
- Turnbull, P.W. and Zolkiewski, J. (1995), "Customer portfolios: Sales costs and profitability", in *Interaction, Relationships and Networks: Past-Present-Future*.
- Weinstein, A. (1994). *Market segmentation revised edition*. Chicago, IL: Probus Publishing Company.

Exploring the Effect of Corporate Entrepreneurial Intention on the Channels of University-Industry cooperation: an Empirical Analysis of Southern Italian Firms

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Abstract

This paper aims to uncover the determinants of University-Industry Cooperation (UIC) from an individual perspective, to identify which entrepreneurs' characteristics affect the emergence of UIC and, more specifically, affect the selection of cooperation channels. To this purpose, we employed the Corporate Entrepreneurial Intention (CEI) model (Fini et al. 2012), which allowed to assess the effect of both individual and contextual factors in UIC dynamics, whether no previous attempts have jointly considered both types of variables in UIC literature. After applying structural equation modelling techniques to a sample of 130 entrepreneurs in the Region of Campania (South of Italy), our results show that corporate entrepreneurial behaviour is positively related to forms of UIC with an average and high level of complexity

Keywords – university-industry collaboration, Campania region, structural equation modelling, channels of UI cooperation; entrepreneurial perspective

Paper type – Academic Research Paper

1 Introduction

University – Industry Cooperation (*hereinafter* UIC) is defined as “*the interaction between any parts of the higher educational system and industry aiming mainly to encourage knowledge and technology exchange*” (Ankrah and Al-Tabbaa 2015). There has been a growing interest in university–industry relationships as made evident by the abundant literature on the topic (D’Este and Patel, 2007; Lai, 2011; Liefner and Schiller, 2008; Tether and Tajar, 2008) grounding on the common belief that collaborative research by academia with industry may be a powerful source of innovation (Ambos et al., 2008; Mansfield, 1998). Literature on UIC generally focuses on a few general aspects of analysis, including the determinants underpinning U-I collaborations, the barriers to cooperation and the selection of main channels of interaction (Perkmann et al. 2013). In most cases, the factors affecting UIC dynamics have been investigated from the academic perspective, at both institutional and individual level, while less attention has been given to the firm’s perspective and, most specifically, to that of the entrepreneur (Ankrah et al. 2013). Our paper instead, tries to explore the factors affecting the UI cooperation from the perspective of the company. Extant literature that studies UI relationships from a firm’s perspective, is generally focused on the analysis of the factors affecting this collaboration by considering the effect of the contextual factors and the effect of firms’ characteristics influencing or inhibiting the emergence of firms’ cooperation with academia, the propensity of firms to cooperate with university, the intensity of the cooperation itself and finally, the selection of UIC channels (Fontana et al, 2006; Moraes Silva et al, 2019; Segarra-Blasco and Arauzo – Carod 2008; Maietta 2015; Eom, K. Lee 2010; Thune, 2007)). However, most scholars focus on the typical firm variables (size, industry, absorptive capacity, R&D intensity) and neglect to consider the perspective of the entrepreneur. In other words, to the best of our knowledge, there are no studies that try to identify which are the entrepreneur’s characteristics that may eventually affect the choices of cooperation with academia. Conversely, if we look at the academic counterpart of the UI relationship i.e., the *researcher* or *scientist*, we find abundant empirical evidence about which individual attributes of researchers explain the UIC dynamics, suggesting the importance of considering the individual perspective in this field (Abramo et al, 2012, Rasmussen, 2011; Fini et al, 2009; Visintin and Pittino, 2014). In order to fill this gap, we position ourselves within the literary strand focused on the determinants of UI Cooperation from the perspective of firms, to explore how the individual characteristics of entrepreneurs affect firms’ propensity to cooperate with university and their selection of UIC channels. To this purpose, we adopt the Corporate Entrepreneurial Intention (CEI) model (Fini et al. 2012), which allows to assess the effect of both individual and contextual factors in UIC dynamics, whether no previous attempts have jointly considered both types of variables in UIC literature from the perspective of the entrepreneur. We apply structural equation modelling techniques to a sample of 130 entrepreneurs in the Region of Campania (South of Italy). The Region of Campania represents an interesting case of study since, despite the presence of a relative high number of academic and research institutions, innovative firms and a set of target regional policies to incentivize

UIC R&D, UIC is still considered uncommon from the industrial side. Our results show that attitude toward entrepreneurial behaviour is positively related to forms of UIC with a greater level of complexity. This study makes a contribution to the literature focused on the determinants of UIC from the firm's perspective, by considering the entrepreneurs' individual characteristics. The remainder of the paper is organized as follows. Section 2 reviews main studies exploring the determinants of UIC from a firm perspective. Section 3 develops research hypotheses. Section 4 examines the specific context of firms in Campania and presents data and methodology used in this study. Section 5 discusses main results, before concluding (Section 6).

2 Theory

From a firm's perspective, scholars consider the main determinants to UIC at the organizational level (ex. firm's size; experience; R&D intensity; absorptive capacity) or at the industrial level (characteristics of the firm's main sector of activities). Among the studies that analyse the determinants at the firm level, the role of firm size in affecting the propensity of firms to collaborate with PROs is one of the most recursive topics (Mohnen and Hoareau, 2003; Cohen et al., 2002; Arundel and Geuna, 2004; Laursen and Salter, 2004). One of the basic assumptions is that the larger the firm, the larger is the amount of resources available to establish relationships and engage effectively in more complex strategies, such as cooperation with research institutions (Tether, 2002; Miotti and Sachwald, 2003; Negassi, 2004). However, recent studies provide mixed results regarding the role of firm size on UIC. On the one hand, it has been shown that the propensity to engage in an alliance with an academic partner depends on the *absolute size* of the industrial partner (Fontana et al. 2006) and that conversely, for small and innovative firms - especially in manufacturing and service industries - it is very difficult to find R&D partners (Segarra-Blasco and Arauzo – Carod 2008). On the other hand, the positive link between firm size and UIC has been questioned by a few scholars arguing that the role of firm size is not particularly significant to UIC dynamics and that, in contrast, small firms would be more prone to cooperate with academic partners given the shortage of internal resources, as R&D capacity, facility and financial resources (Eom, K. Lee 2010). However, according to some scholars, firm size does not determine the intensity of UIC, but rather the purpose of the cooperation. As a way of illustration, Santoro e Chackrabarti (2002) show that large firms chose types of UI channels that involve higher intensity knowledge transfer and research support to have access to university facilities and advance their non-core technologies. In contrast, small firms rely more on those types of cooperation that allow them to reinforce their knowledge and gain access to academic infrastructure to advance core technologies. Firms' sectoral characteristics represent another key variable in the study of the industry–university cooperation (Meyer-Krahmer and Ulrich Schmoch, 1998; Santoro and Chakrabarti, 2002; Schartinger et al., 2002). In general, it has been shown that the likelihood of establishing U–I linkages increases with the strength of the firms' knowledge base (Giuliani and Arza 2009). Moreover, empirical evidence shows different trends when comparing the behaviour of

high tech and low tech firms. By way of illustration, Segarra-Blasco and Arauzo – Carod (2008) find out that low-tech firms show a lower propensity to cooperation with academia in general, by taking evidence from on a sample of 4.150 Spanish innovative companies. Additionally, a recent article by Moraes Silva et al. (2019) observes that the sector has a moderator effect in the relationship between firms' propensity to UIC and their barriers to innovation. By using the Brazilian Innovation Survey (PINTEC) on a sample of technology-based SMEs, the authors show that, while knowledge service firms cooperate with university to overcome financial obstacles to their innovation activities, in high tech manufacturing sectors the propensity to UIC is mainly motivated by the possibility to mitigate knowledge barriers to innovation. Finally, it has been demonstrated that firm's sectoral characteristics shape the selection of UIC channels. For example, Cohen et al. (2002) show that patents and licenses are key channels of information transfer from research institutions to industry in pharmaceuticals, more than in any other manufacturing industries. Firm's experience of collaboration is also recognized as an important driver of UIC. This is explained by the fact that cooperating with academic institutions on research projects demands not only that firms learn how to work across the company's boundaries, but also that they build the skills necessary to work with partners with a different system of incentives. Starting from this assumption, Bruneel et al. 2010 demonstrate that prior experience of collaborative research alleviates the barriers related to differences in the orientations of industry and universities. These findings are supported by a large-scale survey including more than 3000 firms participating to research projects funded by the UK Engineering and Physical Sciences Research Council (EPSRC). Similarly, Eom, K. Lee (2010) during a study conducted on more than 3000 Korean firms, finds that the formation of new relationships between university and industry, is positively related to firm's participation to public R&D projects. Firm geographical location is among the firm characteristics that are identified as drivers of university–industry R&D collaboration, with specific regard to firm's location in innovative clusters and ecosystems (D'Este et al., 2013; Fernández-Esquinas et al 2016; Eom, K. Lee 2010 ; Scandura 2016). Indeed, it is well established among the studies on systems of innovation that firms' proximity to universities favours the development of research partnerships. This is generally based on the assumption that short distance facilitates interaction and the exchange of tacit knowledge, while embeddedness contributes to the development of trust mechanisms that positively affects the emergence of collaboration (Granovetter 1983; Boshma 2005; Lundvall and Johnson, 1994). In this vein, Maietta (2015) while exploring the drivers of U-I R&D collaboration in low-tech industries, observe that long co-location contributes to explaining the relationships among firms and universities, especially when the relationship involves IP exploitation activities. Other variables are customarily included in literature on UIC. These include firms' absorptive capacity (Fernández - Esquinas et al. 2016) and R&D intensity (Schartinger et al., 2001; Arundel and Geuna, 2004). Specifically, firms with high levels of absorptive capacity (usually measured by the presence of staff with PhD degrees), are particularly prone to cooperate with universities through knowledge generation and the creation of new organizations, which require a high intensity of exploitation or exploration activities (Fernández - Esquinas et al. 2016).

On the other hand, firm's R&D intensity is considered to increase the probability of UIC (Schartinger et al., 2001; Arundel and Geuna, 2004) because firms that invest heavily in R&D are likely to possess a high technological capability that also allows them to absorb the knowledge developed outside the firm (Segarra-Blasco and Arauzo – Carod 2008; Maietta 2015; Eom, K. Lee 2010). The presence of prior ties between managers and researchers, is one of the few UIC determinants to be considered at the individual level. In this regard, Thune (2007) explored collaborative UI R&D projects from the perspective of both researchers and R&D managers to show the important role of social capital and network embeddedness in providing opportunities and resources needed to stimulate collaboration in both application and process innovation. Despite the rich literature devoted to understanding the determinants of UIC from a firm's perspective, there are still some research gaps. First, while there is evidence about the firms' characteristics affecting UIC dynamics, too little is known about the characteristics of the entrepreneur that may influence the emergence of UIC. Secondly, most studies tend to focus on the determinants of UIC intensity, while only a few scholars have deepened what determines the selection of channels of UIC from an entrepreneurial perspective. In order to fill these gaps, our study aims to uncover the determinants of UIC from an individual perspective to identify which entrepreneurs' characteristics affect the emergence of UIC and, more specifically, the selection of cooperation channels.

3 Research hypotheses

In order to analyse the characteristics of the entrepreneur affecting UIC, we use the Corporate Entrepreneurial Intention (CEI) framework (Fini et al. 2012). CEI grounds on the "Theory of Planned Behavior" (Ajzen, 1991), which states that intentions are the result of individual attitudes, subjective norms, and perceived behavioural control. Specifically, CEI refers to the entrepreneurs' "*willingness to create new value in their firms by engaging in innovative, risky, and proactive actions*" (Fini et al., 2012 p. 397). Specifically, the actions' innovativeness refers to an entrepreneur's intention to take part in experimentation and creative processes leading to the creation of new products, services, or technological processes. Actions' proactiveness is defined as an entrepreneur's forward-looking perspective, that foresees the trends of future demand and contributes to re-shape the surrounding environment. Finally, actions' riskiness refers to the entrepreneurial willingness to commit to risky projects in order to achieve the firm's goals (Covin and Slevin, 1989). CEI is considered to be the result of both personal characteristics and perceptions of the external environment. On this basis, the conceptual model considers three main determinants of CEI (Fini e Toschi 2016) including psychological characteristics, individual skills, and perceived environment support. The first determinant i.e., psychological characteristics includes the *entrepreneurial risk-taking propensity* (Keh et al., 2002) and *entrepreneurial self-efficacy* (Zhao et al., 2005), this last defined as the entrepreneur's confidence in his ability to influence the environment and to successfully achieve business-related goals (McGee et al., 2009). The second determinant i.e., individual skills, refers to the idea that both technical and

managerial skills (such as planning, organizing, staffing, leading, and controlling) would help the entrepreneur to identify opportunities and, more broadly, stimulate the entrepreneurial process (Shane, 2000), by fostering the development of specific mindsets and developing the ability to commit to value-creation in their organizations (Baum et al., 2001). Finally, the third CEI determinant, refers to the perception of government support through initiatives as tax incentives (Munari et al., 2014) or mechanisms put in place by governments to support entrepreneurial activities (e.g. business incubators, science parks, business-plan competitions, potential financial incentives) that shape the environment in which the entrepreneur takes his decisions, thus affecting positively his CEI (Feldman, 2001; Foo et al, 2005; Marlow and McAdam, 2012). As long as CEI increases the level of entrepreneurs' engagement in innovative and proactive actions, we assume that CEI would also affect the level of engagement in cooperation with academia, which is a powerful source of innovation (Ambos et al., 2008; Mansfield, 1998). However, not all types of cooperation require the same level of engagement and do not necessarily lead to value and innovation generation. Therefore, the importance of CEI can vary according to the complexity of the UIC channel. Indeed, the classification proposed by Philpott et al. (2011) illustrates a soft-hard spectrum of UIC according to the level of entrepreneurial sophistication of the individual channel (Klofsten and Jones-Evans, 2000). More specifically, these forms of UIC differ for the level of complexity, including the level of both parties' engagement and new value generation. Less complex forms of interaction, such as human resources mobility; financing of PhD scholarship by industry; teaching activity's externalization, align better with the traditional academic mission (Klofsten and Jones-Evans, 2000; Louis et al., 1989) and are not generally viewed as entrepreneurial activities. These activities are usually associated to the traditional educational mission of university that is seen by companies mainly as a source of skilled labour. The "teaching mission" of university is generally recognized by all the entrepreneurs without particular distinctions. Therefore, the level of CEI of the entrepreneur concerned, should not be particularly relevant in determining these types of UI cooperation channels. Hence, we hypothesize that:

H1. CEI is not significantly related to the development of low-complex UI cooperation channels.

The greatest part of UIC channels are characterized by average levels of complexity and generally refer to academic participation to firm's organizations; co-affiliation to professional associations; temporary exchange of academic staff with industry; board interlocks; sharing facilities (e.g. laboratories, equipment, housing). These channels even if they are not necessarily aimed at producing innovation, are generally characterized by a greater level engagement of the parties that co-participate to the realization of the activity, compared to the low complexity channels. On the other hand, these activities are mostly related to the exchange of complementary capabilities and assets, but do not require a real knowledge transfer among the parties. In light of this, we assume that an entrepreneur needs to present a certain level of CEI.

Therefore, we expect that:

H2. CEI is positively related to the development of average- complex UI cooperation channels

Finally, UI Cooperation channels with high levels of complexity usually include contract research; co-patenting consultancy of university staff members the industry; licensing agreements; university spin-offs; specific knowledge transfer activities organized by the university's technology transfer office (TTO). These activities are often considered as being more entrepreneurial in nature and more compatible with the so called *university third mission* (Louis et al., 1989). These types of collaboration are often at the core of entrepreneurs' businesses and require an high level of engagement of both parties that have to work together to realize an effective knowledge exchange and develop innovations. From a firm perspective, we expect that entrepreneurs have to be very open-minded to implement such forms of cooperation with universities. Hence, we expect that:

H3. CEI is positively related to the development of high -complex UI cooperation channels.

Figure 1 summarizes the proposed model of the micro-foundation of UIC.

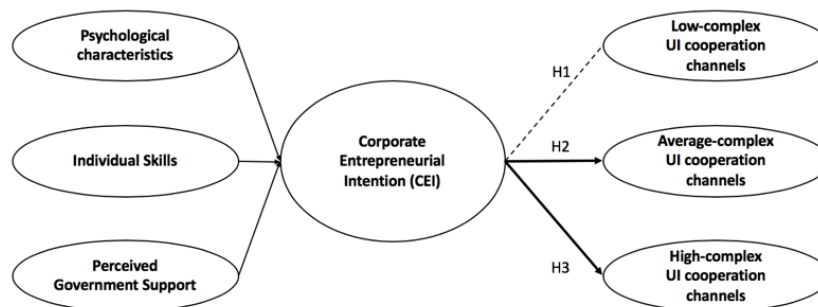


Figure 1. Conceptual model

4 Research design

4.1 Sampling strategy

In order to test our hypotheses, we collected evidence on the determinants of UIC from a firm's perspective, at the individual level. To ensure internal validity, we selected a specific regional context to control for normative environment, contextual munificence, and entrepreneurial opportunities (Beckman and Burton, 2008). Specifically, we locate our study in the Campania region, in the south of Italy. The Region of Campania represents an interesting case of study as it is characterized by a dynamic entrepreneurial landscape and a large number of universities and research centres. More specifically, Campania hosts 7 Universities (6 public and 1 private); 40 advanced research centres focused on technology transfer and innovation services; 30 business support structures

(incubators, accelerators). Campania is the 5th Italian region for the number of innovative start-ups (726 in October 2018) and 24,000 employees in Research & Development activities (above the national average). Furthermore, in the last decade the Regional Government has been taking initiative in implementing plans and ad-hoc interventions to stimulate UIC. In order to build our sample, we contacted the five provincial sections of the *Confindustria Campania* (the Campania regional section of the Italian National Industrial Association) and we asked them to provide us with contact information about all of their affiliated firms. We contacted all of them and we sent them an online structured questionnaire addressed to each firm's founder or, in a few cases, to the CEOs (in case of large companies). After three rounds of e-mails and phone calls, we collected a total number of 133 questionnaires. The data collection started in November 2018 and was completed by the end of February 2019. Our final sample counts 133 enterprises, distributed as follows: large firms (11,7%); medium firms (30,1%); small firms (28,2%) and micro firms (30,1%)¹. Sampled firms' innovation activities include the use and/or development of new technologies (40,8%); application and/or use of new business models (12,6%); use and/or development of both new technologies and business models (32%).

4.2 Questionnaire

We gathered data both at individual and at firm level. Specifically, we developed a survey to collect primary data directly from entrepreneurs. We gathered information on entrepreneurs' personal characteristics as age, gender, professional experience, level and type of education, future investment orientations, perception of the regional environment through a questionnaire that counts 39 closed questions. The questionnaire is divided in different sub-sections: firm profile; entrepreneur profile and individual skills; entrepreneur psychological characteristics; university cooperation; government support. The questionnaire has been realized by using Google form and has been filled online. To the purpose of data triangulation we also verified the validity of firm-level information about the sector, size, year of foundation, type of innovation activities, number of employees; R&D expenditure by using the Aida Database. Finally, we conducted a small-scale field pre-test to collect feedback about question phrasing, time needed to respond, and coverage with respect to the object of research. To this purpose, the questionnaire has been addressed to a panel of 10 entrepreneurs, that provided valuable feedback to improve the clarity of the questions. No major inconsistencies emerged.

4.3 Independent Variable

We characterize the CEI, our independent variable, in terms of the entrepreneur's (i) psychological characteristics (i.e. *entrepreneurial risk-taking propensity* and *entrepreneurial self-efficacy*); (ii) individual skills (technical and managerial) and (iii)

¹ Large firm (> 250 employees and > 50 M revenues); Medium firm (250 - 50 employees and 50 - 10 M revenues); Small firm (50 - 10 employees and <10 M revenues); Micro firm (< 10 employees and < 2 M revenues)

perceived government support (Fini e Toschi 2016) to ultimately measure the entrepreneur's willingness to create new value in the firm by engaging in innovative, proactive, and risky behaviors (Fini et al. 2012). For all measures, we used scales already tested in the existing literature. As for the psychological characteristics, we relied on Baum et al. (2001) and Ajzen (1991), while for the individual skills we adapted Gupta and Govindarajan (2000) and Roberts and Fushfeld (1981). Finally, to measure the perceived government support we used the scales proposed by Fini et al. (2009).

4.4 Dependent Variable

Our dependent variable, the type of channels of UIC implemented, have been operationalized by using the classifications proposed by Shartinger et al. (2002) of 17 types of U-I knowledge interactions, classified in three groups according to their level of complexity (Philpott et al. 2011). For each type of interaction, respondents were asked to indicate the frequency of use for each channel on a four-point scale (i.e. not used; occasionally; often; very often) (Table 1).

Table 1- Structural Model Variables

	Item	Scale format	Research reference
Psychological characteristics			
Entrepreneurial risk-taking propensity	d36	0 to 7 scale	Baum et al., 2001
Entrepreneurial self-efficacy	d28 d30	1 to 7 Likert-like	Gomez-Mejia & Balkin, 1989
Individual skills			
Technical skills	d5	1 to 7 scale	Gupta & Govindarajan, 2000
Managerial skills	d8	1 to 7 Likert-like	Roberts & Fushfeld, 1981
Perceived government support	d33 d34	1 to 7 Likert-like	Fini et al., 2009
Low-complex UIC (y1)			
Human resources mobility (students and researchers to industry)	d24_i4	1 to 4 scale	Shartinger et al. 2002; Philpott et al. 2011
Funding of PhD scholarship by industry	d24_i10	1 to 4 scale	Shartinger et al. 2002; Philpott et al. 2011
Industry externalization of teaching activity to university	d24_i12	1 to 4 scale	Shartinger et al. 2002; Philpott et al. 2011
Average-complex UIC (y2)			
Academic participation to industry organizations	d24_i2	1 to 4 scale	Shartinger et al. 2002; Philpott et al. 2011
Co-affiliation to professional associations	d24_i3	1 to 4 scale	Shartinger et al. 2002; Philpott et al. 2011
Academic staff commitment within industry organizations	d24_i5	1 to 4 scale	Shartinger et al. 2002; Philpott et al. 2011
Temporary exchange of academic staff with industry	d24_i6	1 to 4 scale	Shartinger et al. 2002; Philpott et al. 2011
Board interlocks	d24_i7	1 to 4 scale	Shartinger et al. 2002; Philpott et al. 2011
Sharing facilities (e.g. laboratories, equipment, housing)	d24_i17	1 to 4 scale	Shartinger et al. 2002; Philpott et al. 2011

High-complex UIC (v3)			
Contract research	d24_i9	1 to 4 scale	Sharteringer et al. 2002; Philpott et al. 2011
Consultancy services by university staff members to the industry	d24_i11	1 to 4 scale	Sharteringer et al. 2002; Philpott et al. 2011
Co-patenting	d24_i13	1 to 4 scale	Sharteringer et al. 2002; Philpott et al. 2011
Licensing agreements	d24_i14	1 to 4 scale	Sharteringer et al. 2002; Philpott et al. 2011
University spin-offs	d24_i15	1 to 4 scale	Sharteringer et al. 2002; Philpott et al. 2011
Specific knowledge transfer activities organized by the university's TTO	d24_i16	1 to 4 scale	Sharteringer et al. 2002; Philpott et al. 2011

4.5 Analyses

The hypotheses are tested using a structural equation model. The choice of a structural equation modeling approach (SEM) has been made because SEM is the most suitable analytical tool when the constructs composing the conceptual model are latent in nature and are operationalized through a vector of observed, error-laden, empirical variables. Also, SEM can trace causal paths to multiple dependent variables within the same model, by estimating measurement and structural paths at the same time, instead of than one at a time.

5 Results and Discussions

Figures 2 to 4 show main results from the structural model. Our findings show no significant effect of CEI with regard to Low-Complex UI cooperation channels (Figure 2), which confirms our first hypothesis (H1).

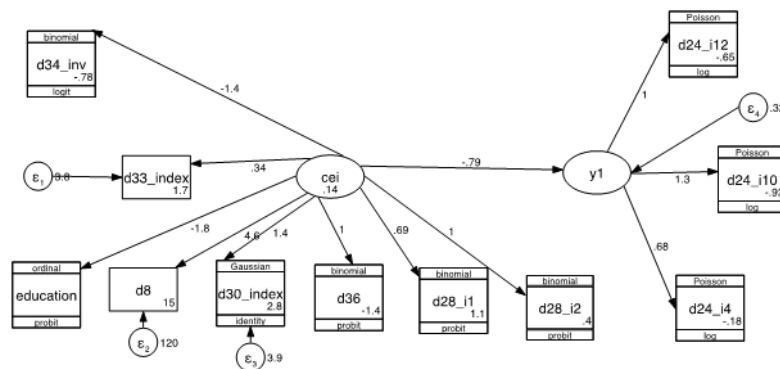


Figure 2. Structural model – CEI effect on Low-Complex UI Cooperation channels

On the other hand, we observed a significant and positive effect of CEI on Average-Complex UIC channels (Figure 3) and, to a greater extent, on High-Complex UIC (Figure 4). Hence, both hypotheses 2 and 3 are confirmed.

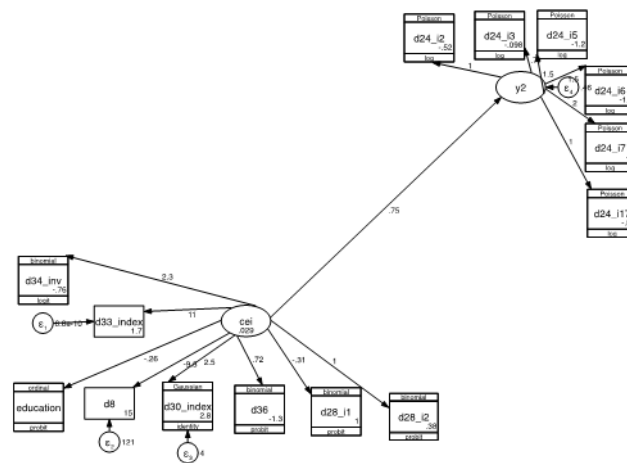


Figure 3. Structural model – CEI effect on Average-Complex UI Cooperation channels

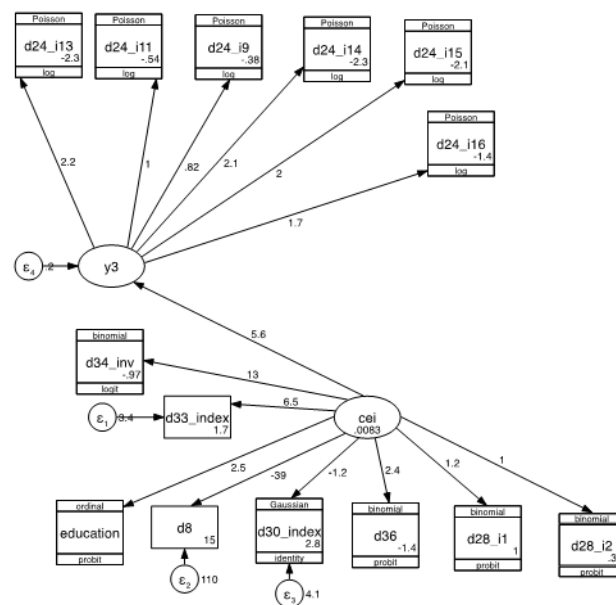


Figure 4 Structural model – CEI effect on High-Complex UI Cooperation channels

More specifically, we found a stronger effect on CEI on High-Complex UIC compared to Average-Complex UIC. This result may be explained by the fact that UIC channels with high levels of complexity are considered more entrepreneurial in nature. More specifically, with regards to CEI's dimensions, these activities, that are likely to be at the core of entrepreneurs' businesses, would necessarily involve higher levels of engagement and risk propensity, as well as a greater extent of technical and managerial activities. Also, these activities may be more vulnerable to external environment factors,

as funding in case of R&D projects or regulations, in case of IP commercialization. Hence, the entrepreneur's perception of the Government support may also be more relevant for these types of activities.

6 Conclusions

This paper aims to uncover the determinants of UIC from an individual perspective to identify which entrepreneurs' characteristics affect the emergence of UIC and, more specifically, the selection of cooperation channels. To this purpose, we employed the Corporate Entrepreneurial Intention (CEI) model (Fini et al. 2012), which allowed to assess the effect of both individual and contextual factors in UIC dynamics, whether no previous attempts have jointly considered both types of variables in UIC literature. After applying structural equation modelling techniques to a sample of 130 entrepreneurs in the Region of Campania (South of Italy), our results show that corporate entrepreneurial behaviour is positively related to forms of UIC channels with average and high levels of complexity. This study makes an original contribution to the literature focused on the determinants of UIC from the firm's perspective, by considering the entrepreneurs' individual characteristics, while most studies tend to limit their analysis to the identification of firm's organizational and sectorial characteristics to UIC. Also, while most scholars tend to focus on the determinants of UIC intensity, this study also contributes to explore what determines the selection of channels of UIC from an entrepreneurial perspective. Our study has also important implications for entrepreneurs willing to increase their engagement in cooperation with universities, by suggesting which types of channels would fit them best according to their individual characteristics. However, our results suffer from some limitations. First, the sample could be expanded to include a greater number of entrepreneurs within the Region in order to gain a deeper exploration of the industry variety effect on patterns of U-I cooperation. Second, a comparative study with other regions would contribute to a greater extent of validation of the results.

References

- Abramo, G., D'Angelo, C.A., Ferretti, M. and Parmentola, A. (2012), "An individual-level assessment of the relationship between spin-off activities and research performance in universities", *R&D Management*, Vol. 42 No. 3, pp. 225-242
- Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50(2), 179-211.
- Al-Tabbaa, O., & Ankrah, S. (2016). Social capital to facilitate 'engineered' university-industry collaboration for technology transfer: A dynamic perspective. *Technological Forecasting and Social Change*, 104, 1-15.
- Ambos, T. C., Mäkelä, K., Birkinshaw, J., & d'Este, P. (2008). When does university research get commercialized? Creating ambidexterity in research institutions. *Journal of management Studies*, 45(8), 1424-1447.

- Ankrah, S. N., Burgess, T. F., Grimshaw, P., & Shaw, N. E. (2013). Asking both university and industry actors about their engagement in knowledge transfer: What single-group studies of motives omit. *Technovation*, 33(2-3), 50-65.
- Arundel, A., & Geuna, A. (2004). Proximity and the use of public science by innovative European firms. *Economics of Innovation and new Technology*, 13(6), 559-580.
- Baum, J. R., Locke, E. A., & Smith, K. G. (2001). A multidimensional model of venture growth. *Academy of management journal*, 44(2), 292-303.
- Beckman, C. M., & Burton, M. D. (2008). Founding the future: Path dependence in the evolution of top management teams from founding to IPO. *Organization science*, 19(1), 3-24.
- Boschma, R. (2005). Proximity and innovation: a critical assessment. *Regional studies*, 39(1), 61-74.
- Bruneel, J., d'Este, P., & Salter, A. (2010). Investigating the factors that diminish the barriers to university–industry collaboration. *Research policy*, 39(7), 858-868.
- Cohen, W. M., Nelson, R. R., & Walsh, J. P. (2002). Links and impacts: the influence of public research on industrial R&D. *Management science*, 48(1), 1-23.
- Covin, J. G., & Slevin, D. P. (1989). Strategic management of small firms in hostile and benign environments. *Strategic management journal*, 10(1), 75-87.
- D'Este, P., & Patel, P. (2007). University–industry linkages in the UK: What are the factors underlying the variety of interactions with industry?. *Research policy*, 36(9), 1295-1313.
- D'Este, P., Tang, P., Mahdi, S., Neely, A., & Sánchez-Barrioluengo, M. (2013). The pursuit of academic excellence and business engagement: is it irreconcilable?. *Scientometrics*, 95(2), 481-502.
- Eom, B. Y., & Lee, K. (2010). Determinants of industry–academy linkages and, their impact on firm performance: The case of Korea as a latecomer in knowledge industrialization. *Research Policy*, 39(5), 625-639.
- Feldman, M. P. (2001). The entrepreneurial event revisited: firm formation in a regional context. *Industrial and corporate change*, 10(4), 861-891.
- Fernández-Esquinas, M., Pinto, H., Yruela, M. P., & Pereira, T. S. (2016). Tracing the flows of knowledge transfer: Latent dimensions and determinants of university–industry interactions in peripheral innovation systems. *Technological Forecasting and Social Change*, 113, 266-279.
- Fini, R., & Toschi, L. (2016). Academic logic and corporate entrepreneurial intentions: A study of the interaction between cognitive and institutional factors in new firms. *International Small Business Journal*, 34(5), 637-659.
- Fini, R., Grimaldi, R. and Sobrero, M. (2009), “Factors fostering academics to start up new ventures: an assessment of Italian founders’ incentives”, *The Journal of Technology Transfer*, Vol. 34 No. 4, pp. 380-402
- Fini, R., Grimaldi, R., Marzocchi, G. L., & Sobrero, M. (2012). The determinants of corporate entrepreneurial intention within small and newly established firms. *Entrepreneurship Theory and Practice*, 36(2), 387-414.
- Fontana, R., Geuna, A., & Matt, M. (2006). Factors affecting university–industry R&D projects: The importance of searching, screening and signalling. *Research policy*, 35(2), 309-323.
- Foo, M. D., Uy, M. A., & Baron, R. A. (2009). How do feelings influence effort? An empirical study of entrepreneurs’ affect and venture effort. *Journal of Applied Psychology*, 94(4), 1086.
- Giuliani, E., & Arza, V. (2009). What drives the formation of ‘valuable’ university–industry linkages?: Insights from the wine industry. *Research policy*, 38(6), 906-921.
- Granovetter, M. (1983). The strength of weak ties: A network theory revisited.
- Gupta, A. K., & Govindarajan, V. (2000). Knowledge flows within multinational corporations. *Strategic management journal*, 21(4), 473-496.

- Keh, H. T., Der Foo, M., & Lim, B. C. (2002). Opportunity evaluation under risky conditions: The cognitive processes of entrepreneurs. *Entrepreneurship theory and practice*, 27(2), 125-148.
- Klofsten, M., & Jones-Evans, D. (2000). Comparing academic entrepreneurship in Europe—the case of Sweden and Ireland. *Small Business Economics*, 14(4), 299-309.
- Lai, W. H. (2011). Willingness-to-engage in technology transfer in industry–university collaborations. *Journal of Business Research*, 64(11), 1218-1223.
- Laursen, K., & Salter, A. (2004). Searching high and low: what types of firms use universities as a source of innovation?. *Research policy*, 33(8), 1201-1215.
- Liefner, I., & Schiller, D. (2008). Academic capabilities in developing countries—A conceptual framework with empirical illustrations from Thailand. *Research policy*, 37(2), 276-293.
- Louis, K. S., & Anderson, M. S. (1998). The changing context of science and university-industry relations. *Capitalizing knowledge: New intersections of industry and academia*, 73-91.
- Lundvall, B. Ä., & Johnson, B. (1994). The learning economy. *Journal of industry studies*, 1(2), 23-42.
- Maietta, O. W. (2015). Determinants of university–firm R&D collaboration and its impact on innovation: A perspective from a low-tech industry. *Research Policy*, 44(7), 1341-1359.
- Mansfield, E. (1998). Academic research and industrial innovation: An update of empirical findings. *Research policy*, 26(7-8), 773-776.
- Marlow, S., & McAdam, M. (2012). Analyzing the Influence of Gender upon High–Technology Venturing within the Context of Business Incubation. *Entrepreneurship Theory and Practice*, 36(4), 655-676.
- McGee, J. E., Peterson, M., Mueller, S. L., & Sequeira, J. M. (2009). Entrepreneurial self-efficacy: refining the measure. *Entrepreneurship theory and Practice*, 33(4), 965-988.
- Meyer-Krahmer, F., & Schmoch, U. (1998). Science-based technologies: university–industry interactions in four fields. *Research policy*, 27(8), 835-851.
- Miotti, L., & Sachwald, F. (2003). Co-operative R&D: why and with whom?: An integrated framework of analysis. *Research policy*, 32(8), 1481-1499.
- Mohnen, P., & Hoareau, C. (2003). What type of enterprise forges close links with universities and government labs? Evidence from CIS 2. *Managerial and decision economics*, 24(2-3), 133-145.
- Moraes Silva, D. R. D., Lucas, L. O., & Vonortas, N. S. (2019). Internal barriers to innovation and university-industry cooperation among technology-based SMEs in Brazil. *Industry and Innovation*, 1-29.
- Munari, F., Rasmussen, E., Toschi, L., & Villani, E. (2016). Determinants of the university technology transfer policy-mix: A cross-national analysis of gap-funding instruments. *The Journal of Technology Transfer*, 41(6), 1377-1405.
- Negassi, S. (2004). R&D co-operation and innovation a microeconomic study on French firms. *Research policy*, 33(3), 365-384.
- Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., ... & Krabel, S. (2013). Academic engagement and commercialisation: A review of the literature on university–industry relations. *Research policy*, 42(2), 423-442.
- Philpott, K., Dooley, L., O'Reilly, C., & Lupton, G. (2011). The entrepreneurial university: Examining the underlying academic tensions. *Technovation*, 31(4), 161-170.
- Rasmussen, E. (2011), "Understanding academic entrepreneurship: exploring the emergence of university spin-off ventures using process theories", *International Small Business Journal*, Vol. 29 No. 5, pp. 448-471.
- Roberts, E. B., & Fusfeld, A. R. (1981). Staffing the innovative technology-based organization. *Sloan Management Review (pre-1986)*, 22(3), 19.

- Santoro, M. D., & Chakrabarti, A. K. (2002). Firm size and technology centrality in industry–university interactions. *Research policy*, 31(7), 1163-1180.
- Scandura, A. (2016). University–industry collaboration and firms’ R&D effort. *Research Policy*, 45(9), 1907-1922.
- Schartinger, D., Rammer, C., & Fröhlich, J. (2006). Knowledge interactions between universities and industry in Austria: sectoral patterns and determinants. In *Innovation, networks, and knowledge spillovers* (pp. 135-166). Springer, Berlin, Heidelberg.
- Segarra-Blasco, A., & Arauzo-Carod, J. M. (2008). Sources of innovation and industry–university interaction: Evidence from Spanish firms. *Research Policy*, 37(8), 1283-1295.
- Shane, S. (2000). Prior knowledge and the discovery of entrepreneurial opportunities. *Organization science*, 11(4), 448-469.
- Tether, B. S. (2002). Who co-operates for innovation, and why: an empirical analysis. *Research policy*, 31(6), 947-967.
- Thune, T. (2007). University-industry collaboration: the network embeddedness approach. *Science and public policy*, 34(3), 158-168.
- Visintin, F. and Pittino, D. (2014), “Founding team composition and early performance of university-based spin-off companies”, *Technovation*, Vol. 34 No. 1, pp. 31-43
- Zhao, H., Seibert, S. E., & Hills, G. E. (2005). The mediating role of self-efficacy in the development of entrepreneurial intentions. *Journal of applied psychology*, 90(6), 1265.

The Effects of Entrepreneurial Experiences of the Heads of Departments on Third-Party Funding and Patent Output of Universities

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Abstract

The aim of this paper is to examine the role of entrepreneurial experiences of heads of departments and their impact on the ability to acquire external funds and the commercialization of research results measured by patents. The study is based on data from 208 Austrian university departments and combines data from different sources encompassing the CVs of the heads of departments, the commercial register, funding data and performance data intellectual capital reports. The results show a positive relationship between entrepreneurial experience and the third-party funding and patent output of the departments.

Keywords: Entrepreneurial university, third-party funds, entrepreneurial experience, patent output

Paper type: Academic research paper

1 Introduction

In recent decades, a number of concepts and strategies, such as the entrepreneurial university (Etzkowitz, 2003), new public management (Leisyte and Kizniene, 2006), the third mission of universities (Zomer and Benneworth, 2011), the Triple-Helix (Etzkowitz and Leydesdorff, 2000), and the mode 2 of knowledge production (Gibbons *et al.*, 2002) have been proposed to progressively transform universities into entrepreneurial institutions. These universities are closely linked to the demands of industry, society and governments (Etzkowitz, 2016), they are often required to diversify their funding streams (Tijssen, 2006; Slaughter and Leslie, 2001), and they are characterized by the

implementation of management tools primarily known from the private sector (Peus *et al.*, 2015). As a consequence, the role of scientists has changed from truth-seeking academics to entrepreneurial actors capable of considering the practical implications of their research and matching their knowledge with innovation (Elia *et al.*, 2017; Etzkowitz and Viale, 2010).

This study aims to take a closer look whether entrepreneurial experience of the heads of departments might influence the ability to acquire external research and the department's commercialization activities by patenting. Entrepreneurial experience is assessed by prior industry or leadership experience of the heads of departments. While previous studies have mainly investigated the role of the scientific experience of academic leaders in the research performance of their institution in later decades (Goodall, 2006, 2009; Goodall *et al.*, 2014), research on other non-scientific experiences of academic leaders is still in its infancy. By adding this 'entrepreneurial' perspective, our research contributes to the literature by understanding of how entrepreneurial universities can improve their performance to fulfill the increasing demands by industry, society and governments. Entrepreneurial experiences of the heads of departments can also be considered as important form of human capital of entrepreneurial universities (Secondo *et al.* 2017).

Our research methodology has been organized in several phases: First, we analysed the literature on entrepreneurial universities and leadership of universities to understand the relationship between different scientific and non-scientific experiences and other key performance indicators. Then, we captured data from 208 Austrian university departments in the natural and technical sciences and combined data from different sources. We have collected data about the heads of departments from CVs and the commercial register, used funding data from the biannual survey by Statistics Austria and collected data from publication databases of the universities (intellectual capital reports). We conducted OLS, logistic and negative binomial regression analyses to test our hypotheses.

In the next section, we review the relevant literature and propose testable hypotheses. The method and data used are described in section 3 and the results are presented in section 4. In section 5, we discuss our results in the context of the literature.

2 Theoretical background and hypotheses development

Today's universities play a central societal and economical role and the effort to adapt policies and practices to better translate knowledge into economic activities has increased worldwide (Etzkowitz, 2016). In contrast to traditional universities, which focused mainly on teaching (first mission) and/or research (second mission; for a concise overview of the evolution of universities since the first industrial revolution, see Elia *et al.*, 2017), entrepreneurial universities and their members need to collaborate more strongly with industrial and governmental partners to mutually create new innovations and to foster the development of a region (Elia *et al.*, 2017).

As noted by Etzkowitz (2016), key elements of an entrepreneurial university include the endeavor to move research out of the university as protected intellectual property, to

organize firms within the university, and to integrate academic and business elements into new formats such as university–industry research centres. According to Tijssen (2006), entrepreneurial universities embrace an entrepreneurial and innovative spirit, promote an entrepreneurial culture, foster relationships with industry, transfer knowledge and technologies, and integrate managerial and market-related practices and tools.

Within the university, several levels exist on which entrepreneurial patterns occur. These levels either concern the university itself, the members of the university, or the interaction with the environment of the university (Röpke, 1998). Many universities have taken various actions to raise awareness for an entrepreneurial approach among students (Secundo *et al.*, 2017; Packham *et al.*, 2010), but also among staff members. These universities promote managerial and attributional changes toward the commercialization of research findings because the entrepreneurial orientation of universities relies largely on cultural determinants, such as the managerial culture at universities, the governance culture of the higher education sector or the overarching socio-economic culture of a country (Tijssen, 2006).

In this changing process, academic leaders play a crucial role, particularly when managing severe changes and merging the individual scientific autonomy with new organizational goals (Bergner, 2015). Changing governance structures, greater autonomy, the need to diversify funding streams and the increasing request to transfer knowledge in collaboration with different partners will require new capabilities from academic leaders (Rybníček, 2015).

In the light of the new challenges, tasks and strategies that come together with the entrepreneurial university, it is evident that a more entrepreneurial mindset and business-oriented culture is needed at universities. Therefore, different management tools, more commonly used in the private sector, have already been transferred to public universities (Peus *et al.*, 2015; Rybníček, 2015). Similar to the implementation of new management tools, it is also to be expected that the necessary leadership skills at universities will converge with those observed in the private sector. Thus, scientists in leading positions will have to take over similar roles and duties as those leading in the private sector (Peus *et al.*, 2015).

In the context of changing funding patterns, heads of departments have to increasingly acquire research funds from various sources. In the literature, it is argued that industry experience and leadership experience are of importance for budgeting and the acquisition of external research funds. Scholars studying entrepreneurial universities, for instance, stress the role of leadership capabilities and inter-sectoral mobility in the success of acquiring third-party funds and managing research departments.

Regarding industry leadership experience, scholars recently delivered empirical evidence about the effect of leadership capabilities and management practices on the performance of universities. McCormack *et al.* (2014), for instance, investigated 248 heads of departments in UK universities, revealing a direct link between management practices and performance in research and teaching.

Regarding industry experience, previous studies reported that inter-sectoral mobility can facilitate the building of competencies and relationships that are important for the

acquisition of research projects. Concretely, industry experience expands the social capital, which again helps to develop and acquire research grants in collaboration with various partners. The network of the head of department represents an important resource the entire department can benefit from (Harvey *et al.*, 2002). In addition, industry experience helps to build up trust in collaboration with non-academic partners and to establish a cooperative culture. Social capital of the head of department developed in previous jobs also facilitates the emergence of a common language and a better understanding of collaborative research work (Rouse *et al.*, 1992).

Based on these arguments we state:

Hypothesis 1a: Industry experience of heads of departments has a positive impact on the level of third-party funding.

Hypothesis 1b: Leadership experience of heads of departments has a positive impact on the level of third-party funding.

Apart from traditional forms of technology transfer by means of collaborative research projects and contract research, the commercialization of research results has become increasingly important in many countries in recent years. With the implementation of the Bayh–Dole Act in 1980, US universities are allowed to file patents on inventions they elect to own for almost four decades. In the 1990s a number of European countries started to establish Bayh–Dole-type regulation to foster academic patenting, aiming to enhance the utilization of industry-relevant scientific research, contribute to economic development and job creation and to improve resource generation (Weckowska *et al.*, 2018). Promoting the commercialization of research by the university through patenting is a key pillar of the entrepreneurial university.

In Austria, the University Act 2002 changed the legal framework and allowed universities on the institutional level to claim the intellectual property (IP) of their inventions. Prior to that, it was solely the professor's privilege to apply for patents, although this rarely occurred. In recent years, as in many other European countries (Pinheiro *et al.*, 2015), a number of specific promotion programmes and initiatives with targeted funding schemes have been established, supporting universities in their commercialization activities. Austrian universities established Technology Transfer Offices, created IP policies and established long-term plans and goals to become more entrepreneurial (BMWWF, 2016).

We claim that industry and leadership experience both have a positive impact on the likelihood of generating patents as both types of occupational engagement facilitate or enable the identification of business and market opportunities. This can be argued based on the diversity hypothesis (Dietz and Bozeman, 2005), reasoning that more diversity in work experience allows researchers to develop stronger network ties, skills and access to enhanced knowledge gatekeepers, which, in turn, enables the commercialization of innovative research outputs.

In a related vein, recent studies suggest that third-party funding is also correlated with the generation of patents (Gulbrandsen and Smeby, 2005). Interestingly, Hottenrott and

Thorwarth (2011) found that while a higher share of industry funding has no effect on the *number* of patents generated by professors, it has a positive impact on *citations* per patent.

Based on these arguments we propose the following hypothesis:

Hypothesis 2a: Industry experience of the heads of departments is positively associated with the patent output.

Hypothesis 2b: Leaderships of the heads of departments is positively associated with the patent output.

Hypothesis 2c: There is a positive relationship between third-party funding and the patent output.

3 Methods and data

The study is based on a sample of 208 university departments in natural and technical sciences from ten public Austrian universities. We thus covered all public universities apart from medical universities and arts universities. We focused on natural and technical sciences as in both disciplines external funding has grown considerably in the last two decades and plays a crucial role (BMWWF, 2014). Therefore, we assume that in these disciplines academic research is relevant to industry and, vice versa, industry experience is relevant to the university departments and their heads. Considering the organizational and governance structure of Austrian universities, departments can be considered as relevant units of observation.

We considered the development of the departments over a period of three years between 2013 and 2015 and selected those departments that had the same head of department over this period of time, which was the case for 77% of in total 270 natural and technical sciences departments from the ten universities. As the turnover is rather small, we did not take into account those departments that changed their heads. Today many universities consider leadership or managerial experience in the appointment of professors (e.g. Vienna University of Technology, University of Graz), following the trend to integrate these qualifications and experiences already in the job specifications of a professorship (Rybníček *et al.*, 2016).

We collected data from various sources to determine our dependent and independent variables. The measurements for industry and leadership experience are not overlapping and capture different aspects, qualities and qualifications of the CVs and the commercial register: To determine industry experience, we analysed mainly the CVs from the heads of departments. For the analyses, we developed a coding system to collect data regarding industry experience (excluding positions at universities, non-governmental organizations or public institutions). Additionally, we included board responsibilities from the Austrian commercial register. For leadership experience we analysed the Austrian commercial register and focused here on the functions ‘managing director’, ‘owner of the company’ and ‘authorized representatives’ of the company. In this context, we determined the type and duration of position. Leadership experience is measured in months (reporting day was 31st July 2017), while industry experience is a binary variable as it was not possible to extract the number of years from all CVs.

In addition, we collected separately the number of publications of the heads of departments and calculated a dichotomous variable with those heads that belong to the top 25% in terms of the publication output investigating the impact of the top performers. It is argued that the publication output of the head of departments has also an impact on the various forms of outputs, the variable is included as control factor.

Data about R&D funding are collected by Statistics Austria, which biannually conducts an obligatory survey about the public and private third-party funding sources among the university departments. We used the amount of third-party funding as a percentage of the total funding. In addition, we distinguished between public and private third-party funds as the percentage of total funding. Third-party public funding includes funding from national and international public science and research promotion funds. Funds from the European Commission and the Framework Programmes are included as well. Third-party private funds cover funds from private organizations, with enterprises as the most important source.

In addition, Statistics Austria collects data about R&D personnel, which is used to determine the number of researches, measured as full-time equivalent, at department level. We used the data for the survey in 2013 and 2015 and calculated the mean for the three-year period.

Considering the different types of variables, we conducted OLS, logistic and negative binomial regression analyses. We analysed residuals, error terms and outliers to check for heteroscedasticity and normality of the residuals. The private third-party funds did not meet the assumption of normality to conduct an OLS regression and we hence used a binary variable, distinguishing between the top 25% and employing a logistic regression. In addition, the number of patents, which serves as dependent variable in one hypothesis test, had a highly skewed count data and revealed over-dispersion. We thus ran a negative binomial regression model for studying the patent output.

We controlled for size, discipline and age, which should have an impact on the output according to the literature (Carayol and Matt, 2006). For the variable size and age, we also calculated the squared value in order to control for any possible non-linear effects (Bolli and Somogyi, 2011). In addition, we used the location of the university (= Vienna) as control, took into account the discipline (natural science versus technical sciences) and checked whether the departments belong to a technical university.

4 Results

With regard to our main variables of interest, industry and leadership experience, the data show that among the 208 heads of departments, 118 had prior industry experience and 64 had leadership experience lasting, on average, 60 months. Fifty-four heads of departments belong to the top 25% group in relation to their publication output. Overall, 100 departments are engaged in natural sciences and 108 departments belong to technical sciences and engineering. A total of 125 departments belong to one of the three technical universities and 77 departments are part of the three universities in Vienna.

To test hypotheses 1a and 1b dealing with the effect of industry and leadership experience, we conducted a regression model with the share of total third-party funds (Table 1). We first analysed the effect of industry experience (Table 1, Model 1) and then investigated the role of leadership experience (Table 1, Model 2) including different controls. For all models we checked outliers and heteroscedasticity, which raised no concerns of them violating any assumptions. Model 1 revealed a low positive coefficient for industry experience. Leadership experience revealed no effect (Table 1, Model 2). However, size, discipline and the location of the department had an effect on the amount of acquired third-party funds. Larger departments and departments in technical sciences and engineering have a higher likelihood of acquiring third-party funds. Universities in Vienna have lower levels of third-party funds, which is partly explained by a lower share of private third-party funding and fewer industrial companies. In both models we also included the publication output of the heads of departments, which revealed no influence either. Thus, we found support for hypothesis 2a, but have to reject hypotheses 2b.

Table 1: Dependent variable: third-party funds total (in %) of the department 2013–2015 (standardized beta)

Independent	Model 1	Model 2
Industry experience of the head of department	0.167**	
Leadership experience of the head of department		0.029
Size	0.329***	0.322***
Technical sciences	0.210***	0.243***
Vienna	-0.189***	-0.212***
Technical university	-0.101	-0.119
Age	0.597	0.637
Age squared	-0.601	-0.656
Publication output of the head of department (top)	-0.007	0.026
N	207	207
F-value	6.060***	5.967***
Adj. R ²	0.164	0.140

+ p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

In addition, we tested the effect of industry and leadership experience on the amount of third-party funding from private sources by separate models. As the private third-party funding variable was skewed and did not meet the requirements to run an OLS regression, we conducted a logistic regression, splitting the departments into two groups. We compared the departments that had private third-party funding of more than 20% of total funding with the reference group below 20%. We were particularly interested to explain the determinant for the success of the top performing departments and thus cut at 20%. Table 2 (Models 1 and 2) depicts the results of this analysis. We found a positive coefficient for the effect of industry experience on private third-party funding, which was not significant, though. We found no evidence for an effect of leadership experience on acquiring private third-party funds. The discipline again explains the level of private third-party funding, showing that technical sciences and engineering departments have higher levels thereof. In contrast, size, age of the head of department and type of university had no significant effect. The variable location (Vienna) reveals a strong magnitude but the term was not significant.

Table 2: Dependent variable: private third-party funds of the department 2013–2015 (> 20%), logistic regression (coefficient beta)

Independent	Model 1	Model 2
Constant	-5.146	-3.863
Industry experience of the head of department	0.407	
Leadership experience of the head of department		0.003
Size	0.009	0.013
Technical sciences	3.372**	3.559**
Vienna	-19.107	-19.234
Technical university	-0.454	-0.584
Age	-0.551	-0.610
Age squared	0.005	0.005
Publications of the head of department (top 25%)	-0.273	-0.212
N	208	208
Chi-square	40.049***	39.953***
Log-likelihood	82.444	82.541
Cox & Snell R ²	0.175	0.175

+ p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

Hypotheses 2 deals with the patent output of university departments and the role of entrepreneurial experience of the heads of departments. Due to the nature of the dependent variable number of patents, which was skewed, we ran a negative binomial regression model.

Table 3, depicts the results with the main effect variables and control factors. Leadership experience was entered as a binary variable in this model. The regression analysis shows that both industry and leadership experience had positive coefficients, with leadership experience being significant on the 1% significant level. The leadership coefficient is 0.778. Thus, heads of departments with leadership experience are more likely to publish patents, which provides support for our hypothesis 2b. However, hypothesis 2a has to be rejected.

In addition to industry and leadership experience we also investigated the impact of third-party funding on the likelihood of generating patents. However, we found no support for the assertion that there is a positive relationship between third-party funding and the patent output. Both, private and public third-party funds showed no significant impact. Therefore, hypothesis 2c has to be rejected.

The discipline and location of the university had no effect on the patent output either. However, we found that the age of the head of department had a negative significant effect and the size of the department a weak positive impact on the patent output. The publication output was positively correlated with the patent output of departments revealing that the top-performing heads of departments are able to convert ideas that can be commercialized. Technical universities were less likely to generate patents, which might be explained by specific patent policies within some universities and a weaker position in negotiating arrangements on how to deal with intellectual property rights in third-party-funded research projects.

Table 3: Dependent variable: Patents 2013–2015, negative binomial model (coefficient beta)

Independent	B	Exp(B)
Constant	-15.602**	
Industry experience	0.205	0.815
Leadership experience	0.778**	0.459
Third-party funding public	-0.003	0.997
Third-party funding private	0.011	1.009
Size	0.049***	1.050
Technical sciences	0.215	0.807
Technical university	-0.971**	2.640
Vienna	-0.438	1.550
Age	-0.664*	1.904
Age squared	-0.006**	0.994
Publication output of the head of department (top)	1.347***	0.260
N	208	
Likelihood-Ratio Chi-square	161.434***	

+ p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

5 Discussion and Conclusion

Today's universities are confronted with increasing demands from economy and society. To meet these new requirements, universities have to reconsider their research focus, to adopt their funding sources, and to adjust their internal rules and organization. These changings are also influencing the necessary qualities and characteristics of university leaders. Our study contributes to the literature by investigating the role of industry experience, leadership experience and research output of the heads of departments on key aspects of entrepreneurial universities like third-party funding and the patent output.

Leaders play a crucial role in this transition as they are responsible for the implementation of changes (Peus *et al.*, 2015) and serve as entrepreneurial role models, and they must be able to identify business opportunities (Kirby *et al.*, 2011). Hence, we assumed that industry and leadership experience of the heads of departments should impact scientific and entrepreneurial key aspects such as the departments' potential to acquire third-party funds and the generation of patents.

With regard to the impact on third-party funding our investigation revealed a low positive effect for industry experience. However, leadership experience had no effect on the level of third-party funding. In contrast, we found evidence that leadership affects the patent output of departments. Presumably, heads of departments with leadership experience are more likely to take a possible route of commercializing research results by patents. Therefore, our results suggest that entrepreneurial universities can profit from a head of department with industry experience in those activities, which Etzkowitz (2016) summarizes as the initial phase of entrepreneurial universities (e.g. raising additional resources). However, if universities seek to enter in the second phase of Etzkowitz's (2016) classification, i.e. taking an active role in commercializing the intellectual property of its members, the leadership experience of heads gains in importance. Apparently, heads of departments with former leadership experience are more acquainted with this challenge or they are more likely to see and take the chance to apply for a patent and commercialize

the own scientific research. Thus, our results are in line with Kirby *et al.* (2011), who postulate that nowadays university leaders must be capable of identifying business opportunities.

Based on our research, we also derived several practical implications. When universities seek to focus on other, for example, entrepreneurial activities, then new competencies come into play. The entrepreneurial university requires scientists that can handle the demands of both universities and economy. In that regard, Etzkowitz and Viale (2010) refer to scientists with double and even triple lives in university, industry and government. Scientists with experiences outside the university will be capable of adapting quickly to changes introduced by the entrepreneurial university. Our results suggest that heads of departments with leadership experience are better equipped to commercialize research findings by patents.

Our results support the idea of encouraging scientists to acquire leadership skills and leadership experiences. Recent research suggests that the motivation to lead significantly influences how well a leader performs (Bergner *et al.*, 2018). This motivation is influenced by the individual's interests and previously gained leadership experience (Bergner *et al.*, 2018).

When interpreting the results of this study one has to bear in mind the limitations. We focused our research on natural sciences, technical sciences and engineering and the results can thus not be generalized to other disciplines. Moreover, we have excluded heads of departments who did not consistently carry out their position from 2013 to 2015, though this could have had an influence on our results. We have not dealt with dynamic effects. Such effects could occur, for instance, as more efficient researchers might more successfully acquire external funds, which further strengthen their capacity to publish and attract additional third-party funds. We have not considered experiences in the public sector or in non-profit organizations, as we assume that entrepreneurial universities increasingly align with requirements, tools and skills more commonly associated with the private sector. Finally, we measured only the number of patents as one form of commercializing scientific findings; however, it might also be of interest to investigate the impact of spin-off companies.

References

- Bergner, S. (2015), "Personale Führung an Universitäten", in Gutschelhofer, A., Rybníček, R. and Raggautz, A. (Eds.), *Universitäre Steuerung: Konzepte, Anwendungen und Trends für ein qualitatives Hochschulmanagement*, Styrian Spirit of Management and Entrepreneurship, Neue Ausg, Leykam, Graz, pp. 221–233.
- Bergner, S., Kanape, A. and Rybníček, R. (2018), "Taking an interest in taking the lead. The influence of vocational interests, leadership experience and success on the motivation to lead", *Applied Psychology Advance online publication*.
- BMFWF (2014), "Universitätsbericht 2014", available at: https://www.bmdw.gv.at/Presse/AktuellePresseMeldungen/Documents/Universit%C3%A4tsbericht_2014.pdf.

- BMWWF (2016), "Österreichischer Forschungs- und Technologiebericht 2016", available at: https://www.bmvit.gv.at/innovation/publikationen/technologieberichte/downloads/ftbericht2016_printversion.pdf.
- Carayol, N. and Matt, M. (2006), "Individual and collective determinants of academic scientists' productivity", *Information Economics and Policy*, Vol. 18 No. 1, pp. 55–72.
- Dietz, J.S. and Bozeman, B. (2005), "Academic careers, patents, and productivity. Industry experience as scientific and technical human capital", *Research Policy*, Vol. 34 No. 3, pp. 349–367.
- Elia, G., Secundo, G. and Passiante, G. (2017), "Pathways towards the entrepreneurial university for creating entrepreneurial engineers. An Italian case", *International Journal of Entrepreneurship and Innovation Management*, Vol. 21 1/2, pp. 27–48.
- Etzkowitz, H. (2003), "Research groups as 'quasi-firms'. The invention of the entrepreneurial university", *Research Policy* No. 32, pp. 109–121.
- Etzkowitz, H. (2016), "The entrepreneurial university. Vision and metrics", *Industry and Higher Education*, Vol. 30 No. 2, pp. 83–97.
- Etzkowitz, H. and Leydesdorff, L. (2000), "The dynamics of innovation. From National Systems and "Mode 2" to a Triple Helix of university–industry–government relations" No. 29, pp. 109–123.
- Etzkowitz, H. and Viale, R. (2010), "Polyvalent knowledge and the entrepreneurial university. A third academic revolution?", *Critical Sociology*, Vol. 36 No. 4, pp. 595–609.
- Goodall, A.H. (2006), "Should top universities be led by top researchers and are they?", *Journal of Documentation*, Vol. 62 No. 3, pp. 388–411.
- Goodall, A.H. (2009), "Highly cited leaders and the performance of research universities", *Research Policy*, Vol. 38 No. 7, pp. 1079–1092.
- Goodall, A.H., McDowell, J.M. and Singell Jr., L.D. (2014), "Leadership and the research productivity of university departments", available at: <https://ssrn.com/abstract=2385160> (accessed 6 December 2017).
- Gulbrandsen, M. and Smeby, J.-C. (2005), "Industry funding and university professors' research performance", *Research Policy*, Vol. 34 No. 6, pp. 932–950.
- Harvey, J., Pettigrew, A. and Ferlie, E. (2002), "The determinantes of research group performance. Towards Mode 2?", *Journal of Management Studies*, Vol. 39 No. 6, pp. 22–2380.
- Kirby, D.A., Guerrero, M. and Urbano, D. (2011), "Making universities more entrepreneurial. Development of a model", *Canadian Journal of Administrative Sciences / Revue Canadienne des Sciences de l'Administration*, Vol. 28 No. 3, pp. 302–316.
- Leisytė, L. and Kizniene, D. (2006), "New Public Management in Lithuania's higher education", *Higher Education Policy*, Vol. 19 No. 3, pp. 377–396.
- McCormack, J., Propper, C. and Smith, S. (2014), "Herding cats? Management and university performance", *The Economic Journal*, Vol. 124 No. 578, F534–F564.
- Packham, G., Jones, P., Miller, C., Pickernell, D. and Thomas, B. (2010), "Attitudes towards entrepreneurship education. A comparative analysis", *Education + Training*, Vol. 52 8/9, pp. 568–586.
- Peus, C., Welp, I., Weisweiler, S. and Frey, D. (2015), "Führung an Hochschulen", in Felfe, J. (Ed.), *Trends der psychologischen Führungsforschung: Neue Konzepte, Methoden und Erkenntnisse*, Psychologie für das Personalmanagement, Hogrefe, Göttingen, pp. 527–539.
- Röpke, J. (1998), *The entrepreneurial university: Innovation, academic knowledge creation and regional development in a globalized economy*, Working Paper, Philipps-Universität Marburg.
- Rouse, W.B., Cannon-Bowers, J.A. and Salas, E. (1992), "The role of mental models in team performance in complex systems", *IEEE Transactions on Systems, Man, and Cybernetics*, Vol. 22 No. 6, pp. 1296–1308.

- Rybnicek, R. (2015), "Akzeptanz einer modernen Universität", in: Gutschelhofer, A., Rybnicek, R. and Raggautz, A. (Eds.), *Universitäre Steuerung: Konzepte, Anwendungen und Trends für ein qualitatives Hochschulmanagement*, Styrian Spirit of Management and Entrepreneurship, Neue Ausg, Leykam, Graz, pp. 235–246.
- Rybnicek, R., Bergner, S. and Suk, K. (2016), "Führung in Expertenorganisationen", in Felfe, J. and van Dick, R. (Eds.), *Handbuch Mitarbeiterführung*, Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 227–237.
- Secundo, G., Schiuma, G. and Passiante, G. (2017), "Entrepreneurial learning dynamics in knowledge-intensive enterprises", *International Journal of Entrepreneurial Behavior & Research*, Vol. 23 No. 3, pp. 366–380.
- Secundo, G., Elena-Perez, S., Martinaitis, Z., Leitner, K-H. (2017), "An Intellectual Capital framework to measure Universities' third mission activities, *Technological Forecasting and Social Change*, Vol. 123, pp. 229-239.
- Slaughter, S. and Leslie, L.L. (2001), "Expanding and elaborating the concept of academic capitalism", *Organization*, Vol. 8 No. 2, pp. 154–161.
- Tijssen, R.J.W. (2006), "Universities and industrially relevant science. Towards measurement models and indicators of entrepreneurial orientation", *Research Policy*, Vol. 35 No. 10, pp. 1569–1585.
- Weckowska, D.M., Molas-Gallart, J., Tang, P., Twigg, D., Castro-Martínez, E., Kijeńska-Dąbrowska, I., Libaers, D., Debackere, K. and Meyer, M. (2018), "University patenting and technology commercialization. Legal frameworks and the importance of local practice", *R&D Management*, Vol. 48 No. 1, pp. 88–108.
- Zomer, A. and Benneworth, P. (2011), "The rise of the university's third mission", in Enders, J., Boer, H.F. and Westerheijden, D.F. (Eds.), *Reform of Higher Education in Europe*, SensePublishers, Rotterdam, pp. 81–103.

Entrepreneurial Universities and Strategy: Primary Issues

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Abstract

Analysing the entrepreneurial role of universities discussed by scholars, this paper is directed to investigate diversification and multinationalisation strategy of universities through the proposition of a single case study. Thus, the purpose of this paper is to discover the reasons that led our university case study to develop its strategy and the role of its intellectual capital in supporting the chosen strategy. Our case is investigated through Secundo et al.'s (2016) collective intelligence framework for universities. Answering the research question, our findings include why our university case study chooses to pursue its business strategy to achieve teaching, research, and the third mission.

Keywords: entrepreneurial university, business strategy, intellectual capital, diversification, multinationalisation.

Academic Research Paper

1 Introduction

Universities changed their strategies during the time. They moved from being higher education centres to become entrepreneurial organizations to support the triple helix (Etzkowitz and Leydesdorff, 2000). Within the triple helix university-industry-government relations contribute to societal development through the knowledge promotion (Carayannis and Campbell, 2012; Lombardi et al., 2017; Trequattrini et al., 2018).

The changing university models allow for the understanding of entrepreneurial universities (Etzkowitz, 1983, Clark, 1998; Etzkowitz, 2016; Lombardi et al., 2017; Trequattrini et al., 2018). In this direction, we analyse the strategy construction of entrepreneurial universities (Buckland, 2009) and build on the intellectual capital (IC) of university (Secundo et al., 2018a). Thus, we investigate the university case study called “A” discovering its business strategy as entrepreneurial university, and how university IC supported its purpose aligned to its operating ecosystem (Secundo et al., 2018a; Secundo et al., 2018b).

Thus, we analyse the definition of a diversification and multinationalisation strategy adopted by university case study A as well as how its IC is composed referring to entrepreneurial university strategies (Dumay, 2013; Dumay and Garanina, 2013; Dumay and Guthrie, 2017) and contributing to fourth stage literature on IC (Secundo et al., 2018a). Our case is investigated through Secundo *et al.*'s (2016) collective intelligence framework for universities. Answering the research question, our findings include why our university case study chooses to pursue its business strategy to achieve teaching, research, and the third mission. Our results adds to the literature on University's strategies (Mintzberg and Rose, 2003) adopting a contingent approach (Etzkowitz and Leydesdorff, 2000).

The paper is organised as follows: Section 2 presents the literature review. Section 3 examines the methodology. Section 4 presents case study results. Section 5 proposes the discussion and conclusions.

2 Literature analysis

The advent of the fourth stage of IC research allows composing IC (Cuozzo et al., 2017) through resources supporting teaching, research and third mission activities (Lombardi et al., 2017; Secundo et al., 2018a). Universities use IC in developing strategies to obtain social and economic developments (Secundo *et al.*, 2018b). In this scenario, strategies of diversification and internationalization are investigated (Zanoni Beretta, Barzatta, 2011).

Universities can choose the diversification strategy adopting several activities (Neffke and Henning, 2013). Particularly, main activities supporting such strategy are based on the increasing number of courses and research activities (Mintzberg and Rose, 2003) or specialising in some courses and research activities (Agasisti, 2016; Donina *et al.*, 2015;

Seeber *et al.*, 2016). Diversification strategy of universities is aligned to their IC, analysing human capital, relational capital and structural capital.

Disclosing existing human capital, universities become more appealing to attract experts and researchers (Low *et al.*, 2015). Relational capital support universities in fortifying the brand (Nguyen *et al.*, 2016) and accessing new market sectors (Fernández-Olmos and Díez-Vial, 2012; Lombardi *et al.*, 2017). Structural capital helps universities in cutting production costs of new services (Camison and Villar-Lopez, 2010) and focusing research and curricula (Observatory of the European university, 2006).

Additionally, universities choose to adopt both a multinational strategy with international purposes and more abroad branches. Particularly, multinationalisation strategy (Guimon, 2016; Maslen, 2012; Pearce, 2016) allows to universities to have the local and international presence (Greenholz, 2000; Lombardi *et al.*, 2017). In this way, universities activates knowledge exchange (Lombardi, 2019; Powell, 2014) also in the relationships university-industry-government (Guan and Zhao, 2013; Lombardi *et al.*, 2017; Trequattrini *et al.*, 2018). Multinational strategy of universities is aligned to the IC, analysing human capital, relational capital and structural capital and allows for the recognition of universities as knowledge hubs.

In the light of previous literature, our research question is the following: *RQ1: Why does universities adopt diversification vs multinational strategy?*

3 Research Methodology

To develop our analysis, we used a qualitative method (Shah and Corley, 2006) through the application of a case study methodology (Yin, 2014). Thus, we adopted an exploratory case study with the purpose of extending IC theories in the University's contexts. Focusing on Italian University having a strategic plan oriented to third mission, we selected our case study A (or university A).

We fixed a specific research protocol to ensure reliability (Yin, 2014). After, we analysed university annual reports and the strategic plan and we conducted semi-structured interviews (Qu and Dumay, 2011) with university board members, analysing vision, mission, and objectives; the background and role of board members; the impact of chosen strategy on stakeholders, the role of IC in sustaining the strategy. Additionally, we used Secundo *et al.*'s (2016) collective intelligence framework based on four key questions to define the strategy: what, who, how, and why.

We used the open in-vivo coding in NVivo (Miles *et al.*, 2013) to analysed data. Our results were discussed among the authors and with the people interviewed (Yin, 2014). Lastly, we used a chain of evidence matrix to increase reliability (Yin, 2014).

4. Results

In this section, we show results defined through the application of the framework by Secundo *et al.* (2016), summarizing some main findings.

Adopting the what dimension by Secundo et al. (2016) framework, the university case study A performs teaching, research and third missions through an open model of governance with the involvement of stakeholder. The university A builds on the fourth stage of IC research (Dumay and Garanina, 2013; Secundo et al., 2018a) in the ecosystem in which it operates (Secundo et al., 2018b). The strategic plan of the university A' allows to recognize the diversification and the internationalisation strategy.

About the who dimension by Secundo et al. (2016) framework, main internal and external stakeholders are identified in relation to the strategy adopted. They are professors and researchers, strategic task force, employees and administrative offices, and national and international students, national and international students, professional institutions. Adopting the why dimension by Secundo et al. (2016) framework, the university A adopts international programme students and professors' exchange, the development of an international branch, multiple collaborations with institutions. Such strategy identifies the multinational strategy.

Adopting the how dimension by Secundo et al. (2016) framework, actions of the university A are explained in the light of the diversified international strategy. The university A increases diversified students programmes, invests in education directed to professors and employees, builds external collaborations with labour and territorial institutions, establishes several regulations and research indicators.

5. Discussion and conclusions

Our analysis provides both theoretical and practical contributions to the literature. First, the practical contribution supports the diversified strategy adopted by university A in pursuing teaching, research and third mission goals (Etzkowitz, and Leydesdorff, 2000). In this way, we found historical and economic reasons connected to decisions assumed during the time. The university A plays a role in the triple helix context (Etzkowitz and Leydesdorff, 2000; Trequattrini et al., 2018).

IC is being re-shaped in the entrepreneurial university strategies (Secundo et al., 2018a). The university A adopts a multinational strategy based for example on student and academic exchanges (Kosmützky and Putty, 2016); relationships and project opportunities; cross-cultural competence valuation. Additionally, the university A adopts the IC ecosystem and it has a role in the triple helix through intangibles (Secundo et al., 2018a; Secundo *et al.*, 2018b).

Confirming the relevance of contingency factors, the analysis shows the diversification and multinationalisation strategies by the university A. The future research is directed to continue this research through a multiple case study. Thus, the limitations of this paper originates from the analysis of one case study.

References

- Agasisti, T. (2016), "Cost structure, productivity and efficiency of the Italian public higher education industry 2001–2011", *International Review of Applied Economics*, Vol. 30 No. 1, pages 48–68.
- Buckland, R. (2009), "Private and public sector models for strategies in universities", *British Journal of Management*, Vol. 20 No. 4, pages 524–536.
- Camison, C. and Villar-Lopez, A. (2010), "Foreign intensity and economic performance: The mediating role of internationally exploitable assets and competitive strategy", *Journal of Small Business Management*, Vol. 48 No. 2, pages 116–151.
- Cuozzo B., Dumay J., Palmaccio M., Lombardi R., *Intellectual capital disclosure: A structured literature review*, Journal of Intellectual Capital, vol. 18, n. 1, 2017, pp. 9–28.
- Donina, D., Meoli, M. and Paleari, S. (2015), "The new institutional governance of Italian state universities: what role for the new governing bodies?", *Tertiary Education and Management*, Vol. 21 No. 1, doi:10.1080/13583883.2014.994024.
- Dumay, J. (2013), "The third stage of IC: towards a new IC future and beyond", *Journal of Intellectual Capital*, Vol. 14 No. 1, pages 5–9.
- Dumay, J. and Garanina, T. (2013), "Intellectual capital research: A critical examination of the third stage", *Journal of Intellectual Capital*, Vol. 14 No. 1, pages 10–25.
- Dumay, J., Guthrie, J. and Rooney, J. (2017), "The Critical Path of Intellectual Capital", *The Routledge Companion to Intellectual Capital*.
- Eisenhardt, K.M. and Graebner, M.E. (2007), "Theory Building From Cases: Opportunities and Challenges", *Academy of Management Journal*, Vol. 50 No. 1, pages 25–32.
- Etzkowitz, H. and Leydesdorff, L. (2000), "The dynamics of innovation: from National Systems and 'Mode 2' to a Triple Helix of university–industry–government relations", *Research Policy*, Vol. 29 No. 2, pages 109–123.
- Fernández-Olmos, M. and Díez-Vial, I. (2012), "Effect of firm's resources on international diversification: An application in the Iberian ham industry", *European Management Journal*, pages 196–208.
- Greenholz, J. (2000), "Assessing cross-cultural competence in transnational education: The intercultural development inventory", *Higher education in Europe*, Vol. 25 No. July, pages 411–416.
- Guan, J. and Zhao, Q. (2013), "The impact of university–industry collaboration networks on innovation in nanobiopharmaceuticals", *Technological Forecasting and Social Change*, Vol. 80 No. 7, pages 1271–1286.
- Guimon, J. (2016), "Universities as multinational enterprises? The multinational university analyzed through the eclectic paradigm", *Multinational Business Review*, Vol. 24 No. 3, pages 216–228.
- Kazantsev, N. and Zakhlebin, I. (2014), "Knowledge Management & E-Learning smart city development in terms of human capital and", *Knowledge Management & E-Learning*, Vol. 6 No. 4, pages 410–425.
- Kosmützky, A. and Putty, R. (2016), "Transcending Borders and Traversing Boundaries", *Journal of Studies in International Education*, Vol. 20 No. 1, pages 8–33.
- Leydesdorff, L. and Etzkowitz, H. (2001), "The transformation of university–industry–government relations", *Electronic journal of Sociology*.
- Lombardi R. (2019), *Knowledge transfer and organizational performance and business process: past, present and future researches*, Business Process Management Journal, vol. 25, No. 1, pp. 2–9.
- Low, M., Samkin, G. and Li, Y. (2015), "Voluntary reporting of intellectual capital", *Journal of Intellectual Capital*, Vol. 16 No. 4, pages 779–808.

- Lombardi R., Lardo A., Cuzzo B., Trequattrini R. (2017), *Emerging trends in entrepreneurial universities within Mediterranean regions: an international comparison*, Euromed Business Journal, Emerald Group Publishing, vol. 12, n. 2, pp. 130-145.
- Maslen, G. (2012), "The rise of the multinational university", *University World News*, Vol. 223, p. 1.
- Miles, M.B., Huberman, A. M. and Saldana, J. (2013), *Qualitative Data Analysis: A Methods Sourcebook*, Sage Publications, Thousand Oaks, CA, 3rd Ed.
- Mintzberg, H. and Rose, J. (2003), "Strategic Management Upside Down: Tracking Strategies at McGill University from 1829 to 1980", *Canadian Journal of Administrative Sciences / Revue Canadienne des Sciences de l'Administration*, Vol. 20 No. 4, pages 270–290.
- Neffke, F. and Henning, M. (2013), "Skill relatedness and firm diversification", *Strategic Management Journal*, Vol. 34 No. 3, pages 297–316.
- Nguyen, B., Yu, X., Melewar, T.C. and Hemsley-Brown, J. (2016), "Brand ambidexterity and commitment in higher education: An exploratory study", *Journal of Business Research*, Vol. 69 No. 8, pages 3105–3112.
- Observatory of the European University. (2006), *Methodological Guide*, Lugano.
- Pearce, A. (2016), "Internationalisation strategy implemented through faculty exchange: strategic entrepreneurship in a 'new' UK university", *International Journal of Business Innovation and Research*, Vol. 10 No. 1, pages 43–64.
- Powell, J.J.W. (2014), "University roots and branches between 'glocalization' and 'mondialisation': Qatar's (inter)national universities", *International Perspectives on Education and Society*.
- Qu, S.Q. and Dumay, J. (2011), "The qualitative research interview", *Qualitative Research in Accounting & Management*, Vol. 8 No. 3, pages 238–264.
- Secundo, G., De Beer, C., Schutte, C.S. and Passiante, G. (2017), "Mobilising intellectual capital to improve European universities' competitiveness: the technology transfer offices' role", *Journal of Intellectual Capital*, pages 00–00.
- Secundo, G., Dumay, J., Schiuma, G. and Passiante, G. (2016), "Managing intellectual capital through a collective intelligence approach", *Journal of Intellectual Capital*, Vol. 17 No. 2, pages 298–319.
- Secundo G., Lombardi R., Dumay J. (2018a), *Intellectual Capital in Education*, Journal of Intellectual Capital, vol. 19, n. 1, pp. 2-9.
- Secundo, G., Massaro, M., Dumay, J.C. and Bagnoli, C. (2018b), "Intellectual Capital Management in the fourth stage of IC research: a critical case study in University settings", *Journal of Intellectual Capital*, Vol. 19 No. 1, pages 157–177.
- Secundo, G., Del Vecchio, P., Schiuma, G. and Passiante, G. (2017), "Activating entrepreneurial learning processes for transforming university students' idea into entrepreneurial practices", *International Journal of Entrepreneurial Behaviour and Research*, Vol. 23 No. 3, pages 465–485.
- Seeber, M., Cattaneo, M., Huisman, J. and Paleari, S. (2016), "Why do higher education institutions internationalize? An investigation of the multilevel determinants of internationalization rationales", *Higher Education*, Vol. 72 No. 5, doi:10.1007/s10734-015-9971-x.
- Shah, S.K. and Corley, K.G. (2006), "Building better theory by bridging the quantitative – qualitative divide", *Journal of Management Studies*, Vol. 43 No. 8, pages 1821–1835..
- Trequattrini R., Lombardi R., Lardo A., Cuzzo B. (2018), *The Impact of Entrepreneurial Universities on Regional Growth: a Local Intellectual Capital Perspective*, Journal of the Knowledge Economy, vol. 9, n. 1, pp. 199–211.
- Wiedenhofer, R., Friedl, C., Billy, L. and Olejarova, D. (2017), "Application of IC-models in a combined public-private sector setting for regional innovation in Slovakia", *Journal of Intellectual Capital*, Vol. 18 No. 3, pages 588–606.

- Yin, R.K. (2014), *Case Study Research: Design and Methods*, Sage Publications, Thousand Oaks, CA, Kindle Ed.
- Zanoni Beretta, A. and Barzatta, P. (2011), “A new model for the strategic planning in the University Settings (Italian Version)”, *Harvard Business Review*, Vol. May, pages 99–105.

Understanding E-learning Design in European Universities: a Mixed Method Study

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Abstract

An e-learning system, based on the Fee model (2009), consists of three components: technology, learning content and learning / e-learning design. In the literature on universities, there are not many contributions on the design of e-learning, understood as a process (Trentin, 2001).

This article intends to understand, through an empirical analysis, how European universities implement e-learning design. In particular, the goal is to study the e-learning and design system, within selected European universities, to understand the phases of the project and to understand how much the university takes into account the territory.

The study approach adopted to conduct the research was mixed: quantitative and qualitative.

First of all, the quantitative survey was carried out on the websites of the top 100 European universities in the Quacquarelli Symonds ranking.

Subsequently, the qualitative construction of some case studies and semi-structured interviews with managers of e-learning services of some European universities was carried out.

The quantitative survey shows that the 100 best European universities, present in the Quacquarelli Symonds ranking, adopt e-learning methods, allowing to identify, among them, the universities involved in case studies.

The qualitative construction of case studies and semi-structured interviews with managers of e-learning services of some of these European universities underlines a specific attention to the e-learning design of the courses, even if more focused on the professional figures working there and not entirely on the e-learning course project.

The article aims to provide a detailed study on the design of e-learning in the educational context. The analysis of multiple case studies allows us to identify how the selected universities carry out the activity of educational design through the use of technology.

The study has two main limitations. The first difficulty lies in the difficulty of having a complete view of the examined phenomenon. The second limit refers to the number of respondents and universities contacted.

The future objective will be to intensify these activities by involving other actors (teaching staff, governance) and new universities.

Keywords – E-Learning, Knowledge Management, European Universities, Knowledge, E-learning/Learning Design

Paper type – Academic Research Paper.

1 Introduction

E-learning is a teaching and learning system provided on a digital device such as a computer or mobile device (Brown and Voltz, 2005; Clark and Mayer, 2011); which allows the transfer of educational material (Carroll, 2013), which can cover part or all of the course (Dizionario Treccani, 2015), in blended mode. This system can be based on Cloud Computing (Masud and Huang, 2012), in which data storage takes place within the network, using hardware resources, in a secure manner (Ahmed, 2015); on request, paying based on their use (Riahi, 2015) and can be provided, free of charge, to a large number of students located in any geographical location (Sinclair, et al., 2015), provided you have an internet connection (Jansen, and Schuwer, 2015), through the so-called Massive Open Online Courses (MOOCs).

E-learning, in universities, can be considered as a tool to implement advanced technological learning (Almpanis 2015), to allow sustainable development in higher education (Azeiteiro et al., 2015), to allow improvement of the knowledge and skills based on technology (Bhuasiri, et al., 2012).

E-learning, according to Wild et al. (2002), has many of the same attributes of the basic knowledge management processes and, therefore, can be used as a tool for knowledge management to generate, encode and transfer knowledge, through the use of technology (Ruggles, 2009).

Liebowitz e Frank (2016) talk about a synergistic relationship between knowledge management and e-learning. According to Iqbal and Islam (2013), at least two factors are driving the fusion of knowledge management and e-learning: knowledge acquisition and information sharing (Chawhan, 2012; Shamizanjani et al., 2014), establishing knowledge-based learning within universities (Aurelie Bechina Arntzen, et al., 2009).

According to Chen, and Hsiang (2007) e-learning systems must be designed to emphasize knowledge development.

Fee (2009) states that e-learning systems consist of three components: technology, learning content and learning design.

Technology is a basic infrastructure that allows the implementation of e-learning (Urh et al, 2015) through the transfer of information during training or the acquisition of skills by users (Ghiringhelli and Quacquarelli, in Nacamulli, 2003).

The learning content refers to the associated learning material and activities (Al-Yahya, et al., 2015).

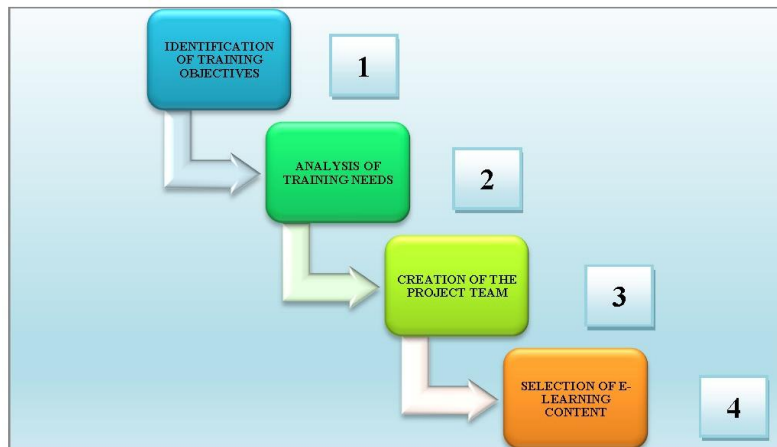
The project Learning/E-learning is the set of decisions (Horton, 2011) on how to plan activities and learning interventions (Conole, 2013, p.7), establishes objectives and teaching plans (Rienties, et al, 2015) based on educational information, an appropriate use of resources and technologies.

According to Trentin (2001) learning design is characterized by a complex educational process that includes four phases (see figure 1): (1) identification of the general objectives of the training course (Cocozza, 2004); (2) analysis of the current state of performance of the subjects to be trained and definition of the level of performance to be achieved (Esposito and Mantese, 2003) and (3) creation of a dedicated design team, in which various professional figures are involved. E.g.: Instructional Design; Curriculum Planner; Content Designer. (4) The selection of e-learning contents (Ghiringhelli and Quacquarelli, in Nacamulli, 2003) aims to transfer information within a training context; acquire skills from users; promote an educational model focused on cooperation and shared learning and finally promote the organizational and shared learning dynamics that take place in the communities of practice.

Following the Fee model (2009), within the literature on e-learning in universities, it emerges that it is particularly rich in aspects related to technology (Leidner, and Jarvenpaa, 1995; Arbaugh, 2000; Venkatesh, and Davis, 2000; Alavi and Leidner, 2001; Piccoli, et al., 2001; Martins, and Kellermanns, 2004; Bhuasiri et al., 2012; Hassanzadeh et al., 2012; Al-Adwan et al., 2013; Islam, 2013; Kurilovas et al., 2014; Songkram, 2015; Masud, 2016; Elkaseh et al., 2016) and educational content (Hwang, et al, 2006; Arbaugh, 2008; Franceschi, et al., 2009; Koutsabasis et al., 2011; Adeola et al., 2013; Carril et al., 2013; Parkes et al., 2013; Almpanis, 2015; Oproiu, 2015; Azeiteiro et al., 2015; Parkes et al., 2015), while the problem of e-learning design has not been studied in depth (Urh, 2015; Islam et al., 2015).

This article aims to understand, through an empirical investigation, the type of attention paid by universities to e-learning design. In particular, the objective is to verify how some selected European universities implement the design of courses, through e-

learning systems, following the process outlined by Trentin (2001) and therefore trying to bridge the gap in the literature.



Source: Adapted from Trentin (2001).

Figure 1: E-learning Design process.

The article is organized as follows: the theoretical background will be analyzed in the next session; the research method adopted will then be examined, then the main results obtained and the discussions; finally, the conclusions will be illustrated.

2 Theoretical background: the role of design in e-learning

"Good learning" in e-learning systems depends on a combination of work technology, meaningful content and effective e-learning design (Fee, 2009). These three components are complementary and must be carefully combined: the design must make the most of the content and the technology must allow both the content and the design. For professionals involved in the development of e-learning, not only access to content and technology is important, but also design.

The study by Al-Samarraie et al, (2017) analyzes the design of e-learning in order to understand how the organization and the structural aspects of the representation of e-learning, grouped according to their coherence, can facilitate the processes cognitive in reading and storing content. The authors, through an empirical investigation, have discovered that the incorporation of cognitively isolated elements into a system representation can influence the ability to read and remember the content, which in turn affects the user's preference for the use of e-learning system.

Benson and Samarawickrema (2009) consider the importance of addressing learning and the context of teaching in design e-learning through transactional distance theory. The authors suggested, through the analysis of some case studies, that it is necessary to design appropriate levels of dialogue and structure for students and the learning context in order

to reduce transactional distance, ie the separation between students and between teacher and learner.

Brown and Voltz (2005) analyze the e-learning resource design phase that combines activities such as design planning and teaching, creative writing and software specifications. The observations were based on the analysis of six areas – activity, scenario, feedback, delivery, context and impact – in order to cover the problems of all the disciplines involved in e-learning design, but in particular focus on learning as a motivation driving.

Anderson, et al. (2001) consider e-learning design as a process of exclusive prerogative of teachers who need to think about how to set up and build the course and which teaching materials to use. The authors examine the variable called "educational presence", within a computer conference environment, consisting of three categories: design and organization, facilitation of discourse and direct instruction.

The aim of Lister's research (2014) is to identify, through the similarities and differences of some models and research of common themes, the components that are important to include in the design of e-learning to improve learning.

Rientee and Toetenel (2016) have demonstrated the extent to which teacher-based learning design decisions involve the commitment, satisfaction and academic performance of virtual learning environments (VLEs), allowing them to build a shared vision.

Rienties, et al (2015), considering empirically Learning Management Systems (LMS) and learning performance, study learning design. This research combined three different data sources (i.e. learning design data, LMS and learning performance and showed that academics seem to design modules with an "invisible" design in their mind, capable of impacting the performance of learning.

The main objective of the research conducted by Rodríguez-Triana, et al. (2015) is to help teachers monitor their design decisions made or not in combined CSL (Computer Supported Collaborative Learning) scenarios. The results obtained show that the monitoring-sensitive design process and the underlying monitoring-sensitive scripting model were able to align scripting and monitoring, respectively two well-known approaches to Learning Design (LD) and Learning Analytics (LA).

The article by Lockyer et al. (2013) investigates how learning analysis can help assess whether a learning project improves understanding and assessment of the student's intent and teaching activity. This work found that the evaluation potential of the learning analysis would be significantly improved with reference to the learning project that documents the pedagogical intent.

The research reported by Bennett et al. (2015) was conducted to advance the understanding of university teacher design practices that could be aimed at identifying activities or influences that support such tools. The analysis considered design as a process through which teachers anticipate the characteristics of their students and respond to various forms of feedback, informed by their beliefs and their teaching competence, within the limits of their particular context.

According to Haya et al. (2015) Learning Analytics is a key tool to support Learning Design and the student social learning survey. The article through the adoption of the Analytics toolkit aims to explore the potential of computational methods that can support teachers and students who participate in collaborative scenarios and allow an effective learning process.

Teräs and Herrington (2014) describe the use of an educational design research process to find the right balance in an authentic e-learning project in a fully online postgraduate program implemented by the Tampere University of Applied Sciences (TAMK).

But according to an empirical survey conducted by Urh (2015), there is a lack of attention on the part of universities to design e-learning linked to the educational aspect (Islam et al., 2015). In fact, the correct training requires the teacher to understand how to design and distribute the course materials and how to guide the students appropriately, in order to transmit knowledge, skills and allow the learning and management of the related training process (Fee, 2009; Trentin, 2001).

This article, through empirical analysis, tries to fill this gap.

To do this we will try to define the concept of e-learning design with respect to four elements: Strategy; Organization; Users and context.

This sequel was adopted based on the three elements identified by Roberts (2004), strategy, organization and context, and "people" (users), by Daft (2010). This subdivision was made to have an e-learning vision according to different points of view.

The strategy identifies all the questions related to the hypothetical choices of the universities regarding the design of e-learning.

The organization is understood as the way in which they implement e-learning design strategies.

The user is intended as a possible user of the e-learning design service. This area includes all questions related to potential users of the service.

The context is linked to the general concept of technology and more precisely to the impact that technology has on the organization and the influence of the organization itself in reference to learning design.

3 Methodology

The research method adopted is mixed (Creswell, 2014): first the quantitative data were collected, through the examination of the websites of European universities and then the qualitative analysis, through the construction of a multiple case study and some interviews semi-structured.

The survey was implemented through two steps:

- (1) The collection of quantitative data on European universities.
- (2) Identification of universities and e-learning services managers to be interviewed and development of the four case studies, including the pilot case.

3.1 First Step.

In the first phase, the study focused on the acquisition of documentary information found on the Internet (Corbetta, 2014). The activities carried out by the various universities have been taken into consideration through the analysis of their websites. This method was adopted and compared with others, because it was considered more convenient in order to obtain quantitative data on European universities in a short time. The survey, in particular, was conducted by examining the websites of the top 100 European universities in a ranking, which allows for the collection of university data by region.

The international ranking used was Quacquarelli Symonds, known as the QS World University 2015/16, which includes the top 800 universities in the world divided into four sectors: research, teaching, employability and internationalization (ANVUR, 2014).

The ranking used focused exclusively on the 100 best universities, identified by region, which included the word "Europe" in the "drop down" list of "QS World University 2015/16". This ranking has been selected compared to others, because it allowed us to search for the best universities, by geographical area, noting only the European universities that are the subject of this research.

The method used to collect the data was characterized by the creation of a specific database in which different information was entered for each university based on the type of training offered.

The research, in particular, made it possible to verify the presence on the university's website of appropriate e-learning platforms. The survey was conducted by entering the "home page" of each university and searching through specific keywords such as "E-learning", "MOOCs", "Online Courses" and "Distance Learning" the system used.

3.2 Second Step.

Then we selected within the 100 European universities in an international ranking, three universities and were able to identify the university of the pilot case. The selection of case studies and pilot cases took place this way. Analysis of the data collected on the websites showed that the largest number of universities in the nationality ranking came from two European countries: the United Kingdom and Germany.

Within these two countries we selected: the University of Dresden (Germany) and Queen's University of Belfast - Northern Ireland (United Kingdom) because the learning / MOOC services provided were more consistent with the purposes of our investigations.

The third university was selected taking into account the presence in the ranking of an Italian university, with a long historical tradition in Europe and the adoption of teaching methods based on e-learning (University of Bologna (Italy)).

The three European universities identified were respectively: University of Dresden (Germany), Queen's University Belfast - Northern Ireland (United Kingdom) and University of Bologna (Italy).

The pilot case was built on data from a university not included in the 100 best universities in the QS rankings. The selection of this university took place on the basis of

the prestigious services offered by the University of Naples Federico II through the "Federica Platform".

We have identified, for each of these universities, the contacts of the managers of the respective e-learning services, always referring to the websites. The interviews were conducted with those responsible for e-learning services, because these professionals are mainly involved in the design and supply of these e-learning services.

The interviews were conducted in the period May-September of the year 2016.

We interviewed, within the four universities mentioned, five subjects who hold the role of manager, within adequate structures for the provision of the e-learning / MOOC service of appropriate IT centers.

In particular, the first interview was addressed to two managers of the Federico II University of Naples (pilot case), who played the role: one of Production Manager of Federica Web Learning and the other of Communication Manager Project "Virtual Campus" - web platforms: federica.unina.it; federica.eu.

The Federico II University has a Federica Web-learning service center (Center for innovation, experimentation and dissemination of multimedia teaching) active in the area of new multimedia technologies.

In this context, the Federica-Campus virtual project plays an essential role as an advanced web learning model for those who cannot attend university in the traditional way.

The second interview was directed to the manager of the MedienZentrum (multimedia center) of the University of Dresden (Case Study 1). The Media Center is a multimedia infrastructure that aims to digitize learning and teaching (Schoop et al, 2016). Nearly 100 people work at the Media Center. The team consists of scientists, designers, psychologists, educators and economists. MedienZentrum supports educators in the planning, implementation and evaluation of sustainable e-learning courses.

The third interview was directed to the manager of E-learning services and to the MOOCs of the University of Belfast (Case Study 2). This university has a Center for educational development that offers counseling and a series of professional development and support activities for the main study, learning, teaching and evaluation programs, as well as for the provision of e-learning services, mostly implemented through mixed learning.

The fourth interview was conducted at the head of the e-learning sector Center of Information Systems and Applications of the University of Bologna (Case Study 3). This infrastructure designs, implements and manages university IT services. Within this center, the e-learning sector, which aims to satisfy the demand for e-learning services at the University, plays an important role and provides the necessary support to those who provide training activities through the online teaching (blended learning).

The analysis of the case studies was carried out first of all by examining the data coming from the Internet, including, among others, the number of e-learning courses and MOOCs provided by the four universities identified.

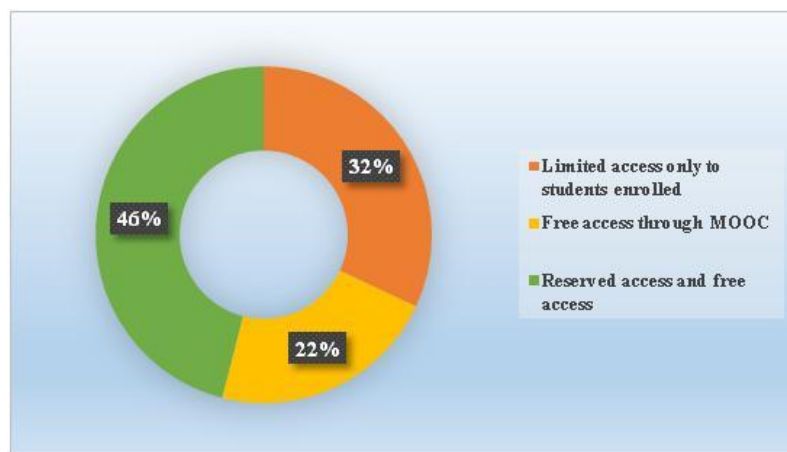
Subsequently, we collected and processed the data that emerged from the interviews with the managers of the e-learning services of the four universities mentioned above.

Semi-structured interview questions were grouped into four parts, based on their content in: Strategy; Organization; Users and context and referring to the problems described in the previous section.

A final synoptic overview we prepared to test the similarities or differences (Yin, 2014) between the realities of the universities examined in relation to the design of e-learning.

4 Findings and discussion.

From the study of quantitative analysis it emerges that the 100 European universities identified provide training not only through classroom lessons, but also with a variety of web-based courses (E-learning) also in free mode (MOOC). Learning activities are provided at a distance (see Figure 2) in a different way: with limited access to members only (32%); with free access via MOOC (22%); the reserved and free mode (46%).



Source: Adapted from QS World University Rankings® 2015/16.

Figure 2: Access to e-learning services/MOOCs in the top 100 European universities.

From the analysis of the data coming from the websites of the four case studies relating to the Universities: (pilot case) of the Federico II University of Naples (Italy); University 1: University of Dresden (Germany), University 2: Queen's University Belfast (United Kingdom), and, University 3: University of Bologna (Italy), emerges as described in table 1.

An examination of the synoptic table (table 2), in which the questions posed and the relative answers provided by the managers of the four universities interviewed were divided into four parts (Strategy, Organization, Users and Context), the elements of homogeneity and diversity indicated below.

Table 1: A.Y. 2015/2016: Numerical data on the four selected European universities.

Description	Pilote-case: University of Naples Federico II – Italy	Case Study 1: University of Dresden – Germany	Case Study 2: Queen's University Belfast – UK	Case Study 3: University of Bologna – Italy
<i>Year of Constitution</i>	1224	1828	1845	1088
<i>Students Enrolled</i>	75,982	35,961	23,870	78,026
<i>Teaching Staff</i>	5,650	4,879	1,715	5,851
<i>Technical- Administrative Staff</i>	2,804	not available (n.a.)	n.a.	3,021
<i>Faculties</i>	n.a.	14	03	n.a.
<i>Schools</i>	04	05	20	11
<i>Departments</i>	26	n.a.	n.a.	33
<i>Graduate Courses</i>	143	n.a.	77	210
<i>Post-graduate Courses</i>	244	n.a.	138	154
<i>Graduate and Post- graduate Courses</i>	387	133	215	364
<i>Blended courses</i>	They are approximately 300.	There are within Faculty of Languages, Literature and Cultural Studies; Education; Economics and Business and faculty of Civil Engineering.	There are within Faculty of literature, humanities and social sciences; Engineering and Physical Sciences and faculty of Medicine, Health and Life Sciences.	There are within the school of Agriculture and Veterinary Medicine; Economics, Management and Statistics; Pharmacy, Biotechnology and Motor Science; Law; Engineering and Architecture; Letters and Cultural Heritage; Languages and Literature, Translation and Interpretation; Medicine and Surgery; Psychology and Education Sciences; Political Science.
<i>MOOCs</i>	75	Not existing	02	Not existing

Source: Adapted from websites: <http://www.unina.it>; <https://tu-dresden.de/tu-dresden/>; <http://www.qub.ac.uk/>; <http://www.unibo.it>

Within the "Strategy" framework, there is an element in common between the four universities: adoption of blended learning.

Specifically, in the area of strategy, with reference to the question of the existence of blended learning methods, all four respondents confirmed the existence of forms of blended learning in their universities.

In the other three boxes referring respectively to "Organization", "Users" and "Context" there are no similarities in the answers provided, but only non-conformities.

Table 2: Summary of parts of Interviews conducted a four European universities.

	Synthetic content question	Pilote-case: University of Naples Federico II – Italy	Case Study 1: University of Dresden – Germany	Case Study 2: Queen's University Belfast – UK	Case Study 3: University of Bologna – Italy
Strategy	1.Motivating the adoption of e-learning courses in universities.	Need to innovate their teaching methods	Need to innovate their teaching methods	Opportunities to offer students/users service at any time.	Opportunities to offer students/users service at any time.
	2.Presence of teaching forms in blended learning mode.	Adopting blended learning models.	Adopting blended learning models.	Adopting blended learning models.	Adopting blended learning models.
Organization	1.Choosing a course in e-learning and professional figures involved.	Assistance from course managers in carrying out educational activities in e-learning	The professionals involved in this project come from different fields.	The professionals involved in this project come from different fields.	The design is carried out independently by the teachers and there is only the coaching by a technician using the platform.
	2.Technologies adopted: Cloud Computing.	Using Cloud Computing on Federica.eu Platform	No-existence of Cloud Computing.	Using Cloud Computing	No-existence of Cloud Computing.
	3.Technologies adopted: Mobile-Learning.	Using Mobile Learning.	Using Mobile Learning.	Using Mobile Learning.	No-existence of Mobile Learning.
Users	1.The number of students likely to follow these courses in e-learning.	Existence of precise data.	Lack of reliable data.	Lack of reliable data.	Lack of reliable data.
	2.Types of services offered to users/students in a synchronous, asynchronous and collaborative way.	Provision of e-learning services in asynchronous form, without collaborative and synchronous forms.	Provision of e-learning services in asynchronous form, without collaborative and synchronous forms.	Adopting teaching methods both in synchronous, asynchronous form and also encouraging activities in a collaborative form.	The main use of the asynchronous system and only in specific cases is synchronous and collaborative forms, through forums and discussions.
Context	1.The main factors affecting the increase/decrease in the use of e-learning teaching methods in universities.	Increased use of such technologies due to institutional actors' policies, but also the tendency to use the different ways of delivering training.	Increased use of such technologies as a result of the ease with which students can use online digital devices anytime, and can share educational materials more easily with others.	Increased use of such technologies due to the development that the technological factor has gained in recent years in the university context.	Increased use of such technologies due to the development that the technological factor has gained in recent years in the university context.
	2.The use of such technologies: worsens or improves learners' learning.	Learning would depend on how learners use e-learning.	Inadequate statistical data to make a difference with traditional teaching methods.	Using technology could adversely affect learning.	Technology would improve students' learning

There are, therefore, situations in the different parts of the interview, in which not all four universities responded uniformly. The answers were divided in equal parts or only three respondents gave identical answers with respect to the fourth or two or are identical and the other two differ from the first and between them.

We must consider, in particular, what happened in the strategy section in which the answers of the interviewees to the question on the motivations related to the adoption of e-learning / MOOCs courses focused on two different aspects.

The managers of the University Federico II of Naples and the Technische Universität Dresden underlined the internal need of the organization to innovate teaching methods. The managers of the other two universities of Queen's University in Belfast and of the Alma Mater Studiorum-University of Bologna have focused on the opportunity to offer a service to students/users always, at any time, to facilitate the students who work and those outside headquarters.

The same situation is expressed in the part referring to the "Organization" in which there are two identical answers and the other two are different on the design of an e-learning course.

The manager of the University of Federico II, interviewed on the design of the e-learning course, stated that there is an intervention by the "course manager" which is divided into three phases: contact with the teacher; recording of lessons and publication of the event. In the first phase, the course director contacts the teacher to provide instructions on the preparation and publication of the slides. At the end of the production of the lessons, we pass to the second phase of the shooting. Recordings of lessons can be made at the center or at the teacher's office or in contexts relevant to the subject. The final phase is represented by communication and dissemination in order to publicize the presence of the course on the web platform. The manager of the University of Bologna emphasized that the teachers carry out the project independently, even if there is technical assistance from a technician on the use of the platform.

To this question, the manager of the Technische Universität Dresden has shown that the professionals involved in this project come from different fields.

The manager interviewed by Queen's University Belfast stressed that the project is subject to the approval of the faculty's executive committee and that the professionals involved are different. The educational designer and the graphic designers, the marketing team, the technical support and the academic module coordinator.

In the question that is connected to the existence or not of cloud computing, it emerges that in two universities this system is set up and the other two are not, while on the use of mobile-learning only one university is without one.

The following questions that refer to the use of cloud computing and mobile learning stand out in the use of these two systems, in the existing platforms at the University of Naples Federico II and in that of Queen's University in Belfast. On the contrary, the University of Bologna does not provide cloud computing or a mobile learning system. Finally, the Technische Universität Dresden does not use the cloud computing system, but instead has set up a mobile learning service.

Also in the "Users" area to the question regarding the number of students who are inclined to follow these courses through e-learning, three identical opinions emerge on the lack of such data and in the fourth, there are such extremes. It emerged that there are no reliable figures in the universities of Dresden, Bologna and Belfast. Only in the University of Naples it is possible to find the number of members for the federica.eu platform which corresponds to 10,000-12,000 students and on "Federica Web Learning (Federica.unina)" visited by over 500,000 users a month, since it is completely accessible by anyone.

The questions related to students interested in courses provided in synchronous, asynchronous and collaborative mode highlighted these three types in only two universities, on the contrary, in the other two there are different ways.

In the University of Dresden and in the University of Federico II, only the methods of supply are adopted in asynchronous form, while in the University of Bologna the asynchronous system is mainly used and only in specific cases the synchronous system.

Finally, the University of Belfast adopts teaching methods both in synchronous and asynchronous forms and encourages collaborative activities. The latter type is used, through forums and discussions within the University of Bologna, while it is completely

absent in the remaining two universities, namely, at the University of Dresden and the University of Naples Federico II.

In the "context" sector there are similar answers related to the increase in the use of learning technologies, although the reasons differ.

From the interview given to the managers of the four universities it emerges that there has been an increase in the use of these technologies in each of the universities in question. The motivation can be attributed to the policies of institutional actors in the University of Naples Federico II, but also to the tendency to use different technological methods to avoid attending university.

There is a total divergence in the answers given on the question of improving or worsening learning through the use of e-learning. At Federico II University, learning does not depend on the use of technology, but on the way in which students use e-learning. At the University of Bologna, on the contrary, it would seem that technology would improve students' learning. As deduced by the University of Belfast the use of technology could negatively influence learning, because it would imprison the user to the rules dictated by it and, finally, for the University of Dresden there is no statistical data to make difference with the traditional teaching methods.

The overall analysis makes it possible to affirm that, although the four universities adopt some of the strategies in common, they differ, as demonstrated by the analyzes relating to the "organizational aspect" and that connected to the "users". It should be noted that contextual issues have not been taken into consideration, as these are answers related to subjective issues.

It can also be stated that the empirical survey carried out to fill the gap established in the literature on course design (teaching activities) through e-learning in universities, highlighted the following problem.

It is clear, in fact, a certain attention on the part of the managers to situations linked to the phase relating to the composition of the "team" in the design of e-learning. Each university defines the professional figures that will be part of this specific team. All this means, therefore, that according to this analysis, there is a certain focus of the subjects questioned more on the activity linked to the construction of the course and therefore to the professional figures connected to them and not to the entire e-learning path as outlined by Trentin (2001).

5 Conclusions

This article explored issues related to learning methods adopted by European universities through the use of technologies.

According to Fee (2009), we can distinguish three components in the study of e-learning: technology, content and learning design.

The aim of the research was, in particular, to empirically verify how some selected European universities apply the planning of educational activities through e-learning.

Attention to the aforementioned topic arose from the discovery of a gap in managerial literature on the design of e-learning within universities. It has been discovered that there is not much research done in this area.

The survey was conducted using a mixed approach, characterized by the explanatory design in which the quantitative data were identified, identifying the universities that were the object of exploration and then the qualitative ones, through the construction of multiple case studies and semi-structured interviews. A pilot case was also used to better answer the questions to be included in the interview.

From the examination of the answers obtained from the qualitative interviews, we can deduce the attention of the four universities studied to the dynamics related to the design of e-learning courses, even if focused on the professionalism that operates and not on the entire e-learning design process. There is no specific attention by the four universities to the e-learning process (Fee, 2009; Trentin, 2001; Islam et al., 2015).

The universities interviewed concentrate their answers on the professionals who work in design, e.g. to the manager of the course at the University of Naples Federico II and Educational designer and Graphic designer, at Queen's University in Belfast.

In conclusion, it should be emphasized that, based on current data relating to the design of e-learning courses, there seems to be a certain affinity between the four experiences.

We are aware that the search is currently not complete, but that there are some limitations.

The first criticism is linked to the difficulty of having a complete view of the examined phenomenon and refers exclusively to the design of e-learning. The intention is therefore to ask new questions and make further inquiries, to have more certainties and to investigate more accurately.

The second limit refers to the number of respondents and universities contacted.

The future objective will be to intensify these activities by involving other actors (teaching staff, governance) and new universities.

References

- Adeola, O. S., Adewale, O. S., and Alese, B. K. (2013), "Integrated E-learning system (IES) for the Nigeria universities: an architectural overview", *American Journal of Database Theory and Application*, Vol. 2, No. 1, pp.1-8.
- Ahmed, F. F. (2015) "Comparative Analysis for Cloud Based e-learning", *Procedia Computer Science*, Vol. 65, pp. 368-376.
- Al-Adwan, A., Al-Adwan, A., and Smedley, J. (2013), "Exploring students acceptance of e-learning using Technology Acceptance Model in Jordanian universities", *International Journal of Education and Development using Information and Communication Technology*, Vol. 9 No. 2, pp. 4.
- Alavi M., and Leidner D.E. (2001) "Research Commentary: Technology- Mediated Learning - A Call for Greater Depth and Breadth of Research". *Information Systems Research*, Vol. 12, No. 1, pp. 1-10.

- Almpanis, T. (2015) "Staff Development and Institutional Support for Technology Enhanced Learning in UK Universities", *Electronic Journal of e-Learning*, Vol. 13, No. 5, pp. 366-375.
- Al-Samarraie, H., Selim, H., Teo, T. and Zaqout, F. (2017), "Isolation and distinctiveness in the design of e-learning systems influence user preferences", *Interactive Learning Environments*, Vol. 25 No. 4, pp. 452-466.
- Al-Yahya, M., George, R. and Alfaries, A. (2015) "Ontologies in E-learning: review of the literature", *International Journal of Software Engineering and Its Applications*, Vol. 9 No. 2, pp. 67-84.
- Anderson, T., Liam, R., Garrison, D. R., and Archer, W. (2001). *Assessing teaching presence in a computer conferencing context*. Vol. 5, No. 2.
- ANVUR (2014), "Rapporto sullo stato del sistema universitario e della ricerca 2013", Anvur, Roma.
- Arbaugh, J. B. (2000) "Virtual classroom characteristics and student satisfaction with internet-based MBA courses, *Journal of management education*, Vol. 24, No. 1, pp. 32-54.
- Arbaugh, J. B. (2008). "Does the community of inquiry framework predict outcomes in online MBA courses?". *The International Review of Research in Open and Distributed Learning*, Vol. 9, No. 2.
- Aurelie Bechina Arntzen, A., Worasinchai, L., and Ribière, V. M. (2009) "An insight into knowledge management practices at Bangkok University", *Journal of Knowledge Management*, Vol. 13, No. 2, pp. 127-144.
- Azeiteiro, U. M., Bacelar-Nicolau, P., Caetano F. J. and Caeiro, S. (2015) "Education for sustainable development through e-learning in higher education: experiences from Portugal", *Journal of Cleaner Production*, Vol. 106, pp. 308-319.
- Bennett, S., Agostinho, S. and Lockyer, L. (2015) "Technology tools to support learning design: Implications derived from an investigation of university teachers' design practices", *Computers & Education*, Vol. 81, pp. 211-220.
- Benson, R., and Samarawickrema, G. (2009) "Addressing the context of e-learning: using transactional distance theory to inform design", *Distance Education*, Vol. 30 No. 1, pp. 5-21.
- Bhuasiri, W., Xaymoungkhoun, O., Zo, H., Rho, J. J. and Ciganek, A. P. (2012) "Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty", *Computers & Education*, Vol. 58, No. 2, pp. 843-855.
- Brown, A. R., and Voltz, B. D. (2005) "Elements of effective e-learning design", *The International Review of Research in Open and Distributed Learning*, Vol. 6 No. 1.
- Carril, P. C. M., Sanmamed, M. G. and Sellés, N. H. (2013) "Pedagogical roles and competencies of university teachers practicing in the e-learning environment." *The International Review of Research in Open and Distributed Learning* Vol. 14 No. 3, pp. 462-487.
- Carroll, N. (2013). "E-learning—the McDonaldisation of education." *European Journal of Higher Education* Vol. 3 No. 4, pp. 342-356.
- Chawhan, A. K. (2012) "Knowledge Management and E-learning", *CSI Communications*, Vol. 36, No. 3, pp. 10-11.
- Chen, R. S., and Hsiang, C. H. (2007) "A study on the critical success factors for corporations embarking on knowledge community-based e-learning", *Information Sciences*, Vol. 177, No. 2, pp. 570-586.
- Clark, R. C., and R. E. Mayer (2011), *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*, John Wiley & Sons.
- Cocozza, A. (2006), *Direzione delle risorse umane. Politiche e strumenti per l'organizzazione e la gestione delle relazioni di lavoro*, FrancoAngeli, Milano.

- Conole, G. (2013), *Designing for learning in an open world*, Springer Science & Business Media, London.
- Corbetta, P. (2014), *Metodologia e tecniche della ricerca sociale*. Seconda edizione, Il Mulino, Bologna.
- Creswell, J. W. (2014), *Research design: Qualitative, quantitative, and mixed methods approaches*, Fourth Edition, Sage Publication, London.
- Daft R.L. (2010) *Organizzazione aziendale*. Quarta edizione, Apogeo, Milano.
- Elkaseh, A. M., Wong, K. W., and Fung, C. C. (2016), "Perceived ease of use and perceived usefulness of social media for e-learning in Libyan higher education: a structural equation modeling analysis", *International Journal of Information and Education Technology*, Vol. 6, No. 3, pp. 192-199.
- Esposito, G., and Mantese G. (2003), *E-learning: una guida operativa. Come realizzare e valutare un progetto*, FrancoAngeli, Milano.
- Fee, K. (2009) *Delivering E-Learning: A complete strategy for design application and assessment*, Kogan Page Publishers, London.
- Franceschi, K., Lee, R. M., Zanakis, S. H., and Hinds, D. (2009). "Engaging group e-learning in virtual worlds". *Journal of Management Information Systems*, Vol. 26, No. 1, pp. 73-100.
- Ghiringhelli C., and Quacquarelli B. (2003), "Progettare l'apprendimento dentro e fuori dalla rete", in Nacamulli R. C. D. (Ed.) *La formazione, il cemento e la rete*, Etas, Milano, pp. 139-178.
- Hassanzadeh, A., Kanaani, F. and Elahi, S. (2012), "A model for measuring e-learning systems success in universities", *Expert Systems with Applications*, Vol. 39, No. 12, pp. 10959-10966.
- Haya, P. A., Daems, O., Malzahn, N., Castellanos, J., and Hoppe, H. U. (2015), "Analysing content and patterns of interaction for improving the learning design of networked learning environments", *British Journal of Educational Technology*, Vol. 46, No. 2, pp. 300-316.
- Horton, W. (2011), *E-learning by design*, John Wiley & Sons.
- Hwang, A., and Arbaugh, J. B. (2006). "Virtual and traditional feedback-seeking behaviors: Underlying competitive attitudes and consequent grade performance". *Decision Sciences Journal of Innovative Education*, Vol. 4, No. 1, pp. 1-28.
- Iqbal, M., and Islam, M. (2013) "Assessing the tangible and intangible impacts of the convergence of E-learning and knowledge management", *International Journal of Information Sciences and Techniques*, Vol. 3. No. 4, pp. 33-41.
- Islam, A. N. (2013) "Investigating e-learning system usage outcomes in the university context", *Computers & Education*, Vol. 69, pp. 387-399.
- Islam, N., Beer, M. and Slack, F. (2015) "E-learning challenges faced by academics in higher education", *Journal of Education and Training Studies*, Vol. 3, No. 5, pp. 102-112.
- Jansen, D., and Schuwer R. (2015), *Institutional MOOC strategies in Europe. Status Report Based on a Mapping Survey Conducted in October-December 2014*, EADTU, Heerlen.
- Koutsabasis, P., Stavrakis, M., Spyrou, T., and Darzentas, J. (2011). "Perceived impact of asynchronous e-learning after long-term use: implications for design and development". *Intl. Journal of Human-Computer Interaction*, Vol. 27, No. 2, pp. 191-213.
- Kurilovas, E., Kubilinskiene, S. and Dagiene, V. (2014) "Web 3.0-Based personalisation of learning objects in virtual learning environments", *Computers in Human Behavior*, Vol. 30, pp. 654-662.
- Leidner, D. E., and Jarvenpaa, S. L. (1995) "The use of information technology to enhance management school education: A theoretical view". *MIS quarterly*, Vol. 19, No. 3, pp. 265-291.
- Liebowitz, J. and Frank, M., (2016) *Knowledge management and e-learning*, CRC press.

- Lister, M. (2014). "Trends in the design of e-learning and online learning". *Journal of Online Learning and Teaching*, Vol. 10, No. 4, pp. 671-679.
- Lockyer, L., Heathcote, E. and Dawson S. (2013), "Informing pedagogical action: Aligning learning analytics with learning design", *American Behavioral Scientist*, Vol. 57, No. 10, pp. 1439-1459.
- Martins, L. L., and Kellermanns, F. W. (2004). "A model of business school students' acceptance of a web-based course management system". *Academy of Management Learning & Education*, Vol. 3, No. 1, pp. 7-26.
- Masud, M. (2016), "Collaborative e-learning systems using semantic data interoperability", *Computers in Human Behavior*, Vol. 61, pp. 127-135.
- Masud, M. A. H., and Huang X. (2012), "An e-learning system architecture based on cloud computing", *System*, Vol. 10, No. 11.
- Oproiu, G. C. (2015), "A study about using e-learning platform (Moodle) in university teaching process", *Procedia-Social and Behavioral Sciences*, Vol. 180, pp. 426-432.
- Parkes, M., Reading, C. and Stein, S. (2013), "The competencies required for effective performance in a university e-learning environment", *Australasian Journal of Educational Technology*, Vol. 29, No. 6.
- Parkes, M., Stein, S. and Reading C. (2015), "Student preparedness for university e-learning environments." *The Internet and Higher Education*, Vol. 25, pp. 1-10.
- Piccoli, G., Ahmad, R., and Ives, B. (2001). "Web-based virtual learning environments: A research framework and a preliminary assessment of effectiveness in basic IT skills training". *MIS Quarterly*, Vol. 25, No. 4, pp. 401-426.
- Riahi, G. (2015), "E-learning systems based on cloud computing: A review", *Procedia Computer Science*, Vol. 62, pp. 352-359.
- Rienties, B., and Toetenel, L. (2016), "The impact of learning design on student behaviour, satisfaction and performance: A cross-institutional comparison across 151 modules", *Computers in Human Behavior*, Vol. 60, pp. 333-341.
- Rienties, B., Toetenel, L. and Bryan A. (2015), "Scaling up learning design: impact of learning design activities on LMS behavior and performance" in *Proceedings of the Fifth International Conference on Learning Analytics And Knowledge, LAK '15, ACM*, pp. 315-319.
- Roberts J. (2006), *L'impresa Moderna*, Il Mulino, Bologna.
- Rodríguez-Triana, M. J., Martínez-Monés, A., Asensio-Pérez, J. I. and Dimitriadis, Y. (2015), "Scripting and monitoring meet each other: Aligning learning analytics and learning design to support teachers in orchestrating CSCL situations", *British Journal of Educational Technology*, Vol. 46, No. 2, pp. 330-343.
- Ruggles, R. (2009) *Knowledge management tools*, Routledge.
- Schoop E., Köhler T., Börner C., and Schulz J. (2016), "Consolidating eLearning in a Higher Education Institution: An Organisational Issue integrating Didactics, Technology, and People by the Means of an eLearning Strategy" in Spender J. C., Schiuma G., and Noenning J. R. (Ed.) *Towards a New Architecture of knowledge: Big Data, Culture and Creativity. Proceedings, IFKAD*, pp. 1545-1557.
- Shamizanjani, M., Naeini, S. M., and Nouri, M. (2014) "Knowledge management mechanisms in E-Learning environment: A conceptual mode", *Knowledge Management & E-Learning: An International Journal (KM&EL)*, Vol. 5, No. 4, pp. 468-491.
- Simkova, M., Tomaskova, H. and Nemcova Z. (2012), "Mobile education in tools", *Procedia-Social and Behavioral Sciences*, Vol. 47, pp. 10-13.
- Sinclair, J., Boyatt, R., Rocks, C. and Joy, M. (2015), "Massive open online courses: a review of usage and evaluation", *International Journal of Learning Technology* Vol. 10, No. 1, pp. 71-93.

- Songkram, N. (2015), "E-learning System in Virtual Learning Environment to Develop Creative Thinking for Learners in Higher Education", *Procedia-Social and Behavioral Sciences*, Vol. 174, pp. 674-679.
- Teräs, H., Herrington, J. (2014), "Neither the frying pan nor the fire: In search of a balanced authentic e-learning design through an educational design research process", *The international review of research in open and distributed learning*, Vol. 15, No. 2.
- Testoni, L. (2014), "MOOCs e biblioteche accademiche: tra possibilità di "esserci" e criticità", *JLIS. It*, Vol. 5, No. 1, pp. 241-263.
- Treccani Dictionary (2015), "Vocabolario della lingua italiana on line", available at: <http://www.treccani.it/vocabolario/> (accessed 07 June 2016).
- Trentin, G. (2001) *Dalla formazione a distanza all'apprendimento in rete*, FrancoAngeli, Milano.
- Urh, M., Vukovic, G. and Jereb, E. (2015), "The model for introduction of gamification into e-learning in higher education", *Procedia-Social and Behavioral Sciences*, Vol. 197, pp. 388-397.
- Venkatesh, V., and Davis, F. D. (2000) "A theoretical extension of the technology acceptance model: Four longitudinal field studies" *Management science*, Vol. 46, No. 2, pp. 186-204.
- Wild, R. H., Griggs, K. A., and Downing, T. (2002). A framework for e-learning as a tool for knowledge management, *Industrial Management & Data Systems*, Vol. 102, No. 7, pp. 371-380.
- Yin R. K. (2014), *Case study research: Design and methods*, Fifth edition, Sage publications, London.

Entrepreneurial Activities and Models of Advanced European Science and Technology Universities

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Abstract

This paper explores the entrepreneurial activities and models of Science & Technology universities. Employing a mixed-method design with a questionnaire and semi-structured interviews we find three main entrepreneurial models based on different configuration of activities and different organizational and regional characteristics: (1) an “engage” model, which focuses on local economic development (2) a “formal” model, which focuses on the financial advantage of universities and their faculties and (3) a “comprehensive” model, which focuses on the local economic development and the financial advantage of universities and their faculties. This paper extends previous literature by encompassing the conventional distinction between formal and informal entrepreneurial activities. It also contributes to the emerging literature on entrepreneurial university models and the strategic approaches by identifying the different models of entrepreneurial universities in the European setting of S&T universities focusing on the role played by organizational and ecosystem factors in affecting the adoption of a specific model by universities.

Keywords – entrepreneurial university, entrepreneurial activities, entrepreneurial university models

Paper type – Academic Research Paper

1 Introduction

In the last 40 years, universities are increasingly using the knowledge from research and teaching to fulfil their so-called "Third Mission" in society and economy. Through knowledge generation and technology transfer activities, universities are indeed considered the engine of social, cultural and economic development (Etzkowitz et al., 2000). In this respect, the concept of entrepreneurial universities has recently been conceived (Etzkowitz et al., 2000) with reference to any entrepreneurial activity performed by universities *“with the objective of improving regional or national economic performance as well as the university’s financial advantage and that of its faculty (pp 313)’*. According to such a definition, universities perform a broad range of entrepreneurial activities, including patenting, licensing, research collaboration, consulting, networking, entrepreneurship education and support for the creation and growth of new ventures (either spin-offs or start-ups). Although several previous works have mapped the different entrepreneurial activities performed by universities (e.g. Philpott et al., 2011), the scope of these works was mainly limited to the distinction between formal and informal activities (e.g. Abreu and Grinevich, 2013). Moreover, although several studies have acknowledged entrepreneurial universities as a global phenomenon, only a few of them investigated the different entrepreneurial models that universities may adopt (e.g. Giuri et al., 2018; Baglieri et al., 2018). In fact, most of them considered, either explicitly (Etzkowitz et al., 2000) or implicitly, that universities undertake the same entrepreneurial activities to the same extent, and thus refer to a single model of entrepreneurial universities, ignoring the fact that universities could adopt different strategic approaches to the entrepreneurial paradigm. In this respect, there is a lack of studies aimed at identifying the interplay between the organisational and territorial factors that may induce a university to embrace a specific model.

In order to fill these gaps, this article aims at identifying: (1) a broader set of entrepreneurial activities; (2) different university entrepreneurial models analysing the role of organizational and ecosystem factors.

2 Theoretical background

2.1 Entrepreneurial activities

To embark on their new ‘mission’ of economic and social development, universities employed a range of entrepreneurial activities. They are involved in research and technology commercialization, incubation programs, more recently they also invest heavily in entrepreneurship education programmes (O’Connor, 2013) and provide funds for the technology development process (Markman et al., 2008), along with traditional research collaboration, networking, consulting and face-to-face communication with industry and society (Geuna and Muscio, 2009). Scholars have tried to categorize these activities by distinguishing between *“formal”* and *“informal”* activities. On the one side of the spectrum, scholars include patenting, licensing and spin-offs in the formal

entrepreneurial activities, which are also identified as *Research Commercialisation* (Perkmann et al., 2013); on the other side, training, networking, contract research, consulting and face-to-face communication in informal entrepreneurial activities have been identified as *Academic Engagement* (Perkmann et al., 2013).

2.2 Entrepreneurial universities models

Literature has provided a limited picture about the existence of different university entrepreneurial models with some notable exceptions (Giuri et al., 2018; Baglieri et al., 2018; Cesaroni and Piccaluga, 2016). Literature has acknowledged the importance of having a strategic orientation towards technology transfer and entrepreneurship in driving resource allocation decisions and setting priorities (Siegel et al. 2007; Giuri et al. 2018; Bozeman et al. 2015; Battaglia et al. 2017), and strategic positioning in the environment (Giuri et al. 2018), but it still lacks an analysis of the different strategic approaches reflected by different university entrepreneurial models.

This emerging literature has focused on the relationships and complementarities between research and technology transfer by looking at formal entrepreneurial activities and strategic university objectives (Cesaroni and Piccaluga, 2016; Baglieri et al., 2018; Giuri et al., 2018). These studies share the common view that entrepreneurial universities may be considered as a system of several entrepreneurial activities that the universities may perform differently. However, none of the existing studies has focused on a broad and empirically-based set of entrepreneurial activities or tried to identify the different models of entrepreneurial universities by adopting a combined ecosystem and organisational perspective.

3 Research methodology

The research methodology of this paper follows a mixed-method approach. This research benefits from the work of the CESAER¹ task force on innovation, which was formed to study the role of universities in innovation ecosystems. Specifically, we have adopted a sequential explanatory design composed of two sequential steps: a quantitative approach (based on a questionnaire) followed by a qualitative one (based on multiple case studies). We have also used information from the ETER² and RIS³ datasets to check for differences in organizational and regional factors. This research design enables the quantitative findings, related to entrepreneurial activities and models, to be further validated.

¹ <https://www.cesaer.org>

² <https://www.eter-project.com/>

³ Regional Innovation Scoreboard

3.1 Data and sample

The data collection is based on a quantitative and a qualitative survey. The former investigates through a questionnaire the role of universities in innovation ecosystems, their activities, the degree of collaboration with other ecosystem actors, the existence of different funding mechanisms to foster entrepreneurial innovation and the main activities of TTOs. In this paper, we focus on the first section of the questionnaire which investigate the entrepreneurial activities performed by member universities. The questions used a four-point Likert scale. Universities were also asked to furnish the number of spin-offs, and the number of commercialized or pending patents for the year 2015.

The latter, though semi-structured interviews and written case study, corroborate the quantitative results, with the aim of investigating the strategy adopted by each university to foster entrepreneurship and innovation.

Overall, out of the 50 questionnaires that were sent, we received 20 answers, thus achieving a response rate of 40%. These sampled universities cover a population of approximately 502.000 students in S&T fields from 14 different European countries. Of these 20 universities, 6 agreed to participate in semi-structured interviews and written case studies. The descriptive statistics of the sampled S&T universities are reported in table 1.

Table 1. Sample and population statistics. Source: ETER (2014)

	<i>Students enrolled at ISCED 5 – 7 level</i>		<i>PhD Students (ISCED 8 level)</i>		<i>Academic Staff (FTE)</i>	
	<i>Sample</i>	<i>European S&T universities</i>	<i>Sample</i>	<i>European S&T universities</i>	<i>Sample</i>	<i>European S&T universities</i>
Mean	25.133,9	21.865,0	1.912,6	2.171,3	2.645,0	1.984,0
Median	22.720	18.728	1.796	2.189	2.171	1.283
Standard Deviation	9.573,9	15.848,2	1.046,0	814,8	1.731,4	1.186,8
Min	10.444	2.739	228	41	881	212
Max	46.076	158.076	4.440	4.461	7.084	7.084
Observations	20	367	20	367	367	20

3.2 Data analysis

The data analysis consisted of three stages. In the first stage, we used an exploratory factor analysis to group the different university entrepreneurial activities into macro-dimensions. In the second stage, in order to position each university along the spectrum of activities and to elaborate a taxonomy of the different models that universities adopt to foster innovation in their ecosystems, we employed a two-step cluster analysis: hierarchical clustering and k means. We performed a descriptive analysis to define and analyse each cluster using: organizational indicators retrieved from the ETER database (i.e. the involved academic staff out of the total number of staff; students enrolled on the

total number of academic staff and core budget); technology transfer indicators (i.e. spin-offs, patent applications and commercialised patents); ecosystem indicators retrieved from EuroStat and the Regional Innovation Scoreboard for 2017 (i.e. employment in the public and private sectors; R&D expenditure of the public and private sectors; co-publications of public and private and product/process innovations; lifelong education and population with tertiary education). The third stage comprised the confirmation of the quantitative results of the prior stages through a qualitative approach: the entrepreneurial activities and models, as well as the identification of the best practices for each cluster, were corroborated by means of semi-structured interviews with the rectors, vice-rectors and heads of TTO.

4 Results

4.1 A framework for classifying university entrepreneurial activities

The factor analysis revealed the presence of five factors. On the basis of a literature review on university technology transfer and entrepreneurial universities, and further confirmation through a qualitative approach, we denoted the five factors as follows: research commercialization, entrepreneurship education for students; the creation of an entrepreneurial climate; support for technology development, venture creation and growth; academic engagement (Table 2). After the first iteration, we noted that the first two factors (i.e. research commercialization, entrepreneurship education for students) presented high cross-loadings with the other factors. This implies that these variables represent factors *per se*, and they were therefore removed from the factor analysis, but reintroduced in the conceptual framework. The remaining ten items in the factor analysis explained 73% of the variation (Table 2).

Table 2. Rotated factor loadings. Method: Principal component analysis. Rotation: Varimax with Kaiser normalization

		Factor loadings			Cronbach's alpha	Reference
	Item	Factor 1	Factor 2	Factor 3		
Research commercialisation	Technology Transfer Office (TTO) activities (IPR, licensing, etc.)	n.a.	n.a.	n.a.	n.a.	Siegel and Wright (2015); Geuna and Muscio (2009); Perkmann et al. (2013)
Entrepreneurship education for students	Entrepreneurship education for students	n.a.	n.a.	n.a.	n.a.	Kuratko (2005); Rauch and Hulsink (2015)
Support for technology development, new venture creation and growth	Incubator programmes	,879			0,760	Siegel and Wright (2015); Amezcua et al. (2013)
	Business plan competitions	,843	,245			

	Mentoring programmes for entrepreneurs	,711		,314	
	Life-long education for graduate students and/or researchers and/or industry members		,821		
Academic Engagement	International networking with universities	,795	-,222	0,749	Gunasekara (2006); Uyarra, (2010); Perkmann et al. (2013)
	International networking with companies	,887	,236		
	Entrepreneurship education for the faculty	,214		,779	
Creation of an entrepreneurial climate	Training staff in the commercialisation of technologies	-,285		,833	Philpott et al. (2011); Friedman and Silberman, (2003)
	Assistance in finding investors	,386	,369	,648	

4.1.1 Research commercialization

Research commercialization has been also identified with *academic entrepreneurship* (Siegel and Wright, 2015), referring to either the founding a firm by faculty members with the objective to commercially exploit a patented or non-patented invention (Perkmann et al., 2013), or the licensing a patented or otherwise protected invention in return of royalties (Jensen and Thursby, 2001). Commercialization is regarded as a first measurable and tangible impact of UTT (Markman et al., 2008; Philpott et al., 2011). These activities are institutionalized (Geuna and Muscio, 2009) into a specific knowledge intermediary organization, the Technology Transfer Offices (TTOs), created to support researchers to consider commercializing their research results and to provide assistance along the process.

4.1.2 Entrepreneurship education

Entrepreneurship education has become an important activity for university managers, professors and researchers (Kuratko, 2005) because of the positive benefits associated of having students with entrepreneurial attitude, skills and intention which could foster entrepreneurship and innovation, and therefore, stimulate economic growth (Rauch and Hulsink, 2015). Several studies (e.g. Bae et al., 2014; Fayolle and Gailly, 2015; Nabi et al. 2017) have shown that entrepreneurship education can have an impact the entrepreneurial intention of academics and students. As a result, the number of entrepreneurship courses is increasing (Kuratko, 2005) as is the creation of entrepreneurship centres where these courses are offered (Siegel and Wright, 2015).

4.1.3 Creation of an entrepreneurial climate

An internally oriented entrepreneurial activity is the creation of an entrepreneurial climate within a university. Borrowing from the organizational climate construct defined in the context of innovation implementation (Klein and Sorra, 1996), we defined entrepreneurial climate as the extent to which entrepreneurship is rewarded, promoted and supported, and we included all the activities that foster such an entrepreneurial climate, including entrepreneurship training to the faculty, training staff (academics and non-academics) in the commercialisation of new technologies and assisting researchers in finding investors. The creation of an entrepreneurial climate is particularly important for universities to achieve the third mission. Philpott et al. (2011) argued that: “For universities embarking on the journey towards the entrepreneurial university ideal, they must first undertake education and training of their academic community”. The authors acknowledged that without such entrepreneurial training, a university risks having a “schizophrenic entrepreneurial divide within their institution”.

4.1.4 Support for technology development, venture creation and growth

Research commercialisation can be considered an old and consolidated form of academic entrepreneurship, which focuses solely on gaining direct financial returns while supporting a faculty along the process (Siegel and Wright, 2015; Corbett et al., 2014; Grimaldi et al., 2011). A new perspective on academic entrepreneurship that reflects wider social and economic benefits for a university ecosystem is materialising, with the support for technology development, venture creation and growth addressed to alumni, students and young researchers. The overall aim is to create an ecosystem that supports science-based entrepreneurship and innovation throughout the university (Fini et al., 2018; Corbet et al., 2014). The university ecosystem support includes a diversified range of activities: (1) incubators/accelerators, either as programmes or institutions (2) entrepreneurship courses (3) the provision of spaces where students, faculty members and external firms can connect and organise student business plan competitions (4) commercialisation funds for alumni and students (Siegel and Wright, 2015) to increase the level of technology development with a variety of programmes e.g. proof of concept, university seed findings, innovation grants etc. (Bradley et al., 2013; Hayter and Link, 2015).

4.1.5 Academic Engagement

Research commercialisation reflects a generative role of universities that is based on knowledge capitalisation and other capital formation projects (Gunasekara, 2006; Uyarra, 2010). In the last 30 years, universities have complemented this approach with a developmental role of innovation ecosystems, based on the concept of “engaged institutions” (Gunasekara, 2006; Uyarra, 2010). In this conceptualization, universities, through their resources, skills and knowledge - which determine a capacity to attract talent, innovative companies, university and other actors - play a significant role in regional and international networking and institutional capacity building (Gunasekara,

2006). As such, universities act as innovation ecosystem integrators by bringing together different actors (e.g. firms, governments, RTOs, banks, investment funds) and by indirectly governing the relationships between these actors. Universities become “regional animators” (Gunasekara, 2006; Uyarra, 2010) as they build regional and international networks while coordinating the activities of several actors in a synergic way and providing leadership and vision (Colombelli et al. 2017; Rissola et al., 2017).

Engaged universities perform different activities: collaborative and contract research, networking, consulting, training and other forms of knowledge exchange (Perkmann et al., 2013).

4.2 Entrepreneurial university models

The two-step clustering procedure revealed three clusters (Table 3). Through an ANOVA test we found statistically relevant differences between them. In order to characterise the clusters, we provided information on organisational technology transfer and regional indicators (Tables 4,5,6 and 7).

Table 3. Results of the two-step cluster analysis

	CLUSTER 1 n=6	CLUSTER 2 n=10	CLUSTER 3 n=4	ANOVA (F test)
Research commercialisation				
Mean	3,33	4,00	3,75	F = 6,80*
Standard deviation	0,52	0	0,52	
Entrepreneurship education for students				
Mean	2,50	3,70	3,75	F= 12,10**
Standard deviation	0,55	0,48	0,50	
Support for technology development, venture creation and growth				
Mean	2,15	3,00	3,95	F= 5,02*
Standard deviation	1,04	0,94	0,10	
Academic engagement				
Mean	2,54	2,91	4,00	F= 13,32**
Standard deviation	0,23	0,58	0	
Entrepreneurial climate				
Mean	1,80	3,32	2,56	F = 8,57**
Standard deviation	0,55	0,43	1,37	

Table 4. Organisational indicators for universities. Mean values. Source: ETER (2014)

	Staff	Academic staff	Academic staff/ Overall Staff	Enrolled students	Enrolled students / Academic staff	Core Budget (M €)
Cluster 1	4.502	2.615	0,53	24.940	15,42	157,9 €
Cluster 2	7.007	4.213	0,60	32.744	9,29	324,4 €
Cluster 3	4.221	2.012	0,49	22.893	12,83	275,0 €

Table 5. Technology transfer indicators. Mean values. Source: self-reported data (2015)

	Patent applications	Commercialised patents	Spin-offs
Cluster 1	44,8	5,5	6,7
Cluster 2	47,0	14,7	20,8
Cluster 3	29,5	10,7	14,0

Table 6. Ecosystem indicators. Standardised values with respect to the best performing European region, which equates to 1. Mean values. Source: Regional Innovation Scoreboard (2017)

	<i>Population with tertiary education</i>	<i>Lifelong learning</i>	<i>R&D expenditure - public sector</i>	<i>R&D expenditure - private sector</i>	<i>Non-R&D innovation expenditure</i>	<i>Product or process innovation</i>
<i>Cluster 1</i>	0,461	0,319	0,484	0,386	0,384	0,489
<i>Cluster 2</i>	0,631	0,570	0,695	0,540	0,310	0,611
<i>Cluster 3</i>	0,812	0,579	0,653	0,453	0,379	0,591

Table 7. Population, GDP pro capita and share of employment at the NUTS 2 level. Mean values. Source: Eurostat (2016)

	<i>NUTS2 Population</i>	<i>GDP pro capita</i>	<i>Agriculture, forestry and fishing</i>	<i>Industry and Construction</i>	<i>Wholesale and retail trade, transport, accommodation and food service activities</i>	<i>Public administration, defence, education, human health and social work activities</i>
<i>Cluster 1</i>	3.106.559,00	16.766,51 €	3,8%	41,0%	27,7%	27,5%
<i>Cluster 2</i>	2.941.261,50	42.697,88 €	2,5%	25,1%	32,7%	39,7%
<i>Cluster 3</i>	2.478.900,00	48.332,51 €	5,1%	24,8%	33,2%	36,9%

4.2.1 Cluster 1: the engaged entrepreneurial model

The first cluster contains six universities (30% of the sampled universities). Compared with the universities belonging to the other clusters, these universities perform all the entrepreneurial activities to a lesser extent. Among these activities, they give more importance to research commercialisation (3,33), academic engagement (2,54) and entrepreneurship education for students (2,50). However, despite a similar number of patent applications (44,8), this cluster is less effective in commercializing patents (5,5), as well as in spin-off creation (6,7). The organisational indicators reveal that this cluster has the highest number of students per academic (15,42) and a lower budget (157,9 M€). The analysis of some ecosystem indicators revealed the peripheral role that such universities play in these ecosystems, as demonstrated by the considerable share of employment in industry and construction (41,0 %) and the small number of people with tertiary education (0,461). The relatively high value of non-R&D innovation expenditures (0,384) revealed

that the firms in these ecosystems focus on incremental product or process innovation. In this respect, the role of universities seems to be secondary, with respect to the industries that are leaders in these ecosystems. Universities tend to support firms in solving specific technical problems and transferring mainly tacit knowledge. A case in point in this cluster is University A, which applies three major approaches to transform *knowledge generated into useful solutions for companies*: protection and commercialisation of research results in collaboration with companies (e.g. patent co-ownership), development of joint research projects with medium-large sized firms, and the creation of spin-offs within the university's ecosystem. Engagement through lifelong education is of great importance for these universities. University B, for example, collaborates with local industrial associations to offer master courses for managers, employees and graduate students. This master course is an example of work-study alternation and it is aimed at developing both technical and managerial skills.

In consideration of these factors, we called this cluster: *“engaged entrepreneurial model with focus on local economic development”*

4.2.2 Cluster 2: the formal entrepreneurial model

The second cluster is the largest and it contains ten universities (50% of the sampled universities). These institutions on average perform all the entrepreneurial activities. With respect to cluster 3, this group is more committed to commercialising research results (4,00) and to creating an entrepreneurial climate (3,32). This cluster is the one with the lowest students / academic ratio (9,29) and the highest core budget (324,4 M€). As far as research commercialisation concerned, this group of institutions is the best performing, with an average of 47 patent applications, 14,7 commercialized patents and 20,8 spin-offs. The great value of R&D expenditure of the public sector (0,695), lifelong learning (0,570), population with tertiary education (0,631) and the highest share of employment in the public sector (39,7%) has revealed the prominent role of universities in these ecosystems. The universities in this cluster build an entrepreneurial climate that stimulates bottom-up student initiatives (e.g. student-led entrepreneurial organisations, entrepreneurial projects run by students etc.) which are complemented with top-down management. An example is the initiative of University C through which entrepreneurial individuals (students, professors, researchers etc.) undertake entrepreneurial initiatives that support a university-wide innovative and entrepreneurial climate. In order to leverage on and manage such initiatives, the university has established a TTO core team that is actively engaged with these entrepreneurial individuals, thereby creating a university-wide entrepreneurial community and to ensure a synergic effect of the different entrepreneurial bottom-up initiatives. The effectiveness of research commercialisation resides in incentives for researchers (including non-monetary ones) and for TTO employees as well as in TTO budgetary and HR autonomy.

In consideration of these factors, we identified this cluster as *“formal entrepreneurial model based on the systemic exploitation of research results”*

4.2.3 Cluster 3: the comprehensive entrepreneurial model

The third cluster comprises four universities (20% of the sampled universities). These universities perform all the aforementioned entrepreneurial activities: academic engagement (4,00) supporting activities (3,95), research commercialisation (3,75) and entrepreneurship education for students (3,75). The entrepreneurial climate is more limited (2,56), but with a large variability within the cluster (standard deviation of 1,37). With respect to the organisational and technology transfer indicators, this cluster falls between clusters 1 and 3, while the ecosystem indicators are similar to the second cluster.

Research commercialisation is performed by means of the identification and capturing of innovation opportunities at an early stage. This is done, for example, at University D, through in situ short interviews not only with academic staff but also with MSc students. In doing so, the university TTO explores and maps the university innovation ecosystem and is very effective in signalling research collaboration opportunities with external actors. The university TTO then supports researchers in explaining their research through infographics, props, animations, prototypes and interactive objects. Finally, the selected ideas are exposed at a research exhibition, which is an annual event with external companies. The universities in this cluster have a holistic approach to entrepreneurial supporting activities. For instance, University D supports entrepreneurial individuals along the different stages of entrepreneurial journeys with different supporting tools. Through the incubator, the university offers different programmes that combine entrepreneurship education, support for early-stage start-ups to identify their market/product combinations in a pre-acceleration programme and support for late stage start-ups to help them accelerate. In this cluster, the universities adopt a student-based support system. The students with some entrepreneurial experience at university E coach other students that have new ideas. In addition to research commercialisation, supporting activities and entrepreneurship education, these institutions also engage with the ecosystems to create open innovation ecosystems where external parties can collaborate with researchers and benefit from their skills, knowledge and unique research facilities. These universities, in close collaboration with firms and governments, focus on fundamental and pre-competitive research areas with a high innovation potential. A case in point is University F. Its innovation strategy is closely linked to the research strategy, and in particular in those areas which show a high innovation potential. To achieve this, long-term innovation partnerships are undertaken and translational organisations, upon which new partnership can be build, are attracted. In doing so, the university creates and orchestrates the innovation ecosystem by providing leadership and vision for the future. Similarly, University E is committed to improving and expanding cooperation with the business community at an international, European and national level. Cooperation with regional knowledge institutions, companies and governmental bodies – by means of regional innovation clusters, for example – plays a significant role. Engagement and collaboration in this cluster is also performed with SMEs, which require special support, in consideration of their limited resources.

Given these factors, we identified this cluster as “*comprehensive entrepreneurial model with focus on local economic development and the university’s financial advantage*”

5 Discussion and conclusions

The findings of this paper contribute to university technology transfer and entrepreneurial university literature with respect to two main research streams.

First, we contribute to the literature that acknowledges different entrepreneurial activities. Our main contribution concerns the extension of the conventional distinction between formal and informal entrepreneurial activities (e.g. Perkmann et al., 2013; Philpott et al., 2011; Bradley et al., 2013b; D’Este and Patel, 2007; Link et al., 2007). We propose a framework that brings them together acknowledging other entrepreneurial activities.

Second, we contribute to the emerging literature on university entrepreneurial models (Baglieri et al., 2018; Giuri et al., 2018; Sánchez-Barrioluengo and Benneworth, 2018; Cesaroni and Piccaluga, 2016) by highlighting three different strategic approaches with different entrepreneurial activity configurations. In line with previous literature, we argue that entrepreneurial universities may not only focus on formal entrepreneurial activities with the objective of gaining financial returns but may also focus on other types of entrepreneurial activities with the objective of providing social and economic returns to the ecosystem (Cesaroni and Piccaluga, 2016). In addition, this study provides interesting insights about the relationship between a university’s organisational characteristics and characteristics of its ecosystem through the adoption of a specific model. In this vein, we contribute to the literature that acknowledges how different factors can influence university strategies (Grimaldi et al., 2011). In particular, organisational resources appear to be relevant in greatly influencing the ability of a university to implement the needed set of entrepreneurial activities in the medium term. In this vein, we acknowledge the importance of system-level factors (i.e. the institutional characteristics of regions) in shaping the university strategy (Grimaldi et al., 2011). We suggest the need for further research aimed at explaining which social, technological/industry, organisational and policy/institutional characteristics lead universities to embrace a specific entrepreneurial model.

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References

- Abreu, M., & Grinevich, V. (2013), "The nature of academic entrepreneurship in the UK: Widening the focus on entrepreneurial activities", *Research Policy*, Vol.42 No. 2, pp. 408-422.
- Alexander, A.T. and Martin, D.P. (2013), "Intermediaries for open innovation: A competence-based comparison of knowledge transfer offices practices", *Technological Forecasting and Social Change*, Vol. 80 No. 1, pp. 38-49.
- Autio, E., Kenney, M., Mustar, P., Siegel, D. and Wright, M. (2014), "Entrepreneurial innovation: The importance of context", *Research Policy*, Vol. 43 No. 7, pp. 1097-1108.
- Bae, T. J., Qian, S., Miao, C., & Fiet, J. O. (2014), "The Relationship between Entrepreneurship Education and Entrepreneurial Intentions: A Meta-Analytic Review", *Entrepreneurship theory and practice*, Vol.38 No. 2, pp. 217-254.
- Baglieri, D., Baldi, F. and Tucci, C.L., (2018), "University technology transfer office business models: One size does not fit all". *Technovation*, (in press).
- Battaglia, D., Landoni, P., & Rizzitelli, F. (2017), "Organizational structures for external growth of university technology transfer offices: an explorative analysis". *Technological Forecasting and Social Change*, 123, pp 45-56.
- Boh, W. F., De-Haan, U., & Strom, R. (2016), "University technology transfer through entrepreneurship: faculty and students in spinoffs". *The Journal of Technology Transfer*, Vol. 41 No. 4, pp. 661-669.
- Bozeman, B. (2000), "Technology transfer and public policy: a review of research and theory", *Research Policy*, Vol. 29 No. 4-5, pp. 627-655.
- Bradley, S.R., Hayter, C.S. and Link, A.N. (2013), "Models and methods of university technology transfer", *Foundations and Trends® in Entrepreneurship*, Vol. 9 No. 6, pp. 571-650.
- Cesaroni, F. and Piccaluga, A. (2016), "The activities of university knowledge transfer offices: towards the third mission in Italy", *The Journal of Technology Transfer*, Vol. 41 No. 4, pp. 753-777.
- Colombelli, A., Paolucci, E. and Ughetto, E., (2017), "Hierarchical and relational governance and the life cycle of entrepreneurial ecosystems". *Small Business Economics*, pp.1-17.
- Colombelli, A., De Marco, A.M., Paolucci, E., Ricci, R., Scellato, G., (2018), "University technology transfer and the evolution of regional specialization: the case of Turin" paper presented at the workshop organized for the Special Issue of *The Journal of Technology Transfer* "University technology transfer, regional specializations, and local dynamics: Exploring the recipes for successful innovation and growth in Italian industry"
- Corbett, A.C., Katz, J.A. and Siegal, D.S. eds., (2014). *Academic entrepreneurship: Creating an entrepreneurial ecosystem*. Emerald Group Publishing.
- D'Este, P., & Patel, P. (2007). "University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry?", *Research policy*, 36(9), 1295-1313.
- Daraio, C., Bonaccorsi, A., Geuna, A., Lepori, B., Bach, L., Bogetoft, P., Cardoso, M.F., Castro-Martinez, E., Crespi, G., De Lucio, I.F. and Fried, H., (2011). "The European university landscape: A micro characterization based on evidence from the Aquameth project". *Research policy*, Vol. 40, No. 1, pp.148-164.Vancouver
- Etzkowitz, H., Webster, A., Gebhardt, C. and Terra, B.R.C. (2000), "The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm", *Research Policy*, Vol. 29 No. 2, pp. 313-330.
- Fayolle, A., & Gailly, B. (2015), "The impact of entrepreneurship education on entrepreneurial attitudes and intention: Hysteresis and persistence". *Journal of Small Business Management*, 53(1), 75-93.

- Fini, R., Rasmussen, E., Siegel, D., & Wiklund, J. (2018), "Rethinking the Commercialization of Public Science: From Entrepreneurial Outcomes to Societal Impacts", *Academy of Management Perspectives*, 32(1), 4-20.
- Friedman, J., & Silberman, J. (2003), "University technology transfer: do incentives, management, and location matter?". *The Journal of Technology Transfer*, Vol. 28 No. 1, pp 17-30.
- Geuna, A. and Muscio, A. (2009), "The Governance of University Knowledge Transfer: A Critical Review of the Literature", *Minerva*, Vol. 47 No. 1, pp. 93–114.
- Giuri, P., Munari, F., Scandura, A., & Toschi, L. (2018), The strategic orientation of universities in knowledge transfer activities, *Technological Forecasting and Social Change*, (in press).
- Grimaldi, R., Kenney, M., Siegel, D. S., & Wright, M. (2011), "30 years after Bayh–Dole: Reassessing academic entrepreneurship", *Research Policy*, 40(8), 1045-1057.
- Grimpe, C. and Hussinger, K. (2008), "Formal and Informal Technology Transfer from Academia to Industry: Complementarity Effects and Innovation Performance", ZEW Discussion Papers.
- Gunasekara, C., (2006). "Reframing the role of universities in the development of regional innovation systems". *The Journal of Technology Transfer*, 31(1), pp.101-113.
- Hayter, C.S. and Link, A.N. (2015), "On the economic impact of university proof of concept centers", *The Journal of Technology Transfer*, Vol. 40 No. 1, pp. 178–183.
- Jensen, R. and Thursby, M. (2001), "Proofs and prototypes for sale: The licensing of university inventions", *American Economic Review*, Vol. 91 No. 1, pp. 240–259.
- Kenney, M. and Patton, D., (2009), "Reconsidering the Bayh-Dole Act and the current university invention ownership model", *Research Policy*, Vol. 38 No. 9, pp.1407-1422.
- Klein, K.J. and Sorra, J.S. (1996), "The challenge of innovation implementation", *Academy of Management Review*, Vol. 21 No. 4, pp. 1055–1080.
- Kuratko, D.F. (2005), "The emergence of entrepreneurship education: Development, trends, and challenges", *Entrepreneurship Theory and Practice*, Vol. 29 No. 5, pp. 577–598.
- Levie, J. (2014), "The university is the classroom: teaching and learning technology commercialization at a technological university", *The Journal of Technology Transfer*, Vol. 39 No. 5, pp 793-808.
- Link, A.N., Siegel, D.S. and Bozeman, B. (2007), "An empirical analysis of the propensity of academics to engage in informal university technology transfer", *Industrial and Corporate Change*, Vol. 16 No. 4, pp. 641–655.
- Markman, G.D., Siegel, D.S. and Wright, M. (2008), "Research and technology commercialization", *Journal of Management Studies*, Vol. 45 No. 8, pp. 1401–1423.
- Nabi, G., Liñán, F., Fayolle, A., Krueger, N., & Walmsley, A. (2017), "The impact of entrepreneurship education in higher education: A systematic review and research agenda", *Academy of Management Learning & Education*, Vol.16 No. 2, pp 277-299.
- O'Connor, A. (2013), "A conceptual framework for entrepreneurship education policy: Meeting government and economic purposes", *Journal of Business Venturing*, Vol. 28 No. 4, pp. 546–563.
- Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., Fini, R., et al. (2013), "Academic engagement and commercialisation: A review of the literature on university–industry relations". *Research Policy*, Vol. 42 No. 2, pp. 423–442.
- Philpott, K., Dooley, L., O'Reilly, C. and Lupton, G. (2011), "The entrepreneurial university: Examining the underlying academic tensions", *Technovation*, Vol. 31 No. 4, pp. 161–170.
- Rauch, A. and Hulsink, W. (2015), "Putting entrepreneurship education where the intention to act lies: An investigation into the impact of entrepreneurship education on entrepreneurial behavior", *Academy of Management Learning & Education*, Vol. 14 No. 2, pp. 187–204.

- Rissola, G., HervÃ, F., Slavcheva, M. and Jonkers, K., (2017). "Place-Based Innovation Ecosystems: Espoo Innovation Garden and Aalto University" (Finland) (No. JRC106122). Joint Research Centre (Seville site).
- Sánchez-Barrioluengo, M., & Benneworth, P. (2018), "Is the entrepreneurial university also regionally engaged? Analysing the influence of university's structural configuration on third mission performance", *Technological Forecasting and Social Change*.
- Siegel, D.S. and Wright, M. (2015), "Academic entrepreneurship: time for a rethink?", *British Journal of Management*, Vol. 26 No. 4, pp. 582–595.
- Uyarra, E., (2010). "Conceptualizing the regional roles of universities, implications and contradictions". *European Planning Studies*, Vol.18 No. 8 pp.1227-1246.

Unpacking Higher Educational Institutions (HEIs) performances through the institutional logics lens

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Abstract

In the current knowledge-based economy, Higher Education Institutions (HEIs) are called to play different interconnected roles related to triple university missions. Alongside the two traditional missions of teaching and research, HEIs have experienced the emergence of the so-called “third mission”, which sees HEIs as knowledge-based agents part of ecosystems of public institutions, companies and citizens oriented to co-knowledge creation. Finding a balance between the traditional missions and the third mission can be a serious challenge. For this reason, HEIs need to revise their objectives, strategies and performance indicator systems to plan, monitor and assess their social, cultural, and economic impact. Actually, there is no shared approach (and related KPIs) to assess in an univocally and standardised manner the performance of HEIs, in order to effectively reflect the whole range of academic missions, by reducing the possible tensions between them created at various organizational levels. Thus, the authors decided to carry out a qualitative inductive study based on the institutional logics perspective to: i) analyse how HEIs performances are measured, ii) to improve university performance measurement systems and iii) to mitigate the tensions within and among the different missions and the logics behind them.

Keywords – Higher Education Institutions (HEIs), third mission, institutional logics, entrepreneurial university, key performance indicators (KPIs).

Paper type – Academic Research Paper

1 Introduction

Higher Education Institutions' (HEIs) role has been deeply evolving as a result of the two academic revolutions that have introduced, respectively, a second and a third mission besides the first one (Geuna & Muscio, 2009). First mission regards teaching activities that imply knowledge preservation and transmission. Second mission includes the research activity and, consequently, knowledge production. Indeed, third mission includes every activity that HEIs are asked to perform besides the teaching and research activities, including technology transfer (Battaglia et al., 2017; Chau et al., 2017) and the exploitation and dissemination of knowledge and other capabilities outside their boundaries (Etzkowitz, 1998). Recent studies have also started to theorize the existence of a fourth mission, which refers to the role of HEIs in contributing to the development of economies and societies, addressing real world issues, and co-developing the sustainability paradigm through multi-stakeholder partnerships (Bienkowska & Klofsten, 2012; Rinaldi et al., 2018; Trencher et al. 2014). In this regard, in modern knowledge-intensive societies and economies HEIs have increasingly started to engage a broader public than just students or the scientific community, being even more involved in complex ecosystems with institutions, industries and third parties (e.g. incubators, accelerators, competence centers, venture capitalists, etc.) (Clauss et al., 2018; Etzkowitz & Leydesdorff, 2000; Leydesdorff & Etzkowitz, 2001; Secundo et al., 2017).

The huge amount of internal and external interactions, the variety of partners involved in value co-creation processes, and the intangible nature of the most relevant resources generated by these processes make HEIs' performance assessment a difficult task (Hewitt-Dundas, 2012; Meissner & Shmatko, 2017; Öner, 2017; Secundo et al., 2017). Since the pursuit of all three missions requires the direct commitment of the academics, at all hierarchical levels, it follows that the three missions can "compete" among themselves. In general, tensions and contradictions between the different missions of the HEI, are mainly due to a structure of incentives that is not yet systematically organized (Secundo et al., 2017). To date, in effect, there is no shared framework of key performance indicators (KPIs) that effectively reflect the whole range of academic missions and the possible tensions that can exist among them at various organizational levels. This paper deals with this problem by adopting a well-defined management theoretical approach, i.e. the institutional logics perspective (Thornton et al., 2012; Wooten & Hoffman, 2008), in order to build a systemic framework. Thanks to an inductive analysis, based on semi-structured interviews and many secondary sources (Bryman & Bell, 2011; Zikmund et al., 2012), this paper identifies nine different institutional logics, which shape HEIs' activities and performances. Compared to the several existent sets of KPIs, the framework proposed by the authors can be intended as a metamodel, namely a high level conceptual representation that enables all the KPIs defined in the sets currently available in the practice to be reclassified and included under a specific category. Thus, our framework provides several insights: first of all, it offers a synoptic view as well as a comparison between different sets of KPIs; second, it identifies the performance areas that are not effectively covered (or overlooked) by the current indicators; third, it highlights the

tensions and the contradictions among either the three missions or within each one of the them; finally, it allows a comparison between generalist and vocational universities, especially with regards to their third mission and entrepreneurial role. The lack of homogeneity individuated in the different institutions (universities and national and international ranking agencies) provides insights on the potential causes and solutions to improve HEIs performance indicator systems and mitigate the tensions within and among the different missions and the logics behind them. The findings of this paper may contribute to the scientific debate and to the procedural practice (both to the policy and the single university institution level) with regard to HEI performance indicators and the organisational issues related to the role of such institutions in the society. To our knowledge, this is the first paper developing a framework of HEI performance indicators through the lens of the institutional logics. Our findings may thus contribute to the literature regarding the institutional theory.

2 Theoretical background

2.1 The three academic missions

Nowadays HEIs are called to play different interconnected roles that respond to three different missions. For a while, the teaching mission was the main activity in many HEIs. Then, institutional pressures (as a consequence of governmental initiatives and reforms) have led HEIs to draw a greater attention to research activities that have become increasingly important for either overall or individual assessments. Moreover, since late 1980s, pursuing just these two missions was considered not enough and the third mission started emerging (Etzkowitz & Leydesdorff, 2000).

The teaching activity is the older reputation key factor (Maassen, 2017). It consists of an education offering which mainly comprises courses at all levels (e.g. bachelor and master courses, postgraduate courses, doctoral courses, etc.). The educational activity should be fostered by the ongoing dialogue with the other economic actors of the territory (Sauder & Espeland, 2009), since a cutting-edge education is required to reflect the needs of the reference context (Barron, 2017; Brankovic, 2017; Marginson, 2007).

The research mission, usually characterised by a cross-disciplinary nature, can be fostered by both research centres and labs (Etzkowitz et al., 2000) and the participation in specific projects (Secundo et al., 2017). Research activities are in many cases related to the needs of the territory of which the universities are part (Trencher et al., 2017). However, the research evaluation, especially in terms of publications (Amsler & Bolsmann, 2012; Brankovic, 2017), is currently measured by its impact on the international community and it represents the key factor for both HEIs' reputation and academic career evaluation.

Finally, the third mission includes the relationships among HEIs and a broad variety of stakeholders at both local and/or national and international level (Etzkowitz & Leydesdorff, 2000; Etzkowitz et al., 2000), pointing out HEIs' role as knowledge-based agents for local value creation. It results in a series of multiple and integrated knowledge-

based activities that range from the traditional knowledge and technology development to innovation ecosystems development, as well as social innovation and community engagement (Geuna & Muscio, 2009; Hsu et al., 2015; Leydesdorff & Etzkowitz, 2001; Lockett & Wright, 2005; Secundo et al., 2017). Some concrete examples of third mission-related activities are: and continuing education and training courses (Marginson & van der Wende, 2007), consulting services (Jacob et al., 2003; Klofsten and Jones-Evans, 2000), patents creation and licensing (Jacob et al., 2003; Klofsten and Jones-Evans, 2000; Mazdeh et al., 2013), sponsored applied research (Clauss et al., 2018), startup creation and spin-offs (Clauss et al., 2018; Jacob et al., 2003), internal and external specific programmes to develop creativity and entrepreneurship mindsets (Clauss et al., 2018; Klofsten and Jones-Evans 2000).

2.2 The role of the institutional and organisational logics in measuring academic missions

The notion of institutional logic has been extensively developed by social sciences. It refers to the set of beliefs, rules, values and practices by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality (Thornton et al., 2012). Oftentimes, organisations are called to deal with different logics shaping their identity. Rules and social expectations that legitimate an organisation behaviour are identified in the management literature as “organisational logics” (Spicer & Sewell, 2010). Organisational logics, thus, may be seen as a way of designing one or more different institutional logics within a specific organisational context (Dunn & Jones, 2010). Hence, according to institutional logics, the organisational context is composed by a range of forces including several (and often conflicting) sets of beliefs, rules, values, and practices that affect human behaviour (van Gestel & Hillebrand, 2011). In the institutional studies literature this field of forces is called organisational field (Wooten & Hoffman, 2008). Therefore, HEIs operate in a particularly complicated organisational field, in which different institutional logics operate, often conflicting each other. Having based this research on such a theoretical approach, that used both the institutional logics and the organisational field, a solid explanation of the variety of KPIs that are currently used for assessing HEIs’ performances could have been provided.

3 Methodology

The survey method adopted in this research is based on an inductive qualitative analysis (Eisenhardt, 1989; Yin, 2013), through which university KPIs could be mapped following the institutional logics perspective. The research was designed in two steps: i) a set of semi-structured interviews has been carried out by authors (Zikmund et al., 2012) and ii) secondary data sources have been analysed (Bryman & Bell, 2011). Then, the two steps have been combined through data triangulation in order to systematically classify KPIs and identify any rise of tensions among the three academic missions and even within each individual mission. In particular, in the first step, 9 in-depth interviews (Brinkmann & Kvale, 2015) have been carried out with the heads of the research activity,

the third mission, and technology transfer office from three important Italian HEIs. These semi-structured interviews have been carried out on the basis of a protocol open to new topics time after time, enabling to identify what organisational and institutional logics underlie the performances evaluation of HEIs in pursuing their three academic missions. Interviews lasted from 45 minutes to an hour and a half and they have all been conducted face-to-face by at least two out of the three authors. In order to ensure naturalness, the interviewees were only made aware of overall research purpose, without revealing specific questions and preventing them from coming up with the answers in advance (Easton, 2010). The interviews have been recorded and transcribed, and then triangulated with secondary data sources (Eisenhardt, 1989), whose analysis represented the second step of the research. Thus, the authors analysed the integrated and/or the performance plan of 4 Italian generalist universities (University of Milano-Bicocca, University of Bologna, University of Turin, Sapienza University of Rome) and 2 Italian vocational universities (Polytechnic University of Turin and Polytechnic University of Milan) to identify what KPIs underpin the assessment of both organisational and individual activities, goals, and objectives. This desk analysis of the practice has been accompanied by the analysis of the indicators employed by some of the main national and international agencies involved in HEIs evaluation and activities monitoring (Italian National Agency for the Evaluation of Universities and Research Institutes, U-Multirank, Quacquarelli Symonds World University ranking, European Indicators and Ranking Methodology for University Third Mission, Times Higher Education World University Rankings, Academic Ranking of World Universities). The indicators found in the integrated and/or performance plans were then compared with those employed by the rating agencies in order to check for matches or inconsistencies with regard to the institutional logics previously individuated. Finally, the authors carried out a coding process with the support of the software Atlas.ti in order to ensure relevance and comparability between theory and data, as well as reproducibility, accuracy, and rigour (Strauss & Corbin, 1990). Every source has been independently encoded by at least two of the authors of this paper. Through “open coding”, in a first stage, the issue under consideration has been discovered, labelled, and categorised. Consequently, the researchers discussed in order to achieve a shared interpretation of the findings. Using “axial coding” (Bryman & Bell, 2011), data have been reorganised with the aim of finding any link among both the categories and the subcategories established. More specifically, the number of codes attributed to the institutional logics was reduced to nine, respectively three for each mission, as further outlined in the next paragraph.

4 Results

The teaching mission is well established in the Italian HEIs. Indeed, for a long time, the career advancement has been based on the teaching ability of academics in many departments. The focal role attributed to the teaching mission has frequently been reflected in drafting handbooks and books as a main publication activity. Nowadays, the commitment in teaching activities by single academics is less incentivised and less

rewarded than in the past, while there is an increasing focus on research and international publications; however, teaching performance is still one of the main criteria for allocating funds to universities and departments. The data analysis has led the authors to identify three main institutional logics, with some overlaps and some conflicts among each other: the logic of inclusiveness, the vocational logic and the logic of excellence.

1- The logic of inclusiveness is focused on providing higher education to as many people as possible, assuming that HEIs should contribute to increase the cultural level of the territory. Some KPIs emerged from the analysis, for instance, are the total number of students, the percentage of incoming visiting students, the number of e-learning or blended learning courses.

2- The vocational logics is based on the idea that HEIs must provide students with the means required for a successful career, creating talented and skilled people for the reference territorial system. Some KPIs emerged from the analysis are, for example, the percentage of graduates with a curricular internship, the percentage of students employed 18 months after graduation in local companies, and the number of degree courses revised according to employment opportunities.

3- The logic of excellence is founded on the assumption that HEIs' mission is to provide students with the means required for a successful career and to contribute to the competitiveness of the territorial system through a meritocracy-based promotion. Some KPIs emerged by the analysis are the student degree of satisfaction, the percentage of outgoing visiting students, and the number of grants for deserving students.

The role of research as a key academic mission has rapidly and significantly evolved in recent years. Indeed, research has been historically seen as a domestic or local matter by a large number of HEIs, while, nowadays there are increasingly pressures toward internalisation and publishing in peer-reviewed journals recognised by the scientific communities even at a supranational level. According to the analysis of the primary and secondary sources, the authors have identified three main institutional logics, with some overlaps and some conflicts among each other: the logic of focalisation, the materiality logic and the logic of excellence.

1- The logic of focalisation is based on the assumption that the scientific research of HEIs must focus mainly on some specific issues, for which university itself wishes to become a reference point. The two KPIs emerged by the analysis are the participation in strategic partnerships with other leader HEIs in the same area and the participation in joint research centres.

2- The materiality logic is founded on the idea that the scientific research of HEIs must contribute to solve problems considered to be relevant beyond the academic contest. Some KPIs emerged by the analysis are, for instance, the percentage of private funding for research and dissemination activities out of the total, the per capita financing of national and international projects, and the percentage of publications cited in international patents.

3- The logic of excellence is focused on the assumption that the scientific research of HEIs should pursue the highest possible level, in terms of impact and recognition by the international academic communities. Some KPIs emerged by the analysis are the

percentage of papers published in highly-rated journals according to re-search evaluation criteria, the percentage of papers with foreign co-authors and the percentage of publications cited by other authors (impact factor).

The third mission tends to include just everything that is not teaching or research. For this reason, the various fields of study may have a very different perception of its content. For instance, the third mission is regarded by the tech departments in terms of patents and spin-offs, while the humanities departments consider it in terms of dissemination; by contrast, medical science thinks in terms of translational medicine, namely translating research findings into protocols and therapy options that ultimately benefit the patient instead of remaining just a publication. The social sciences tend to perceive the third mission mainly in terms of public engagement and cooperation with the civil society. Concerning this dimension of the third mission, recent studies have also started to recognize the existence of a “fourth mission”, which refers to the role of universities in contributing to the development of economies and societies and addressing real world issues, co-developing the sustainability paradigm through multi-stakeholder partnerships (Rinaldi et al., 2018; Trencher, Yarime, McCormick, Doll, & Kraines, 2014b). Despite the difficulty of identifying the third mission, the analysis of the sources has enabled the authors to identify three basic logics: the logic of dissemination, the translational logic and the entrepreneurial logic.

1. The logic of dissemination is founded on the assumption that HEIs must disseminate scientific knowledge and best practices to a broad audience and to the organisations which may benefit from that. Some KPIs emerged by the analysis are, for instance, the number of MOOCS, the number of public engagement initiatives, and the percentage of private funding for dissemination activities.

2. The translational logic is based on the idea that HEIs should contribute to translating the frontier research findings to new widespread solutions that may be then adopted by companies, institutions, and communities at an operational level. Some KPIs emerged by the analysis are the revenues from granted patents, the number of registered patents in the last 10 years, and the percentage of university patents registered.

3. The entrepreneurial logic is founded on the assumption that HEIs must directly contribute to creating new products, services and/or business models. Some KPIs emerged by the analysis are, for example, the total income of incubated companies, the revenues from technology transfer activities, and the number of active spin-offs and start-ups.

The results (tables from 1 to 9), followed by the explanation of the acronyms used (table 10), report show significant differences among the various logics. Starting from the teaching mission, the authors have pointed out a consistent coverage as to both the logic of inclusiveness and the vocational logic, and a broad and significant coverage as to the excellence logic.

With regards to the research mission, the logic of focalisation is almost ignored (only two indicators were found, both individuated only from the analysis of the integrated plans of the two polytechnics); the logic of materiality is only partially covered (missing

sources such as ANVUR and QS) whereas there is a broad and significant coverage as to the excellence logic.

Although the third mission is the more recent mission and it is not easy to measure the impact of HEI initiatives on the society, it seems to be well covered. The authors found a broad and significant coverage as to the dissemination logic, only a partial coverage as to the translational logic, and an almost full coverage as to the entrepreneurial logic (considerable attention from ANVUR and from the vocational universities in this case).

Tab. 1 – Teaching inclusiveness logic KPIs

Teaching inclusiveness logic	National and international evaluation agencies						Generalist universities				Vocational universities	
	ANV	ARWU	E3M	QS	THE	U-M	U.BIC	U.BO	U.SAP	U.TO	P.MI	P.TO
% of degree courses in foreign languages						x	x		x	x		x
% of drop-outs after N+1 years (r)	x			x			x	x	x	x		x
% of incoming visiting students						x	x	x	x	x	x	x
% of limited enrolment courses (r)							x					
% of professors recruited from other universities							x		x			x
% of professors with a PhD degree obtained in other universities												x
% of students attending e-learning or blended learning courses							x			x		
% of students satisfied with the infrastructure				x		x		x	x			x
Amount of tuition fees for national and international students						x						
Grants for deserving students								x				
N° of "star" professors recruited (or who have served for at least 3 years in foreign universities or research institutions)							x					
N° of e-learning or blended learning courses							x			x	x	x
N° of incoming visiting professors					x		x		x	x	x	x
N° of MOOCS												x
N° of outgoing visiting professors									x	x		x
Participation in strategic partnerships with other leader HEIs in the same											x	x

area												
Per capita value of resources allocated in favour of students (based on economic conditions and merit)				x				x	x			
Resources allocated for helping physically and learning disabled students				x					x	x		
Teaching assistant / N° of enrolled students	x						x					
Total number of students	x					x	x	x	x	x	x	x

Tab. 2 – Teaching vocational logic KPIs

Teaching vocational logic	National and international evaluation agencies						Generalist universities				Vocational universities	
	ANV	ARWU	E3M	QS	THE	U-M	U.BIC	U.BO	U.SAP	U.TO	P.MI	P.TO
% of graduated PhD students currently employed												x
% of graduated with a curricular internship						x		x	x	x		
% of students employed (or unemployed) in 1,3, or 5 years	x			x		x	x	x			x	x
% of students employed 18 months after graduation in local companies						x						
N° of companies involved in job placement initiatives	x			x		x		x				
N° of degree courses revised according to employment opportunities							x					x
N° of students accessing to career guidance services								x				
N° of students involved in vocational and permanent training courses								x				x
Participation in strategic partnerships with other leader HEIs in the same area											x	
Qualitative KPI: quality of the service provided				x				x				

Tab. 3 – Teaching excellence logic KPIs

Teaching excellence logic	National and international evaluation agencies						Generalist universities				Vocational universities	
	ANV	ARWU	E3M	QS	THE	U-M	U.BIC	U.BO	U.SAP	U.TO	P.MI	P.TO
% of degree courses in foreign languages						x	x		x	x		x
% of ECTS registered abroad out of total ECTS registered	x						x			x		
% of incoming visiting students					x	x	x	x	x	x	x	x
% of limited enrolment courses (r)							x					
% of master's degree students with a bachelor's degree taken in another University	x						x	x	x	x		x
% of on-time graduates with a minimum n° of ECTS obtained abroad	x						x	x	x			
% of outgoing visiting students						x		x	x	x	x	x
% of professors with a PhD degree obtained in other universities												x
% of students passing the academic year with the minimum n° of ECTS planned in the Course Schedule	x						x	x	x	x		x
% of students who have taken a previous degree abroad	x						x	x				x
Extra-regional mobility	x						x	x	x	x		x
Faculties / N° of students	x			x		x	x					x
Grants for deserving students								x				
N° of double degrees taken through exchange programmes						x	x					
N° of incoming visiting professors					x		x		x	x	x	x
N° of on-time graduates who did not change degree programme	x					x	x	x		x		x
N° of outgoing visiting professors									x	x		x
Per capita months spent in the University by professors from foreign research institutions								x				
Per capita value of resources employed in favour of students based on economic condition and				x				x	x			

merit												
Professors' formative training / N° of professors								x				
Qualitative KPI: teaching quality					x			x			x	x
Teaching assistant / N° of enrolled students	x						x					

Tab. 4 – Research focalisation logic KPIs

Research focalisation logic	National and international evaluation agencies						Generalist universities				Vocational universities	
	ANV	ARWU	E3M	QS	THE	U-M	U.BIC	U.BO	U.SAP	U.TO	P.MI	P.TO
Participation in strategic partnerships with other leader HEIs in the same area											x	x
Participation in joint research centres											x	x

Tab. 5 – Research materiality logic KPIs

Research materiality logic	National and international evaluation agencies						Generalist universities				Vocational universities	
	ANV	ARWU	E3M	QS	THE	U-M	U.BIC	U.BO	U.SAP	U.TO	P.MI	P.TO
% of private funding for research and dissemination activities out of the total						x	x	x				x
% of paper co-authored with non-academics			x			x						x
% of publications cited in international patents						x						x
Incomes from competitively financed researches						x	x	x	x	x	x	x
Per capita financing of national and international projects								x				

Tab. 6 – Research excellence logic KPIs

Research excellence logic	National and international evaluation agencies						Generalist universities				Vocational universities	
	ANV	ARWU	E3M	QS	THE	U-M	U.BIC	U.BO	U.SAP	U.TO	P.MI	P.TO
% of double PhD degrees												
% of foreign PhD students					x				x	x	x	
% of joint PhD programmes												x
% of multidisciplinary PhD programmes											x	
% of new recruits with a research evaluation score above the median and the worst quartile of their research area and role												
% of papers published in highly-rated journals according to research evaluation criteria								x		x	x	x
% of papers with foreign co-authors					x	x				x		
% of PhD students who obtained an admission pass in other Italian universities	x						x	x	x			x
% of professors with a PhD degree obtained in other universities												x
% of publications cited by other authors (impact factor)		x			x							
% of research and doctoral fellowships	x						x					
Average number of publications for new recruits in highly-rated journals according to research evaluation criteria										x		x
Completed research projects / Planned research projects								x			x	
Investment in research infrastructures and equipment								x			x	
N° of published papers / N° of professors									x			
N° of incoming visiting professors					x		x		x	x	x	x
N° of indexed publications (in Web of Science Core Collection, Scopus, institutional databases, etc.)		x		x	x	x	x	x	x	x	x	x

N° of multidisciplinary publications						x						
N° of new recruits in charge of competitive projects / N° of new recruits												
N° of outgoing visiting professors									x	x		x

Tab. 7 – Third mission dissemination logic KPIs

Third mission dissemination logic	National and international evaluation agencies						Generalist universities				Vocational universities	
	ANV	ARWU	E3M	QS	THE	U-M	U.BIC	U.BO	U.SAP	U.TO	P.MI	P.TO
% of completed continuing education programs			x									
% of continuing training activities funded during the year	x						x					
% of private funding for dissemination activities			x			x	x	x				
% of private funding for sponsored research			x			x	x	x				
N° of active continuing education programmes	x		x				x					
N° of agreements and collaborative projects with third parties / Total funds	x			x			x		x		x	x
N° of companies participating in continuing education courses			x				x					
N° of ECTS provided during continuing education programs / Total n° of ECTS provided			x									
N° of MOOCS											x	
N° of partnerships for providing sponsored continuous training programs							x					
N° of public engagement initiatives	x			x			x		x		x	
N° of publications other than teaching and scientific ones						x						
N° of students enrolled in continuing education programs			x									

N° of students involved in vocational and permanent training courses								X				X
Qualitative KPI: implementation of tools for evaluating the sustainability impact			X					X			X	X
Total income from activities other than teaching and research / N° of faculties	X											
Total income from continuing education activities	X					X	X					X

Tab. 8 – Third mission transnational logic KPIs

Third mission transnational logic	National and international evaluation agencies						Generalist universities				Vocational universities	
	ANV	ARWU	E3M	QS	THE	U-M	U.BIC	U.BO	U.SAP	U.TO	P.MI	P.TO
% of university patents registered	X						X				X	X
N° of registered patents / N° of professors	X							X				
N° of registered patents in the last 10 years				X		X	X				X	
Qualitative KPI: initiatives to strengthen support and interface structures								X				
Revenues from granted patents	X						X					

Tab.9 – Third mission entrepreneurial logic KPIs

Third mission entrepreneurial logic	National and international evaluation agencies						Generalist universities				Vocational universities	
	ANV	ARWU	E3M	QS	THE	U-M	U.BIC	U.BO	U.SAP	U.TO	P.MI	P.TO
N° of active spin-offs and start-ups			X	X		X	X	X			X	X
N° of collaborations between university and spinoffs / N° of spin-offs	X						X					X
N° of spin-offs' employees / N° of faculties	X						X					
Qualitative KPI: participation in incubators, science parks, consortia or associations for technology transfer	X		X							X	X	X

Revenues from granted patents												
Revenues from technology transfer activities									x			x
Spin-offs acquired by third parties (even partially) or listed on the stock exchange / N° of spin-offs	x						x					x
Sponsored research incomes / N° of professors	x				x		x	x		x		x
Total income of incubated companies	x										x	
Total income of spin-offs / N° of faculties	x						x					

Tab. 10 – Legend for tables from 1 to 9

ANV	Italian National Agency for the Evaluation of Universities and Research Institutes (ANVUR)
ARWU	Academic Ranking of World Universities by ShanghaiRanking Consultancy
E3M	European Indicators and Ranking Methodology for University Third Mission
QS	Quacquarelli Symonds World University ranking
THE	Times Higher Education World University Rankings
U-M	U-Multirank
U.BIC	University of Milano-Bicocca
U.BO	University of Bologna
U.SAP	Sapienza University of Rome
U.TO	University of Turin
P.MI	Polytechnic University of Milan
P.TO	Polytechnic University of Turin

5 Discussion and conclusions

This paper, based on the institutional logics perspective, classifies, through a framework, the KPIs in the HEI context. The ever changing role of the HEIs is in fact requiring a change also in their management. The emergence of recent logics related to the third mission, such as the entrepreneurial or the translational, has repercussions on the performance assessment system.

The purpose of this framework is not only to provide a valuable tool, firmly grounded in organisational theory, for analysing and comparing KPIs, but also to support HEIs in order to analyse and resolve tensions and contradictions as regards the goals that are specific to each institution. The nine institutional logics identified reflect nine different views of the role that HEIs are supposed to play in society, requiring strategic and organisational efforts required in order to harmonise them. The comparison among

the KPIs already part of the integrated/performance plans of the universities (both generalist and vocational) and the indicators considered by the most influential university ranking agencies provided insights for the development of a proper set of indicators which take into account all the missions of the universities.

According to the results, the teaching mission appears to be covered by a wide number of KPIs. Every logic presents a consistent or broad number of indicators. This is well explained by the fact that the teaching activity is the older reputation key factor (Maassen, 2017). The research mission, instead, shows a good coverage only with respect of the logic of excellence. The logic of focalisation and materiality are only partially covered from part of the two polytechnics. This result is not quite surprising since focalisation and relevance are the two research logics referring to a possible impact on the society, presenting some overlaps with the third mission as well. It would be interesting to analyse if a strong entrepreneurial attitude by universities (that is part of the third mission) also stems from a major focalisation and materiality in research. Concerning the third mission, both the dissemination and the entrepreneurial logics appear to be well covered. This means that universities are even more gaining understanding of the importance of create synergies with a huge variety of stakeholders, pointing out the role of universities as knowledge-based agents for local value creation (Geuna & Muscio, 2009; Hsu et al., 2015; Leydesdorff & Etzkowitz, 2001; Lockett & Wright, 2005; Secundo et al., 2017). Another interesting aspect is that, even if polytechnics are involved in a greater number of technologies transfer activities than generalist universities, they have not yet disclosed a systematic performance indicator system from what can be viewed by their integrated and performance plans.

The limitations of this paper can be all considered as further research opportunities. First, this research is mainly focus on the Italian context and it may be heavily influenced by country-specific characteristics; further research developments should be then focused on a comparative analysis in other Countries with different cultures and beliefs. Second, the role of HEIs is evolving very rapidly due to both internal and external factors. An analysis over time of the indicators could help to understand how the performance assessment systems are chancing, especially with regards to the more recent logics such as the entrepreneurial and the translational. Third, it is still not clear how to consider and represent the cross-sectional elements with respect to all the three missions (i.e., internationalisation). So, the framework still needs to be revised to give major importance to these cross-cutting elements.

References

- Amsler, S. S., & Bolsmann, C. (2012). University ranking as social exclusion. *British Journal of Sociology of Education*, 33(2), 283–301. <https://doi.org/10.1080/01425692.2011.649835>
- Aversano, N., Rossi, F. M., & Polcini, P. T. (2017). I sistemi di misurazione della performance nelle università: considerazioni critiche sul sistema italiano. *Management Control*, 1, 15–36.
- Barron, G. R. S. (2017). The Berlin Principles on Ranking Higher Education Institutions: limitations, legitimacy, and value conflict. *Higher Education*, 73(2), 317–333. <https://doi.org/10.1007/s10734-016-0022-z>

- Battaglia, D., Landoni, P., & Rizzitelli, F. (2017). Organizational structures for external growth of University Technology Transfer Offices: An explorative analysis. *Technological Forecasting and Social Change*, 123, 45–56. <https://doi.org/10.1016/j.techfore.2017.06.017>
- Bienkowska, D., & Klofsten, M. (2012). Creating entrepreneurial networks: academic entrepreneurship, mobility and collaboration during PhD education. *Higher Education*, 64(2), 207–222. <https://doi.org/10.1007/s10734-011-9488-x>
- Brankovic, J. (2017). *Organizing Institutional Environment: A sociological inquiry into university responses to global imperatives (PhD dissertation)*.
- Brinkmann & Kvale. (2015). *InterViews: learning the craft of qualitative research interviewing*, (Los Angeles: Sage Publications.).
- Bryman, A., & Bell, E. (2011). *Business research methods*. Oxford: Oxford University Press.
- Chau, V. S., Gilman, M., & Serbanica, C. (2017). Aligning university–industry interactions: The role of boundary spanning in intellectual capital transfer. *Technological Forecasting and Social Change*, 123, 199–209. <https://doi.org/10.1016/j.techfore.2016.03.013>
- Clauss, T., Kesting, T., Miller, K., & Meerman, A. (2018). Quo vadis entrepreneurial university? The need for multi-levels of analysis. *International Journal of Technology Management*, 1–8.
- Dunn, M. B., & Jones, C. (2010). Institutional logics and institutional pluralism: The contestation of care and science logics in medical education, 1967–2005. *Administrative Science Quarterly*, 55(1), 114–149. <https://doi.org/10.2189/asqu.2010.55.1.114>
- Easton, G. (2010). Critical realism in case study research. *Industrial Marketing Management*, 39, 118–128.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14, 532–550.
- Etzkowitz, H. (1998). The norms of entrepreneurial science: cognitive effects of the new university–industry linkages. *Research Policy*, 27(8), 823–833. [https://doi.org/10.1016/S0048-7333\(98\)00093-6](https://doi.org/10.1016/S0048-7333(98)00093-6)
- Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and “Mode 2” to a Triple Helix of university–industry–government relations. *Research Policy*, 29(2), 109–123. [https://doi.org/10.1016/S0048-7333\(99\)00055-4](https://doi.org/10.1016/S0048-7333(99)00055-4)
- Geuna, A., & Muscio, A. (2009). The Governance of University Knowledge Transfer: A Critical Review of the Literature. *Minerva*, 47(1), 93–114. <https://doi.org/10.1007/s11024-009-9118-2>
- Hewitt-Dundas, N. (2012). Research intensity and knowledge transfer activity in UK universities. *Research Policy*, 41(2), 262–275. <https://doi.org/10.1016/j.respol.2011.10.010>
- Hsu, D. W. L., Shen, Y.-C., Yuan, B. J. C., & Chou, C. J. (2015). Toward successful commercialization of university technology: Performance drivers of university technology transfer in Taiwan. *Technological Forecasting and Social Change*, 92, 25–39. <https://doi.org/10.1016/J.TECHFORE.2014.11.002>
- Jacob, M., Lundqvist, M., & Hellsmark, H. (2003). Entrepreneurial transformations in the Swedish University system: the case of Chalmers University of Technology. *Research Policy*, 32(9), 1555–1568.
- Kapetaniou, C., & Lee, S. H. (2017). A framework for assessing the performance of universities: The case of Cyprus. *Technological Forecasting and Social Change*, 123, 169–180. <https://doi.org/10.1016/j.techfore.2016.03.015>
- Klofsten, M., & Jones-Evans, D. (2000). Comparing academic entrepreneurship in Europe—the case of Sweden and Ireland. *Small Business Economics*, 14(4), 299–309.
- Leydesdorff, L., & Etzkowitz, H. (2001). The Transformation Of University–industry–government Relations. *Electronic Journal of Sociology*, 5(4).

- Lockett, A., & Wright, M. (2005). Resources, capabilities, risk capital and the creation of university spin-out companies. *Research Policy*, 34(7), 1043–1057. <https://doi.org/10.1016/J.RESPOL.2005.05.006>
- Maassen, P. (2017). The university's governance paradox. *Higher Education Quarterly*, 71(3), 290–298. <https://doi.org/10.1111/hequ.12125>
- Marginson, S. (2007). Global University Rankings: Implications in general and for Australia. *Journal of Higher Education Policy and Management*, 29(2), 131–142. <https://doi.org/10.1080/13600800701351660>
- Marginson, S., & van der Wende, M. (2007). To Rank or To Be Ranked: The Impact of Global Rankings in Higher Education. *Journal of Studies in International Education*, 11(3–4), 306–329. <https://doi.org/10.1177/1028315307303544>
- Mazdeh, M. M., Razavi, S. M., Hesamamiri, R., Zahedi, M. R., & Elahi, B. (2013). An empirical investigation of entrepreneurship intensity in Iranian state universities. *Higher Education*, 65(2), 207–226.
- Meissner, D., & Shmatko, N. (2017). “Keep open”: the potential of gatekeepers for the aligning universities to the new Knowledge Triangle. *Technological Forecasting and Social Change*, 123, 191–198. <https://doi.org/10.1016/j.techfore.2016.03.012>
- Öner, M. A. (2017). Social dynamics of university intellectual capital. *Technological Forecasting and Social Change*, 123(June), 120–121. <https://doi.org/10.1016/j.techfore.2017.06.025>
- Rinaldi, C., Cavicchi, A., Spigarelli, F., Lacchè, L., & Rubens, A. (2018). Universities and smart specialisation strategy. *International Journal of Sustainability in Higher Education*, 19(1), 67–84. <https://doi.org/10.1108/IJSHE-04-2016-0070>
- Sauder, M., & Espeland, W. N. (2009). The Discipline of Rankings: Tight Coupling and Organizational Change. *American Sociological Review*, 74(1), 63–82. <https://doi.org/10.1177/000312240907400104>
- Secundo, G., Elena Perez, S., Martinaitis, Ž., & Leitner, K. H. (2017). An Intellectual Capital framework to measure universities' third mission activities. *Technological Forecasting and Social Change*, 123, 229–239. <https://doi.org/10.1016/j.techfore.2016.12.013>
- Spicer, A., & Sewell, G. (2010). From national service to global player: Transforming the organizational logic of a public broadcaster. *Journal of Management Studies*, 47(6), 913–943. <https://doi.org/10.1111/j.1467-6486.2010.00915.x>
- Strauss, A., & Corbin, J. (1990). Basics of qualitative research: Grounded theory procedures and techniques. Newbury Park, Calif. Sage Publications.
- Thornton, P. H., Ocasio, W., & Lounsbury, M. (2012). *The institutional logics perspective: foundations, research, and theoretical elaboration*. Oxford: Oxford University Press.
- Trencher, G., Yarime, M., McCormick, K. B., Doll, C. N. H., & Kraines, S. B. (2014). Beyond the third mission: Exploring the emerging university function of co-creation for sustainability. *Science and Public Policy*, 41(2), 151–179. <https://doi.org/10.1093/scipol/sct044>
- Trencher, G., Nagao, M., Chen, C., Ichiki, K., Sadayoshi, T., Kinai, M., ... Yarime, M. (2017). Implementing sustainability co-creation between universities and society: A typology-based understanding. *Sustainability (Switzerland)*, 9(4). <https://doi.org/10.3390/su9040594>
- van Gestel, N., & Hillebrand, B. (2011). Explaining stability and change: The rise and fall of logics in pluralistic fields. *Organization Studies*, 32(2), 231–252. <https://doi.org/10.1177/0170840610397475>
- Wooten, M., & Hoffman, A. J. (2008). Organizational Fields: Past, Present, and Future. In R. Greenwood, C. Oliver, R. Suddaby, & K. Sahlin (Eds.), *Handbook of Organizational Institutionalism* (pp. 130–147). Sage Publications. <https://doi.org/10.4135/9781849200387>
- Yarime, M., Trencher, G., Mino, T., Scholz, R. W., Olsson, L., Ness, B., ... Rotmans, J. (2012). Establishing sustainability science in higher education institutions: towards an integration of

- academic development, institutionalization, and stakeholder collaborations. *Sustainability Science*, 7(S1), 101–113. <https://doi.org/10.1007/s11625-012-0157-5>
- Yin, R. K. (2013). *Case study research: Design and methods*. Sage publications.
- Zikmund, W., Babin, B., Carr, J., & Griffin, M. (2012). *Business research methods*. Mason: Cengage Learning.

A Structured Literature Review about Knowledge Management in Entrepreneurial Universities

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Abstract

This paper aims to review and critique the Knowledge Management (KM) literature within Entrepreneurial universities, providing an overview of the results of a content analysis aimed to setup the emerging trends and suggest directions for future studies. The content analysis has been conceived into a larger and systematic literature review conducted on 1106 articles indexed at Scopus and initially submitted to a bibliometric analysis. Finally, 150 papers published in a variety of academic journals specializing in the field of Entrepreneurship, KM and Higher Education have been analyzed through a content and a bibliometric analysis to minimize mistakes in interpreting findings of collected studies. To undertake such analysis, we have used VOSviewer, a tool for constructing and visualizing bibliometric networks and clusters. KM within Entrepreneurial University is a research area of growing importance. Findings show that literature on KM models and tools in the Entrepreneurial University is fragmented and dominated by unrelated research. The content analysis here presented depicts the trends of a heterogeneous literature, but focused on some research streams such as: 1) Knowledge creation in Entrepreneurship Education; 2) Knowledge transfer in University-Industry collaboration; 3) Entrepreneurial University to support Knowledge based regional development; 4) KM processes for University's spin-offs. Implications for theory and practices are depicted.

Keywords – knowledge management, entrepreneurial universities, structured literature review, third mission, knowledge transfer

Paper type – Academic Research Paper

1 Introduction

Universities are historically identified as closely related to the growth of economy and society and the university's mission evolved during the centuries to respond to changing societal needs (Paleari et al. 2015). Lots of studies show that universities in developed countries have become increasingly entrepreneurial (Mowery et al., 2004; Siegel, 2006; Miller et al., 2018). Starting in the late '80s, academics and policy makers have coined the term "entrepreneurial university" (Etzkowitz, 1983, Clark, 1998; Röpke, 1998; O'Shea et al., 2005; Guerrero et al., 2018; Philpott et al., 2011; Etzkowitz, 2016), to describe universities that perform effectively their "third mission" contributing to the regional economic and cultural growth (Clark, 1998; Etzkowitz, 2000, Secundo et al., 2017).

In this context, the entrepreneurial university plays an important role as both a knowledge-producer and a disseminating institution (Guerrero and Urbano, 2012). The scope of the university activities involved in this "third mission" was defined by E3M (2010), which grouped them into three dimensions: technology transfer and innovation, continuing education, and social engagement. This raises Entrepreneurial universities as being knowledge hubs and strategic orchestrators of processes of knowledge creation, absorption, transfer and dissemination defined as KM processes in Entrepreneurial University. KM comes from strong and complex interactions of public-private stakeholders (Margherita and Secundo, 2011; Philpott et al., 2011; Etzkowitz, 2016; Maas and Jones, 2017) including faculty, staff, students, alumni, industries, and managers, but also citizens and entrepreneurs all involved in the knowledge creating and disseminating processes typical of the University's innovation mission (Etzkowitz, 2000; Vorley and Nelles, 2008). By presenting the results of a content analysis conducted into a larger and structured review of the literature (Secundo, et al., forthcoming), the article aims to identify lessons learned and research gaps, and by this to provide an agenda for future researches.

Next sections of the paper are structured as follows: after the introduction, in Section 2 the methodology is illustrated. Section 3 presents the review's findings in terms of content analysis. Conclusions and implications are detailed in the final sections.

2 Methodology

This paper is based on a structured literature review (SLR) as described by Massaro et al. (2016). A "SLR offers an empirical grounding that avoids missing seminal articles and reduces researcher bias" (Tranfield et al., 2003, p. 209). SLR approach lies in the

keyword and content analysis (McCulloh et al., 2013; Ribiere and Walter, 2013) and the inclusion of more detailed content-driven analysis to develop findings. Recently, SLR are evolving thanks to the wide availability of academic researches and go beyond purely synthesizing and deducing prior contributions (Massaro et al., 2016). To identify articles relevant to the literature review in this paper, the following steps have been followed: research questions definition; structuring of a research protocol; article selection from the Scopus database; definition of the coding framework; critical analysis and discussion of the results.

Firstly, the research questions that led the research done in this paper consisted in:

RQ1. What is the focus of the literature within KM for entrepreneurial universities?

RQ2. What are the implications for the research?

RQ3. What are the implications for the research?

For article selection we used Scopus database as it comprises over 20,000 peer-reviewed journals (Mishra et al., 2017) and is more ample than Web-of-Science (WoS) (Thelwall, 2018). Moreover, nearly 97% of papers indexed in Web of Science (WoS) are also enclosed in Scopus (Waltman, 2016). We queried the following KWs combination: “Knowledge management” OR “KM” and “Entrepreneurial University*” OR “Stakeholder University”. Data were collected in September 2018 - October 2018. One criterion was to consider only journal articles published up to 2018 (inclusive), excluding conferences, book chapters, research notes, editorials, and commentaries, (Keupp et al. 2012). We followed the exclusion criteria proposed by Vlaanderen et al. (2018). So from an initial set of 1106 items, we obtained 150 articles for analysis (excluding conference papers, book, book chapter, short survey and paper not sticking with our research questions).

The next step consisted in developing the coding framework based on similar research frameworks. In this article, we defined five categories for coding the articles, as follows:

- *Timing of the papers published*: Nr. of articles published over time;
- *Geographic distribution of articles*: Articles distribution among countries;
- *Types of Journals*: Distribution of papers among journals and citations received;
- *Analysis of Author and Citations*: Number of citations, citations per year, Citations and collaborations among authors;
- *Keywords and topics*: The type and frequency of keywords used and the emergent topic areas.

To undertake such analyses, we used VOSviewer, a tool for constructing and visualizing bibliometric networks and clusters (Van Eck & Waltman, 2014). While the results obtained on relation the first 4 categories have been detailed into a larger and systematic literature review that will appear in a forthcoming paper.

Finally, departing from the results obtained from descriptive analysis and in the aim of comprehending the emerging trends, research gaps as well as for identifying future directions a content analysis was conducted. In the next section the main findings of this analysis are presented and discussed.

3 Clustering and Content analysis

The bibliographic coupling was used for performing the content analysis (Kessler, 1963) for the 150 papers encompassed in the data sample. The results obtained from such analysis allows the identification of 7 clusters and 29 papers (as only papers with 20 citations at least are considered).

The clusters contain those articles that may spot a specific topic/approach. In addition, a clustering algorithm was adopted as proposed by (Van Eck & Waltman, 2014; 2017) to guide the content analysis of the articles.

Table 1 shows 7 clusters grouping 29 papers.

Table 1. Bibliographic coupling clusters

	Authors	Citations	Title
Cluster 1 (8 items - red)	Bramwell A., Wolfe D.A. (2008)	182	Universities and regional economic development: The entrepreneurial University of Waterloo
	Carayannis E.G., Campbell D.F.J. (2011)	52	Open Innovation Diplomacy and a 21st Century Fractal Research, Education and Innovation (FREIE) Ecosystem: Building on the Quadruple and Quintuple Helix Innovation
			Entrepreneurial academics: Developing scientific careers in changing university settings
			Freedom and autonomy in the university enterprise
			What motivates academic scientists to engage in research commercialization: 'Gold', 'ribbon' or 'puzzle'?
	Duberley J., Cohen L., Leeson E. (2007)		Faculty entrepreneurs and research productivity
	Bridgman T. (2007)	23	Toward a sustainable relationship between City and university: A stakeholdership approach
	Lam A. (2011)		Combining entrepreneurial and scientific performance in academia: Towards a compounded and reciprocal Matthew-effect?
		20	
	Lowe R.A., Gonzalez-Brambila C. (2007)	121	
	Russo A.P., van den Berg L., Lavanga M. (2007)		
	Van Looy B., Ranga M., Callaert J., Debackere K., Zimmermann E. (2004)	80	
		20	

197			
Cluster 2 (7 items - green)	Acworth E.B. (2008)	61	University-industry engagement: The formation of the Knowledge Integration Community (KIC) model at the Cambridge-MIT Institute
			Economic impact of entrepreneurial universities' activities: An exploratory study of the United Kingdom
			The entrepreneurial university, academic activities and technology and knowledge transfer in four European countries
	Guerrero M., Cunningham J.A., Urbano D. (2015)	70	The development of University Technology Transfer stakeholder relationships at a regional level: Lessons for the future
	Kalar B., Antoncic B. (2015)		Process model for university-industry research collaboration
		33	Universities and industrially relevant science: Towards measurement models and indicators of entrepreneurial orientation
	McAdam R., Miller K., McAdam M., Teague S. (2012)		Creating university spin-offs: A science-based design perspective
		32	
	Philbin S. (2008)		
	Tijssen R.J.W. (2006)	43	
	Van burg E., Romme A.G.L., Gilsing V.A., Reymen I.M.M.J. (2008)	55	
74			
Cluster 3 (4 items – blue)	Clarysse B., Wright M., Van de Velde E. (2011)	92	Entrepreneurial Origin, Technological Knowledge, and the Growth of Spin-Off Companies
	Knockaert M., Ucbasaran D., Wright M., Clarysse B. (2011)		The relationship between knowledge transfer, top management team composition, and performance: The case of science-based entrepreneurial firms
		61	What drives scientists to start their own company? An empirical investigation of Max Planck Society scientists

	Krabel S., Mueller P. (2009)		The effectiveness of university knowledge spillovers: Performance differences between university spinoffs and corporate spinoffs
	Wennberg K., Wiklund J., Wright M. (2011)	93	
		103	
Cluster 4 (4 items - yellow)	Bonardo D., Paleari S., Vismara S. (2010)	53	The M&A dynamics of European science-based entrepreneurial firms
	Hannon P.D., Collins L.A., Smith A.J. (2005)	24	Exploring Graduate Entrepreneurship: A Collaborative, Co- Learning Based Approach for Students, Entrepreneurs and Educators
			The effect of university culture and stakeholders' perceptions on university-business linking activities
	Horowitz Gassol J. (2007)		A contemporary approach to entrepreneurship education
		20	
	Jones C., English J. (2004)		
		139	
Cluster 5 (2 items - violet)	Drahota A., Meza R.D., Brikho B., Naaf M., Estabillo J.A., Gomez E.D., Vejnaska S.F., Dufek S., Stahmer A.C., Aarons G.A. (2016)	28	Community-Academic Partnerships: A Systematic Review of the State of the Literature and Recommendations for Future Research
	Wright M., Piva E., Mosey S., Lockett A. (2009)		Academic entrepreneurship and business schools
		45	
Cluster 6 (2 items - light blue)	Cantú F.J., Bustani A., Molina A., Moreira H. (2009)	21	A knowledge-based development model: The research chair strategy
	Rubin T.H., Aas T.H., Stead A. (2015)		Knowledge flow in Technological Business Incubators: Evidence from Australia and Israel
		30	
Cluster 7 (2 items - orange)	Siegel D.S., Waldman D.A., Atwater L.E., Link A.N. (2003)	327	Commercial knowledge transfers from universities to firms: Improving the effectiveness of university-industry collaboration

By reading clustered articles, four different researches areas emerged as follows:

- *Research area 1: Knowledge creation in Entrepreneurship education*
- *Research area 2: Knowledge transfer in University-Industry collaboration*
- *Research area 3: Entrepreneurial University to support Knowledge based Regional Development.*
- *Research area 4: KM processes for University's spin-offs*

Research area 1: Knowledge creation in Entrepreneurship education with a specific focus on the “Entrepreneurially equipped students: processes and strategies” in terms of new roles and configuration of business schools (Wright et al., 2009), co-learning processes and innovation in the supply of entrepreneurship education (Hannon et al., 2005), a more student-centered teaching practice (Jones and English, 2004). This is coherent with that done in recent years in Higher Education Institutions (HEIs) where dedicated Entrepreneurship Centers have been established with the aim to support a broad spectrum of learning and research initiatives, providing funding for various educational programs as well as supporting social community development (Maas and Jones, 2017).

Research area 2: Knowledge transfer in University-Industry collaboration - In such area, contributions have been identified in terms of “Models of Knowledge transfer from University to firms” and “Performance measurements in knowledge transfer.” Some of the most relevant contributions are: Acworth (2008) that illustrate the role of Knowledge Integration Community models to enhance University–Industry links by providing a comprehensive and effective approach to a multidirectional process of knowledge sharing, which goes beyond traditional, unidirectional ‘knowledge transfers’ from academia to industry; Siegel et al., (2004) that focus on identifying and analyzing the role of organizational practices in fostering and promoting successful university/industry technology transfers.

Research area 3: Entrepreneurial University to support Knowledge based regional development, with thematic perspectives on “Knowledge based models for regional development” and “Quadruple Helix collaboration,” About the first, there is evidence for the roots of regional development driven by knowledge based model in the study of Russo et al. (2007) that reflected on the role of universities as driving forces for urban development and as measurement of the Universities’ impact for economic development (Guerrero et al., 2015). Bramwell and Wolfe (2008) discuss the different mechanisms of knowledge transfer through which universities can contribute to growth and innovation of local and regional economies. Meanwhile, Lowe and Gonzalez-Brambila (2007) focus on analyzing the role of faculty entrepreneurs by assessing their productivity performance in terms of knowledge creation as expressed in publications, licenses etc.

Research area 4: A fourth area regards the KM processes for the Universities spin-offs, with two thematic perspectives related to the “Drivers for the development of spin-offs” and “Research commercialization.” About the first, different trends arise in the commercialization of tacit and explicit knowledge as well as incompatibility and non-complementarity of science and commerce (Duberley et al., 2007), effectiveness of knowledge transfers when a substantial part of the original research team joins the new venture as founders (Knockaert, et al., 2011). While Krabel and Mueller (2009) analyze the factors that influence scientists’ entrepreneurial activity, highlighting the relevance of patenting activity, entrepreneurial experience and personal opinions regarding the benefits of commercializing research.

4. Discussions and Implications

The aim of this section is to discuss and critique the main findings for answering RQ.3 “What are the implications for the research?” The answer to this question moves toward the implication of “*a future research agenda about KM in the Entrepreneurial University area*”.

A relevant aspect to consider is the rapid acceleration of digital technologies reshaping markets and society globally (Nambisan et al., 2017) on academic entrepreneurship (Rippa and Secundo, 2018). Among the actors involved in these disruptive changes, universities are challenged in the way they pursue and interpret their threefold missions; e.g., education, research and “third mission” (Lombardi et al., 2019; Dalmarco et al., 2018; Etzkowitz, 2016). As far as the latter is concerned, the impact of digital technologies needs to be investigated encompassing activities like research collaborations with industry, patent applications, transformation of innovative ideas in spin-offs, entrepreneurial education of highly skilled individuals, technology transfer or business incubators. A second research area requiring more research is related to the dissemination of entrepreneurship education outside the business school to cover all the University’s departments. Society requires people who are educated in the “Sense of initiative and entrepreneurship” (EC, 2006). Third, another neglected aspect of managing knowledge in universities is the ‘collective’ involvement of all the stakeholders contributing to achieving the third mission (Secundo et al., 2016) that moves from the assumption that considers a university as a collective intelligence system (Vargas et al., 2019) in which alternate processes of exploration and exploitation generate a twisting learning path (Centobelli et al., 2018). Finally, the comprehension of how knowledge flows from Industry to University remains underdeveloped since the prominent studies in the field analyzed how the knowledge moves from academia to industry (Chedid and Teixeira, 2019). Given the vibrant nature of research on entrepreneurial universities from one side and KM from the other side, future studies that address the dynamic and multifaceted aspects of the above-mentioned future research areas should be welcome in additions to this literature. This may also be another entry point for micro researches trained in psychology and Information technology, a group currently conspicuously absent from this research stream. This provides useful implications for the definition of future research

contributions by scholars that could offer additional perspectives of investigations, also thanks to the involvement of a larger number of practitioners.

5 Conclusions and future research

In the conclusions of this study, it is important to recall its initial motivation, based on the argument that the Entrepreneurial University represents a particular research context because of a different level of representativeness, accountability and responsiveness of different stakeholders, requiring focused studies about KM studies. Universities are now viewed as key economic actors within regions and are central actors in shaping and influencing entrepreneurial ecosystems. This has meant that universities now have to become more entrepreneurial in offerings, outlook and culture (Miller et al., 2018). Content analysis performed in the paper allowed identifying four main thematic clusters as main areas of specialization of the scientific debate, with related sub areas. We categorize the main areas as: 1) Knowledge creation in Entrepreneurship education (focus on the “Entrepreneurially equipped students: processes and strategies”), 2) Knowledge transfer in University-Industry collaboration (focus on “Models of Knowledge transfer from University to firms” and “Performance measurements in knowledge transfer), 3) Entrepreneurial University to support Knowledge based regional development (focus on “Knowledge based models for regional development” and “Quadruple Helix collaboration”) and 4) KM processes for the University spin-offs (Focus on “Drivers for the development of spin-offs” and “Research commercialization”). The analysis of papers included in these areas allowed deriving a more robust awareness on the state of art for the debate on KM and Entrepreneurial University in terms of conceptual and organizational models, causal mechanisms of functioning, tools and performance metrics, and impact on regional development.

Some limitations can be identified in the nature of journals analyzed as well as the database selected. As authors, we are aware that this could represent a limitation since we cannot assume that valuable research related to our topics could have been published on different venues not listed in our database. Second, the validity of the evidence collected is limited to the timeframe considered. Third, as every beginning of a new journey (Massaro et al., 2016), a SLR is relevant for the contribution of inspiration more than for the state of the art it is able to provide. Accordingly, we hope this work contributes to identifying lacks in the debate on KM and entrepreneurial university and providing inspiration for the future works of scholars and practitioners interested in the advancement of such promising future research areas.

References

- Acworth, E. B. (2008), “University–industry engagement: The formation of the Knowledge Integration Community (KIC) model at the Cambridge-MIT Institute”, *Research policy*, Vol. 37, No. 8, pp. 1241-1254.
- Bonardo, D., Paleari, S. and Vismara, S. (2010), “The M&A dynamics of European science-based entrepreneurial firms”, *The Journal of Technology Transfer*, Vol. 35, No. 1, pp. 141-180.

- Bramwell, A. and Wolfe, D. A. (2008), "Universities and regional economic development: The entrepreneurial University of Waterloo" *Research Policy*, Vol. 37, No. 8, pp. 1175-1187.
- Bridgman, T. (2007), "Freedom and autonomy in the university enterprise", *Journal of Organizational Change Management*, Vol. 20, No. 4, pp. 478-490.
- Carayannis, E. G. and Campbell, D. F. (2011), "Open innovation diplomacy and a 21st century fractal research, education and innovation (FREIE) ecosystem: building on the quadruple and quintuple helix innovation concepts and the "mode 3" knowledge production system", *Journal of the Knowledge Economy*, Vol. 2, No. 3, pp. 327.
- Centobelli, P., Cerchione, R., and Esposito, E. (2018), "Exploration and exploitation in the development of more entrepreneurial universities: A twisting learning path model of ambidexterity", *Technological Forecasting and Social Change* (In press).
- Chedid, M. F. and Teixeira, L. (2019), "The University-Industry Collaboration", In *Advanced Methodologies and Technologies in Modern Education Delivery* (pp. 701-715), IGI Global.
- Clark, B. R. (1998), *Creating Entrepreneurial Universities: Organisational Pathways to Transformation*. IAU Press and Pergamon.
- Clarysse, B., Wright, M. and Van de Velde, E. (2011), "Entrepreneurial origin, technological knowledge, and the growth of spin-off companies", *Journal of Management Studies*, Vol. 48, No. 6, pp. 1420-1442.
- Drahota, A. M. Y., et al. (2016), "Community-academic partnerships: A systematic review of the state of the literature and recommendations for future research", *The Milbank Quarterly*, Vol. 94, No.1, pp. 163-214.
- Duberley, J., Cohen, L., and Leeson, E. (2007), "Entrepreneurial academics: developing scientific careers in changing university settings", *Higher Education Quarterly*, Vol. 61, No. 4, pp. 479-497.
- E3M Project (2012), "Green paper: Fostering and measuring "third mission" in higher education institutions", retrieved online at <<http://www.e3mproject.eu/docs/Green%20paper-p.pdf>> accessed 11 June 2015.
- Etzkowitz, H. (1983), "Entrepreneurial scientists and entrepreneurial universities in American academic science", *Minerva*, Vol. 21, No. 2-3, pp. 198-233.
- Etzkowitz, H. (2000), "Tech transfer, incubators probed at Triple Helix III", *Research Technology Management*, Vol. 4, No. 6, pp. 4.
- Etzkowitz, H. (2016), "The entrepreneurial university: vision and metrics", *Industry and Higher Education*, Vol. 30, No. 2, pp. 83-97.
- Gassol, J. H. (2007), "The effect of university culture and stakeholders' perceptions on university-business linking activities.", *The Journal of Technology Transfer*, Vol. 32, No. 5, pp. 489-507.
- Guerrero, M., and Urbano, D. (2012). The development of an entrepreneurial university. *The journal of technology transfer*, 37(1), 43-74.
- Guerrero, M., Cunningham, J.A. and Urbano, D., (2015), "Economic impact of entrepreneurial universities' activities: An exploratory study of the United Kingdom", *Research Policy*, Vol. 44, No. 3, pp. 748-764.
- Guerrero, M., Urbano, D., Cunningham, J. A., and Gajón, E. (2018), "Determinants of Graduates' Start-Ups Creation across a Multi-Campus Entrepreneurial University: The Case of Monterrey Institute of Technology and Higher Education", *Journal of Small Business Management*, Vol. 56(1), 150-178.
- Hannon, P. D., Collins, L. A., and Smith, A. J. (2005), "Exploring graduate entrepreneurship: a collaborative, co-learning based approach for students, entrepreneurs and educators", *Industry and Higher Education*, Vol. 19, No. 1, pp. 11-23.
- Jones, C. and English, J. (2004), "A contemporary approach to entrepreneurship education", *Education+ training*, Vol. 46, No. 8/9, pp.416-423.

- Kalar, B. and Antoncic, B., (2015), "The entrepreneurial university, academic activities and technology and knowledge transfer in four European countries", *Technovation*, Vol. 36, pp. 1-11.
- Knockaert, M., Ucbasaran, D., Wright, M. and Clarysse, B. (2011), "The Relationship Between Knowledge Transfer, Top Management Team Composition, and Performance: The Case of Science-Based Entrepreneurial Firms", *Entrepreneurship Theory and Practice*, Vol. 35, No. 4, pp. 777-803.
- Krabel, S. and Mueller, P. (2009), "What drives scientists to start their own company?: An empirical investigation of Max Planck Society scientists", *Research Policy*, Vol. 38, No.6, pp. 947-956.
- Lam, A. (2011), "What motivates academic scientists to engage in research commercialization: 'Gold', 'ribbon' or 'puzzle'?", *Research Policy*, Vol. 40, No. 10, pp. 1354-1368.
- Lombardi, R., Massaro, M., Dumay, J., and Nappo, F. (2019), "Entrepreneurial universities and strategy: the case of the University of Bari", *Management Decision* (in press).
- Lowe, R. A. and Gonzalez-Brambila, C. (2007), "Faculty entrepreneurs and research productivity", *The Journal of Technology Transfer*, Vol. 32, No.3, pp. 173-194.
- Maas, G., and Jones, P. (2017). The role of entrepreneurship centers. In Maas G., and Jones, P. *Entrepreneurship Centres: Global Perspectives on their Contributions to Higher Education Institutions* (pp. 11-16). Palgrave Macmillan.
- Margherita, A., and Secundo, G. (2011). "The stakeholder university as learning model of the extended enterprise", *Journal of Management Development*, Vol. 30, No. 2, pp. 175-186.
- Massaro, M., Dumay, J., & Guthrie, J. (2016), "On the shoulders of giants: undertaking a structured literature review in accounting", *Accounting, Auditing & Accountability Journal*, 29(5), 767-801. <https://doi.org/10.1108/AAAJ-01-2015-1939>
- McAdam, R., Miller, K., McAdam, M., and Teague, S. (2012), "The development of University Technology Transfer stakeholder relationships at a regional level: Lessons for the future", *Technovation*, Vol. 32, No. 1, pp. 57-67.
- McCulloh, D.I., Armstrong, H. and Johnson, A. (2013), *Social Network Analysis with Applications*, Wiley, Hoboken.
- Miller, K., Alexander, A., Cunningham, J. A., & Albats, E. (2018). Entrepreneurial academics and academic entrepreneurs: A systematic literature review. *International Journal of Technology Management*, 77(1-3), 9-37.
- Mishra, D., Gunasekaran, A., Papadopoulos, T., and Hazen, B. (2017), "Green supply chain performance measures: A review and bibliometric analysis", *Sustainable Production and Consumption*, 10, 85-99.
- Mowery, D. C., R. R. Nelson, B. N. Sampat and A. A. Ziedonis (2001), 'The growth of patenting and licensing by the U.S. universities: an assessment of the effects of the Bayh-Dole act of 1980,' *Research Policy*, 30(1), 99-119.
- Nambisan, S. (2017). Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship, *Entrepreneurship Theory and Practice*, 41(6), 1029-1055.
- O'Shea, R., Allen, T. J., Chevalier, A., & Roche, F. (2005). Entrepreneurial orientation, technology transfer and spin-off performance of US universities. *Research Policy*, 34(7), 994-1009.
- Paleari, S., Donina, D., & Meoli, M. (2015). The role of the university in twenty-first century European society. *The Journal of Technology Transfer*, 40(3), 369-379.
- Philbin, S. (2008), "Process model for university-industry research collaboration", *European Journal of Innovation Management*, Vol. 11, No.4, pp. 488-521.
- Philpott, K., Dooley, L., O'Reilly, C. and Lupton, G. (2011), "The entrepreneurial university: Examining the underlying academic tensions", *Technovation*, Vol. 31, No. 4, pp. 161-170.

- Rippa, P. and Secundo, G. (2018) Digital Academic Entrepreneurship: The potential of digital technologies on academic entrepreneurship, *Technological Forecasting & Social Change*, doi.org/10.1016/j.techfore.2018.07.013.
- Röpke, J. (1998), The entrepreneurial university. Innovation, academic knowledge creation and regional development in a globalized economy.
- Rubin, T. H., Aas, T. H. and Stead, A. (2015), "Knowledge flow in technological business incubators: evidence from Australia and Israel", *Technovation*, Vol. 41, pp. 11-24.
- Russo, A. P., van den Berg, L. and Lavanga, M. (2007), "Toward a sustainable relationship between city and university: a stakeholdership approach", *Journal of Planning Education and Research*, Vol. 27, No. 2, pp. 199-216.
- Secundo, G., Elena- Perez, S., Martinaitis, Ž, Leitner, K. H., (2017) An Intellectual Capital framework to measure third mission activities, *Technological Forecasting and Social Change*, 123, 229-239.
- Secundo, G., Ndou, V. Del Vecchio, P., De Pascale G., (forthcoming) Knowledge Management in Entrepreneurial Universities: a Structured Literature Review and Avenue for future Research Agenda, *Management Decision* (forthcoming).
- Siegel, D. S., Waldman, D. A., Atwater, L. E., and Link, A. N. (2003), "Commercial knowledge transfers from universities to firms: improving the effectiveness of university-industry collaboration", *The Journal of High Technology Management Research*, Vol. 14, No. 1, pp. 111-133.
- Siegel, D.S., Waldman, D.A., Atwater, L.E. and Link, A.N. (2004), "Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: qualitative evidence from the commercialization of university technologies", *Journal of engineering and technology management*, Vol. 21, No. 1-2, pp.115-142.
- Siegel, D. S. (ed.), (2006), *Technology Entrepreneurship: Institutions and Agents Involved in University Technology Transfer*, Vol. 1. Edgar Elgar: London.
- Thelwall, M. (2018), "Dimensions: A competitor to Scopus and the Web of Science?", *Journal of Informetrics*, Vol. 12, No. 2 , pp. 430-435.
- Tijssen, R. J. (2006), "Universities and industrially relevant science: Towards measurement models and indicators of entrepreneurial orientation", *Research Policy*, Vol. 35, No. 10, pp. 1569-1585.
- Tranfield, D., Denyer, D., and Smart, P. (2003), "Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review", *British Journal of Management*, Vol. 14, No. 3, pp. 207-222.
- Van Burg, Elco, A. Georges L. Romme, Victor A. Gilsing, and Isabelle MMJ Reymen (2008), "Creating university spin-offs: a science-based design perspective", *Journal of Product Innovation Management*, Vol. 25, No. 2, pp. 114-128.
- Vargas, V. R., Lawthom, R., Prowse, A., Randles, S., and Tzoulas, K. (2019), "Sustainable development stakeholder networks for organisational change in higher education institutions: A case study from the UK", *Journal of Cleaner Production*, Vol. 208, pp. 470-478.
- Vorley, T. and Nelles, J. (2008), "(Re) conceptualising the academy", *Higher Education Management and Policy*, Vol. 20, No. 3, pp. 1-17.
- Waltman, L. (2016), "A review of the literature on citation impact indicators", *Journal of Informetrics*, Vol. 10, No. 2, pp. 365-391.
- Wennberg, K., Wiklund, J. and Wright, M. (2011), "The effectiveness of university knowledge spillovers: Performance differences between university spinoffs and corporate spinoffs", *Research Policy*, Vol. 40, No. 8, pp. 1128-1143.
- Wright, M., Piva, E., Mosey, S., and Lockett, A. (2009), "Academic entrepreneurship and business schools", *The Journal of Technology Transfer*, Vol. 34, No. 6, pp. 560-587.

Systems Change in Community Organisations. Porta Futuro, the Local Experiment of the City of Bari

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Abstract

*The overall aim of this paper is to provide knowledge on the importance of **systems thinking as strategic in understanding organisational community systems**. If “systems” literature can be complex and inaccessible since there are many different approaches to and ways of understanding systems thinking, the article explores the theory and practice behind the use of systems approaches in tackling public challenges as they represents a different way of looking at the world. The latter is understood as an open, complex set of systems that are social ecosystems themselves but are interconnected to external environments. The starting point is the recognition that all individuals consist of and are part of multiple interconnecting systems – biological, social, organisational.*

The systems thinking approach takes this recognition and makes use of it as the basis for understanding and changing the world. It also sees the relationships within and between systems as crucially important by recognising that there is huge complexity in these relationships. These open systems need to keep evolving and learning, as if they are micro organizations, in relation to changes and needs of multiple stakeholders. Systems become, then, learning organizations.

In essence, systems thinking is a worldview; merely, an attitude of inquiry and reflection. Thinking and working, in ways that recognise the interconnectedness of the community, is the first step to being able to make the systemic changes that community residents expect to see.

*The proposed approach is firstly based on the review of the literature available on **systems change following systems thinking** as its precursor, and collaborative community governance. In order to testify the suggested research question, this paper is based on a case-study approach (Yin R.K. 2005, 2006, 2009, 2013) whose value resides in allowing an in-depth investigation of complex issues in their natural real-life settings. It provides not only phenomena’s insights but practical challenges in understanding the case as an integrated whole. In particular, starting from the relevant scientific literature, this paper aims at creating a relationship between evidence from the scientific literature review and facts provided by the case-study so to highlight the levers and main featuring*

aspects that make a specific organisational model. This will help acknowledging the underlying elements for a first possible theoretical framework to explain how sustainable development of communities and territories can be achieved through the perspective of systems change.

Starting from the consideration that the underlying values of PORTA FUTURO BARI are transparency, reliability, ethics, solidarity, cooperation, talent and creativity's enhancement, the originality of this paper is related to the value of the experiment itself, which has an impact on the community and the metropolitan territory as a whole.

Originality is also given by the approach used to explain the unfolding dynamics of community organisation aimed at delivering development through the perspective of systems change that leverages on some variables present within that system such as power/authority, communication, relationships (social capital) and modelling capacity.

The paper will tell if, first of all, such an experiment at the local level is successful in creating an urban hub that is a community platform where people are empowered to make change of the systems where they are embedded in. Hence, to understand if the local community is able to design and promote the building of sustainable actions, practices and organisations that offer new opportunities for participation and engagement of peoples, for sharing and integrating spaces, resources and values for knowledge creation, for co-creating value through co-producing people for a collaborative-driven urban development.

Keywords – organisation, systems thinking, systems change, collaborative governance

Nature of the proposed paper: Academic Research Paper

1 Introduction

The crucial point of this paper is how to produce change into systems starting from the perspective of systems thinking as applied to the study of community organizations. The case-study presented in this work tells about a service delivery-based local experiment conducted by the Municipality of Bari, named PORTA FUTURO.

PORTA FUTURO BARI is an employment service hub, funded by the Regional Government (Apulia Region) under the National Operative Plan “GOVERNANCE and SYSTEM ACTIONS 2007-2013, ACTION 3, also supported by the project named “Networked young community: the Public Sector at the service of a new policy of employment”

This local social experiment aims to adequately orient metropolitan users to the job market, with particular attention to youth, and to promote the matching with the current supply system. The goal of this employment centre is to consolidate what can be defined as a Territorial Community, made of public institutions, public and private agencies, representatives of trade unions and professions, enterprises and cooperative systems, universities, research centres and schools, gathered together in a fruitful and systematic debate on issues regarding the social issues and its related dynamics.

Conceived and planned as an aggregator that mobilises resource, information, competences, skills and opportunities, PORTA FUTURO is aimed to become a driver for

social innovation and local development. However, it is important to point out that PORTA FUTURO is an umbrella project which develops in two steps and time lines. The first step, which is already finalised, refers to PORTA FUTURO 1, a generation Job Centre committed and specialized in welcoming, supporting and guiding young people to access training and job market. While PORTA FUTURO 2 stands as an incubator/accelerator that will welcome a series of start-ups and, at the same time, advanced services to support, consult and launch of innovative start-up on the territory. Having said that, the paper will respond to the following research question:

RQ1: can systems thinking be useful for community groups? And if yes, which elements could be most useful to lead to systems change?

The paper attempts to explain the connections between literature review on systems thinking and the empirical evidence collected through the case-study by addressing the need for systems thinking in the public sector as it encourages practitioners to understand and analyse the contexts within which they operate, and to design programmes that can adapt as conditions on the ground change. Hence, the theoretical underpinnings of systems thinking are useful and functional to the achievement of territorial development. It increases the possibility of transformational change since it helps practitioners to bring together many different stakeholders, especially those with radically different backgrounds and perspectives, to identify problems and solutions to challenges.

Moreover, systems thinking is, today, pivotal and functional to deal with the achievement of Sustainable Development Goals whose debate within the international community is overwhelming. Mapping the activities around the individual goals will certainly accelerate progress. But looking across the goals at possible synergies and trade-off takes us to the next level. Clearly the SDGs do not work in isolation, for example health (SDG 3) is impacted by food and nutrition, sanitation, education and increasingly climate change; the sustainability of cities (SDG 11) is an amalgamation of a number of the other goals such as food, energy, education, infrastructure. A strong system approach is required to successfully deliver SDGs, which enables organisations to operate jointly, on an inter-relationship based level and sustainably.

2 Literature review

2.1 Systems thinking as a theory and an approach

Traditional thinking encouraged scholars to focus on individual parts of a problem occurring within a system. But what it is meant by systems? They are social, environmental, economic and political systems. These interact to form bigger market, governance and ecological systems. Each of these systems is made up of multiple inter-linked parts and actors that influence each other (e.g. formal and informal institutions, natural processes, people and behaviours). For instance, a market system is made up of companies, government agencies, rules and regulations and physical assets (such as infrastructure) as well as environmental, social and political factors that will influence how the market operates and who participates in it. It is not possible to understand what is

happening in any of these systems by looking at their individual parts, understanding the broader context, appreciating interactions among levels and taking an interdisciplinary approach (Leischow and Milstein, 2006).

However, this approach was weak in approaching issues of organizational change since it lacked of systems understanding in order to quick-fix problem solution.

To understand what is happening in each system it is strongly important to grasp how the different parts of the system interact and affect each other, which actors are affecting the system and what motivates them. In other words, it is important to understand not only the tangible side of the system (its infrastructure, to put it bluntly), but the intangible factors of a system, such as the different human activities that are having an impact on the system as a whole.

Today, new challenges are making the future increasingly unpredictable and are forcing scholars to think in different ways. The reality is that any combination of factors and conditions could occur. Together, factors would combine to create challenges that communities would have to deal with or opportunities they would have to respond to and, of course the exact combination of opportunities and challenges affecting the individuals of a community could change, each and in every moment. What systems thinking implies is that it is necessary to be informed by a deep understanding of the bigger picture of what is happening, of all the different components that they need to respond to. In other words, each system exists within and interacts with a hierarchy of nested systems (Midgley, 2000).

Systems thinking is that missing piece which also represents that missing glue that holds it all together. By identifying interactions between different parts of a system, being a city, a sector, an organisation, it makes sure that each part delivers more than the sum of the parts going deeper to address the underlying causes. A systems approach highlights the importance of the circumstances, or context, in which an action is taken in order to understand its implementation and potential impact. Arguably, the work of systems thinking is never done and efforts to bring this body of thought and practice into an organization are always challenging. Hence, it is important to argue that to develop systems thinking as an organizational habit of mind means learning and practicing in order to arrive at the managing change within a system. The systems approach offers a further advantage with respect to the well-recognized gap between research and practice, which limits the extent to which advances in research translate to advances in improving public policies in general. Most efforts to link research to practice and policy have merely highlighted the challenges of transferring knowledge from single-discipline, highly controlled research to practice settings. Interdisciplinary investigation using a systems approach can potentially help close this gap (Mabry et al., 2008).

A systems approach to solving collective problems requires new tools, including data, methods, theories, and statistical analysis different from those traditionally used in linear approaches. No single discipline can provide these tools. Therefore, it is necessary to approach research on public issues with a collaborative team of scholars and researches who bring knowledge and expertise from a variety of disciplines and sectors (Leischow et al., 2008). The theoretical frameworks and methodologies that result from such

collaboration can generate new conceptual syntheses, new measurement techniques (e.g., social network analysis), and interdisciplinary fields of inquiry (e.g., behavioural genetics) with the capacity to tackle complex population problems (Fowler et al., 2009).

In essence, systems thinking is a worldview, and an attitude – of inquiry and reflection. Thinking and working in ways that recognise the interconnectedness of the world is the first step – it seems to me – to being able to make the systemic changes that we need to see.

The purpose of this short introduction is to clarify what systems thinking means to lead, then, to the significance of systems change.

2.2 System change as an approach to manage complexity

System thinking enables to see complexity and unpredictable “emergent change” everywhere. Much systems thinking seems to assume that to change a system, it is important to have some power or authority within that system. Community organisations, though, rarely have formal power over the thing they are trying to change, especially groups of people who have come together to try and take control of a neighbourhood or parts of its asset. But what is systemic change?

A greater understanding of systems and how they behave enables to design interventions that bring long-term change to how systems operate, or systemic change. A key part of systemic change for organisations is a change in the relationships between stakeholders so that poor women and men hold more of the power (including the power to influence the system) and benefits within the system.

From this stage point, it is important to note that a small shift in one element of a complex system can produce larger changes in other elements (Meadows, 1999) so to produce a far-reaching impact on the community as a whole as they are designed to maximize benefit and minimize negative consequences. To explain change and accurately envision future changes, let alone achieve them, it is very much helpful to emphasise on the term “*complexity*”. In complex systems, change results from the interplay of many diverse and apparently unrelated factors. Those of us engaged in seeking change need to identify which elements are important and understand how they interact. Systems are in a state of constant change and as Boulton argued, one of the authors of the book *Embracing Complexity: Strategic Perspectives for an Age of Turbulence*” (Boulton, 2015) the use of the metaphor of the forest is adequate to explain complexity as it typically goes through cycles of growth, collapse, regeneration, and new growth. This metaphor also encourages organisation scholars to adapt their analysis and strategy according to the stage that their political surroundings most closely resemble: growth, maturity, locked-in but fragile, or collapsing. In the early part of the cycle’s growth phase, the number of species and of individual plants and animals increases quickly, as organisms arrive to exploit all available ecological niches. The forest’s components become more linked to one another, enhancing the connectedness of the ecosystem while multiplying the ways the forest regulates itself and maintains its stability. Nevertheless, the forest’s internal connectedness and efficiency eventually reduce its capacity to cope with exogenous shocks paving the way for a collapse and eventual regeneration.

Change in complex systems occurs in slow, steady processes such as demographic shifts and in sudden, unforeseeable jumps. Nothing seems to change until suddenly it does, a stop–start rhythm made by events that disrupt social, political, or economic relations and which can open the door to previously unthinkable reforms. Events alike have also been defined as critical junctures (Acemoglu, Robinson et al, 2009) often force political leaders to take up sound policies and make them more willing to take the risks associated with innovation, as the status quo suddenly appears less worth defending.

The literature review on systems change delivers some important key points to be considered. In the effort of promoting systems change it is important to:

- **Foster community and cultivate networks**, this means that most of the qualities of a living system are aspects of a single fundamental network pattern: nature sustains life by creating and nurturing communities. Therefore, lasting change would require a density of interrelationships within a community. To achieve systems change, leaders must cross department boundaries and bring people addressing parts of the problem around the same table.
- **Work at multiple levels of scale**, referring to the core ecological system of “nested systems”. Like Russian "matryoshka" dolls that fit one into the other, most systems contain other systems and are contained within larger systems: cells within organs within individuals within communities. Having considered that, changing a system affects both the systems within it and the systems in which it is nested. The challenge for change agents is choosing the right level, or levels, of scale for the changes they seek. The answer is often working at multiple levels: top down, bottom up, outside in, and inside out.
- **Make space for self-organisation**, meaning that the central concept is that a network pattern is capable of self-organization. Networks that can effect systems change do self-organise when the right conditions are established.
- **Seize breakthrough opportunities when they arise**. Since systems change can be so difficult as a system encounters a point of instability where it is confronted by new circumstances, instability itself can either precipitate either offer a breakthrough of new possibilities due to systems' capacities for self-organization.
- **Facilitate change**, it means that it is opportune to create conditions that take advantage of the system's capacity for generating creative solutions through the nurturing of networks of connection and communication, creating climates of trust and mutual support, rewarding innovation. Effective leaders recognize emergent novelty, articulate it, and incorporate it into organizations' designs.

3 Porta Futuro Bari as a case-study

This case-study provides an overview of an experimental local government project which explains how people, within a community, commonly go about creating a social and environmental value to develop the necessary skills to run sustainable businesses. Access to suitable training, and clear pathways to land-based careers, are crucial to common good land use. Unfortunately, in many cases these are not forthcoming whereas,

at the moment, it is difficult for people to develop secure livelihoods and careers due to the labour market crisis. This is both because of a lack of structured training and work pathways, and because of wider structural issues. The experience of PORTA FUTURO aims to shed light to the systemic change that has occurred in the premises of the Metropolitan area of Bari where institutions and communities have identified space for improvements by introducing and justifying a strategy for improving a critical situation as regards to employment issues.

The history of PORTA FUTURO BARI comes from a past experience conducted in the City of Rome. On July 5, 2011, the Province of Rome, on the basis of other similar national and international experiences, inaugurated in Rome PORTA FUTURO, a new generation Job Centre hosted at the premises of the new “Mercato del Testaccio”. It was intended as a pilot experience on work placement and fully integrated with the functioning of the Employment Centres existing on the territory. It later gained positive results at both national and EU level. Porta Futuro Rome currently provides youth with reception, orientation, training and networking services on work and skills development issues.

Following the numerous contacts between the Puglia Region and the Province of Rome since the very start of the experimentation of Porta Futuro, the Puglia Region has signed a Memorandum of Understanding with the Province of Rome in September 2012 with the aim of transferring part of the gained know-how from the Rome’s experiment to the Apulian regional territory. On the basis of the results obtained in the three-year period of operation, the Ministry of Public Administration subsequently supported the idea of making PORTA FUTURO as replicable experiment also in all Convergence Objective Regions so to fund the “Young People on the Net: the Public Sector at the service of a new employability” Project leveraging on grants connected to PON GOVERNANCE 2007-2013, ACTION E.

3.1 Why Porta Futuro in Bari?

The motivations behind the creation of PORTA FUTURO in Bari are of two types: one is related to the need of cope with the current economic and social crisis of the area; the second refers to the political programme of the Mayor elected in 2014 and actually in power which included the adoption of strategic employment policies.

According to the first motivation, the historical moment that the local context is going through is characterized by a strong economic and employment crisis that has generated a strong social fragmentation and widened the range of exclusions, especially of the youngest, which today affects more than 46% of the young population resident in the Metropolitan Area of Bari. A condition of social emergency that forces the system of local authorities to question themselves on their role as active promoter of active development and protection policies, more inspired by the principles of collaboration and horizontal subsidiarity, to be shared with the main economic and social actors engaged in the territory.

On top of attempting to find a solution to a wider collective problem through stringent public policies, there is also the issue of revitalising and regenerating the fragile

neighbourhood where PORTA FUTURO is going to be located, that is “Quartiere Libertà”. This neighbourhood, born from the first expansion to the west of the city as a territorial sign of a need to establish productive and infrastructural functions and further subjected to aggressive urban sprawl phenomena and consequent housing and social degradation, is currently characterised by a strong level of gentrification, initiated during the 1980s and 1990s, also due to the immigration waves of the last twenty years. In the middle of all this, there is the Tobacco Factory that will host PORTA FUTURO BARI, as it stands as the icon of decades of abandonment and structural inertia, a mere representation of a structural incapacity of dialogue between institutions (constituency, municipality, university, ministry) and programmatic myopia on the vision of rebirth of this neighbourhood. Taking into account these premises, PORTA FUTURO stands as an extraordinary opportunity for a neighbourhood regeneration programme and social re-composition upon which creating a renewed identity and rebuilding a stronger motivation.

As far as the second motivation is concerned, the Municipality of Bari, as declared in the political program of the current Mayor, in collaboration with the main representatives of the territorial economic-social partnership and in line with the measures adopted by the new Apulia Region Extraordinary Work Plan on employability, has planning integrated interventions to address the issues of work and the protection of the weakest social groups exposed to the crisis, including PORTA FUTURO, will have a strong strategic centrality. Also, the Apulia Region welcomed this project and immediately deployed all the necessary means to promote the experimentation through the setup a specific and local model for its own territory. By sharing the powers with the Municipality of Bari, the first pilot project started off in the City of Bari in the prestigious Tobacco Factory building where the Institutional Pact between the Region and the Municipality could be finally welded by virtue of delivering youth policies for urban transformation. On these premises, it is important to note that this has been the start of a closer relationship between public investments on employment policies addressed to job placement and training through modern guidance services able to provide effective responses to the job demand of young people in the Metropolitan area of Bari.

3.2 The vision of porta futuro

PORTA FUTURO BARI complies with a series of national and territorial goals policies regarding the activation employment policies to support young people's access to the labour market, which are as follows:

- objectives of the European Commission on NEETs
- objectives of the Apulia Region regarding either the strengthening of human capital either urban regeneration
- the programming and objectives of the Puglia Region regarding Smart Competences (Smart Puglia2020)
- the schedules and objectives contained in the Pact for Bari between the Region and the Municipality
- the programmatic guidelines of the Mayor 2014-2019.

Applying a systems thinking approach starting the premises above, the vision of PORTA FUTURO BARI is to create an urban hub with a metropolitan dimension, which can foster the full integration of young people in the labour market on the territory, guaranteeing reception, support, training and placement both at the level of demand (under 35) and supply (companies, districts, representations).

The main objectives of PORTA FUTURO BARI are four:

1. categorize the needs of young people by qualifying the social demand for work through a system of reception and skills balance;
2. strengthen the skills of young people through training and job placement;
3. support individual and collective experiences of self-employment, youth entrepreneurship and/or social innovation practices also through the forms of incubators;
4. foster a more efficient and effective dialogue between the school system, professional training, public educational and training agencies, employers and union representatives and districts aimed at producing value.

PORTA FUTURO BARI consists of two phases in an evolutionary logic and, in line with the main national and international experiences, the two phases/sections will be complementary but specialized in functions:

- *Phase 1 (2015-2016)*: recovery, restructuring and redevelopment of the Tobacco Factory, ground floor for the provision of the following services: reception, skills assessment, job placement through basic training policies and company recruitment;
- *Phase 2 (2017-2020)*: extension of the space on the first floor as well as functions focusing on social innovation and business start-up experiences, including a residential portion to incubate new business initiatives according to a logic of turnover. This space will host an innovation atelier and a FAB LAB (from the Italian “fabrication” laboratory) that is a small workshop that offers personalized digital fabrication services, equipped with a series of computerized tool, capable of creating, in a flexible and semi-automatic way, a wide range of objects.

3.3 How does Porta Futuro work?

Considered the above premises, it is important to take into account that PORTA FUTURO as a whole is an ambitious, innovative and challenging project also from the Governance point of view. This mainly for three reasons:

- i. it is the setting where various territorial actors cooperate to create a management framework, putting their own commitment into a system as well as their competences, for the achievement of common goals;
- ii. it is the result of a strong commitment, by the multi-tier local governments, to solve contingent economic and social issues and to consequently equip themselves with tools for planning, management and monitoring beyond the due observance of rules, laws, guidelines and principles of good governance;

- iii. it is supposed to solve the strong fragmentation in the provision of employment services that, so far, have involved different actors (Universities and schools from one side, and institutions from the other one) acting individually without any coherent and synergic effort. In this scenario, PORTA FUTURO's effort in designing and offering a coherently designed policy for employment means to seriously think in terms of effectiveness by identifying new indicators that measure experience and punctually verify user satisfaction, thus resolutely going beyond the simple detection of system efficiency data. This latter attitude requires an approach strongly oriented towards citizens as a user and, in terms of governance, it means formulating specific performance metrics, preparing new reporting systems to be punctually assessed in addition to the usual administrative and financial statements.

At this point, it is important to argue that the governance of a complex organizational actor such as PORTA FUTURO, equipped with a set of resources and skills of its own and many others borrowed from a network of actors and external collaborators (who are also bearers of different and distinctive knowledge, resources, cultures and skills), cannot be resolved in merely prescriptive terms. It is not possible to prefigure a system of rules, standards and procedures capable of pre-ordering all the possible operational interactions between the actors. The ability to manage the relationships between the actors involved and engaged in the project all contributing at creating value for all, is fundamental for the success of PORTA FUTURO.

4 Conclusions

The overall goal of this work has been oriented towards the need to give sense of the importance of systems thinking, while facing with an overly complex view, particularly in dealing with some of today's challenging organizational, social and economic issues. Starting from systems thinking, this paper seeks a subversive approach to bring systems change to the conversation.

Firstly, this paper has explained how systems thinking expands upon the multilevel, multi-sector strategies to support policies supporting employment in a developing area. It provides a primer on the concepts of such thinking and examines how the systems approach can be applied to identify the determinants, strategies, and actions that must be considered to address the economic and social crisis. The case-study provides a practical example of how systems thinking can be used to advance effective change as regards to public policies in the realm of employment issues.

The research question was: can systems thinking be useful for community groups? And if it can, which elements could be most useful? By the case-study described, it could be argued that PORTA FUTURO delivers insights from systems thinking that can be useful for community groups of people trying to change a system.

Born in the wake of the Roman experience PORTA FUTURO BARI and compared to other similar examples at the national and international scale (Barcellona, Bologna, Turin), has distinguished itself for effectiveness and innovation. It allows the integration

of two types of innovation, tangible (within the infrastructural recovery of the site and of the urban neighbourhood) and intangible (with the immaterial benefits of the multiple services delivered to young people, businesses and citizens) both oriented towards the creation of favourable conditions and spaces for socialization and social inclusion in the neighbourhood area with important effects of urban regeneration and local development.

A pivotal role has been played by the Community of the City of Bari, more particularly, its awareness of being a Community that recognizes itself in a model of growth being sensitive to inequalities and rights; a Community enabled to design policies adequately oriented towards integration, inclusion and cohesion; a Community that manages to bring together not only institutions but also economic and financial actors, category representatives, civil society, associations and the third sector on the objectives of social cohesion, development and equity.

The actions conducted by the Community and at the level of the Community are nurtured by a systems thinking approach that provides a way to understand adaptive challenges, as well.

References

- Acemoglu D., Johnson S., Robinson J.A., Yared P. (2009), "Reevaluating the Modernization Hypothesis", *Journal of Monetary Economics*, *Journal of Monetary Economics* 56 (2009) 1043–1058
- Ackoff R. L., Addison H. J., & Carey A. (2010), *Systems thinking for curious managers: With 40 new management F-laws*, Devon, United Kingdom: Triarchy Press
- Ackoff, R. (1974), *Redesigning the Future*, New York, John Wiley
- Adger W.N, Brown K. (2009), *Vulnerability and Resilience to Environmental Change: ecological and social perspectives*, In Castree N., Demeritt D., Liverman D., Rhoads B. (eds). *Companion to Environmental Geography*. Blackwell, Oxford.
- Adger W.N, Kelly, P.M, Winkels, A, Huy L.Q, Locke C. (2002), "Migration, Remittances, Livelihood Trajectories and Social Resilience", *Ambio* 31 (4). June 2002
- Adger W.N, Lorenzoni I, O'Brien K.L. (2009), "Adaptation Now", in: Adger, W.N., Lorenzoni, I, O'Brien, K.L., *Adapting to Climate Change: thresholds, values, governance*, Cambridge University Press.
- Alford J., O'Flynn J. (2009), "Making sense of public value: concepts, critiques and emergent meanings", *International Journal of Public Administration*, 32, pp. 171–191
- Beck Jørgensen, T., Bozeman B. (2007), "Public values", *Administration & Society*, 39, 3, pp. 354-381
- Benington J. & Moore M. H. (2011), "Changing value in complex and changing times", in J. Benington & M. H. Moore (Eds.), *Public value: theory and practice* (pp. 1-30). New York: Palgrave Macmillan
- Boulding, K. (1956) "General Systems Theory: The Skeleton of Science", *Management Science*, April, pp. 197–208
- Bovaird T., Loffter E. (2003), *Public management and governance*, New York: Routledge
- Bozeman B. (2007), *Public Values and Public Interest: Counterbalancing Economic Individualism*, Georgetown University Press, Washington, D.C.
- Brooks N., Adger N.W., Kelly M.P. (2005), "The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation", *Global*

- Casti J. (1994), *Complexification. Explaining a Paradoxical World Through the Science of Surprise*, London, Abacus
- Checkland P. (1981), *Systems Thinking, Systems Practice*, New York, John Wiley
- Daft R. L. (2013), *Organization theory & design*. Mason, OH: South-Western.
- Denhardt J. and Denhardt R. (2003), *The New Public Service. Serving not Steering*, M.E. Sharp, New York
- Eden C, Jones S., Sims D. (1983), *Messing About with Problems*, New York, Pergamon Press
- Flood R. L. (2010), "The relationship of 'systems thinking' to action research", *Systemic Practice and Action Research*, 23(4), 269-284
- Forrester J. W. (1991), *System dynamics and the lessons of 35 years*. In *The systemic basis of policy making in the 1990s*, edited by K. B. De Greene, editor, Cambridge, MA: MIT Press
- Gharajedaghi J. (2011), *Systems thinking: Managing chaos and complexity: A platform for designing business architecture*, Burlington, MA: Morgan Kaufmann
- Handy C. (1993), *Understanding organizations: How understanding the ways organizations actually work can be used to manage them better*. New York, NY: Oxford University Press
- Jung Y. (2014b), *Mindful walking: The serendipitous journey of community-based ethnography*, *Qualitative Inquiry*, 20(5), 621-627
- Kolb D. (1984), *Experiential Learning: experience as the source of learning and development*, New York, Prentice-Hall
- Kooiman J., (2003), "Governing as Governance", Sage
- Manfredi F. (2013), "Community Governance. Comunità in azione", Cacucci Editore
- Meadows D. (1999), *Leverage points: Places to intervene in a system*, Hartland, VT: The Sustainability Institute
- Meadows D. (2008), *Thinking in Systems: A Primer*, White River, Vermont: Chelsea Green Publishing
- Midgley G. (2000), *Systemic intervention: Philosophy, methodology and practice*, New York: Kluwer Academic/Plenum
- Miller J. (1978), *Living Systems*, New York, McGraw-Hill
- Moore, M. (1995), *Creating Public Value* (Harvard University Press, Cambridge)
- O'Connor J., McDermott I. (1997), *The Art of Systems Thinking*, Thorsons, London
- Putnam R. (1993), *Making Democracy Work: Civic Traditions in Modern Italy* (Princeton University Press, Princeton)
- Putnam R. (1995), *Bowling alone: America's declining social capital*. *Journal of Democracy*, 6, pp. 65-78
- Roethlisberger F. J. (1968). *Man-in-organization: Essays of F. J. Roethlisberger*. Cambridge, MA: Harvard University Press
- Schon D. (1971), *Beyond the Stable State: Public and Private Learning in a Changing Society*, London, Maurice Temple Smith
- Scott R.W., (1981), *Developments in Organization Theory 1960-1980*, *American Behavioural Scientist* 24, pp. 407-22
- Seddon J. (2008), *Systems thinking in the public sector: The failure of the reform regime and a manifesto for a better way*. Axminster, United Kingdom: Triarchy Press.
- Senge P. M. (2006), *The fifth discipline: The art and practice of the learning organization*. New York, NY: Doubleday
- Stoker G. (2006), *Public value management: a new narrative for networked governance?* *The American Review of Public Administration*, 36, 1, pp. 41-57

- Von Bertalanffy L. (1933), *Modern theories of development: An introduction to theoretical biology*. Oxford, United Kingdom: Oxford University Press
- Von Bertalanffy L. (1950), The theory of open systems in Physics and Biology, *Science*, 111, 23-29
- Von Bertalanffy L. (1972), "The history and status of general systems theory", *The Academy of Management Journal*, 15(4), 23-29.
- Weber M. (1964), *The theory of social and economic organization*, New York, NY: The Free Press
- Werhane P. H. (2002), "Moral imagination and systems thinking", *Journal of Business Ethics*, 38(1/2), 33-42
- Wheatley M. (2006), *Leadership and the New Science: Discovering Order in a Chaotic World*, San Francisco: Berrett-Koehler Publishers
- Wheatley M. (2007), *Finding Our Way: Leadership for an Uncertain Time*, San Francisco: Barrett-Koehler Publishers
- Zimmerman M. A. (2000), "Empowerment Theory: Psychological, Organizational, and Community Levels of Analysis", In *Handbook of Community Psychology*, ed. Julian Rappaport and Edward Seidman. New York: Plenum Press

Sucessful Alumni Knowledge Management - the Asset of Higher Education and Research Institution

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Abstract

Alumni are one of the most important assets of the universities and their role and place in the university is more often becoming matter of scientific discussion. Author suggests universities to apply systems thinking and look at the wider environment and interactions of various subsystems, alumni community being one of them.

Many authors discuss Higher Education and Research Institution (further HERI) customers and their segmenting (Weaver, 1976; Juran, 1988; Conway, Mackay and Yorke, 1994; Kotler and Fox, 1995; Pereira and Silva, 2003; del Barrio-García and Luque-Martínez, 2009; Taiwo, 2010). The research approves that alumni are HERI customers not only at the particular moment when they purchase HERI services but also continuously (Kotler and Fox, 1995; Heckman and Guskey, 1998; Taiwo, 2010).

Alumni as customer lifecycle is adapted to classical customer lifecycle and merged with Alumni Triple Helix Segmentation. The alumni lifetime engagement is cyclic and with each cycle, it aims for deeper engagement and closer ties, more personal relationship and higher investment in the university. Alumni knowledge management exploits the concept of alumni being customer – that changes attitudes and perspectives towards the strategic activities and knowledge that HERI intends to manage in alumni matters.

Keywords – alumni, knowledge management, systems thinking

Paper type – Academic Research Paper

1 Introduction

Higher education has a history of hundreds of years. Right now, because of rapid technology development and the globalization, the higher education market is radically changing. It is not only privilege of elite circles, higher education nowadays is widely available. Universities are not only centres of knowledge, they are becoming generators

of innovative companies and cornerstones of countries' future prosperity. The higher education market is quite uneven – university competition is moving to the government level where all self-respecting countries take part by generous funding of excellence initiatives. USA and western Europe dominate the rankings and continue to invest strategically in the higher institutions. Worldwide the new life-cycle of a student is transformed to a life-long relationship with the university. After graduation starts new phase of mutually beneficial relationship of alumni and universities. Alumni relations and fundraising is a large industry in USA and Western Europe – it provides significant share of higher education financing and provides means for industry cooperation with universities supporting common research, valorisation, career development. Alumni play a vital role in university support and development. In business it is common and convenient to apply monetary measures for success. Rather in alumni–university relationship intellectual capital, knowledge, information and connection to the labour market are difficult to measure and thus underestimated and insufficiently applied as success metrics. Most commonly knowledge management is associated with organizational efforts to manage its' inner knowledge for better and sustainable business development. Customer knowledge management goes over organizational borders and involves three types of knowledge – to, from and about the customer. That precisely fits with alumni role in the university because the university cannot exist nowadays without the knowledge and experience of the industry because it is preparing the resources that will be the future driver of the labor market. At the same time it is important for the university to tell to alumni and industry what is going on in the campus of the university – what skills students are learning, what are recent inventions, what equipment is in the campus and how these all can be applied in the industry for mutual benefit. Implementation of alumni knowledge management model and systematic use of metrics will timely indicate strategic and knowledge gaps between the universities and the industry. Cooperation with alumni has a multiplier effect because it increases the quality of higher education, it provides technology and knowledge transfer, development of intellectual capital and increase of university brand value.

2 Systems thinking in HERI

The organizations are designed in functions. Each function has its own target and budget. But, as we all know, we work across the functions. So we shouldn't be surprised that we see tensions between meeting functional goals and serving customers. The system governs the way we behave together and the way we behave to our customers. Systems thinking is management approach that looks at the overall system and main processes and integral part of the system rather than separate entities. The key to improvement is looking at the processes as interrelated. Same with key stakeholders of the organization. Understanding them as subsystems and their various interrelated roles and relationships is critical to achieve desired targets, improvements and continuous positive impact on community. Same concept applies to universities – it is important to apply systems perspective (Banathy, 1999; Ison, 1999; Furst-bowe, 2009; Dunnion, 2012). However the

challenges arise due to traditions, organizational structures, academic autonomy and financing issues (Furst-bowe, 2009). There are several frameworks used by HERI that help organizations to implement systems thinking – e.g. Baldrige Education Criteria for Performance Excellence (Furst-bowe, 2009), the Vanguard Method (Dunnion, 2012), etc.

(Muraškovskis, 2015) describes three principles of systemic thinking – hierarchy, evolutionism and emergentism:

- Hierarchy – arrangement of items in different levels, branching and interconnecting links among these items;
- Evolutionism – development of a system within time. We can look at it from two viewpoints – as system itself (ontogenesis) or part of a whole (phylogenesis).
- Emergentism – interconnectedness, interaction and evolution of subsystems.

In other sources emergentism is described as concept “when the whole is greater than the sum of the parts” (Morowitz, 2004; Hitchins, 2007).

By applying these principles when we think about higher education, we can look at the forces that affect it on a wider scope. If we analyze the place of alumni, particularly their knowledge in whole system, we have to look for all intersections of alumni/university knowledge and processes by applying hierarchy and emergentism principles. Until now alumni have not been considered as integral part of the system but they are important subsystem with great influence on the HERI processes (Furst-bowe, 2009; Pham and Jaaron, 2017). Universities must look for most effective ways to engage alumni for increased impact on the study process, research, employability, innovations and resulting impact on community as a whole. In next chapters author discusses the role of alumni within the HERI system and particularly the knowledge management as a way of engagement for sustainable development.

3 Knowledge management in universities

Universities shift from their traditional academic to a new entrepreneurial role as promoters of innovation to significantly contribute to their local economics. Moving away from universities’ traditional two roles of creating knowledge (research) and disseminating knowledge (teaching), (Draghici *et al.*, 2015) describe three main roles for the universities: “education (smart people), research (new knowledge) and knowledge transfer to society (entrepreneurship, technology, expertise)”. (Oosterlinck, 2001) discusses that universities are expected not only to be active in science and technology development but also to turn these developments into innovations and even further implement creation of new ventures. Thus universities are required to maintain bilateral knowledge flow to keep up with innovative learning and teaching (Metaxiotis and Psarras, 2003). Knowledge management in universities:

- Creates link between work and education;
- Helps to create talents matching to workplace demands;
- Contributes to convergence of new knowledge with existing one;

- Incorporates real problems in the learning and knowledge creation process.

Universities are players of the knowledge industry (Rowley, 2010). Universities must foster creation and sharing of knowledge among most important stakeholders – teaching, non-teaching staff, students, alumni, sponsors and other (Hoq and Akter, 2012). Hoq and Akter in their research propose in university context to adapt three layers of knowledge management (Hoq and Akter, 2012) that are described also by (Pan L. and Scarbrough, 1998). Researchers Trivella and Dimitrios propose three basic elements for knowledge management in universities: people, processes and technology (Trivella and Dimitrios, 2015). Academic and nonacademic staff must collaborate, share and access the knowledge, be aware of existing processes (policies and procedures) and it all must be supported by appropriate technological solutions. (Oosterlinck, 2001) adds another factor context (or environment as in the model of (Davenport, De Long and Beers, 1998)) relating to the culture and history of the institution, that are influencing norms, values and attitudes.

Traditional higher education institutions, where significant part of funding is public, are encumbered with excessive control by government institutions. The requirements of accountability dictate quality and governance practices and often negatively impact efficiency and ability to follow the pace of other players of knowledge intensive industries. Now universities must balance between curiosity or mission driven academic research and strategy driven corporate R&D research. At the same time, lifecycle of students' relationship with universities has shifted from traditional view of termination at the graduation point to a life-long relationship. Nowadays needs of students and alumni are continuous growth in knowledge and skills demanded by rapidly developing market. Continuous learning availability is growing with expanding support of technologies. Universities are large, specific and complex organizations with many organizational branches and diverse functions and activities. Thus, the most important first step is to apply systems approach to know which is strategic knowledge and sources of such knowledge.

4. Alumni knowledge management for sustainable development of HERI and communities

4.1 Alumni as *HERI* subsystem

All alumni (alumnus, alumna) definitions are very similar – “A former member of a group, company, or organization” (Cambridge University Press, 2017). However, interpretations can vary. Universities sometimes redefine a wider or narrower scope of alumni. Wider definition comes by including in the concept all persons who have ever entered the organization, even if not formally graduated (e.g. students who are excluded because of academic debts). Narrower concept, on the contrary, deals only with those graduates who after graduation meaningfully reconnect to their alma mater and participate in university activities. (Medeisiene *et al.*, 2017).

Some universities involve students in alumni definition calling them “alumni in training” – according to this concept, universities engage students in alumni activities as if they were alumni (Pumerantz, 2005)(Cohen, 2016)(Feudo, 2010). This concept helps to demonstrate alumni relations to the students from the very beginning of their life in the university thus making them loyal alumni after the graduation.

Alumni are one of the most important assets of the universities (Chi, Jones and Grandham, 2012) but what is their role and place in the university?

Many authors have researched HERI customers and their segmenting according to the impact, roles, as primary, secondary, tertiary or as internal and external. Defining HERI customers is not a trivial task and there is a lot of scientific discussion about it (Weaver, 1976; Juran, 1988; Conway, Mackay and Yorke, 1994; Kotler and Fox, 1995; Pereira and Silva, 2003; del Barrio-García and Luque-Martínez, 2009; Taiwo, 2010).

Customer definitions describes individuals or organizations that purchase the goods or services at a particular time period or intend to do so (Britannica, 2011; Oxford university press, 2017). Alumnus (alumna – female, alumni - plural) is “a person who has attended or has graduated from a particular school, college, or university” (Cambridge University Press, 2017). At first customer and alumni definitions are controversial since customer definition describes present or future transaction but the alumni definition regards the transactions and relationship that have ended. This has been a common perception in European HERI for a long time. Recently most of universities implement alumni relations management as a common practice and an important part of HERI strategic management. Alumni are HERI customers not only in when they actually purchase HERI services but also continuously because the value of their diploma always depends on the HERI performance at that particular moment (Kotler and Fox, 1995; Heckman and Guskey, 1998; Taiwo, 2010).

Author offers new Alumni Triple Helix Segmentation principle that adds to typical segmentation of finances and knowledge the binding element – co-creation capacity. In each segmentation component four subgroups emerge – streamline, status, star and strategic. Such segmentation divides alumni in three strategically most important segments and additionally in each of these segments allows engaging alumni according to their level of activity. This segmentation will set up basis for alumni knowledge management according to their engagement segment and level of activity. The concept is adapted from key account management. There the customers are segmented according to their attractiveness and organization’s relative business strength as seen by the customer. (Homburg, Workman and Jensen, 2000) define KAM “as the designation of special personnel and/or performance of special activities directed at an organization’s most important customers”. Currently industry applies KAM also in B2C and it is supported with university programs (University of Pretoria, 2016).

4.2 Alumni knowledge management

Alumni knowledge management model (Figure 2) exploits the concept of alumni being customer – that changes attitudes and perspectives towards the strategic activities and knowledge that HERI intends to manage in alumni matters. The model also discovers

all possible combinations of HERI-alumni intersections by combining university strategic functions with typical alumni relations processes and implementing knowledge management cycle in each of these intersections.

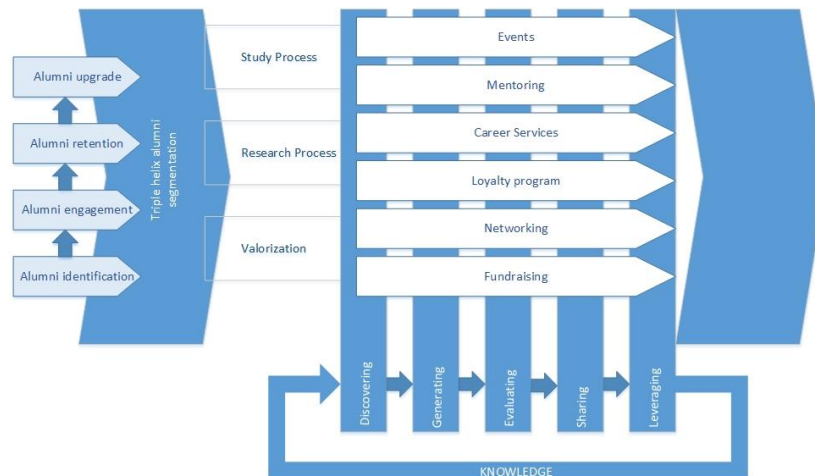


Figure 2 Alumni Knowledge Management model inspired by model of (Gebert et al., 2003)

Model is based on Alumni Triple Helix Segmentation and Key Account Management principles of customer upgrade from least active place in segmentation to the most engaged position. The approach involves customer (this case alumni) identification, engagement, retention and upgrade to the next segmentation (involvement) level. Alumni engagement and knowledge management takes place in all intersections of university and alumni activities. Typical HERI processes are study, research and valorization processes (Draghici et al., 2015). Typical alumni relations processes are event management, mentoring, career services, loyalty program development, networking and fundraising activities. Knowledge management cycle (Jashapara, 2004) involves knowledge discovering, generating, evaluating, sharing and leveraging in each of the intersections of university and alumni relations processes. However full implementation of such a model requires significant organizational and IT support as well as intrinsic interest and understanding in all HERI organizational structures to engage alumni.

5 Conclusions

Universities in their lifetime always have engaged in cooperation with their alumni. The underlying reasons for organized alumni gatherings and university deliberate relationship building with alumni have been the same in 18th century as well as nowadays - networking among alumni, alumni lobbying and knowledge support for improvements in the universities and financial support by alumni to the university. Nowadays, because of rapid technology development and the globalization, higher education market is radically changing thus it is important to research which activities exactly support alumni

long-term engagement in universities. Literature review reveals that alumni are HERI customers not only in direct meaning when they purchase HERI services but also continuously because the value of their diploma always depends on the HERI performance at that particular moment. By applying systems approach we see the wider role of alumni – they are a bridge between HERI and the society at large. The real success of the HERI is often measured by the success of its alumni and how they represent its values in everyday lives and work. Strengthening this bridge involves two way cooperation, including alumni in all possible life stages of HERI in a participatory way. Research proves that universities must invest in alumni relations to improve alumni engagement and views about continuous collaboration with HERI. University must acknowledge alumni as customer role and treat them respectively at the same time demonstrating them challenges and possibilities in this role. Alumni knowledge management is until recently underestimated resource of HERI and community development as a whole. Author has developed a model that describes alumni knowledge management in all university and alumni process intersections.

References

- Banathy, B. H. (1999) 'Systems Thinking in Higher Education : Learning Comes to Focus', 145, pp. 133–145.
- del Barrio-García, S. and Luque-Martínez, T. (2009) 'The value of client perceptions in university strategic planning: an empirical research study', *Industry and Higher Education*, 23(6), pp. 423–436. doi: 10.5367/000000009790156391.
- Britannica, E. (2011) *Encyclopedia - Britannica Online Encyclopedia, EBU*. Available at: <http://www.school.eb.com.au/all/comptons/article-9275557?query=martin+luther&ct=null>.
- Cambridge University Press (2017) *Cambridge dictionary. Alumni*. Available at: <http://dictionary.cambridge.org/english/alumni> (Accessed: 18 September 2017).
- Chi, H., Jones, E. L. and Grandham, L. P. (2012) 'Enhancing mentoring between alumni and students via smart alumni system', *Procedia Computer Science*. Elsevier Masson SAS, 9, pp. 1390–1399. doi: 10.1016/j.procs.2012.04.153.
- Cohen, D. (2016) *The Alumni Revolution*. CreateSpace Independent Publishing Platform.
- Conway, T., Mackay, S. and Yorke, D. (1994) 'Strategic Planning in Higher Education: Who Are the Customers', *International Journal of Educational Management*, 8(6), pp. 29–36. doi: 10.1108/09513549410069202.
- Davenport, T. H., De Long, D. W. and Beers, M. C. (1998) 'Successful Knowledge Management Projects', *Sloan Management Review*, 39(2), pp. 43–57. doi: 10.1016/j.ygeno.2009.01.004.
- Draghici, A. *et al.* (2015) 'A Knowledge Management Approach for The University-industry Collaboration in Open Innovation', *Procedia Economics and Finance*. Elsevier B.V., 23(October 2014), pp. 23–32. doi: 10.1016/S2212-5671(15)00377-9.
- Dunnion, J. (2012) 'Systems Thinking and Higher Education : The Vanguard Method', (2012). doi: 10.1007/s11213-012-9258-4.
- Feudo, J. A. (2010) *Alumni relations. A Newcomer's Guide to Success*. Case Council for Advancement and Support of Education.
- Furst-bowe, J. (2009) 'Systems Thinking : Critical to Quality Improvement in Higher Education', 2(2), pp. 2–4.
- Gebert, H. *et al.* (2003) 'Knowledge-enabled customer relationship management: integrating customer relationship management and knowledge management concepts', *Journal of*

- Knowledge Management*. doi: 10.1108/13673270310505421.
- Heckman, R. and Guskey, A. (1998) 'The Relationship between Alumni and University: Toward a Theory of Discretionary Collaborative Behavior', *Journal of Marketing Theory and Practice*, 6(2), pp. 97–112. doi: 10.1080/10696679.1998.11501799.
- Hitchins, D. K. (2007) *Systems Engineering: A 21st Century Systems Methodology*, *Systems Engineering: A 21st Century Systems Methodology*. doi: 10.1002/9780470518762.
- Hoq, K. M. G. and Akter, R. (2012) 'Knowledge Management in Universities: Role of Knowledge Workers', *Bangladesh Journal of Library and Information Science*, 2(1), pp. 92–102. doi: 10.3329/bjlis.v2i1.12925.
- Ison, R. (1999) 'Applying Systems Thinking to Higher Education', 112, pp. 107–112.
- Jashapara, A. (2004) *Knowledge Management: An Integrated Approach*, *Fisheries Research*. doi: 10.1016/S0165-7836(02)00158-3.
- Juran, J. M. (1988) 'Juran on planning for quality', *New york: Free press*.
- Kotler, P. and Fox, K. (1995) *Strategic Marketing for Educational Institutions*, *EnglewoodCliffs PrenticeHall*.
- Medeisiene, A. et al. (2017) *New strategies for working life collaboration*. Vilnius.
- Metaxiotis, K. and Psarras, J. (2003) 'Applying knowledge management in higher education: The creation of a learning organisation', *Journal of Information and Knowledge Management*, 2(4), pp. 353–359. doi: 10.1109/ITHET.2006.339762.
- Morowitz, H. (2004) *The Emergence of Everything: How the World Became Complex*. Oxford: Oxford University Press, U.S.A.
- Muraškovskis, J. (2015) *Talantīgās domāšanas noslēpumi*. Riga: Fonds Asni.
- Oosterlinck, A. (2001) 'University/industry knowledge management: A university perspective', *Paris: Organisation for Economic Co-operation and Development*, pp. 1–20. Available at: <http://www.oecd.org/edu/skills-beyond-school/2668232.pdf>.
- Oxford university press (2017) *Oxford dictionary. Alumni*. Available at: <https://en.oxforddictionaries.com/definition/alumnus> (Accessed: 18 September 2017).
- Pan L., S. and Scarbrough, H. (1998) 'A socio-technical view of knowledge-sharing at Buckman Laboratories', *Journal of Knowledge Management*, 2(1), p. 55. doi: 10.1108/EUM00000000004607.
- Pereira, M. and Silva, M. Da (2003) 'A key question for higher education: Who are the customers', ... of the 31st Annual Conference of the
- Pham, D. T. and Jaaron, A. A. M. (2017) 'Design for Mass Customisation in Higher Education : a Systems-Thinking Approach'. Systemic Practice and Action Research. doi: 10.1007/s11213-017-9426-7.
- Pumerantz, R. K. (2005) 'Alumni-in-Training: A Public Roadmap for Success', *International Journal of Educational Advancement*, 5(4), pp. 289–300. doi: 10.1057/palgrave.ijea.2140221.
- Rowley, J. (2010) 'Is higher education ready for knowledge management?', *The International Journal of Educational Management*, 14(7), pp. 325–333. doi: 10.1108/09513540010378978.
- Taiwo, A. S. (2010) 'Customers: Identifying the needs in higher education', *Educational Research*, Vol. 1(7), pp. 210–218.
- Trivella, L. and Dimitrios, N. K. (2015) 'Knowledge Management Strategy within the Higher Education. The Case of Greece', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 175, pp. 488–495. doi: 10.1016/j.sbspro.2015.01.1227.
- Weaver, T. (1976) 'What is the Good of Higher Education?', *Higher Education Review*.

The Extraordinary Jubilee of Mercy: a Model of Sustainable Management

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Abstract

The aim of this paper is to describe and analyse a best practice event organized and managed by the Italian Public Administration concerning the achievement of UN's Sustainable Development Goals (SDGs). Specifically, we are going to answer the following research questions: RQ1, Which approach is the most appropriate for the management of highly complex events and inter-institutional projects?; RQ2, Which is the connection between 2030 Agenda and great events?

Large-scale events, which are characterized by a dynamic complexity involving different national public administrations and institutional levels, require a special attention in selecting an adequate event management systems. For this reason, after a detailed literature review on network management, this chapter aims to define the basics of a theoretical framework useful to understand collaboration among several actors, considering that participative approaches should help achieve outcomes in a more effective way. Furthermore, this paper explores the concept of sustainable development and focuses on the traditional elements of social, environmental and economic pillars within context of planned events.

Given the objective of this work, the analysis of a best practice event will be useful to identify the main variables, in terms of sustainable strategic planning, execution and control, required to achieve the greatest level of efficiency in terms of cost optimisation and quality of service delivery, also exhorting the Italian public sector to look for a structural renewal, to better use its available resources, as well as to foster a global sustainable growth. From this point of view, a relevant experience is the case of the Extraordinary Jubilee of Mercy, coordinated by the Prefect of Rome, explored in the last section of the paper. Indeed, the latter, decided to adopt actions consistent with sustainability standards, thanks to the design of an inter-institutional network and the engagement of institutions at different levels. The Prefect of Rome achieved, in a very short term, three main results: coordination of the activities of the working groups (SDG 17, “Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development”); integration of internal and external surveillance and

communication systems (SDG 9, “Build resilient infrastructure, promote inclusive and sustainable and foster innovation”); collaboration with higher education institutions to acquire and disseminate knowledge (SDG 4, “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”). To systemise and combine the outcomes of these processes, as well as to analyse their consistency with sustainable development, the System Thinking technique was used.

Keywords – Network management; 2030 Agenda; Sustainable Development Goals; Sustainable events; Italian Public Administration

Paper type – Practical Paper

1 Introduction

Events, especially the large-scale ones, produce several impacts on the territory, which cannot be exclusively related to an economic nature. The evaluation of the environmental and social effects (according to a triple bottom line approach) of an event is very complex, not only because the effects are often indirect and intangible, and therefore difficult to be perceived and measured in time, but also because the variables which affect the outcomes are actually manifold. Moreover, because of the wide range of the goals pursued and of the heterogeneity of the subjects involved both directly and indirectly (stakeholders), it appears very difficult to single out the parameters according to which measure the success of an event. Several scholars, indeed, state that “the performances measures are different according to the subjects involved in the valuation (promoters, organizers, communities, sponsors, public...) and to the goals pursued” (Gartner & Lime, 2000; Bowdin et al., 2011; Richards & Palmer, 2010).

Consequently, the organizational efficiency needs to pivot on the specific competencies of the civil and ecclesiastical authorities. The visitors’ hospitality will result attentive, inclusive and relished inasmuch as the institutions will be able to work in synergy and harmony.

Interesting theoretical inputs can also be obtained from the analysis of the case study of the Extraordinary Jubilee of Mercy, co-designed and co-organized by two national governments (Italy and the Vatican State) and involving the Catholic Church “as a recognized universal international institution” (Meneguzzo et al., 2017).

According to what has just been written, in the last Jubilee, a sort of “responsible cooperation” among the several stakeholders has been enacted, with the activation of bidirectional relations between all the involved subjects and of concrete steps in a long-term vision, keeping in mind what the event will leave to the territory, the so-called legacy (Allen et al., 2011).

This paper highlights some initiatives and operations carried out during the 2016 Jubilee of Mercy which might steer the sustainable growth of the City of Rome if implemented on the long run. To this aim, this analysis focuses on some of the

Sustainable Development Goals which constitute the most ambitious challenge for the international community until 2030.

Our contribution starts from the analysis of this event, in which the authors have been directly involved as participants to the inter-institutional task force in charge of managing the event (led by the Technical Secretariat for the Jubilee). The paper is divided into three sections: the first one is dedicated to a thorough analysis of the existing literature on event management, with a focus on the sustainable theories of the planning, implementation and evaluation of large-scale events. In the second section, the case of the Extraordinary Jubilee of Mercy is examined, with reference to the management and organizational decisions taken by the Italian institutions. In the end, section three presents a conclusive evaluation of the issue.

2 Theoretical network management framework

Participative approaches could be useful for analyzing the design and the implementation of the event ‘Extraordinary Jubilee of Mercy’, so, theoretical framework includes studies related to the organizational and network management sciences, in particular to the coordination mechanisms in order to understand the effectiveness of the network in terms of guidance and building stakeholder commitment (Mandell, 1999; Klijn, 2010).

Prominent international scholars have suggested that, in complex and changing times, in fragmented societies, participative approaches (Agranoff and McGuire, 2001; Milward and Provan, 2003) should help accomplish outcomes in a more effective way. In their researches, complexity is referred to as the increased connectivity among organizations (public, private and nonprofit actors) at different levels (local, national and supranational), interacting in an external and multi-dimensional environment (economic, social and cultural).

There is a growing need for contemporary governments to look at innovative methods to deal with complex and social problems, the so-called ‘wicked issues’ (Clarke and Stewart, 1997), and networks seem to be at the forefront of this change (Mandell, 1999); thus the engagement of public actors is considered the rule rather than the exception (Ferlie et al., 2005).

As a consequence, in the last stage of public governance, the shift to network management (Kickert et al., 1997) happened naturally according to the societal requirement going beyond the traditional models, which were inadequate to understand the features of the external environment, considered complex, dynamic and diverse (Eljassen and Kooiman, 1993). As stated by Isett et al., the study of networks in public administration literature has rapidly evolved, identifying three mainstreams that emphasize exactly how networks in the public sector are nowadays used as a mechanism to encourage collaborations (Isett et al. 2011). Shortly, these are: (i) policy networks, as a set of public agencies, private sector and nonprofit organizations with a common interest, looking for decisions and pursuing political agendas in a specific area of policy; (ii) collaborative networks, as pools of government agencies, nonprofit and for profit

organizations, working to ensure citizens' satisfaction in providing public services and goods; and (iii) governance networks, where collective actions of several actors are required to find solutions to public issues which cannot be solved by one individual.

As stated by Pollitt and Hupe, "networks are envisaged as the more adequate way to make sense of contemporary complexity", and problems are identified in the lack of knowledge, the involvement of many interdependent players and various decision-making arenas (Pollitt and Hupe, 2011). Thus, networks are considered multi-organizational arrangements in managing problems; they overturn traditional governing structures through formal and informal ties, characterized by reciprocity, mutual interdependencies and various individuals and organizational actors involved in the formulation, implementation and delivery of public services.

In this sense, public networks are recognized by scholars (e.g. Milward and Provan, 2003), as well as by practitioners and even policy-makers, as a model of governance characterized by quality, flexibility and innovativeness in improving coordination in order to increase efficiency and effectiveness (e.g. in the arenas of health and social care, local development, education, security and culture). Network management investigates the way networks are governed and managed and, in particular, which are the mechanisms to promote and build stakeholders' commitment to the final achievement (Provan and Kenis, 2008).

3 Theoretical sustainable event management framework

In recent times, the attention for sustainability, also in events, has increased. By sustainable is defined "a development that satisfies the needs of the present without compromising the ability of future generations to satisfy their own needs" (World Commission on Environment and Development, 1987).

By approaching the event evaluation in terms of sustainability, it is necessary to examine different points of view: it is the case of the environmental, cultural, economic, political and social sustainability. Thus, "for an event to be sustainable, it should be part of a larger strategic project of cultural, social and economic development" (Richards & Palmer, 2010).

The capacity to organize and manage events based on the principle of sustainable development implies the existence of strong and cooperative institutions able to initiate inclusive, representative and reactive decision-making processes (target 16.7), involving all the stakeholders according to the "quintuple helix scheme" theorised by Carayannis and Campbell (2010). In this model, the government, businesses, universities and civil society cooperate toward the sustainable development, sharing resources, instruments and especially, know how. The virtuous circles initiated by the cooperative approach stimulate, indeed, the crossed fertilisation of sustainable ideas and projects (innovation) able to overcome the limitations of the "mental models" (knowledge mix, expertise, capacity) of the single subjects and of the limited resources available. In this way, large-scale events cannot be clustered within the boundaries of a single public administration or agency, but are characterised by a dynamic complexity that involves several offices and

institutional levels (central/federal; regional; metropolitan/local). Moreover, in times of economic crisis and expenditure cuts, institutions arise as solid only when they manage to operate soundly in terms effectiveness, responsibility and transparency (target 16.6 “Develop effective, accountable and transparent institutions at all levels”) but also with economy and efficiency.

For these reasons, it is important to examine, in the upcoming section, the Extraordinary Jubilee of Mercy, an example of best practice of the Italian public administration. The need for achieving extraordinary objectives with ordinary resources led the Prefect of Rome, through the Technical Secretariat for the Jubilee to single out modern, innovative, shared and long-lasting solutions for the management of the event, based on the synergies between all the subjects involved and in line with the SDGs (Fiorani & Di Gerio, 2016).

4 Case Study: The Extraordinary Jubilee of Mercy

In the Catholic tradition, the Jubilee is a major religious event which dates back to the XIV century with Pope Boniface VII. The 2016 Holy Year was defined “extraordinary” not only because it does not fall within the traditional 25-year timeframe, but also because it was the first “thematic” – dedicated to the Mercy – and “decentralised” Jubilee in the history of Christianity. With an unprecedented decision made by Pope Francis, the Holy Doors were opened also in the cathedrals and sanctuaries in all the Dioceses of the world, including 91 States and 560 Doors of Mercy. In line with this “globalist spirit”, the first Holy Door was opened in Bangui, Central African Republic, on the 29th November 2015. The Extraordinary Jubilee of Mercy, announced by Pope Francis on the 11th April 2015 and formally inaugurated on the 8th December 2015, ended on the 20th November. More than 21 million people arrived to Rome during 2016 from 36 different countries. Such an exceptional inflow of visitors and notable personalities determined important implications for the hospitality system in general, and for the mobility services, infrastructures and national security.

As Morcellini said (2016), “the Jubilee of Mercy set a milestone in Rome’s capacity to organize large-scale events, offering a very different image of the Capital from the one pictured by the medias”.

In this way, the strategic management of the event was assigned by the Italian and the Vatican State governments to the Prefect of Rome. The Prefect was in charge of defining the planning framework for managing the event and of ensuring that the whole information and communication systems worked. In view of these objectives, the Italian government (DPCM, the 4th September 2015) resorted to an innovative instrument: the Prefect of Rome was supported by the Technical Secretariat for the Jubilee (TSJ)¹, a task force aimed at fostering the cooperation among the several local administrations and the integration of their operations. Under the management of the TSJ, the Prefect created

¹ The ‘Technical Secretariat for the Jubilee’ included 10 experts representing public administrations and territorial institutions (Ministry of the Interior, Lazio Region, Municipality of Rome), as well as delegates from Civil Protection, Carabinieri Corps and Fire Corps.

eight thematic working groups, with the task of linking the different areas, and invited all interested institutions to participate (Figure 1).

All parties involved were proactive and accepted to share their resources, their information and competencies: this led to the creation of a new concept of large-scale event, which capitalizes on the synergies between all institutions involved, both at the intra-institutional and at the inter-institutional and inter-governmental levels, and between the eight working groups.

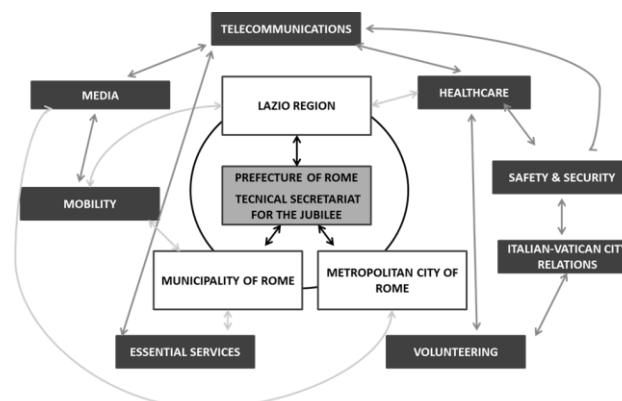


Figure 1. Inter-institutional synergies
(Di Gerio C., Fiorani G.)

A thorough evaluation of the direct and indirect effects, both on the short and medium-long term, is an essential part in the reviewing phase of the event management. Similarly, the social and environmental impact needs to be assessed, in line with the UN Sustainable Development Goals.

The System Thinking map (Figure 2) shows some of the effects related to the Jubilee.

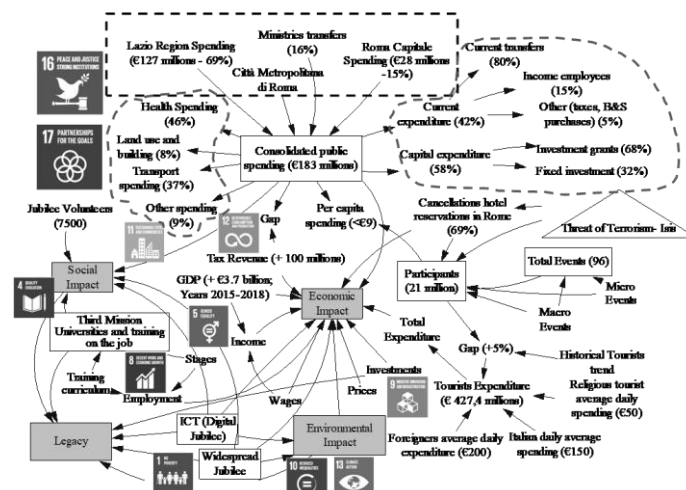


Figure 2. Multi-dimensional impacts: a sustainable Jubilee
(Di Gerio C., Fiorani G.)

As Figure 2 shows, the partnerships (SDG 17, “Partnership for the goals”), i.e. the inter-institutional collaborations between public administrations, nonprofits institutions and enterprises, through the eight thematic working groups coordinated by the Technical Secretariat, together with the presence of strong institutions (SDG 16, “Peace, Justice and Strong Institutions”), are the key success factors of the last Jubilee.

The cooperation with university proved to be paramount (SDG 4, “Quality Education”). This goal, which underlines the link between primary education and professional training, was achieved through a memorandum of understanding between the Prefecture and the three State universities of Rome (La Sapienza, Tor Vergata, Roma Tre) which ensured a scientific and organisational support to the planning, management, communication and post-event evaluation activities. In the “Third Mission” field, the three public universities contributed significantly to the success of the event, sharing their know-how and resources (teachers, recent graduates, spaces and equipment) and offering to students the opportunity to serve an internship, with the aim to let them put into practice what they learned.

Many technological (product and process) innovations (SDG 9, “Industry, innovation and infrastructure”) realised during the Jubilee had a relevant positive impact on the responsible production and consumption models (SDG 12, “Responsible Consumption and Production”). A bright example is the inter-institutional centralised Jubilee Management Room (JMR), hosted by the System Room of the Rome Local Police forces, which played a major role in coordinating the Jubilee-related operations on the field, in monitoring the unfolding of events and assessing the different scenarios in real time. The JMR took advantage of an innovative shared cartographic system so to support the operations of all the Authorities watching the Jubilee events and flank the operation rooms of the single national and local police corps. Within the JMR, the creation of an integrated communication system based on TETRA radio allowed the numerous security forces on the field to share information through a single radio frequency. The JMR also had control on a comprehensive video-surveillance system based on the feed of the single local administrations with the aim to ensure a high degree of security for both the pilgrims and the local community. Thanks to the software and hardware sharing, the numerous entities involved through inter-institutional and public-private partnerships managed to rationalise their projects and intervention policies.

The JMR and the coordination activity of the Prefecture allowed to create public value and to initiate an “intelligent” management process, through a sound use of the resources available on the territory, and constituting a best practice model to be applied to future complex events. It is noteworthy that the planning carried out by the TSJ during the Holy Year was characterized by a particular attention to maximising savings and making the spending more efficient (SDG 12). The short timing (with an advanced notification coming just eight before the inauguration of the event) and the scarcity of financial resources demanded to resort to innovative solutions, including zero cost measures, considerable private capitals contributions, and the exploitation of the equipment already in possess of the national and local administrations.

This Jubilee was also modern, digital and built on a network basis. The 2016 Holy Year was, in fact, the first in the age of social networks, tablets and smartphones, in the era of the continuous connection to the Internet. The Jubilee website and App provided information on monuments and churches, jubilee on foot itineraries, and mobility services. Communication was coordinated by the Italian institutions through the creation of a single website dedicated to the Jubilee called “Roma per il Giubileo” and a physical single Press Point from which all relevant information was conveyed.

The JMR and the single Press Point constituted the brightest examples of the integration of the several entities and administrations which, going beyond their identities and traditions, were called upon to joining their forces within a single operations room, under the same supervision and with a shared “Roma per il Giubileo” logo.

In order to explain more exhaustively the success of this large-scale religious event and the efforts made by the governmental institutions, it is noteworthy to address the link between the Jubilee and the other SDGs.

The interventions to make the City of Rome more inclusive, safe, flexible and sustainable during the event were manifold (SDG 11 “Sustainable Cities and Communities”). Concerning the mobility aspect, the public transport service was strengthened so to meet the high demand peaks in the celebration days and to guarantee the social and environmental sustainability of the event. Moreover, thanks to a single direction of the mobility information¹, it was possible to harmonize the messages about eventual service disruptions or delays, and to convey urban and extra-urban mobility updates in case of necessity. The development of public transport made the City of Rome more sustainable in terms of road system, emissions reduction and livability. The positive environmental impact (SDG 13 “Climate Action”) of the Jubilee is also related to its global and widespread character, which minimized the movement of pilgrims allowing them to obtain the indulgence even in their own countries.

In order to crack down on illegal and unfair treatments to tourists and to raise the security perception of the Italian capital, Codacons, a network of associations for the consumers protection, realized a project called “Sportello del Pellegrino” aimed to provide legal assistance to pilgrims in more than 100 languages and fully managed by volunteers. Furthermore, several initiatives were achieved in favor of disabled pilgrims (SDG 10 “Reduced Inequalities”), in order to guarantee the righteous services. In this way, the App for urban mobility (Mapful) provided information on accessible routes for disabled.

The Jubilee was the driver for the economic and employment growth in the City of Rome and its Province, in particular in the tertiary sector (SDG 8, “Decent Work and Economic Growth”). Nevertheless, the tourist inflow forecasted in 2015 was considerably reduced by the threat of ISIS terrorist attacks, the characterization of this event as a “widespread” Jubilee and the resort to unconventional staying options such as flat-sharing platforms and ecclesiastic structures.

¹ Using ICT to support pilgrims and tourists’ mobility and transfer.

5 Conclusions

The case study here analyzed shows that no one of the 17 2030 Agenda SDGs is feasible without the contribution of strong institutions. In this framework, the so-called quintuple helix cooperation, made up by governments, businesses, non-profit organizations, the civil society and the universities, emerged as paramount in order to ensure the success of the Jubilee.

Moreover, the issues of sustainable development are deeply rooted in an innovative, efficient, digital open and cooperative in public administrations. Based on this recent experience, the extraordinary spirit of sharing and cooperation which inspired the activity of all those involved in the success of the Jubilee of Mercy might constitute a valid example for all the future large-scale events in Italy and abroad. In fact, the challenge for great events is to think over development model in terms of sustainability and efficiency in favor of integration, cooperation, social innovation and able to create inclusive networks; thus the engagement of several public actors is considered the rule rather than the exception.

In conclusion, the case of the Extraordinary Jubilee of Mercy, in our opinion, provides useful theoretical and empirical indications in the field of public management and governance and represents an important conceptual and operational challenge for the Italian public administration system. The integrated system for the management of the event, based on quintuple helix approach and integrated networks, could provide important indications for the future management of large events (sports, culture, promotion of the economy and the image of the country) and for the management of intervention policies facing environmental emergencies (such as recent earthquakes in Central Italy). This change of mind could be useful to turn a best practice into ordinary reality.

The other relevant aspect emerged from the paper concerns to the introduction of a multidimensional assessment of the impact of the event. Short and medium-long term aspects should be taken into consideration, such as social and environmental impacts and legacy, in line with United Nations' Sustainable Development Goals (SDGs). Goal 16 ("Peace, Justice and Strong Institutions") is definitely the one closer to a religious event like this and is the one which better meets the aims of the Jubilee: to promote pacific and inclusive communities and societies for the sustainable development. The extension of the event in the several countries (widespread Jubilee), the legal support provided by the Sportello del Pellegrino, the operations countering corruption and criminality, the public access to information, the promotion of initiatives to reduce inequalities, and the role played by the institutions for a representative, inclusive and reactive decision-making process are all examples of effectiveness, responsibility and transparency.

To conclude, we can answer the research questions stated in the Abstract section.

For what concerns RQ1 (*Which approach is the most appropriate for the management of highly complex events and inter-institutional projects?*), the case of the Extraordinary Jubilee of Mercy highlights the need to adopt a syncretic public policy implementation approach. Indeed, the syncretic approach adopted by the Technical Secretariat for the

Jubilee achieved important results in terms of continuously rebuilding the network of interested actors and developing a collaborative network. Several issues were solved, such as those linked to the traditional institutional fragmentation at local level, the complexity of the network of actors involved, the strong cultural resistance of several stakeholders, both public and private, the implementation of systemic actions, and the lack of financial resources. Despite the high complexity of the event, the TSG was able to avoid a governance process that could be influenced by too many crowded working groups and meetings. Other methodologies, such as the implementation scenarios and the evaluability assessment, largely adopted in the US administration since the '80s (Poister, 1981), could provide useful indications for the management of large inter-institutional events. Ready-to-use technologies, the employment of available equipment and the interaction among public and private administrations were the key factors for delivering a high degree of efficiency and quality.

Concerning RQ2 (*Which is the connection between 2030 Agenda and great events?*), the integration of economic, environmental and social measures allows us to obtain a holistic view of the impacts generated by an event and, at least, its real level of sustainability. Such, material and immaterial legacy is added, considered as the starting point for the creation of a sustainable and smart city attentive to improving the quality of life of its citizens, businesses and institutions and the general well-being of the community.

As many studies show (A GlobeScan, 2016; www.asvis.it; AIESEC, 2017) additional governmental efforts are required over the next 12 years in order to lead the world countries to the full implementation of the 2030 Agenda, also with respect to event management. The Italian government committed itself to this aim with resoluteness and resilience, as in the case of the Joint Italian-German-French Declaration on the US withdrawal from the Paris climate agreement, bearing in mind the outstanding results achieved in the organization of the Jubilee.

References

- Agranoff R., McGuire M., (2001) Big questions in public network management research, *Journal of Public Administration Research and Theory*
- Bowdin G., Allen J., O'Toole W.G., Harris R., McDonnell I., (2006) *Events management*. 2nd ed., Oxford: Butterworth-Heinemann
- Bowdin G., Allen J., O'Toole W.G., Harris R., McDonnell I., (2011) *Events management*. 3rd ed., Oxford: Butterworth-Heinemann
- Clarke M., Stewart J., (1997) *Handling the wicked issues: a challenge for government*, Birmingham: Institute of Local Government
- Dicorato S.L., Marchese B., Paciullo G., Meneguzzo M. (2016). Il consolidamento della spesa delle amministrazioni pubbliche per la realizzazione del Giubileo della Misericordia, in Tramontano A. (ed.) (2016). *Giubileo Straordinario della Misericordia: L'esperienza della Segreteria Tecnica per il Giubileo*, Segreteria Tecnica per il Giubileo
- Eljassen K.A., Kooiman J. (eds.) (1993). *Managing public organisations: lessons from contemporary European experience*, London: Sage

- Ferlie E., Lynn L.E., Pollitt C. (eds.) (2005). *The Oxford Handbook of Public Management*, Oxford: Oxford University Press
- Fiorani G., Di Gerio C. (2016). Valutazione di impatto multidimensionale del Giubileo della Misericordia, in Tramontano A. (ed.) (2016). *Giubileo Straordinario della Misericordia: L'esperienza della Segreteria Tecnica per il Giubileo*, Segreteria Tecnica per il Giubileo
- Fiorani G., Meneguzzo M., Jannelli R. (eds.) (2012). *CSR 2.0 proattiva e sostenibile. Tra mercati globali e gestione della crisi*, Milano: Egea
- Isett K.R., Mergel I.A., LeRoux K., Mischen P.A., Rethemeyer R.K. (2011). Networks in Public Administration Scholarship: understanding where we are and where we need to go, *Journal of Public Administration Research and Theory*
- Kickert W.J.M., Klijn E.H., Koppenjan J.F.M. (1997). *Managing complex networks*, London: Sage
- Klijn E.H. (2010). Trust in governance networks: looking for condition for innovative solutions and outcome, in Osborne S.P. (ed.) (2010). *The New Public Governance? Emerging perspectives on the theory and practice of public governance*, London: Routledge
- Mandell M.P. (1999). The impact of collaborative efforts: changing the face of public policy through networks and network structures, *Policy Studies Review*
- Milward H.B., Provan K.G. (2003). *Managing the Hollow-State: collaboration and contracting*, Public Management Review
- Morcellini M. (2016). Il cantiere formativo progettato dalla Prefettura e dagli Atenei pubblici romani, in Tramontano A. (ed.) (2016). *Giubileo Straordinario della Misericordia: L'esperienza della Segreteria Tecnica per il Giubileo*, Segreteria Tecnica per il Giubileo
- Poister T.H. (1981). Program evaluation: state of the art/ state of the practice, *Public Administration Review*
- Pollitt C., Hupe P. (2011). Talking about government. The role of magic concepts, *Public Management Review*
- Provan K.G., Kenis P. (2008). Modes of network governance: structure, management, and effectiveness, *Journal of Public Administration Research and Theory*
- Richards G. & Palmer R. (2010). *Eventful cities. Cultural management and urban revitalisation*, Oxford: Butterworth-Heinemann

Exploring the Influence of Self-determination in the Collective Intelligence of Collaborative Organizations

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Abstract

In recent years, positive correlations between some factors of collaborative group task processes and the increasing of collective intelligence (CI) have been presented. This work introduces a hypothesis that argues the existence of a new factor of positive influence for the increasing of collective intelligence in collaborative group tasks operating in cooperative environments: self-determination. Therefore, we present an argumentation based on Cooperative Multiagent Systems that spotlights the significance of self-determination in these particular environments. Furthermore, we also introduce a preliminary design of an experimental setup and a methodological framework for validating the hypothesis empirically in human organizations. Our propose consists on measuring, on the one hand, the level of self-determination from the individuals that participate on the decision-making processes, and on the other hand, on measuring the level of collective intelligence achieved by performing collaborative group task. Finally, we propose to use statistical analysis to explore if there are positive correlations between self-determination and collective intelligence in cooperative environments, such as collaborative organizations.

Keywords – Collective Intelligence, Self-determination, Collaborative Organizations, Cooperative Multiagent Systems, Self-determinant Governance

Paper type – Academic Research Paper

1 Introduction

This work argues that individual *self-determination* empowers organizations to collectively take more intelligent decisions, under the assumption that the problems they are solving are collaborative, and the individuals that shape the organization can be considered minimally rational, i.e., the actions they decide to execute guarantee an increase of their performance in the environment (Russell & Norvig, 2004). According to (Romme, 1999), *self-determination* in an organizational or decision-making process is the ability of an individual to block collective decisions that he or she considers may negatively affect their expected utility. In turn, *collective intelligence* is understood as the collective ability to decide joint actions that allow improving the value captured from the environment, i.e., increase their utility.

This argument is based on the theory of Cooperative Multiagent Systems (Wooldridge, 2009, Ferber & Weiss, 1999), and arises from some considerations on how, in cooperative environments, there is an alignment between the level of individual expected utility, and the level of expected utility of the organization; in such a way that the organization only maximizes its utility when all its agents also maximize their individual utility (through the same joint action), and vice versa. In this context, rational agents having the ability to block actions that are considered to be detrimental to their expected utility, ensure that no not-intelligent joint actions are executed.

We also present an experimental setup for complementing the theoretical validation with an empirical one, by reporting the correlation between individual self-determination and collective intelligence. We introduce a methodological framework for measuring, for each decision made collectively, the level of self-determination self-perceived by individuals, based on tools for developing measurement models provided by the Self-Determination Theory (Ryan & Deci, 2000); together with a method for measuring the level of Collective Intelligence (*CI metric*) in collaborative group tasks based on tools introduced by (Woolley et al., 2010, Engel et al., 2014, 2015).

The interest to delve into factors of positive influence for increasing collective intelligence in these contexts is fundamented in its potential impact on new organizational typologies such as Collaborative Networked Organizations (CNO) that emerge in the context of research in Human-Computer Interaction and Collaborative Crowdsourcing (Engel et al., 2015, Bingham et al., 2015), focused on studying the potential for *the many to outperform the few* based on new collaboration opportunities resulting from novel means for people to access information, services and other resources (Camarinha-Matos et al., 2009; Dutton, 2008).

Furthermore, the demonstration of an existing positive correlation between individual self-determination and collective intelligence presents a two-fold motivation for designing human-centric governance systems that respect individual self-determination, such as the existing Sociocracy (Endenburg & Bowden, 1988), Holacracy (Robertson, 2007) or Sociocracy 3.0 (Priest & Bockelbrink, 2017), as well socio-technological artifacts for facilitating its adoption. On one hand they are rendered indispensable for increasing the collective intelligence of the organization adopting the governance system, while

resulting in an increase in satisfaction of the needs of the individual humans that compose the organization.

In recent years, positive correlations between some factors of collaborative group task processes and the increasing of collective intelligence have been presented, both in groups collaborating face-to-face and on groups collaborating through socio-technological systems. Woolley et al., (Woolley et al., 2010) highlighted three factors that show strong correlations with the increase of collective intelligence in groups, and consequently can be considered as factors of positive influence: (1) the average of social sensitivity, i.e., the (average) ability to correctly detect the feelings and viewpoints of people by observing their facial features, (2) the number and distribution of speaking turns, and (3) higher proportion of women in groups. However, as far as we could investigate, there is no systematic research by these authors, or others, that focuses on exploring the level of self-determination from individuals who participate in a decision-making process as a factor of positive influence for the increasing of collective intelligence. Hence, we understand that this positive correlation is an unexplored factor that is worth investigating.

This paper is organized as follows. Section (2) presents and develops the main argument, providing definitions of the necessary concepts and explaining the causality of the proposed correlation, i.e., that the increase of individual self-determination leads to the increase of collective intelligence in particular environments. Next, Section (3) introduces the proposed experimental setup for validating the hypothesis empirically. On the one hand, in (3.1) a particular adaptation of the Self Determination Theory (Ryan & Deci, 2000) questionnaires for scale-building is proposed, in order to measure the level of self-determination from each individual participating in a decision-making process. On the other hand, in (3.2) the framework used by (Woolley et al., 2010, Engel et al., 2014, 2015) is introduced, used for measuring the level of collective intelligence of a group through the resolution of collaborative tasks. Finally, the main conclusions are presented in Section (4) and the references used in Section (5).

2 Self-Determination as an heuristic for *Optimal Joint Policy* search

In agent theory (Russell & Norvig, 2004; Wooldridge, 2009), *intelligence* is defined as the ability of an agent to choose those actions that maximize its utility in a work environment. The difficulty for finding these intelligent actions depends on some characteristics of the agent's working environment, namely, whether it is: *static* or *dynamic* (i.e., the environment behaviour can change over time or not); *deterministic* or *stochastic* (at any given state, the same action always produces the same outcome, that is, for the same action, the environment always transitions to the same successor state); *episodic* or *sequential* (either the optimality of future actions depends or not on the present action); totally or partially observable (agents can determine or not what is the current state of the environment), and *single agent* or *multiagent* (there are other rational agents operating in the environment or not). The latter can be further characterized as *cooperative* versus *competitive* environment (explained below). Each of these

characterization results in an increasingly complex formalization of what is considered a solution to the artificial intelligence problem.

The simplest, yet realistic characterization of the problem in which our argument is framed considers a cooperative multiagent problem. A *multiagent system* can be understood as a system made up of more than one rational agents that has to be coordinated for learning those joint actions that allow them to maximize their utility in a given environment. Differently from the single agent case; in multiagent problems agents present interdependencies, that is, agents not only have to reason about which of their own actions are best for maximizing their individual utility, but they also have to reason about the effects produced by the other agents actions. In other words, agents has to learn the *joint* actions that maximize their utility, and their individual intelligence is measured in terms of these joint actions.

In the simplest workspace, i.e, the static, deterministic, episodic, totally observable, and single agent, a solution is a single action that guarantees a maximum return from the environment. When the workspace turns to be sequential, solutions becomes sequences of actions. This is the case for the well-known search and planning problems (Russell & Norvig, 2004), that help the agent to find objective states (i.e., they model the utility as zero for every state and some arbitrary non-zero positive value for the objective state). If the workspace is now stochastic (as well as sequential), sequence of actions are not appropriate, as the stochasticity of the workspace results in the same sequence reaching a whole set of possible states, with the objective state being only one of them, without certainty that it will be reached. What is required here is to maximize the probability of reaching that objective state. For that, solutions are expressed in terms of *policies*: functions from states to actions, that indicate what action should the agent execute in each state. A solution in these cases is therefore the *optimal* policy, the policy that maximizes the probability of reaching the objective state. For more general problems with a general utility function over the state space, the solution is the policy that results in the maximum *expected* utility extracted from the environment, computed from the expected utility that could be obtained starting from the initial state, and the expectation computed over all possible state trajectories the agent could traverse when acting on its policy, with bifurcations arising from the stochasticity of the actions.

Finally, in a *multiagent system*, agents present interdependencies, that is, agents not only have to reason about which of their own actions are best for to maximizing their individual utility, but they also have to reason about the effects produced by the other agents actions. In other words they have to learn which are the *joint* actions that maximize their individual utility. When the multiagent system is embedded in a sequential and stochastic workspace (and regardless of the dynamicity and observability of the environment), the solution for some agent is a joint policy that produces a maximum expected utility for that agent, that is, a function that indicates for each state (or observation in the more general case of partial observability), what is the joint action that when the agent starts at some initial state, guarantees to produce the long-run maximum expected utility for the agent. Interdependencies between the agents' actions may result in the impossibility to optimize the policy for each individual agents. In the particular case

of *cooperative* multiagent problems, agents are motivated to coordinate themselves because there is a solution that benefits all of them (win-win), as opposed to the *competitive* problems where the solution implies that if one agent maximizes its utility, another may be harmed (win-lose). So in cooperative problems, there is a policy that guarantees, not only to maximize the expected utility of the collective, but also the expected utility of each agent.

In this context, self-determination can be understood as a sensory and cognitive heuristic for finding optimal joint policies, based on the fact that in cooperative environments, any joint action that is harmful to at least one of the agents, is harmful to the organization. Therefore, providing individual agents with the self-determinant ability to block joint actions that from her own perspective could be harmful to her own individual utility, results in the blockage of joint actions that most probably are not those recommended by an optimal joint policy for the collective. In this regard, individual self-determination works as a heuristic for reducing the search space for the optimal joint policy.

3 Design of the experimental setup

In order to empirically validate the correlation between self-determination and collective intelligence, we present a preliminary design of an experimental setup and a methodological framework for data gathering and data analysis that combines both, qualitative and quantitative methods based on (Zhou, 2019). Definitive questionnaires for measuring self-determination are not included.

The main purpose is to measure the level of self-determination from each individual participating in the decision-making of a collaborative joint action, together with the level of collective intelligence (*CI metric*) reached after executing the actions produced by these decisions. According to this, a particular adaptation of the scales offered by the Self-Determination Theory is proposed for measuring self-determination (Ryan & Deci, 2000), and the framework presented by (Woolley et al., 2010, Engel et al., 2014, 2015) for measuring the collective intelligence of groups, the IC metric, is introduced.

By obtaining these measures, it would be possible to study and validate if there are positive correlations between the level of self-determination from each individual participating in the decision-making and the level of collective intelligence (CI) arising by performing the group task. The measurement methods are explained in detail in the following sections.

3.1 Measuring self-determination

In order to measure the level of self-determination, Self-Determination Theory (Deci & Ryan, 2000) offers tools for designing different scales based on *self-regulation*, which assess domain-specific individual differences regarding the types of motivation or regulation. Since, according to Self-Determination Theory, motivation can vary in the

degree of being *autonomous* versus being *controlled*, or in other words can vary depending on the level of self-determination (Deci & Ryan, 2015).

The basis for designing our particular measurement tool are the questionnaires for measuring self-determination in work environments such as the Work Extrinsic Intrinsic Motivation Scale (WEIMS) (Tremblay et al., 2009). These questionnaires have been adapted for measuring self-determination in particular work contexts, also for virtual context such as crowdsourcing micro-tasks platforms (Naderi, 2014). However, to the best of these authors' knowledge, there are no questionnaires designed for properly analyzing the level of self-determination in collaborative decision-making processes. Instead, this aspect has been only partially covered in more general questionnaires related to the level of satisfaction at work (Deci et al., 2017). Thus, a questionnaire to carry out this concrete measurement would be designed following the proposal of (Zhou, 2019): a mixed methods model of scale development and validation analysis. This method introduces 5 different steps.

Step 1: Qualitatively investigating the scale construct. In this stage the phenomenon that is going to be studied is defined as the construct of the scale: self-determination. To this end, we will propose an ethnographic approach to carry out fieldwork (participant observation, semi-structured interviews) over different organizations operating with self-determinant governance structures in order to look into which issues may affect the levels of self-determination of individuals' decision-making, such as the decision-making mechanism; the invisible power structures (Freeman, 1970), i.e, informal networks that exercise dominance in the form of social pressure, or the overload associated with the inclusion of all individuals in decision-making processes.

Step 2: Converting qualitative findings to scale items. Transforming qualitative data to measurable items is a mixing strategy that indicates how qualitative and quantitative data are integrated. In this work, the main goal objective is to spotlight undercovered variables that can affect the levels of individual self-determination discovered in the field work, and classify them in the dimensions or levels of self-determination proposed by Ryan & Deci (Ryan & Deci, 2000). This work differentiates between *autonomous motivation* and *controlled motivation* and suggests that behaviors can be classified based on the degree to which they are autonomous or controlled. Therefore, they introduce a self-determination continuum showing types of motivation with their regulatory styles, loci of causality, and corresponding processes. From more self-determinant to nonself-determinant they distinguish between: (1) intrinsic regulation, (2) integrated regulation, (3) identified regulation, (4) introjected regulation, (5) external regulation, (6) amotivation. In order to explore and test the variables discovered in the fieldwork, a Lickert scale questionnaire would be designed for relating sets of questions with the different dimensions of self-determination proposed by Ryan&Deci (Ryan&Deci, 2000).

Step 3: Conducting mixing validation to review items' content-based validity. Mixing validation indicates that both qualitative approaches (reflection, debriefing, panel review) and quantitative methods (sorting and calculation) are used to validate that the selected items or constructs from the field work tackle exhaustively the construction of the scale to be measured.

Step 4: Administering the scale on the target population. The quantitative survey is a primary method to administer the new instrument (May, 2001). Accordingly, the questionnaire would be sent to a representative sample of the scale we want to measure. Issues related to the size and sample distribution requirements will be considered, specially that advanced statistical analysis, such as factor analysis, require hundreds of responses for each item.

Step 5: Conducting quantitative validation to examine item's construct-based validity. The responses of the items will be analyzed statistically and validated using factor analysis methods (Stevens, 2012).

3.2 Measuring Collective Intelligence (CI)

As it have been shown in (Woolley et al., 2010; Engel et al., 2014; 2015), groups can be characterized by a collective intelligence factor that measures their ability to collectively perform in a wide range of different tasks, which allows the prediction of the groups' performance on other tasks in the future. That is, like individuals, groups have characteristic levels of intelligence, which can be measured systematically through the Collective Intelligence metric (CI metric) based on the statistical approach that psychologists used to measure individual intelligence (Woolley et al., 2015).

In all these experiments, three factors were significantly correlated with the collective intelligence of a group: (1) the average of social sensibility from group members, (2) the number of speaking turns, i.e., the groups where the conversation was dominated by some people express less intelligence than those where conversation is more distributed, (3) higher proportion of women in groups, since women show a better average on social sensibility. However, to the best of these authors' knowledge, there are no systematic research by these authors, or others, that focuses on exploring the level of self-determination of individuals who participate in a decision-making process as a factor of positive influence for increasing of intelligence collective. Consequently, we propose to use the CI metric tests used by (Woolley et al., 2010; Engel et al., 2014; 2015) for measuring Collective Intelligence. These tests are based on a selection of tasks from all quadrants of the McGrath Task Circumplex, a well established taxonomy of group tasks based on the coordination processes they require. These tasks include solving visual puzzles, brainstorming, making collective moral judgments, and negotiating over limited resources. Furthermore, these IC metric tests have been evaluated both, in face-to-face experiments and also in online experiments, i.e., technology-mediated, through a testing platform. Thus, we propose to adapt the online testing platform presented in (Engel et al., 2014;2015) to facilitate participation.

Finally, for exploring if there is a positive correlation between the level of individual self-determination and the increasing of collective intelligence in a group, we propose to embed the questionnaires designed to measure the level of self-determination to the online testing platform used by (Woolley et al., 2010; Engel et al., 2014; 2015) for measuring the CI metric from a group that solves collective task collaboratively. Accordingly, for each completed task we will obtain, on the one hand, the CI metric score associated with the task; and on the other hand, the level of self-determination expressed

by each of the participating individuals. With this pairing, we will be able to explore if there are positive correlations through different statistical analyzes, i.e., we would be able to check if the tasks with a higher CI metric score are also those in which the participants express a higher level of self-determination.

4 Conclusions

In this work, we introduce the hypothesis that individual self-determination is a factor of positive influence for increasing collective intelligence in cooperative multiagent problems in sequential stochastic environments. To validate it, a theoretical argument has been presented as well as an experimental design to perform an empirical validation.

In section (2) an argument framed in agent theory (Russell & Norvig, 2004) is presented. As it have been shown, theoretically there is an existing positive correlation between *self-determination* and the increase of collective intelligence in cooperative multiagent systems because in this particular contexts, any joint action that is harmful to the organization is harmful to at least one of the agents, and vice versa. Consequently, as it has been shown, *self-determination*, i.e., the individual capacity of an agent to block collaborative joint actions when she thinks that it may affect her individual expected utility, serves as a heuristic to collectively compute the search for the optimal joint policy of the organization.

This heuristic is based on reducing the search space of the optimal joint policy by discarding those joint actions that sure are not in the optimal joint policy, i.e., that have been objected by at least one of the individuals, and therefore, are not collaborative. Consequently, it is assumed that when discarding non-collaborative actions, the remaining joint actions, those that are part of a joint collaborative policy, have a greater chance of being in or close to the optimal joint policy.

In section (3) an experimental setup has been presented, describing the tools for measuring both, the level of self-determination from individuals; and the level of collective intelligence in collaborative task solving (CI metric). Accordingly, these tools have been described and evidences from its validity have been presented, concluding that they are able for measuring the level of self-determination of different individuals participating in a joint activity (Deci & Ryan, 2015), and for measuring the level of collective intelligence of a group (CI metric) (Woolley et al., 2010; Engel et al., 2014; 2015). Furthermore, we showed how these tools have been adapted to particular situations previously (Tremblay et al., 2009; Naderi, 2014) and we introduced a methodological framework (Zhou, 2019) to properly validate an adaptation to the particular problem posed in this work .

Finally, we have offered an explanation of how the gathered data will be computed in order to test the correlations, demonstrating that the proposed experimental setup would be able for validating the main hypothesis presented in this work: individual self-determination is a factor of positive influence for the increase of collective intelligence in cooperative certain cooperative contexts.

References

- Bigham, J. P., Bernstein, M. S., & Adar, E. (2015). Human-computer interaction and collective intelligence. *Handbook of collective intelligence*, 57.
- Buck, J.A., & Endenburg, G. (2015). *Sociocracy: The creative forces of self-organization*. Rotterdam: Sociocratic Center. The Netherlands, Tech. Rep. Retrieved May, 8, 2015.
- Camarinha-Matos, L. M., & Afsarmanesh, H. (2008). On reference models for collaborative networked organizations. *International Journal of Production Research*, 46(9), 2453-2469.
- Camarinha-Matos, L. M., Afsarmanesh, H., Galeano, N., & Molina, A. (2009). Collaborative networked organizations—Concepts and practice in manufacturing enterprises. *Computers & Industrial Engineering*, 57(1), 46-60.
- Deci, E. L., & Ryan, R. M. (2015). SDT: Questionnaires: Intrinsic motivation inventory (IMI).
- Deci, E. L., Olafsen, A. H., & Ryan, R. M. (2017). Self-determination theory in work organizations: The state of a science. *Annual Review of Organizational Psychology and Organizational Behavior*, 4, 19-43.
- Dutton, W. H. (2008). Collaborative network organizations: new technical, managerial and social infrastructures to capture the value of distributed intelligence.
- Ferber, J., & Weiss, G. (1999). *Multiagent systems: an introduction to distributed artificial intelligence* (Vol. 1). Reading: Addison-Wesley.
- Endenburg, G., & Bowden, C. W. (1988). *Sociocracy: The Organisation of Decision-making: "no-objection" as the Principle of Sociocracy*. Stichting Sociocratisch Centrum.
- Engel, D., Woolley, A. W., Aggarwal, I., Chabris, C. F., Takahashi, M., Nemoto, K., & Engel, D., Woolley, A. W., Jing, L. X., Chabris, C. F., & Malone, T. W. (2014). Reading the mind in the eyes or reading between the lines? Theory of mind predicts collective intelligence equally well online and face-to-face. *PloS one*, 9(12), e115212.
- Malone, T. W. (2015, April). Collective intelligence in computer-mediated collaboration emerges in different contexts and cultures. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 3769-3778). ACM.
- Malone, T. W. (2018). How Human-Computer 'Superminds' Are Redefining the Future of Work. *MIT Sloan Management Review*, 59(4), 34-41.
- Naderi, B., Wechsung, I., Polzehl, T., & Möller, S. (2014, November). Development and validation of extrinsic motivation scale for crowdsourcing micro-task platforms. In *Proceedings of the 2014 International ACM workshop on Crowdsourcing for Multimedia* (pp. 31-36). ACM.
- Olson, G. M., Malone, T. W., & Smith, J. B. (2013). *Coordination theory and collaboration technology*. Psychology Press.
- Poblet, M., & Plaza, E. (2017). *Democracy Models and Civic Technologies: Tensions, Trilemmas, and Trade-offs*. arXiv preprint arXiv:1705.09015.
- Priest, J., & Bockelbrink, B. (2017). *Sociocracy 3.0*. Sociocracy30.org.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, 55(1), 68.
- Romme, A. G. L. (1999). Domination, self-determination and circular organizing. *Organization Studies*, 20(5), 801-832.
- Romme, A. G. L., & Endenburg, G. (2006). Construction principles and design rules in the case of circular design. *Organization science*, 17(2), 287-297.
- Russell, S., Norvig, P. (2004). *Inteligencia artificial, un enfoque moderno*. Pearson Educación, Madrid
- Stevens, J. P. (2012). Exploratory and confirmatory factor analysis. In *Applied multivariate statistics for the social sciences* (pp. 337-406). Routledge.

- Tremblay, M. A., Blanchard, C. M., Taylor, S., Pelletier, L. G., & Villeneuve, M. (2009). Work Extrinsic and Intrinsic Motivation Scale: Its value for organizational psychology research. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, 41(4), 213.
- Wooldridge, M. (2009). *An introduction to multiagent systems*. John Wiley & Sons.
- Woolley, A. W., Chabris, C. F., Pentland, A., Hashmi, N., & Malone, T. W. (2010). Evidence for a collective intelligence factor in the performance of human groups. *science*, 330(6004), 686-688.
- Zhou, Y. (2019). A Mixed Methods Model of Scale Development and Validation Analysis. *Measurement: Interdisciplinary Research and Perspectives*, 17(1), 38-47.

The Medical Record and the Cycle of Innovation in the Clinical Pathway of Patients Suffering from Pathological Addictions

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Abstract

OECD's countries in the last 15 years are changing their public management systems (Keating, 2001). The diffusion of the New Public Management philosophy (Gruening, 2001; OECD, 2010; Pollitt & Bouckaert, 2000) determine an increasing innovation in the public field.

Innovation management is relevant to improving and increasing performance in healthcare organizations (Dey, Hariharan, & Ho, 2009; Fleuren, Paulussen, Van Dommelen, & Van Buuren, 2014). Moreover, this is strictly connected with an efficient accounting and information system able to process, store and share data (H. Xu, 2011).

In Italy, each Local Health Authority (ASL) adopts a different innovation program defined by the Region of reference. In Piedmont from 2016, the HTH system is used which presents various possibilities for analyzing and managing patient data with pathological addictions (Regione Piemonte, 2015).

In the management of clinical pathways, the management of data and the use of shared platforms among healthcare professionals brings about a better concentration on the need expressed in terms of care and improving its efficiency (Leape et al., 2009).

The management of high volumes of users requires the appropriateness of the care and definition of those useful and functional data to increase performance; in this sense, observations are made more and more necessary concerning the granularity of the data (Biancone, Secinaro, & Brescia, 2018).

In the diagnostic and therapeutic path knowledge acquires a determining role for the well-being of the community of reference. The knowledge we refer to assets comprised, traditionally, human capital, structural or organizational capital, and relational or social, and often they are summarized in the holistic notion of intellectual capital (IC) (Marr et al., 2004; Schiuma et al., 2008).

The theoretical GAP detected relates to the granularity and the type of information contained in the electronic health record whose influence and impact on the different aspects of the IC are unknown (H. Xu, 2011).

This paper contributes on the cycle of innovation and join the theory of rational administration based on the budget.

Our analysis will focus on the case study of the department of dependencies of the Local Health Authority "City of Turin".

The data management system matches the needs of national information through the annual report to the Italian and international Parliament through the comparison in Europe of data dependencies.

Keywords: Technology; ICT; Innovation; Health Sector; Accounting

Nature of the proposed paper: Practical Paper

1 Literature Review

OECD's countries in the last 15 years are changing their public management systems (OECD, 2010; Pollitt and Bouckaert, 2000). The diffusion of the New Public Management philosophy determines an increasing innovation in the public field (Gruening, 2001; OECD, 2010; Pollitt & Bouckaert, 2000).

According to Rogers (2003), innovation stems from the adoption of new guidelines and subsequently from implementation and adoption actions both at the individual level and by multiple adoption units.

Innovation management is relevant to improving and increasing performance in healthcare organizations (Dey et al., 2009; Fleuren et al., 2014). Moreover, this is strictly connected with an efficient accounting and information system able to process, store and share data (H. Xu, 2011).

The change and the novelty effect can be implemented through the provision of a new service, a new way of working or a new technology that is dedicated to the service of the patient .

According to Iyawa et al. (2016), innovation applied to the digital health sector has different applications. These include changes to internal information systems and data management, but also the use of Electronic Health Records (EHR's) as a combination of past and present data of patients who are in charge of a health service and are instrumental in making health decisions (Iyawa et al., 2016).

In this sense, what is created is a structured process that involves, first of all, the generation of the idea of innovation to be brought to the health system (Omachonu & Einspruch, 2010) and, afterward, an initial evaluation of what has been thought of by the reference management.

Innovation management is related to the experiential novelty element that is linked to factors such as physical and virtual structures, as well as the set of relationships with stakeholders and human capital (Marr et al., 2013).

Digital transformation and the use of information systems represents an element of innovation within the healthcare system (Iyawa et al., 2016). The impact it can create is threefold.

First, digital transformation allows improving the quality of care by reducing errors (Leape et al., 2009) and promoting patient safety.

Second, a coordinated data management system increases productivity and improves efficiency throughout the medical process (Agarwal et al., 2010).

Information is now an essential point of innovation (Pollitt and Bouckaert, 2000).

Third, the use of electronic medical records can lead to a positive economic return for the healthcare organization (Wang et al., 2003).

One of the main features of data management systems reflects the direction and priorities that health managers intend to give both in clinical and administrative area (Williams et al., 2019).

The management of high volumes of users requires the appropriateness of the care and definition of those useful and functional data to increase performance; in this sense, observations are made more and more necessary concerning the granularity of the data (Biancone et al., 2018).

The inclusion of structured data within electronic health records allows, ultimately, to increase its granularity, provided that it is accompanied by the structuring of a method capable of verifying its continuous quality (Tange et al., 1998).

For this reason, in recent years there has been more significant interest in the correct management of qualitative and quantitative data, considered vital to improving service and health outcomes (Frost & Sullivan, 2012); this requires a structured process of data quality analysis (Biancone et al., 2019; Neda Firouraghi et al., 2018; World Health Organisation, 2017a).

The metrics used to determine the quality of the data refer to the completeness of the data and their inclusion according to the time criteria established by the health units (Leape et al., 2009; World Health Organisation, 2017a).

Besides, each dimension refers to the consistency of the data internally and externally. In the first case, this means the information capacity of the same data over time in line with what is established by documents and databases, in the second case, instead, the external coherence aims to compare two measures on the basis of the same indicators within the same structure (World Health Organisation, 2017b).

In the diagnostic and therapeutic path knowledge acquires a determining role for the well-being of the community of reference. The knowledge we refer to assets comprised, traditionally, human capital, structural or organizational capital, and relational or social,

and often they are summarized in the holistic notion of intellectual capital (IC) (Marr et al., 2013; Schiuma et al., 2008).

The theoretical GAP detected relates to the granularity and the type of information contained in the electronic health record whose influence and impact on the different aspects of the IC on the accounting and analytical process are unknown (Xu, 2011).

2 Research question(s) or purpose of inquiry

The research aims to explore the methods and dynamics with which healthcare professionals use information tools, with particular reference to the case study of HTH regional software.

Additionally, we will analyze the variables that are effective in improving cost control.

3 Methodology

The clinical record of the ASL "Città di Torino" case study is analyzed to identify the information that most affects the organization to confirm the research hypotheses. In order to carry out our analysis, the case study method was adopted (Yin, 1994). The validity of the collected data is confirmed by the triangulation of different sources of data, interview, archival sources, and direct observation (Gibbert & Ruigrok, 2010). Direct observation is allowed thanks to the assistance provided in 2019 by the Department of Management of the University of Turin thanks to a convention that includes both advice on the ICT system and on the mapping of the data collection processes useful for the construction of the Data Quality Framework (Bai et al., 2018; Biancone et al., 2019; Zozus et al., 2014). The case study was based on the concept of Internal validity too confirmed through interviews of the public managers (Cock & Campbell, 1979; Yin, 1994) and external validity or generalization of the results that can be obtained through an analytical process of mapping the results obtained and therefore reproducible (Lee & Baskerville, 2003; Numagami, 1998; Yin, 1994).

Please consider Figure 1 as a tool of analysis for the initial structure of the Innovation Cycle (Lerro, 2012; Guertler, Wiedemann and Lindemann, 2015).

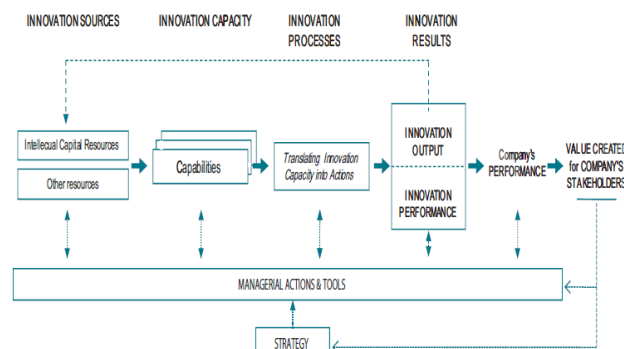
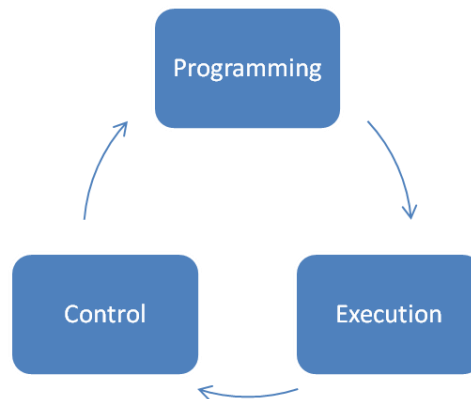


Figure 1: The innovation cycle

Additionally, the article considers the methodology of rational administration based on the balance sheet as a useful tool for corporate decision-making and based on information flows distinguished in the three available phases (Figure 2) (Brescia, 2019; Buchi et al., 2011).



Source: adapted from (Brescia, 2019; Buchi et al., 2011)

Figure 2: Administration process based on the balance sheet

1.1. Case study and sample

The Asl "Città di Torino" has been dealing with the phenomenon of Addictions for years. This function is carried out through the diffusion of outpatient clinics and administration services on the territory.

The broad nature of the treatment intervention is ensured by 29 operating sites, which include health clinics (8), drug administration centers (6), detained assistance centers (1) and specific locations such as the alcology treatment center (4), the pathological gambling center (4), the anti-smoking centers (4), the Drop-In¹ (1) and, finally, centers for new addictions (1).

The territorial competence of the Local Health Authority extends over the entire city of Turin and includes 882,523 residents. Of these, only 0.62% is currently in charge of the services of the dependencies.

There are 1.10 structures per 100,000 inhabitants in line with the national average between 0.7 and 2.5 structures (Dipartimento per le politiche antidroga, 2018).

In terms of estimating direct costs, the most significant impact is given by the forecast budget for employees (42,96% of total direct costs) (Doetter & Neri, 2018; Tradori, De Bernardi, & Brescia, 2019), residential assistance (35,48%), purchase of health services (9,68%), semi-residential assistance (7,89%), consumption of drugs and health goods (3,99%).

The staff involved in the treatment of addiction is made up of 351 professional figures. The subdivision includes: administrative staff (20; 5.70%), health care workers (7; 1.99%), caseworkers (38; 10.83%), professional educators (43; 12.25%), professional

¹ A structure suitable for low-threshold adult patients.

nurses (62; 17,66), doctors (77; 21,94%), psychologists (92; 26,21) or collaborators (12; 3,42%).

In 2018, there were 5497 patients. Of these, 4336 (78,88%) were already in charge of addiction services, 1161 (21,12%) returned following a previous interruption of treatment. The sample includes 1186 women (21,58%) and 4311 men (78,42%).

The primary substance of abuse is heroin for 2481 people (47,21%), alcohol for 1206 (22,95%), cocaine for 482 (9,17%), cannabis for 408 (7,76%), gambling for 270 (5,14%). Finally, 123 patients (2,34%) are in charge of tobacco addiction, 187 (3,56%) for crack and 340 (6,19%) for other addictions; for 242 patients is difficult to understand analysis. The diagnostic groups that have been created to better respond to clinical reporting needs are related to:

- substance dependence (2863 patients);
- alcohol dependence (799 patients);
- substance abuse (404 patients);
- pathological gambling (229 patients);
- alcohol abuse (113 patients).

The granularity of the data requires particular attention to the type of user and the standardization of care, identifying, however, thanks to the computerized system integrated care projects aimed at a higher output. Better standardization and personalization skills can avoid dispersions and allow greater planning capacity with a greater possibility of performance analysis.

4 Results and findings

The analysis of the cycle of innovation and the structure of the virtual medical record shows that some information is not collected completely.

The HTH electronic health record system has used since 2016. The transition to a new system corresponds to the definition of innovation source which, according to Lerro (2013) coincides with human capital. According to Suhonen and Paasivaara (2011), each project innovation in the health field should be accompanied by educational processes, promote workplace spirituality and management of enthusiastic.

The capacity of innovation, in the case study, has not been investigated because the health management decided to implement a data management system electronically as an element of uniformity for all regional clinics.

The innovation output is linked to the possibility for operators (doctors, nurses, psychologists, and educators) to have a virtual space with different types of health information and data that are reported in Figure 3.

	Innovation Source	Innovation Capacity	Innovation Processes	Innovation Results
Personal data Social data sheet Medical data sheet Psychological data sheet Educational data sheet Anamnesis Diagnosis Treatments Delivered Scheduling Monitoring Treatments received Vaccines Hospitalizations Relations Competences	It coincides with the knowledge of the patient, which is linked to the experience of health professionals. Each of them is part of organizational innovation.	Within the case under study is represented by the organizational capacity to integrate all health information and data. That involves the subsequent compilation of the electronic file.	The process is represented by the desire to use the electronic file as a tool that can improve the efficiency and effectiveness of clinical pathways.	The result of the process is based on the value created for the patients. The knowledge-based approach allows for better identification and, subsequently, a justification for improving the effectiveness of care.

Figure 3: The Innovation Cycle in the care path

Moreover, some sections do not specify information concerning the social, medical, psychological, nursing and educational cards, the planning of the treatments and drugs to be submitted, the vaccines carried out, allergies, hospitalizations carried out within the health system; such failures could affect the appropriateness of care within the data retention process.

The use of data and virtual medical records does not in itself lead to economic savings in health care but affects a higher quality of care and results related to the service (Biancone, Secinaro, & Brescia, 2018a).

5 Critical discussion of findings

The most treated cases concern users with problems of unhealthy addictions (drug addiction, alcoholism, gambling) that require special attention to psychological aspects (Miller & Brown, 1997) and data related to previous hospitalizations, useful elements to better direct the activities of health workers in the various health offices. The lack of a complete analysis of this information can lead to a reduced capacity for process and organization of care, besides, it shows a decrease in the granularity of the data useful for the activities of reading the digital medical record (Tange et al., 1998).

Moreover, as reported by figure 4, the missing information concerns the exploratory health area in part of the social, medical, psychological and educational data sheet. Besides, at the same time vaccines, allergies, relations, and competencies are not reported in the electronic part but only in the paper medical record. The main reason for this is the lack of an information flow management policy due to the relatively growing adoption of the electronic file.

In general, this also reflects a lack of attention in terms of the exploitation of the data present today.

The compilation of the EHR's is foreseen for the operational-health area with specific importance to the anamnesis and the diagnosis as well as a qualitative description of the treatments that are provided.

The last hybrid area between the health and economic-managerial area is currently not compiled. Furthermore, the missing information concerns the treatments received and provided, the area of the planning of therapeutic activities, as well as hospital admissions. However, the lack of such information denotes the lack of cost planning (Migliavacca et al., 2016).

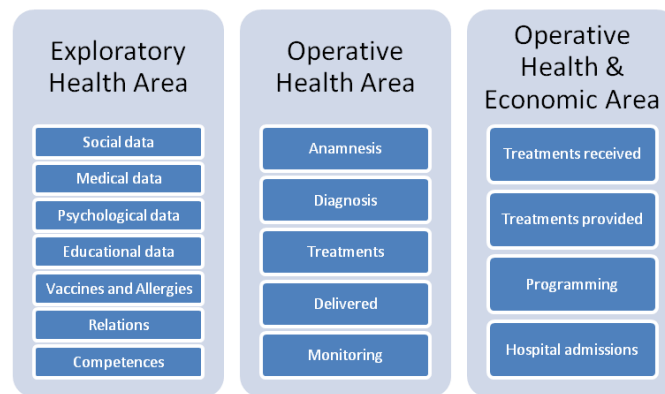


Figure 4: HTH medical areas

Diagnostic groups and services are linked to specific projects such as work and social rehabilitation, home rehabilitation or health promotion and prevention. Each of them has direct costs that engage multidisciplinary teams of professionals and person-hours by type of project. Therefore, that costs should be allocated by the treated dependence. However, this is not the case today because it is not linked to the electronic patient record and therefore not visible. To date, the information tool does not contain the precise data of the performances worked functionally to the integrative care projects.

Furthermore, the capacity of innovation through the use of EHR's shows a lack of programming and control analysis. The lack of data generates difficulties in the precise calculation of direct costs in healthcare structure, which according to Long et al., (1998) represent the higher cost derives for the care of patients with addictions.

In this case, the process of innovation requires the adoption of a data quality framework (Bai et al., 2018) aimed at increasing the granularity and completeness of the data in the treatments received and provided, by programming and hospital admissions (Figure 5).

In particular, according to Xu et al., (2014), the economic data functional to the final evaluation of performance, and to managerial decisions concern personnel costs, the costs of health materials and expenses for health services.

Within the innovation cycle, there is a lack of enhancement of the services provided and the value of human capital and individual skills, as they are not necessary for budget purposes. Therefore, the main limitation consists in not taking into account the reporting

systems; if they are not adequate, they can affect the ultimate effectiveness of the output and the results of the innovation.

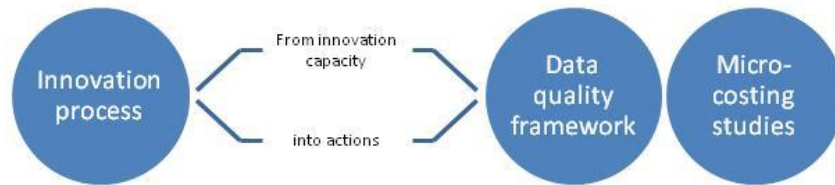


Figure 5: innovation process in the medical record HTH

Therefore, it is useful to combine the methodology of the innovation cycle with that of the rational administration based on the budget that deals with outlining the information flow at the base of company decisions, and therefore also those related to innovation. The three stages of programming, execution, and control are shown with the respective accounting documents in the original graph in figure 6.

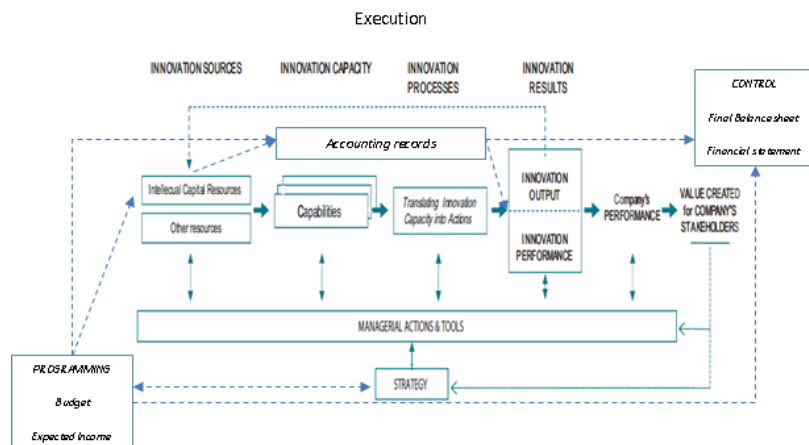


Figure 6: innovation and balance sheet cycle

6 Analysis of possible research impacts in terms of theory development

The confirmation of the Innovation Cycle theory is a valuable tool for managing the organization and appropriateness of care, especially considering the precise parameters (Admissions, Allergies, Vaccines). The selection of a precise innovation process makes it possible to enhance the data entered into databases and virtual clinical records; it is also true that the lack of data produces a lower incidence on the Innovation Cycle.

According to Agarwal et al. (2010), the digital transformation within health care can increase care effectiveness and management efficiency as well as a higher rate of productivity.

According to Buchi et al., (2011), any process presupposes the three critical moments of rational administration based on the balance sheet; for this reason, it will be useful to enhance the missing parameters both on the side of process innovation, aimed at the analysis of micro-costing.

The analysis is qualitative and lays the groundwork for future quantitative studies of the Innovation Cycle fallout on data health organization.

We firmly believe that the valorization of the output deriving from human capital cannot be separated from a better and effective information system at the service of the operators themselves. That also has a direct benefit in the final innovation output through the precise estimation of direct costs.

7 Analysis of possible research impacts for public managers and policy-makers

The redefinition of priorities, company policy and strategies can increase the training of professionals, in particular, the use and compilation of the electronic folder and the information contained therein.

The change of the strategy goes through a process of structuring corporate governance, which takes into account the specific tasks and objectives of compiling software as in the case of HTH. Moreover, it tends to create a personalized care path with the addition of educational projects, reduction of second analysis and further investigations with a doubling of previous diagnoses related to hospitalizations, effective vaccines, allergies with possible influences on the therapies administered.

The four diagnostic areas including substance dependence, alcohol dependence, substance abuse, pathological gambling, and alcohol abuse represent the main service behind which human capital provides its services. The higher completion of the electronic file tool can create a positive impact in terms of economic/financial planning of individual health departments (Wang et al., 2003), as well as providing greater power of decision towards patients (Lin B. & Chan H.G., 2000). Additionally, it would be possible to reduce the costs for duplication of diagnostic tests already carried out.

A further element of reflection may derive from the historical analysis of the indicators of economic needs connected to the individual therapeutic pathways aimed at the epidemiological evaluation. The analysis of the process and the approach implemented in the case study could, through the completeness of the data, allow the transition from financing based on historical costs to financing based on a micro-costing approach (Xu et al., 2014).

The focus, from prior planning, can quickly return the data of the service provided, making it unnecessary to link the cost and the computer systems currently in use.

In conclusion, the theory of the innovation cycle is a good representation of how innovation can spread across the enterprise. If the sources and capacity for change can be easily matched, the innovation process within the reality analyzed is more complicated. This also has an impact on the results.

The observation in the field has allowed denoting four elements:

- the difficulty of managing highly innovative elements;
- the lack of training about the possibilities given, in this case, by the care path electronic record;
- the lack of a data quality framework and, subsequently, the possibility to have precise direct costs;
- the need to link the innovation cycle to the phases of rational administration based on the balance sheet in order to have a better management of innovation in this field.

The information GAP can be solved, through the solution of the four points mentioned above, with strong leadership to pursue a complete and useful information system in all phases, from the path of diagnosis to the treatment of the patient.

Nowadays, the use of the methods in the application can also allow better internal programming of human resources and health expenditure; especially, through the compilation of information such as treatment provided and received, programming and hospital admissions.

Due to the problems of compilation and an information system with several databases and currently still in transition, it is not possible to define the performance arising from the cycle of innovation, to this end, it is difficult to collect the effectiveness of each therapeutic project.

References

- Agarwal, R., Gao, G. (Gordon), DesRoches, C., & Jha, A. K. (2010) The Digital Transformation of Healthcare: Current Status and the Road Ahead. *Information Systems Research*, 21(4), 796–809. <https://doi.org/10.1287/isre.1100.0327>
- Bai, L., Meredith, R., & Burstein, F. (2018) A data quality framework, method and tools for managing data quality in a health care setting: an action case study. *Journal of Decision Systems*, 27, 144–154. <https://doi.org/10.1080/12460125.2018.1460161>
- Biancone, P. P., Secinaro, S., & Brescia, V. (2018) The innovation of local public-sector companies: Processing big data for transparency and accountability. *African Journal of Business Management*, 12(15), 486–500. <https://doi.org/10.5897/AJBM2018.8596>
- Biancone, P. P., Secinaro, S., Brescia, V., & Calandra, D. (2019) Data Quality Methods and Applications in Health Care System: A Systematic Literature Review. *International Journal of Business and Management*, 14(4), p35. <https://doi.org/10.5539/ijbm.v14n4p35>
- Biancone, P. P., Tradori, V., De Bernardi, P., & Brescia, V. (2018). L'approccio del micro-costing nell'analisi comparativa della gestione delle ulcere peptiche in fase acuta. *Alcune evidenze empiriche. Mecosan*, 106.
- Biancone, P., Secinaro, S., & Brescia, V. (2018) A Review of Big Data Quality and an Assessment Method and features of Data Quality for Public Health Information Systems. *International Journal of Management Sciences and Business Research*, 7(1). Retrieved from https://www.researchgate.net/publication/322861621_A_Review_of_Big_Data_Quality_and_an_Assessment_Method_and_features_of_Data_Quality_for_Public_Health_Information_Systems
- Brescia, V. (2019) The popular financial reporting: new accounting tool for Italian municipalities. FrancoAngeli.

- Buchi, G., Fagnola, F., Gibello Ribatto, P., & Puddu, L. (2011) Elementi Essenziali per la Predisposizione e la Certificazione del Bilancio delle Aziende Sanitarie. Retrieved from <http://www.tostisas.it/?idxPg=68&idBlob=2&idRec=719>
- Dey, P. K., Hariharan, S., & Ho, W. (2009) Innovation in healthcare services: a customer-focused approach. *International Journal of Innovation and Learning*, 6(4), 387–405. <https://doi.org/10.1504/IJIL.2009.024135>
- Dipartimento per le politiche antidroga. (2018) Relazione annuale al Parlamento sul fenomeno delle Tossicopendenze in Italia Anno 2018 (Dati 2017). Retrieved from <http://www.politicheantidroga.gov.it/media/2445/339911.pdf>
- Doetter, F. L., & Neri, S. (2018). Redefining the State in Health Care Policy in Italy and the United States. *European Policy Analysis* 4(2)), 234–254. <https://doi.org/10.1002/epa2.1050>
- Fleuren, M. A. H., Paulussen, T. G. W. M., Van Dommelen, P., & Van Buuren, S. (2014) Towards a measurement instrument for determinants of innovations. *International Journal for Quality in Health Care: Journal of the International Society for Quality in Health Care*, 26(5), 501–510. <https://doi.org/10.1093/intqhc/mzu060>
- Frost & Sullivan. (2012) Reducing Information Technology Complexities and Costs for Healthcare Organizations. 14.
- Gibbert, M., & Ruigrok, W. (2010) The “What” and “How” of Case Study Rigor: Three Strategies Based on Published Work. *Organizational Research Methods*, 13(4), 710–737. <https://doi.org/10.1177/1094428109351319>
- Gruening, G. (2001) Origin and theoretical basis of new public management. *International Public Management Journal*, 4(1), 1–25. [https://doi.org/10.1016/S1096-7494\(01\)00041-1](https://doi.org/10.1016/S1096-7494(01)00041-1)
- Guertler, M. R., Wiedemann, F., & Lindemann, U. (2015) The relevance of stakeholder analysis for Open Innovation. 10.
- Iyawa, G. E., Herselman, M., & Botha, A. (2016) Digital Health Innovation Ecosystems: From Systematic Literature Review to Conceptual Framework. *Procedia Computer Science*, 100, 244–252. <https://doi.org/10.1016/j.procs.2016.09.149>
- Keating, M. (2001) Public Management Reform and Economic and Social Development. *OECD Journal on Budgeting*, 1(2), 141–212. <https://doi.org/10.1787/budget-v1-art12-en>
- Lämsäsalmi, H., Kivimäki, M., Aalto, P., & Ruoranen, R. (2006) Innovation in healthcare: a systematic review of recent research. *Nursing Science Quarterly*, 19(1), 66–72; discussion 65. <https://doi.org/10.1177/0894318405284129>
- Leape, L., Berwick, D., Clancy, C., Conway, J., Gluck, P., Guest, J., Isaac, T. (2009) Transforming healthcare: a safety imperative. *BMJ Quality & Safety*, 18(6), 424–428. <https://doi.org/10.1136/qshc.2009.036954>
- Lee, A. S., & Baskerville, R. L. (2003) Generalizing Generalizability in Information Systems Research. *Information Systems Research*, 14(3), 221–243. <https://doi.org/10.1287/isre.14.3.221.16560>
- Lerro, A. (2013) Knowledge-based perspectives of innovation and performance improvement in health care. *Measuring Business Excellence*. <https://doi.org/10.1108/13683041211276401>
- Long, C. G., Williams, M., & Hollin, C. R. (1998) Treating alcohol problems: a study of programme effectiveness and cost effectiveness according to length and delivery of treatment. *Addiction* (Abingdon, England), 93(4), 561–571.
- Marr, B., Schiuma, G., & Neely, A. (2013) Intellectual capital – defining key performance indicators for organizational knowledge assets. *Business Process Management Journal*. <https://doi.org/10.1108/14637150410559225>
- Migliavacca, A., Rainero, C., & Puddu, L. (2016) Aziende, Amministrazione Razionale e Impatto Sociale (Vols 1–7–26). Retrieved from <http://hdl.handle.net/2318/1617692>
- Miller, W. R., & Brown, S. A. (1997) Why psychologists should treat alcohol and drug problems. *The American Psychologist*, 52(12), 1269–1279.

- Neda Firouraghi, Shahrokh Ezzatzadegan Jahromi, Ashkan Sami, Mohamad Reza Morvaridi, & Roxana Sharifian. (2018) Data Quality Assessment and Recommendations to Improve the Quality of Hemodialysis Database. *Journal of Health Management & Informatics*, 5(1), 21–26.
- Numagami, T. (1998) The Infeasibility of Invariant Laws in Management Studies: A Reflective Dialogue in Defense of Case Studies. *Organization Science*, 9(1), 2–15.
- OECD. (2010) Public Administration after ‘New Public Management’. In *Value for Money in Government*. <https://doi.org/10.1787/9789264086449-en>
- Omachonu, V. K., & Einspruch, N. G. (2010) Innovation in healthcare delivery systems: A conceptual framework. *Innovation Journal*, 15(1), 1–20.
- Pollitt, C., & Bouckaert, G. (2000) *Public Management Reform: A Comparative Analysis*. Oxford University Press.
- Regione Piemonte. (2015) Deliberazione della Giunta Regionale., Pub. L. No. 47–1700.
- Ridder, H.-G. (2012) Review of Review of Case Study Research. Design and Methods 4th ed, by Robert K. Yin. *German Journal of Research in Human Resource Management*, 26(1), 93–95.
- Rogers, E. M. (2003) Diffusion of innovations. Retrieved from <http://books.google.com/books?id=4wW5AAAAIAAJ>
- Schiama, G., Lerro, A., & Sanitate, D. (2008) The intellectual capital dimensions of ducati’s turnaround: exploring knowledge assets grounding a change management program. *International Journal of Innovation Management*, 12(02), 161–193. <https://doi.org/10.1142/S1363919608001935>
- Suhonen, M., & Paasivaara, L. (2011) Factors of human capital related to project success in health care work units. *Journal of Nursing Management*, 19(2), 246–253. <https://doi.org/10.1111/j.1365-2834.2011.01215.x>
- Tange, H. J., Schouten, H. C., Kester, A. D. M., & Hasman, A. (1998) The Granularity of Medical Narratives and Its Effect on the Speed and Completeness of Information Retrieval. *Journal of the American Medical Informatics Association : JAMIA*, 5(6), 571–582.
- Tradori, V., De Bernardi, P., & Brescia, V. (2019) The Micro-Costing Approach to Foster the Effectiveness of Decision-Making Processes in the Healthcare System–Some Empirical Evidence from the Piedmont Region. *International Journal of Business and Management*, 14(2), 167–179. <https://doi.org/10.5539/ijbm.v14n2p167>
- Wang, S. J., Prosser, L. A., Bardon, C. G., Spurr, R., Carchidi, P. J., Kitter, A. F., Bates, D. W. (2003) A cost-benefit analysis of electronic medical records in primary care. *The American Journal of Medicine*, 114(5), 397–403. [https://doi.org/10.1016/S0002-9343\(03\)00057-3](https://doi.org/10.1016/S0002-9343(03)00057-3)
- Wang, Y., Kung, L., & Byrd, T. A. (2018) Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations - ScienceDirect. *Technological Forecasting and Social Change*, 126, 3–13. <https://doi.org/10.1016/j.techfore.2015.12.019>
- Williams, P. A., Lovelock, B., Cabarrus, T., & Harvey, M. (2019) Improving Digital Hospital Transformation: Development of an Outcomes-Based Infrastructure Maturity Assessment Framework. *JMIR Medical Informatics*, 7(1), e12465. <https://doi.org/10.2196/12465>
- World Health Organisation. (2017a) Data quality review: a toolkit for facility data quality assessment. Module 1. Framework and metrics. Retrieved from <http://apps.who.int/iris/bitstream/handle/10665/259224/9789241512725-eng.pdf;jsessionid=3F68C05D6A6AF12F84AD350DD4D69A86?sequence=1>
- World Health Organisation. (2017b) Data quality review: a toolkit for facility data quality assessment. Module 2. Desk review of data quality. 56.
- Xu, H. (2011) Data quality issues for accounting information systems’ implementation: Systems, stakeholders, and organizational factors. *Journal of Technology Research*, 11.

- Xu, X., Grossetta Nardini, H. K., & Ruger, J. P. (2014) Micro-costing studies in the health and medical literature: protocol for a systematic review. *Systematic Reviews*, 3(1), 47. <https://doi.org/10.1186/2046-4053-3-47>
- Yin, R. K. (1994) *Case Study Research Design and Methods* (Second Edition). London: Sage.

Health Technology Information and the Impact on the Health Care Research: an Empirical Case

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Abstract

The Health Technology Information (HTI) is an important driver for change for the health sector. The evolution of HIT impacts directly on the health system. Health Information Technology is defined as “the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision making” (Thompson and Brailer, 2004; Payton et.al, 2011). The main electronic software of HIT is health records (EHR longitudinal), health medical records (EMR) and electronic prescribing. It can be expected that the utilization of HIT could lead to care coordination and improved outcomes. In this article the purpose is to make in evidence the creation processes di new knowledge thought the HIT tools. Also, we make a review of the scientific studies on the implementation of the different health information technologies. Consequently, this study may fill the gaps that previous studies may have encountered due to the timing of the studies prior to EHR - EMR implementation. The involved sample is the Scientific Institutes (IRCCS) located in Italy and specifically in the Sicily Region.

Keywords – Health Technology Information, Health Sector, Italy, IRCCS, Knowledge;

1 Introduction

The Health Information Technology (HIT) will radically transform the healthcare sector by increasing efficiencies, decreasing expenditures and increasing quality of health care delivery. Prevalence of chronic diseases and the need for improved quality of care and patient outcomes necessitates the application of HIT to streamline patient care, eliminate waste, and improve care coordination, with the goal of ultimately improving patient health outcomes. Health Information Technology is defined as the “application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision making” (Brailer, 2004; Payton et.al, 2011). This could include software applications such as electronic health records (EHR longitudinal), health medical records (EMR) and electronic prescribing. The Italian government’s Decree Law 179/2012—otherwise known as the ‘Decreto Crescita 2.0’ (‘Growth 2.0 Decree’)—calls for the computerisation of the PA and, in particular, the setting up of electronic healthcare records and the development of a single electronic database accessible by all healthcare providers. The electronic health record (EHR) is the main electronic record-keeping tool, used to collect, store and display citizens’ health and socio-health data. The EHR is expected to generate not only economic benefits—that is, direct cost savings on the production, conservation and reproduction of healthcare documents—but also temporal advantages—that is, it will significantly reduce the time required to locate patients’ previous medical records. This has led the Scientific Institute (IRCCS) —to lead the way in implementing an electronic medical record (EMR) system, primary building block of the future electronic health records (EHR).

This paper aims to respond to the following research questions: to make in evidence the creation processes of new knowledge thought the HIT tools; and the factors that can influence the implementation process. In order to seek these responses, the paper first reviews the relevant literature and illustrates the research methodology and approach. Then it analyses the introduction of EMRs in an observed case study.

2 Theoretical framework

During the past 20 years, with huge advances in information technology and particularly in the areas of health, various forms of electronic records have been studied, analyzed, designed or implemented for improving many aspects of health care (Ajami and Bagheri, 2013). HIT is the application of information technology to health and healthcare (such as bed side terminals, assistive technologies, handhelds, electronics and electronic medical records, etc.) brings together the management and computerization of health information with a wide range of stakeholders; it means that has far-reaching effects on the delivery and consumption of healthcare and health-related services (Payton et.al, 2011). In this paper, HIT is defined as the use of ICT by formal (i.e., professional) and informal caregivers to deliver healthcare services in complex and non-traditional settings. ICT includes the multiplicity of tools that allow the convergence and integration of all

technologies that process information, tools for data management, communication technologies, automation and the whole series of services that organizations adopt to improve their productivity (Castellini et. al, 2006). The digitalization of health processes represents a fundamental step to improve the cost-quality ratio of health services, limit waste and inefficiencies, reduce the differences between territories, as well as to innovate front-end relationships and improve the quality perceived by the citizen. Basically, the HIT professional would combine the use of social media, collaborative platforms, online portals, bedside terminals, assistive technologies, handhelds, electronics, and electronic medical records into “effective means of accessing, communicating and storing information to improve patient care and population health, and reduce healthcare expenditures” (Burns et. al., 2012, Lehoux, 2004, Sheikn et.al., 2015). The benefits of using HIT have been widely studied (Devaraj and Kohli, 2000, Melville et al., 2004), and they show how to significantly change the way with which hospitals interact with patients and other healthcare stakeholders (Kohli and Tan, 2016). HIT can contribute to hospital profitability by reducing paper chart pulling and document transportation (Wang and Biedermann, 2010), reducing medical errors, potentially lowering medical liability costs (Mello et al., 2010) as well as decreasing back office expense (McLeod et al., 2008). In fact, with the growing emphasis on providing the right information to the right person anywhere at any time in today’s globally interconnected world, the healthcare system has been moving toward the EMR and EHRs use (see table N° 1).

Table N°1: Definition EMR and HER (Longitudinal)

Electronic Medical Record	EMR defined as digitally stored healthcare information throughout an individual’s lifetime with the purpose of supporting continuity of care. The flow of clinical information - divided into phases - can be performed in different places, at different times and with different clinical and care staff, through a strong process integration. May include such things as observations, laboratory tests, medical images, treatments, therapies; drugs administered, patient identifying information, legal permissions, and so on. A digital version of the paper charts are in the clinician’s office. An EMR contains the medical and treatment history of the patients in one practice.
Electronic Health Record (Longitudinal)	EHRs focus on the total health of the patient, going beyond standard clinical data collected in the provider’s office and inclusive of a broader view on a patient’s care. EHRs are designed to reach out beyond the health organization that originally collects and compiles the information. EHRs are designed to be accessed by all people involved in the patients care, including the patients themselves. EHR can be defined as a longitudinal record of the health information of a patient, able to be shared among different healthcare environments and also accessible to the patient himself. With fully functional EHRs, all members of the team have ready access to the latest information allowing for more coordinated, patient-centered care.

Source: our elaboration

It is obvious that the paper record system is incapable of supplying with all the patient information they need in a way that they can utilize it. In accord to ICT Healthcare Observatory (2015), EMR represents the main area where healthcare organizations focused their economic resources. The level of use of the functionalities, however, is still

partial, as well as their diffusion at the level of the whole structure; in fact, only 6% of the EMR are dematerialized and the degree of maturity and interoperability among the available electronic records is still too low.

3 Research methods

This paper is part of a larger study on the adoption and implementation of HIT in health care organizations. It uses a sequential design of mixed methods, starting with a quantitative survey followed by a qualitative phase in two parts:

- On-desk analysis: reviewing the literature using the online database (PubMed and Scopus) through specific keywords (such as Information Systems, HIT, EMR and HER) in order to assume the current state of research; and the mapping of the spread of the main HIT applications (EHR - EMR) within the Italian health context. For this reason, we proceeded to develop a survey on IRCCS (Scientific Institute), present in the Italian context; it was possible to identify through the portal of the Ministry of Health (2018), which includes in this typology n°49 Institutes.

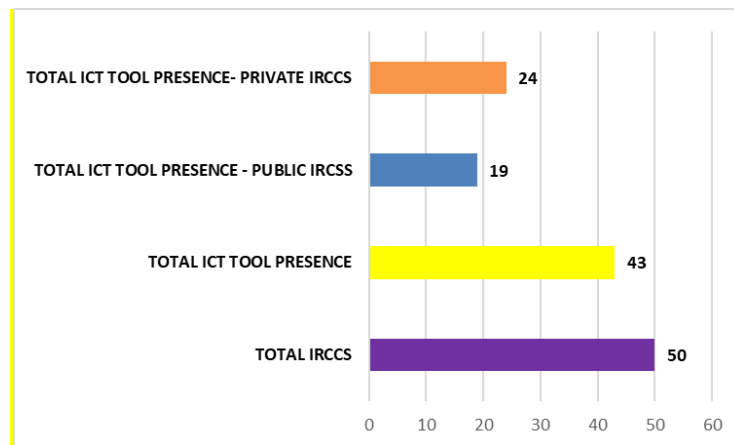
- On the empirical analysis: with semi-structured interviews focusing on the understanding and the implementing that the different people (DG- DS- DA- Office ICT Referent) attribute to the EHR and EMR tool.

The study offers a comprehensive framework that captures knowledge and importance of information technology for the improvement of health care system. The finding of the research is a first step toward to ensure a more consistent and comprehensive understanding of HIT implementation. Despite of the potential benefits of electronic health records, the implementation of this technology faced with barriers and restrictions, such as cost constraints, technical limitations, standardization limits, attitudinal constraints-behavior of individuals, and organizational constraints. We chose to analyze the IRCCS for their distinctive characteristics. They represent the excellence in the organization and management of health services and in the medical and biomedical research field. Moreover, the number of IRCCS present in Italy is not extremely high, resulting in an easily identifiable unit of analysis and allowing a faster and higher rate of feedback for the purposes of our research.

4 Case study Analysis

4.1 Mapping – web site- ICT tool

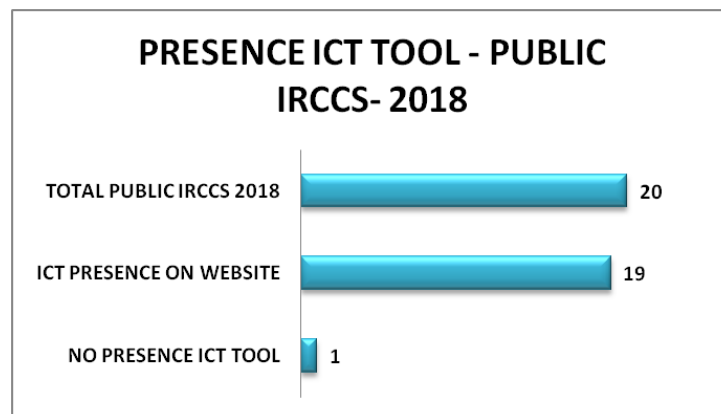
The first Step was the mapping (website) of the spread of the main HIT applications (EHR - EMR) within the Italian health context. For this reason, we proceeded to develop a survey on IRCCS (Scientific Institute), present in the Italian context; it was identified through the portal of the Ministry of Health (2018), which includes in this typology n°49 Institutes.



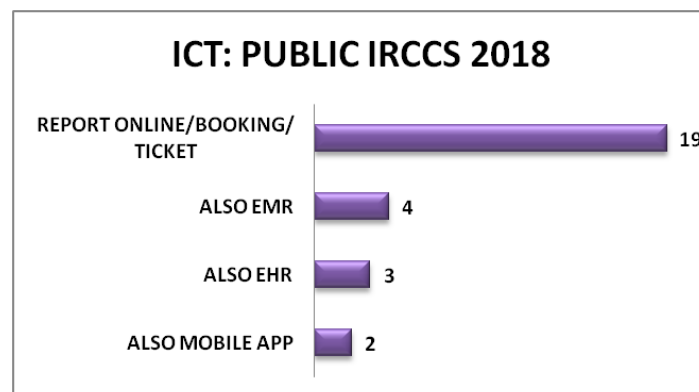
Source: our elaboration

Fig. a): ICT Presence: Sitographic Analysis

Private-sector companies deploy ICT solutions to optimise organisational performance precisely because of its potential to reduce transaction and agency costs (principal-agent issues), but also to rationalise their business processes. The introduction of ICT to the public sector is expected to produce similar results (Bekkers, 2003). Cordella and Bonina (2012) highlight how ‘the success of private sector adoptions to streamline organisational procedures and support electronic mediated exchanges (e-commerce) can act as a stimulus to radicate the engagement of ICTs as a in the public sector.

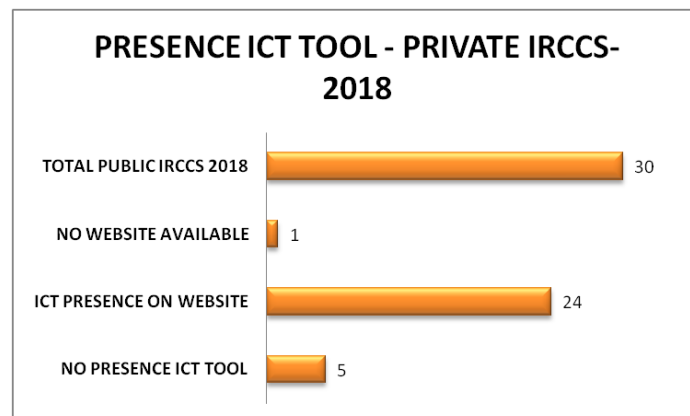


Source: our elaboration

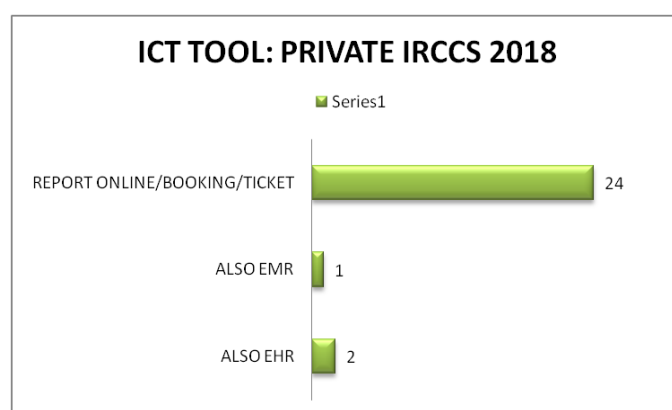


Source: our elaboration

Fig. b) & c): Presence ICT and ICT Tool: Public sector



Source: our elaboration



Source: our elaboration

Fig. d) & e): Presence ICT and ICT Tool: Private sector

The literature cites the factors that need to be taken into account and managed appropriately during the implementation process: the adequacy of the project leadership; the type and influence of the organisational culture (participatory and cooperative or authoritarian and hierarchical); the adequacy of the system implemented; the training provided (Scott et al., 2005; Heeks, 2006; Pagliari, 2007). These factors are critical and can lead to the total failure of a project, causing the healthcare provider to suffer economic and structural damage (Heek, 2006).

4.2 The observed case study

Electronic Health Records (EHRs) are today seen as tools that allow the storing of a patient's history and retrieval of information. Their potential in improving the care process is widely recognized. The case study dealing with the implementation of a project of the EMR at IRCCS, a Scientific Italian institute. The EMR is split into different information fields, the most significant and numerous of which is laboratory tests. The study uses a qualitative approach, based on the observation of a case study to respond to the research question. In particular, the case study method (Cavaye, 1996; Creswell, 2007) enables the object of analysis to be investigated in its natural state by taking into account multiple dimensions that are difficult to analyse using a quantitative approach (Yin, 1994). According to Darke et al. (1998, p. 274) '*case study in research is useful in newer less well-developed research areas particularly where examination of the context and the dynamics of a situation are important*'. In this first phase, the observation of the case study was based on a documentary analysis (social documents, company website and regulations). In the second phase of the observation of the case study, the main sources are the semi-structured interviews, which primarily concerned the introduction of the EMR. Semi-structured interviews were defined based on the objective of the study and the literature on the subject. The semi-structured interviews consisted of 16 questions.

5 Conclusion

Firstly, the research - on the web site - showed that ICT is spreading on health care. This study of research has highlighted - between the literature and the web site - the implementing the ICT tool (as to EHR and EMR) and the potential benefits of the electronic health records which can give for the health care system. In fact, EMR and EHRs meet the goals of integrating patient medical history with facilitating improved quality of higher productivity, but are expensive for organizations, potentially impacting on financial performance and productivity (Kohli and Tan, 2016; Devaraj and Kohli, 2000; Li and Collier, 2000). Since the enactment of "Digital healthcare", the adoption rate of EHR (longitudinal) and EMR systems has increased (Agency for digital Italy, 2018). But, because the case study is different, it would like to have highlighted the main organizational impacts and critical factors in implementing IRCCS, which represents a particularly healthcare organization. The research conducted on observed case study has the aim to identify the organizational impacts and the critical factors of computerization and digitization of medical records. More generally, it would like underscored the

strategic role played by ICT (Zardini et al., 2010) and the efficiency in the healthcare system. But the semi-structured interviews are still being systematized.

6 Limits and future step

The use of Health Information Technology would like the improvement of quality, safety, and efficiency; the reduction of health disparities; the engagement of patients and families in care decisions; the improvement of public health; the ascension of privacy and security of patient health information. Ultimately, it is hoped that meaningful use compliance will result in improved outcomes, increase transparency and efficiency, empower individuals. We do not know how to best design, implement, and use health information technology (HIT). A comprehensive framework that captures knowledge on implementation, use and optimization of health IT will help guide more effective approaches in the future. The proposed research is an essential first step towards ensuring a comprehensive understanding of health, implementation and use. Despite of the potential benefits of electronic health records, such as constraints, technical limitations, standardization limits, attitudinal constraints of individuals, and organizational constraints. A lot of studies indicate that the other factors limit to implement the EHR are resistance to change.

References

- Adinolfi P. and Borgonovi E. (2017), The Historical evolution of health concept and approaches: the challenge of complexity, in *The myths of health care: towards new models of leadership and management in health care sector*, Chapter 2, pp. 13-25, Springer International Publishing.
- Agency for digital Italy (2018) available on <https://www.fascicolosanitario.gov.it>.
- Ajami S and Bagheri-Tadi T (2013), Barriers for Adopting Electronic Health Records (EHRs) by Physicians, *Acta Inform Med.* 2013; 21(2): 129-134.
- Benson T. (2012). *Principles of Health Interoperability HL7 and SNOMED*, 2th. Springer, NY.
- Burns, L.R., and Pauly, M.V. (2012), Accountable Care Organizations May Have Difficulty Avoiding the Failures of Integrated Delivery Networks of the 1990s, *Health Affairs*, 31, (11).
- Cassidy BS. (2004). *Advance Online Editions for Health. Information Professionals. Skills for success in managing an EHR environment.*
- Castellini M. and Virgillito D. (2006), La relazione tra gli strumenti di ICT e la creazione di valore nella gestione delle aziende sanitarie, in *AAVV (2006), "I processi di standardizzazione in azienda"*, Franco Angeli, Milano.
- Comandè, G., Nocco, L. and Peigné, V. (2015), An empirical study of healthcare providers and patients' perceptions of electronic health records, *Computers in Biology and Medicine*, Vol. 59, pp.194–201.
- Cucciniello M., Guerrazzi C., and Nasi G. (2013), *Fascicolo Sanitario Elettronico: modelli di implementazione e raccomandazioni per l'adozione*, OASI report.
- Cucciniello M., Guerrazzi C., Nasi G. and Caccia C. (2014) *Fabbisogni informativi nelle aziende sanitarie: quale coerenza tra stato di maturità, propensione all'investimento e soluzioni offerte*, OASI report.

- Cucciniello M., Guerrazzi C., Nasi G. and Caccia C. (2014), Fabbisogni informativi nelle aziende sanitarie: quale coerenza tra stato di maturità, propensione all'investimento e soluzioni offerte, OASI report.
- Davenport, T. H. and Prusak, L., (1998) *Working knowledge: How organizations manage what they know*, Harvard Business School Press, Boston.
- Decreto del Presidente del Consiglio dei Ministri 29 settembre 2015, n. 178 Regolamento in materia di fascicolo sanitario elettronico. (15G00192) (GU n.263 del 11-11-2015) note: Entrata in vigore del provvedimento: 26/11/2015.
- Decreto del Presidente del Consiglio dei Ministri 29 settembre 2015, n. 178 Regolamento in materia di fascicolo sanitario elettronico. (15G00192) (GU n.263 del 11-11-2015) note: Entrata in vigore del provvedimento: 26/11/2015.
- Department of Health (2018), date list can be obtained at the health website.
- Garets D. and Davis M. (2005), *Electronic Patient Records: EMRs and EHRs*, Healthcare Informatics.
- Garrett P. and Seidman J. (2011), *EMR vs EHR – What is the Difference?* available on <https://www.healthit.gov>.
- Häyrinen K., Saranto K. and Nykänen P. (2008), Definition, structure, content, use and impacts of electronic health records: A review of the research literature, *International Journal of Medical Informatics*, 77 (5), 291-304.
- Health Level Seven® International available on <http://www.hl7.org>.
- HIMSS Electronic Health Record Association (2009), *The Value of Electronic Health Records*, available on <http://www.himssehra.org>.
- Houser SH, Johnson LA (2008), Perceptions regarding electronic health record implementation among health information management professionals in Alabama: a statewide survey and analysis. *Perspectives in Health Information Management/AHIMA*, American Health Information Management Association., 5:6.
- Il Fascicolo Sanitario Elettronico. Linee guida nazionali (2010) Technical report, Department of Health, available on <http://www.salute.gov.it>.
- Jha AK, DesRoches CM, Campbell EG, Donelan K, Rao SR, Ferris TG, et al. (2009), Use of electronic health records in US hospitals, *New England Journal of Medicine*, 360(16), pp.1628–1638.
- Lehoux, P. (2004), 'Patients' perspectives on high-tech home care: a qualitative inquiry into the user-friendliness of four technologies, *BMC Health Serv Res*, 4, (1), pp. 1-9.
- Louis, D. Z., Yuen, E. J., Braga, M., Cicchetti, A., Rabinowitz, C., Laine, C., & Gonnella, J. S. (1999). Impact of a DRG-based hospital financing system on quality and outcomes of care in Italy. *Health services research*, 34(1 Pt 2), 405.
- Marr, B. and Schiuma, G., (2001) *Measuring and Managing Intellectual Capital and Knowledge Assets in New Economy Organisations*, in *Handbook of Performance Measurement*, ed. M. Bourne, Gee, London.
- Ginn C.A., Gagnon M.P., Shaw N., Sicotte C., Mathieu L., Leduc Y., Grenier S., Duplantie J., Abdeljelil A.B. and Legare F. (2012), Users' perspectives of key factors to implementing electronic health record in Canada: a Delphi study, *BMC Med Inform Decis Mak*, 12, 105.
- Osservatori (2017), *Innovazione digitale in Sanità*, School of Management Politecnico di Milano, available on www.osservatori.net.
- Payton, F.C., Pare, G., Le Rouge, C.M. and Reddy, M. (2011), Health care IT: process, people, patients and interdisciplinary considerations, *Journal of the Association for Information Systems*, 12, (Special Issue), i-xiii.
- Presidency of the Council of Ministers (2015), *Linee Guida sulla conservazione dei documenti informatici*, available on <https://www.agid.gov.it>.

- Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of Personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), available on <https://eur-lex.europa.eu>.
- Reina R, Ventura M. and Lacroce A. (2012), A healthcare project: managing knowledge through electronic medical record- empirical cases. *International journal of information systems in the service sector*, vol. 4, p. 1-19.
- Reina R, Ventura M., Cristofaro C.L. and Lacroce A. (2012), Managing the knowledge interdependence with electronic medical record. *measuring business excellence*, vol. 16, p. 31-41.
- Rippen H. E., Pan E. C, Russell C., Byrne C. M. and Swift E. K (2013), Organizational framework for health information technology, *International Journal of Medical Informatics* , 82 , pp. e1-e13.
- Sheikh, A., Sood, H.S., and Bates, D.W. (2015), Leveraging health information technology to achieve the “triple aim” of healthcare reform., *J Am Med Inform Assoc*, 22, (4), pp.849-856.
- Thakkar M and Davis DC. (2006), Risks, barriers, and benefits of EHR systems: a comparative study based on the size of the hospital. *Perspectives in Health Information Management/AHIMA*, American Health Information Management Association.
- Thompson T, Brailer D. *Health IT Strategic Framework*. Washington: US Department of Health and Human Services; 2004.

Multi-dimensional Open Innovation Platform Ecosystem Framework

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Abstract

Ecosystems are of growing significance in research and industry business practice. Definitely, they will change the way how managers perceive central aspects such as strategy, business models, innovation, organization, and competition. There is still a lack of research on the question of how firms can design and integrate different types of ecosystems based on predominant possibilities and purposes. This paper depicts framework of main types of ecosystems and shows how and why these distinct types are being used. These insights lead to propositions for researchers as well as implications for practitioners. Finally, it intends to produce several pathways for future research on open innovation platform ecosystem orchestrators, development and governance.

Keywords – Open Innovation Platform, Ecosystem, Business Model, Framework

Paper type – Academic Research Paper

1. Introduction

Enterprises that leverage the power of platform business models have grown dramatically in size and scale over the past decade. The rise of platforms as new organizational form is now active in North America, Europe, Asia, Africa and Latin America (Evans, Gawer, 2016). No longer the sole domain of social media, travel, books or music, platform business models have made inroads into transportation, banking and even healthcare and energy (Evans, Gawer, 2016). The research above shows that there are differences in how platforms relate to the firm and the firm to the platforms they manage.

Digital business is a creation of new business designs by blurring the boundaries between the digital world and the physical one due to the convergence of people, businesses and things. It promises an unprecedented convergence of a) people, b) businesses and c) things that changes existing business models and creates new revenue opportunities and platform designs (Yablonsky, 2018 a,b). In digital business, business and technology are inextricable. To model a business, managers must understand what is needed for a business to achieve its goals, and how these goals translate into actionable strategy. For example, turning products into digitalized services that generate a steady

revenue stream implies significant changes within all the other components. A digital business requires much more than technology (for example, leadership, talent, skills and new business models).

To architect a digital business platform, organizations must lead their business to take a business driven, outside-in approach. Digital business platforms empower flexible and dynamic digital business. Unlike a traditional business, with a clear inside and outside, a platform provides business with a foundation where resources can come together in different combinations - to create value. Some resources may be inside, permanently owned by the company; some may be shared; and some can come from an outside ecosystem. The value comes largely from dynamic connection of those resources and the actors, and the network effects between them. Platform design facilitates matches among providers and consumers (“users”) or, in other words, a creation or exchange of goods, services and social currency, so that all participants can capture value.

2. Research design and methodology approach

This research seeks to answer the following research questions:

Which dimensions and characteristics distinguish platform ecosystems through their types?

What frameworks could be adopted and used to facilitate understanding, analysis and structure of platform ecosystems and their relationship?

To answer the research questions, we first follow Reuver et al.’s (2017) recommendations to provide clear definitions for key concepts in the digital platform context. Subsequently, we follow Nickerson et al. (2013) step-by-step and well-structured method for taxonomy development. In this process, we code digital platform articles to identify a sample of main digital platform ecosystems’ instances. The resultant taxonomy postulates digital platform ecosystems’ dimensions and characteristics. We investigate an opportunity for cross-fertilization between digital platforms and different types of platform ecosystems.

We initiated our process through a conceptual-to-empirical approach by defining the primary 5 components/dimensions of an established data-driven business model pattern conceptualization (Yablonsky, 2018 a).

We develop taxonomy’s frameworks by analyzing different dimensions and layers of platform business ecosystem, open innovation ecosystem and knowledge ecosystem concepts. In our main research we aimed for a platform value chain, platform ecosystems, and data-driven platform business models to develop taxonomy in order to facilitate understanding, analysis and structure of platform ecosystems and their relationship. The purpose of the paper is also to analyze and clarify the place of ecosystem layer in the platform business model and digital platform stack (Yablonsky, 2018). Based on theoretical conceptualization, combined with empirical evidence, we propose a taxonomy framework for business ecosystems related with multi-level taxonomy containing more than 100 entities. This framework provides new dimensions of platform ecosystem research for ecosystem typology and analysis, and illustrates how the platform innovative

ecosystems can be complemented by the real instances in the global and emerging markets.

3. Defining platforms and ecosystems

We should distinguish a technology platform from a business platform, which includes technology platform as a main block.

Definition 1. (Gawer, 2009)

A *technology platform* is defined as building blocks that act as a foundation upon which an array of firms (a business ecosystem) develop complementary products, technologies or services, proposing such requirements for a platform:

- It should perform a critical function of the overall system or should solve a crucial technological issue of an industry,
- It should be easy to connect to, “build upon” and provide space for new and unplanned usage.

Definition 2. (Parker and Van Alstyne 2015)

A *network technological platform* or *network platform* is usually based on digital network(s) building blocks. Network platforms differ from product platforms because of stronger network effects, switching costs and multihoming costs.

Definition 3. (Eisenmann et al., 2011)

A business platform is a nexus of rules and infrastructure that facilitates interactions among network users.

Definition 4. (Parker and Van Alstyne, 2015)

A *business platform* is a published standard, together with a governance model, that facilitates third-party participation.

Platforms have unique characteristics, with one of the central features being the presence of network effects (Parker, Van Alstyne, Choudary, 2016)). The value of platform affiliation for a user depends on the number of other users.

Most of today’s platforms are principally digital. They capture, transmit and monetize data, including personal data, over the Internet and other networks (Evans and Gawer, 2016). They may not be purely digital, but most successful digital platforms currently take advantage of the digital innovations and power of pervasive Internet connectivity in the hand of billions of users. A platform provides common standards, interfaces and tools to power core technologies in order to increase the productivity and profitability of a company, a set of companies, or users (Teece, 2017a,b). Platform technologies are essential for coordinating suppliers and buyers to deliver consumer value.

Starting from Moore (1996) and Kauffman (1993), the ecosystem concept has been actively discussed in management studies. The primary motivation for utilizing ecosystem concepts has been the desire to exploit self-organizing properties of natural ecosystems (Briscoe & Sadedin, 2007).

Valkokari (2015) distinguished three different economic ecosystem types:

- *Business ecosystems* as well as *service or industrial ecosystems*, where the economic outcomes and business relationships between actors are highlighted.

- *Innovation ecosystems* and *regional clusters* focus on mechanism and policies fostering the creation of innovative startups around so-called regional hubs or clusters.
- *Knowledge ecosystems* have their main outcome in creation of new knowledge through joint research work, collaboration, or the development of knowledge base.

Definition 5. (Teece, 2012)

A *business platform ecosystem* contains a number of firms and other institutions that work together to create and sustain new markets and new products. An ecosystem may be anchored by a platform. The co-evolution of the ecosystem is typically reliant on the technological leadership of one or two firms that provide a platform around, which other system members that provide inputs and complementary goods align their investments and strategies with.

A *business ecosystem* contains a number of firms and other institutions that work together to create and sustain new markets and new products. Business ecosystems continue to advance, becoming the basis of innovative business models. In a digital business ecosystem main digital economic agents (humans, business and smart things/smart machines) can play any combination of roles, such as customer, partner, supplier, employee or competitor.

A platform-based business ecosystem consists of

- Platform,
- Target Group of Customers,
- Target Ecosystem partners,
- Complementary products and services,
- Rival platform ecosystems, and competitive environment in which they exist, upstream and downstream parts of a platform value chain (Tiwana, 2014).

The co-evolution of the business ecosystem is typically reliant on the technological leadership of one or two firms that provide a platform around, which other system members that provide inputs and complementary goods align their investments and strategies with. Usually platform organizations exist in a "business ecosystem" — the network of other organizations that interacts to create shared value (Tiwana, 2014). Teece (2017) mentions that today the concept of "industry" as a group of firms performing similar activities and competing or cooperating with each other is less and less aligned with the way firms think about themselves. In the digital economy firms see their role less in industries and more in business ecosystems.

Platform by enterprise typology indicates (Evans, Gawer, 2016)

- *asset heavy enterprises* with heavy physical assets and *light platform business ecosystem* (example: Samsung with Tizen platform),
- *asset mixed enterprises* with heavy physical assets and platform business ecosystem (example: Apple with App store platform), and
- *asset light enterprises* with light physical assets and *heavy platform business ecosystem* (example: Uber with Uber app platform).

The main outcome of a *knowledge ecosystem* is a new knowledge, and it could be shaped by pointing out the network nodes where the knowledge is created and retained

(Valkokari, 2015). Open source communities are a well-known example of this ecosystem type based on knowledge exchange (Koenig, 2012) and therefore recent research highlights how colocation can also mean virtual proximity, like emotional closeness, between the actors (Coughlan, 2014).

The *innovation platform and ecosystem* approach emphasizes fostering the creation of growth, interaction, and innovative startups around so-called knowledge hubs (Engel & del Palacio, 2011). Within the innovation ecosystem, the financial network that supports the actors (both companies and research institutes and other technology developers) has recently been identified as one of the key platform investment type (Evans, Gawer, 2016). Several concepts about value co-creation within open innovation, such as “collaborative”, “democratized”, “open”, “networked” or “co-“ innovation have been introduced (Lee et al., 2012; Abbate et al., 2015). The technology-intensive business organizations, from specialized startups to diversified multinational enterprises, increasingly participate within innovation ecosystems in different roles such as adopters and patrons of open platforms, and stewards and promoters of innovation communities (Muegge, 2011).

An open innovation process (Chesbrough and Rosenbloom, 2002; Chesbrough and Bogers, 2014) comprises a number of activities that involve resources within and beyond organizational boundaries, mostly human participants (Chesbrough et. all, 2018). The characteristics of the activities and resources within this process depend on the specific purpose of an open innovation platform (Abbate et al., 2015). Open innovation is a multi-dimensional phenomenon that should be described from different perspectives – cultural, organizational and technological spheres – have transformed significantly under the development of innovative network technologies.

This paper investigates business ecosystems and the open innovation platform (OIP) ecosystem in particular. It contributes to research in the strategic management domain by presenting a set of multi-dimensional frameworks that identify how OIP business ecosystems improve management within organizations. Strategy has to guide platform business models portfolios and related business ecosystems trajectories.

4. Ecosystem frameworks

As shown by Parker, Van Alstyne, Choudary (2016), platforms all have an ecosystem with the same basic structure, comprising four types of actors/player/roles:

1. *Owners* of platforms or platform *sponsors* control their intellectual property and governance. The owner sets the direction, controls the underlying platform technology and provides the overall organizing structure for the platform via rules, governance, and ecosystem support. It can assist the ecosystem work by helping participants see how they are better off by being part of the system rather than outside of it. This role can be performed by one or many firms.

2. *Platform providers* operate as a platforms’ interface with users. Platform provider is the point of contact for common components, rules and architecture for the users of the platform. This role can be done by one or many firms.

3. *Users (supply side) or the producers* create their offerings. These are content and application developers. Producers provide specific items that attract users to the platform – music, games, information, services etc.

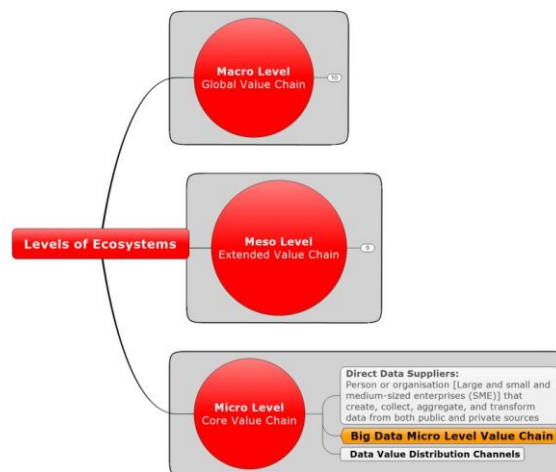
4. *Users (demand side) or the target consumers* of the platform solutions and services use producers’ offerings. They can be individuals, businesses, organizations.

Figure 1 illustrates the main set of ecosystem dimensions.

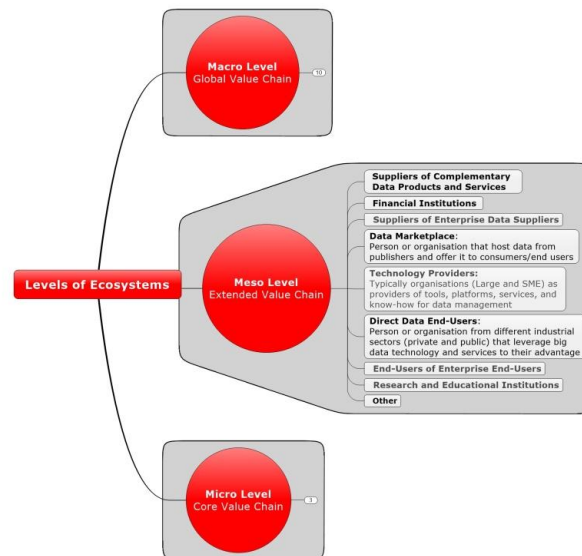


Figure 1. Ecosystem dimensions.

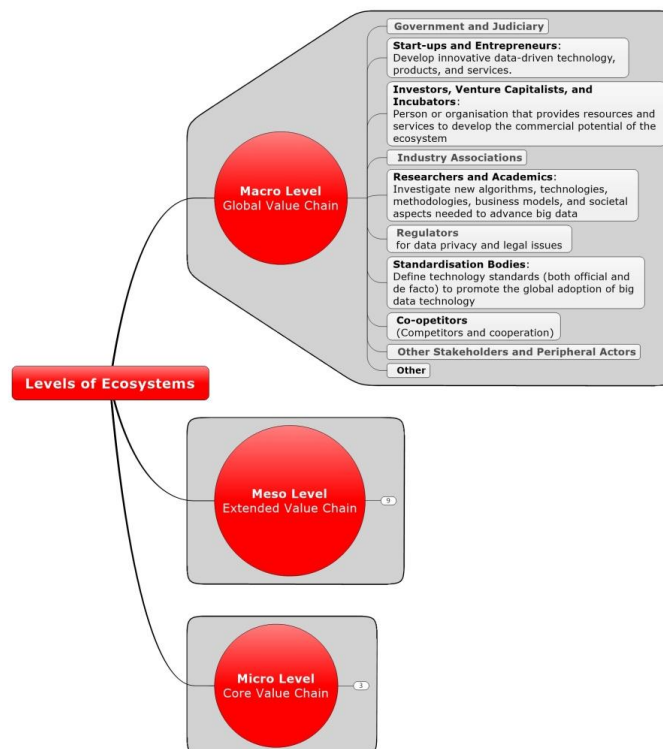
Figures 2, 3, 4 summarize three main levels of platform ecosystems.



Figures 2. Ecosystem micro level



Figures 3. Ecosystem meso level



Figures 4. Ecosystem macro level

Figure 5 summarize the differences and relationship between the three ecosystem types.

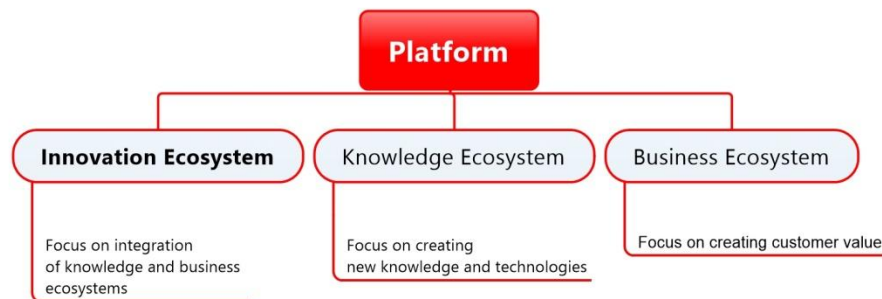


Figure 5. Three platform ecosystem types

It is shown on the Figure 5 that there is different logic of action in the different ecosystem types (Clarysse et al., 2014; Valkokari, 2015) and the same actor can be involved and play different roles in each ecosystem. From the viewpoint of each individual actor, the interaction area between the ecosystem types and their relationships are different. Thus, highly mobile actors, platform owners, or keystone companies are examples of actors boosting the interaction between the ecosystem types. On the other hand, a platform – an organization of things such as technologies or complementary assets (Muegge, 2013) – also may be the interconnecting factor between the ecosystems (Valkokari, 2015). Because of these interconnectivity actors and platforms, ecosystems do interact with each other and therefore are evolving and emerging next to each other. Furthermore, there are both dyadic and triadic interactions between the different types of ecosystem, as indicated in Figure 5.

To meet the needs of potential target consumers, the platform can adopt four major types of innovation ecosystem governance models (Kaganer et al, 2013):

- *Facilitator*: connects suppliers and buyers directly through a bidding process; *case examples*: Freelancer, Elance, oDesk,
- *Arbitrator*: engages multiple suppliers through competitions; *case examples*: crowdSPRING, 99designs, MediaPiston, InnoCentive, Witmart,
- *Aggregator*: aggregates hundreds or thousands of microtasks performed by multiple suppliers; *case examples*: Mechanical Turk, MobileWorks, CrowdFlower, CloudFactory,
- *Governor*: provides project governance and certifies supplier quality; *case examples*: TopCoder, Trada, uTest.

A platform ecosystem usually goes through periods of competitive strength and weakness as external circumstances change, and these dynamics also need to be managed by the platform owner. Teece (2017a,b) described a platform ecosystem lifecycle as consisting of four phases: Birth, Expansion, Leadership, and Self-Renewal. This model provides a useful framework for thinking about how platforms and dynamic capabilities interact.

There are such broad categories of ecosystem value chain types:

- *Linear value chain ecosystem* orchestrates and optimizes the organization's value chain. It is a particular favorite type when multiple partners are involved in a complex value chain.
- *Platform-led ecosystem* mediates the ecosystem using a platform.
- *Decentralized ecosystem* is the business ecosystem itself, which defines and mediates the transactions among partners. Cryptocurrencies, such as Bitcoin, are well-known case of decentralized ecosystem.

These ecosystem types have resulted in different types of business models. In the value chain, the business ecosystem opened up the reach and range of value. Today the platform ecosystems provide access to a wider range of partners with complementary capabilities, and the ability to create and coordinate these highly complex, demand-driven supply networks. Each of mentioned ecosystem types has created its own business model opportunities. These opportunities require a change in perspective, away from a traditional, input/output process to a dynamic ecosystem perspective.

The digital value of platform ecosystem is represented on Figure 6.



Figure 6. Digital value of platform ecosystem

The following key stakeholders are seen as the main actors along the platform value chain:

- *User Enterprises* in all sectors, who want to improve/transform their services and products using innovative technology, data products and services;
- *Data Generators and Providers*, who create, collect, aggregate, transform and model raw data from various public and non-public sources and offer them to customers.
- *Technology Providers*, who provide tools and platforms that offer BD management and analytics tools to extract knowledge from ecosystem data, curate and visualise it;
- *Service Providers*, who develop applications on top of the tools and platforms to provide services to User Enterprises.
- *Entrepreneurs*, who build innovative businesses and services based on the demand and supply side;
- *Researchers and academics*, who provide access to state-of-the-art research in innovative technologies;
- *Policy makers*, responsible for establishing policy framework conditions that foster the adoption of innovative technology in various sectors.

5. Conclusion

This paper puts in evidence a broad overview of platform ecosystem concept modelling using taxonomies and knowledge management tasks. We have investigated the knowledge areas of platform ecosystem governance and created business ecosystem taxonomy framework. This framework was used to find answers on the basic Why-What-Who-How *business ecosystems* relationship questions. For that the Micro-Meso-Macro levels of business ecosystem were developed. Taken together, we introduce a *multi-dimensional platform ecosystem framework* dealing with open innovation ecosystem agenda.

The outcomes of the application could be used for planning, oversight, and control over ecosystem management and the use of ecosystem's knowledge-related resources for research purposes.

References

- Abbate, T., De Luca, D., Gaeta, A., Lepore, M., Miranda, S., Perano, M. (2015). "Analysis of open innovation intermediaries platforms by considering the smart service system perspective", *Procedia Manufacturing*, 3, pp. 3575 – 3582.
- Anders, A., (2016) "Team Communication Platforms and Emergent Social Collaboration Practices", *International Journal of Business Communication*, Vol. 53, No. 2, pp. 224-261.
- Barney, J.B., (1991) "Firm Resources and Sustained Competitive Advantage", *Journal of Management*, Vol. 17, No. 1, pp. 99-120.
- Bergvall-Kåreborn, B., (2018) "A Typology of Crowdtwork Platforms", *Work, Employment and Society*, Vol. 29, No. 6, pp. 969–988.
- Blohm, I., Zogaj, S., Bretschneider, U., Leimeister, J., (2017) "How to Manage Crowdsourcing Platforms Effectively?", *California Management Review*, Vol. 60, No. 2, pp. 122-149.
- Bogers, M., Chesbrough, H., Moedas, C., (2018) "Open Innovation: Research, Practices, and Policies", *California Management Review*, Vol. 60, No 2, pp. 5-16.
- Briscoe, G., & Sadedin, S. (2007). "Natural Science Paradigms". In F.Nachira, A. Nicolai, P. Dini, L. Rivera Lèon, & M. Louarn (Eds.), *Digital Business Ecosystems: The Results and the Perspectives of the Digital Business Ecosystem Research and Development Activities in FP6*: 48–55. Luxembourg: European Commission.
- Chesbrough, H., Rosenbloom, R., (2002) "The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spin-off companies". *Industrial and Corporate Change*, Vol. 11, No 3, pp. 529–555.
- Chesbrough, H., Bogers, M., (2014) "Clarifying an emerging paradigm for understanding innovation". In *New frontiers in open innovation*, ed. H. Chesbrough, W. Vanhaverbeke, and J. West, 3–28. Oxford: Oxford University Press.
- Chesbrough, H., Lettl, C., Thomas Ritter, T., (2018) "Value Creation and Value Capture in Open Innovation", *Journal of Product Innovation Management*, Vol. 35, No 6, pp. 930-938.
- Clarysse, B., Wright, M., & Bruneel, J. (2014). "Creating Value in Ecosystems: Crossing the Chasm between, Knowledge and Business Ecosystems", *Research Policy*, 43(7): 1164–1176.
- Coughlan, T. (2014). "Enhancing Innovation through Virtual Proximity", *Technology Innovation Management Review*, 4(2): 17–22.

- Davenport, T. H. and Prusak, L., (1998) "Working knowledge: How organizations manage what they know", Harvard Business School Press, Boston.
- Engel, J. S., & del Palacio, I. (2011). "Global Clusters of Innovation: The case of Israel and Silicon Valley", *California Management Review*, 53 (2): 27–49.
- Eisenmann, T. G., Parker, G., & Van Alstyne, M. (2011). "Platform Envelopment", *Strategic Management Journal*, 32(12), pp. 1270–1285.
- Evans, P., Gawer, A. (2016). "The Rise of the Platform Enterprise. A Global Survey", *The Center for Global Enterprise*, 30 p.
- Gawer, A. (2009). "Platforms, markets and innovation", Edward Elgar Publishing.
- Helkkula, A., Kowalkowski, C., Tronvoll, B., (2018) "Archetypes of Service Innovation: Implications for Value Cocreation", *Journal of Service Research*, vol. 21, 3: pp. 284-301. , First Published January 1, 2018.
- Howells, J., (2006) "Intermediation and the role of intermediaries in innovation", *Research Policy*, Vol. 35, No. 5, pp. 715-728.
- Kaganer, E., Carmel, E., Hirschheim, R., Olsen, T. (2013) "Managing the Human Cloud", *MIT Sloan Management Review*, Vol.54, No. 2, pp. 23-32.
- Kauffman, S. (1993). "The Origins of Order: Self-Organization and Selection in Evolution", New York, Oxford University Press, 709p.
- Koening, G. (2012). "Business Ecosystems Revisited", *M@n@gement*, 15(2), pp. 208–224.
- Kohler, T., (2015) "Crowdsourcing-Based Business Models: How to Create and Capture Value", *California Management Review*, Vol. 57, No. 4, pp. 63-84.
- Kohler, T., (2017) "How to Scale Crowdsourcing Platforms", *California Management Review*, Vol. 60, No. 2, pp. 98-121.
- Lee, S. M., Olson, D. L., & Trimi, S. (2012). "Co-Innovation: Convergenomics, Collaboration, and Co-Creation for Organizational Values", *Management Decision*, 50(5): 817–831. <http://dx.doi.org/10.1108/00251741211227528>
- Marr, B. and Schiuma, G., (2001) *Measuring and Managing Intellectual Capital and Knowledge Assets in New Economy Organisations*, in *Handbook of Performance Measurement*, ed. M. Bourne, Gee, London.
- Menon, R., Kärkkäinen, H., Wuest, T., Gupta, J., (2018) "Industrial internet platforms: A conceptual evaluation from a product lifecycle management perspective", *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*.
- Moore, J. F. (1996). "The Death of Competition: Leadership and Strategy in the Age of Business Ecosystem", Harper Business, 297 p.
- Muegge, S. (2011). "Business Ecosystems as Institutions of Participation: A Systems Perspective on Community-Developed Platforms", *Technology Innovation Management Review*, 1(2), pp. 4–13. <http://timreview.ca/article/495>
- Nickerson, R.C., Varshney, U., Muntermann, J. (2013). "A Method for Taxonomy Development and Its Application in IS", *European Journal of Information Systems* 22, pp. 336-359.
- Ondrus, J., Gannamaneni, A., Lyytinen, K., (2015) "The Impact of Openness on the Market Potential of Multi-Sided Platforms: A Case Study of Mobile Payment Platforms", *Journal of Information Technology*, Vol. 30, No. 3: pp. 260-275.
- Parker, G., & Van Alstyne, M. (2015). "Platform strategy". In M. Augier & D. J. Teece (Eds.), *The Palgrave Encyclopedia of Strategic Management*. Available at <http://www.palgraveconnect.com/esm/doi/10.1057/9781137294678.0794>
- Parker, G., Marshall W. Van Alstyne, M., Choudary, S. (2016). "Platform Revolution: How Networked Markets Are Transforming the Economy - and How to Make Them Work for You Hardcover", W. W. Norton & Company, 352 p.

- Porter, M.E. and Kramer, M.R. (2011) "Creating Shared Value: how to reinvent capitalism and unleash a wave of innovation and growth", *Harvard Business Review*.
- Rossotto, C., Das, P., Ramos, E., Miranda, E., Badran, M., Licetti, M., Murciego, G., (2018) "Digital platforms: A literature review and policy implications for development", *Competition and Regulation in Network Industries*, Vol. 19, No. 1-2, pp. 93-109.
- Reuver, M., Sørensen, C., Basole, R.C. (2017). "The Digital Platform: A Research Agenda", *Journal of Information Technology*, 33, pp. 124-135.
- Schoemaker, P., Heaton, S., Teece, D., (2018) "Innovation, Dynamic Capabilities, and Leadership", *California Management Review*, Vol. 61, No. 1: pp. 15-42.
- Scott, B., (2019) "Data Science and the Art of Persuasion", *Harvard Business Review*, Jan/Feb2019, Vol. 97, No. 1, p126-137. 12p.
- Teece, D. J. (2012). "Next-generation competition: new concepts for understanding how innovation shapes competition and policy in the digital economy". *Journal of Law, Economics & Policy*, 9(1), pp. 97-118.
- Teece, D. J. (2017). "Dynamic capabilities and (digital) platform lifecycles", *Entrepreneurship, Innovation, and Platforms*, 2017/9/16, pp. 211-225.
- Tiwana, A. (2014). "Platform Ecosystems: Aligning Architecture, Governance, and Strategy". Morgan Kaufmann Publishers, 323 p.
- Valkokari, K. (2015). "Business, Innovation, and Knowledge Ecosystems: How They Differ and How to Survive and Thrive within Them", *Technology Innovation Management Review*, Volume 5, Issue 8, pp. 17-24.
- Yablonsky, S. (2018 a). "Multi-Sided Platforms (MSPs) and Sharing Strategies in the Digital Economy: Emerging Research and Opportunities", IGI Global, 192 p.,
- Yablonsky, S. (2018 b). "A Multidimensional Framework for Digital Platform Innovation and Management: From Business to Technological Platforms", *Systems Research and Behavioral Science*, Volume 35, Issue 4.

Open Innovation Platforms: Exploring the Importance of Knowledge in Supporting Online Initiatives

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Abstract

This paper aims to explore the role of knowledge developed within Open Innovation Platforms (OIPs) – i.e. internal knowledge – in supporting the initiatives launched online. The paper uses a quantitative methodology based on two regression analyses and data collection was done through four well-known OIPs. The final sample consists of 212 projects.

In this study we adopt a knowledge-based perspective and consider OIPs as knowledge platforms. We coded internal knowledge based on two levels of analysis: backers (prior OI experiences) and OIPs (community size).

The findings demonstrate the influence of internal knowledge on the success of projects launched on OIPs. Both our explanatory variables – i.e. internal knowledge at the backers level and at the OIPs level – have a positive impact on the outcomes of the initiatives. We measured the success of initiatives through two dependent variables, i.e. the number of ideas submitted and the number of backers involved.

This study provides insights on successful drivers of OI mechanism and it could be able to provide valid information for different actors. The paper also contributes to the current debate on the role of knowledge in the OI context and sheds some light on the nascent research field related to OIPs.

Keywords – Open Innovation, Knowledge, Open Innovation Platforms, Online Communities, Innovators.

Paper type –Research Paper

1 Introduction

In recent years, Open Innovation (OI) has emerged as a new relevant mechanism of knowledge-sharing. The concept of OI is now widespread and an increasing number of Open Innovation Platforms (OIPs) are spreading all over the world.

Through online OIPs, companies use the crowd as a source of innovation thanks to its knowledge (Jeppesen and Lakhani, 2010; Sawhney et al., 2003). Over the years, more and more companies have resorted to outsourcing the generation of ideas to external and unknown backers, i.e. crowdsourcing (Howe, 2008; Kozinets et al., 2008; Surowiecki, 2005).

Since its origin, the OI paradigm (Chesbrough, 2003a) has caught the attention of many scholars and practitioners. The research stream based on OI is currently characterized by a multitude of contributions that analyze different aspects related to this new phenomenon. The literature in this field is mainly focused on the impact of OI practices on company performance (Spithoven et al., 2013; Ahn et al., 2015; Rauter et al., 2018).

In recent years, however, a growing number of scholars have begun to analyze OIPs and to investigate the role of the Open Innovation Intermediaries (OIIs) (Sieg et al., 2010; Tran et al., 2011; Randhawa et al., 2017; De Silva et al., 2018).

Despite the growth in popularity of OI, scholarly understanding of the underlying dynamics of success among OIPs is currently limited. While the number of studies focussing on OI is constantly increasing, there is a scarcity of empirical studies that investigate the determinants of success of OI initiatives launched through online portals. In particular, there is a lack of contributions that explore the impact of knowledge on the outcomes of the projects on OIPs. The present study aims at contributing to fill these gaps. To the best of our knowledge, there are no prior studies that investigate the successful drivers of projects launched on OIPs, and even more studies focused on the role of knowledge – as will be explained in the following paragraphs – deriving both from the platform (communities) and from the innovators that solve problems/challenges (backers).

Starting from the current literature that consider OIPs as knowledge platforms (De Falco et al., 2017) and previous works that use a knowledge-based perspective for studying OIIs (Randhawa et al., 2017; De Silva et al., 2018), we try to adopt this perspective to explore the OIPs.

The paper is organized as follows. The next section provides a description of OIPs and the related actors' goals. Section 2 presents the literature review and provides the research hypotheses, followed by presentation of the data and methods in section 3. Results are reported in section 4, while the final section provides conclusions and discusses implications.

1.1 OIPs

Companies recur to OIPs in order to open their innovation process and acquire knowledge from external actors (West and Bogers, 2014). As Chesbrough (2003b: 5)

reported: “platforms provide an architecture to combine internal and external innovations”.

A growing number of actors, mainly companies, recur to external ideas from undefined innovators (Howe, 2008; Kozinets et al., 2008; Surowiecki, 2005). OIPs are virtual places where users are invited by innovation seekers – i.e. the proponents of online projects – to support initiatives through their ideas. Backers – also known as innovators or problem solver – contribute to solve the challenges proposed through the submission of one or more ideas. They respond to the call in order to provide their ideas and get a reward.

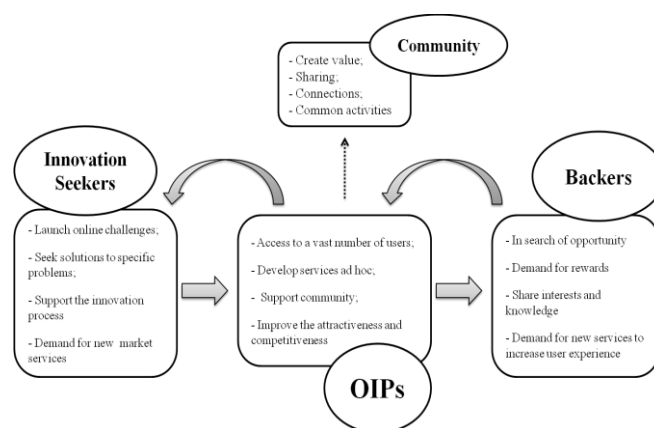
OIPs play a key role in the OI process ensuring access to a multitude of users, both on the demand and the supply side. In fact, they allow the interaction between innovation seekers that launch the challenge and backers that respond to the call. OIPs are also actors that facilitate and regulate activities. Platforms generate network effects and create value by facilitating relationships between different groups of individuals. The value of the service offered to the user derives from the number of people using it.

The more users are present within the OIP, the more successful it will be. In fact, if there are many backers registered as members of the community, this will lead potential promoters of initiatives to launch challenges on the platform; at the same time, if there are many initiatives to be backed on the platform, this will attract the innovators, who will be able to choose among numerous alternatives.

The main goals of the actors can be summarized as follows:

- Innovation seekers open the online call in order to get external ideas;
- Backers submit ideas in order to participate to the innovation process and obtain a reward;
- OIPs favor the development of the community and support the interaction between the parties in order to have a high number of successful projects.

Figure 1 provides a graphical representation of the network effects of the OI mechanism and summarizes the actions of the involved actors.



Source: elaboration by the authors.

Fig.1. The OI mechanism and the main actors: network effects.

2 Literature review and hypotheses development

The current OI literature is rich in studies that – starting from the contribution of Chesbrough (2003a) – highlighted the relevance for companies to resort to external sources (Herzog and Leker, 2010; West and Bogers, 2014).

Recently many scholars started to focus on OIIs that act as facilitators in connecting resources and knowledge between different external actors (Winch and Courtney, 2007; Sieg et al., 2010; Howells, 2006).

In this vein, the studies of Aquilani et al. (2016a,b) analyzed the services provided by OIIs. The first contribution (2016a) provided insights on the underlying dynamics of innovation seekers' choices and on the strategic relevance of OIIs activities, while the second work (2016b) presented new evidences on OIIs services.

In the last few years, some scholars adopted a promising knowledge-based approach to examine OIIs. Randhawa et al. (2017) have resorted to a knowledge-based perspective in order to investigate the influence of OIIs in facilitating collaborations between companies and online user communities. Also De Silva et al. (2018) used this perspective and explored how knowledge-based practices by OIIs affect value creation.

In addition to the literature on OIIs, also a literature on OIPs is developing in recent years, even if it is still at an early stage. In this research field, De Falco et al. (2017) suggested that OIPs are knowledge platforms that create value for the parties. The scholars found that the combination of digital platform and collaborative innovation play a key role for the creative process.

This new research stream is also characterized by the greater importance that communities are assuming. Several studies, in fact, provide evidences of the important role of the community in OIPs (West and Lakhani, 2008; Kathan et al., 2014; Di Pietro et al., 2018), especially in supporting the sharing and integration of knowledge.

The understanding of the dynamic of OIPs is a new challenge for scholars and the few studies that tried to face this topic started to analyze the form of motivations on collaboration and the knowledge of participants to the OI mechanism (Frey et al., 2011; Battistella and Nonino, 2012, 2013).

Frey et al. (2011), investigated the impact of motivation and knowledge of individuals participating in innovation projects. The scholars analyzed how these two type of factors are able to explain the performance of contributors to OIPs.

The studies of Battistella and Nonino (2012; 2013) focused specifically on motivational aspects: the first paper (2012) identified – through 116 OIPs – potential motivations for participating and collaborating in OIPs, taking into consideration the different stages of the innovation process; the second study (2013) explored 26 OIPs and examined how motivational systems and platform models affected the attraction of the individuals with different innovation roles.

Starting from the nascent research stream that analyzes the role of OIPs as knowledge portals and following previous studies that have given significant importance to the knowledge in the OI system (Randhawa et al., 2017; De Silva et al., 2018; De Falco et al., 2017), we adopt a knowledge-based perspective to explore OIPs. In the present study we

focus on the knowledge deriving from participation in the OI mechanism and we suggest that OIPs generate internal knowledge for the actors involved. More precisely, we argue that OIPs are virtual place where it is possible to develop a stock of knowledge.

In the current literature there is a lack of studies that consider this point of view and that in particular use the knowledge-based perspective for OIPs. Prior studies, in fact suggest that online platforms are a virtual loci where OIIs support interactions and exchanges of ideas and knowledge between the two parties involved (Howells, 2006; Gassmann *et al.*, 2011), i.e. the innovation seekers and the innovation solvers. However there are no prior works that specifically adopt a vision of an OIP as a locus of knowledge sharing where participants can increase their experience. We suggest that OIPs enables participants to build an additional stock of knowledge within the community.

Many scholars worldwide shared the idea that communities create new knowledge and implement the knowledge derived from the experience (Kozinets *et al.*, 2008; Erickson and Kellogg, 2003; Liedtka, 1999; Boland and Tenkasi, 1995; Brown and Duguid, 1991).

Communities are online groups of people who share knowledge and enthusiasm as well (Komito, 1998; Kozinets, 1999). They are often considered as voluntary associations of backers who share a common interest, such as the development of innovations – in the OI context – in a given product or service category (West and Lakhani, 2008). The interaction between the members of a community and thus the network established within communities, represent a process of collective invention (Von Hippel, 2005; Osterloh and Rota, 2007; Von Krogh and Von Hippel, 2006).

In line with these studies we embrace the importance of knowledge deriving from communities and we apply this concept also to OIPs. In particular, we argue that an active and vibrant community, characterized by a high number of members is able to build greater knowledge for OIPs and has more probabilities to influence the success of projects/challenges launched on online portals. This is more evident especially if compared to static, less populated communities. In fact a low number of members have limited capabilities to interact and share common activities, thus consequently to create knowledge.

In addition to the knowledge deriving from belonging to the community, we also recognize the importance of knowledge deriving from previous experiences on OIPs by the participants. Backers who have supported other projects before, acquired experience and obtained useful information on the logic of OI mechanism and on the needs of innovation seekers.

Backers rely on their own existing knowledge bases and – as suggested by Frey *et al.* (2011) – their diversity of knowledge and experience affects the quality of their contribution. The scholars (2011: 404) reported that “*innovators blend previously unconnected pieces of existing knowledge to achieve their creative leaps*”.

In the present paper we share the concept that backers firstly leverage their prior knowledge, in fact we consider the knowledge deriving from previous OI experiences. Moreover, we also support the idea that these “creative leaps” could come from the connections and exchanges between the community’s participants. Thus we posit that

OIPs presents a further stock of knowledge created by these actors within communities. Regarding this aspect, a number of scholars highlighted that reuse and transfer of knowledge contribute to the generation of substantial innovations (Hargadon, 2003; Majchrzak et al., 2004).

Prior studies provided evidences that knowledge reuse or transfer is a significant factor in facing new problems or innovative challenges (Jeppesen and Lakhani, 2010; Lovett and Anderson, 1996; Lüthje et al., 2005). Even if backers have a different expertise with respect to the field of the problem and are therefore unable to use their pre-existing knowledge (Jeppesen and Lakhani, 2010), they can leverage the existing body of knowledge embedded in the community. In the OI virtual context, the lack of knowledge stimulates backers to identify connections – useful to develop solutions (Novick, 1988) and so to solve the challenges – and to assimilate external information from the community in a logic that recalls that of absorptive capacity (Cohen and Levinthal, 1990).

In this vein, Frey et al. (2011) proposed that backers with diverse knowledge: a) should identify more connections in order to increase the number of possible combinations of knowledge elements they can create; b) should have flexibility regarding their original idea and explore alternative solution paths in order to develop alternative ideas or increase their ability to help others with the development of their solutions. The scholars suggested that these elements are facilitators of the creation of more ideas of higher quality. They reported (2011: 404) that: *“overall, individuals with a broader stock of existing knowledge are more able to blend disparate knowledge elements and should find more connection points between their knowledge base and a given innovation challenge”*.

In the present paper, both the types of internal knowledge that we considered could represent an added-value for the OI process. In more detail they could affect the success of initiatives in the virtual environment, where projects are characterized by uncertainty. The internal knowledge developed within OIPs could be a strategic element in pushing projects to attract more ideas and more backers. At the same time, the prior knowledge of backers could affect the success of online initiatives.

2.1Hypotheses

As already stated, the purpose of this study is to examine the impact of knowledge on the success of projects launched on OIPs.

Knowledge is a strategic asset for OIPs and in this study, we suggest that it could represent a strategic lever for successful OI initiatives to achieve superior performances in terms of ideas and backers involved.

In this paper we focus on the important role of OIPs as knowledge platforms and we explore the influence of the internal knowledge created through OIPs on project's outcomes.

In sum, we consider both the knowledge that OIP develops thanks to the relationships established between backers of the community, and the knowledge that backers acquired thanks to the support of previous projects.

We argue that communities are a significant source of knowledge for OIPs, and backers that belong to a community acquire an additional stock of knowledge. Furthermore, we assume that backers who have already supported other projects are more experienced than others and – thanks to their acquired experience – they are able to better support other projects as well as a greater number of them.

Put simply, we analyze knowledge on two levels – i.e. backers level and OIPs level – and we assume that both the stock of knowledge held by backers (derived from prior OI experiences) and by OIPs (derived from their communities), could represent successful drivers for the OI mechanism.

According to the above analysis, we propose two research hypotheses linking internal knowledge to projects' success.

Hypothesis 1: higher internal knowledge at the backers level positively affects the success of online initiatives in the OI context, expressed in terms of number of ideas presented and number of backers involved.

Hypothesis 2: higher internal knowledge at the OIPs level positively affects the success of online initiatives in the OI context, expressed in terms of number of ideas presented and number of backers involved.

3 Data and methods

For this study, we collected data from four OIPs: Opeindeo, Openinnovation-suedtirol, Crowdspring, Guerra-creativa. Data collection was done through these OIPs because they are well known platforms and do not belong to private companies (portals created by these firms – e.g. Unilever, PhilipMorris, Tim – are used for themselves).

These platforms cover a variety of initiatives and include the challenges of all the categories. Our final sample consists of 212 projects: 61 from Opeindeo; 19 from Openinnovation-suedtirol; 60 from Guerra-creativa; 72 from Crowdspring. We consider all the challenges posted on the first two platforms (i.e. Opeindeo and Openinnovation-suedtirol), while for the other two platforms (i.e. Crowdspring and Guerra-creativa) we include the initiatives posted between August 2018 and March 2019. As regards the challenges on these last two OIPs, the sample of their projects is not necessarily representative of the overall population of Crowdspring and Guerra-creativa projects. In fact data-collection of these initiatives was performed as a random choice.

In order to examine how internal knowledge can influence the outcomes of initiatives, we carried out an empirical work based on two regression analyses.

3.1 Variables

The success of initiatives launched on OIPs is measured through two dependent variables: the number of ideas and the number of backers. The first variable includes the total number of ideas submitted at the end of the online call. A high number of ideas posted allows call proponents (innovation seekers) to have more choice and to increase the quality level of the projects. Contrariwise, a challenges that receives no ideas is a

failed project. For a project, even receiving a few ideas could be a negative thing, in fact the proponents of the call could be faced with low quality ideas or innovations. Thus, we consider the number of ideas as a proxy of success of the initiatives. A high number of ideas generate competition between a multitude of innovators and elevate the level of competition.

The second dependent variable includes the total number of backers at the end of the online call that submitted their ideas. The number of backers assumes an important role because the success of the projects cannot disregard a large number of innovators. Also in this case, a higher number of backers that respond to the call influence both the quality of the ideas and the level of the challenge.

We consider these two variables because the logic of OI implies an active participation of the crowd/backers, so the goal of proponents is to receive a high number of ideas and involve a high number of innovators. Innovation seekers – when launching the call – aim to accumulate a large number of ideas as well as a large number of backers. The latter will continue to follow the project, as well as the proponent, and in the future they could become supporters also for future initiatives or in the case of the launch of new products/services.

The two explanatory variables used in this study consider the internal knowledge on two levels: backers and OIPs. At the backers level, we considered the knowledge which derived from the participation in other previous projects launched online in the OI context. This prior experience represents a significant factor in the virtual environment of platforms. More experienced backers are more accustomed to OI process – and thus to innovation – and so they can better respond to the challenges. As for the internal knowledge at the backer level we used the sum of the number of projects that backers had supported before. This variable represents the degree to which the backer has been supportive of OI projects, thus establishing contacts and a relationship with the community. This measure included only projects backed before the challenge considered, thus avoiding problems of overlapping projects.

At the OIPs level, instead, we considered the size of community at the time of the launch of the projects. Communities are dynamic, so their members vary over time. It is very common indeed that the number of registered backers changes over the months: many sign up only to support a specific project that interests them, after which they unsubscribe from the platform; others instead participate in numerous projects, following the example of some friends or crowd orientation. For a platform it is important to have an active and populated community. Communities, in fact share knowledge and facilitate the process of generating new ideas. In this vein, new projects launched on OIPs benefit from larger communities. For both our explanatory variables we used the logarithmic transformation (natural logarithm, \ln).

We included several control variables in our analyses: comments (no.), updates (no.), photos (no.), duration (days), sector, awards and the category of the innovation seekers. The last three variables are expressed as dummy variables. Variable definitions are reported in Table I.

4 Results

4.1 Descriptive Statistics

Table I provides descriptive statistics of the variables. The two dependent variables, i.e. number of ideas and number of backers, respectively report maximum value of 1,088 and 687. Both the minimum number of ideas and of backers is zero. The average number of ideas submitted online is about 172, while the average number of backers that supported the initiatives is about 89.

Regarding the explanatory variables, internal knowledge at OIPs level – that is, the community size of the platforms - ranges from 5 to 28,931, while at the backers level internal knowledge – that is, the number of project backers have supported in the past - it ranges from 0 to 3,987. The averages values of the two variables are respectively 4,335 and 443.

Challenges are mostly launched by companies (62%) belonging to production industry (61%) and that offer material rewards (69%). Initiatives are open online for about 34 days and present on average 182 comments, 8 photos and about 3 updates.

Table I. Descriptive Statistics and Variable Description

	Obs	Mean	Std. Dev.	Min	Max	Variable description
<i>Dependent variables</i>						
No. Ideas	212	172.34	167.81	0	1,088	Number of ideas submitted at the end of the online call
No. Backers	212	89.41	131.91	0	687	Number of bakers at the end of the online call
<i>Explanatory variables</i>						
Backers Internal Knowledge	212	443.25	747.17	0	3,987	Number of projects that backers had supported before
OIPs Internal Knowledge	212	4,335.11	6,964.93	5	28,931	Community size of the platforms
<i>Control variables</i>						
Comments	212	182.68	294.26	0	1,376	Number of comments posted during the online call
Duration (days)	212	34.77	20.14	4	135	Duration of call in days
Updates	212	2.77	3.51	0	18	Number of updates posted during the online call
Photos	212	7.90	4.51	0	25	Number of photos posted during the online call
Sector	212	0.61	0.49	0	1	Dummy = 1 if the innovation seeker belongs to production industry; 0 otherwise
Innovation seeker category	212	0.62	0.48	0	1	Dummy = 1 if the innovation seeker is a firm; 0 otherwise
Awards	212	0.69	0.46	0	1	Dummy = 1 for material rewards; 0 otherwise

4. Regression Results

We performed two different regression analysis. In both Model 1 and Model 2, a negative binomial regression is employed, in fact the two dependent variables are a count, respectively the number of ideas presented (Model 1) and the number of backers involved (Model 2).

Both in the first model and in the second model, robust standard errors are used and control variables are included. Furthermore, in the analyses we checked for multicollinearity and heteroskedasticity, and there were no points of concern.

The evidence supports our two hypotheses. First, a higher internal knowledge at backers level has a positive influence on both the number of ideas (coefficient = 0.370, significant at 1%) and the number of backers (coefficient = 0.305, significant at 1%). Second, a higher internal knowledge at OIPs level positively influences the number of ideas (coefficient = 0.157, significant at 5%) and the number of backers (coefficient = 0.279, significant at 1%).

Among the control variables, three have significant coefficients (sector, awards and the category of proponents), while the rest of them have little or no impacts.

Table II. Regression Results

	Model 1:			Model 2:		
	No. Ideas			No. Backers		
Explanatory variables						
<i>Ln_Backers Internal Knowledge</i>	0.370	***	(0.084)	0.305	***	(0.049)
<i>Ln_OIPs Internal Knowledge</i>	0.157	**	(0.066)	0.279	***	(0.039)
Control variables						
<i>Comments</i>	0.001		(0.001)	0.001	***	(0.001)
<i>Duration (days)</i>	0.012	***	(0.001)	0.001		(0.001)
<i>Updates</i>	0.028	***	(0.009)	0.010	*	(0.006)
<i>Photos</i>	0.006		(0.007)	0.003		(0.006)
<i>Sector</i>	0.942	***	(0.162)	0.562	***	(0.119)
<i>Innovation seeker category</i>	1.371	***	(0.135)	0.637	***	(0.092)
<i>Awards</i>	0.383	***	(0.102)	0.886		(0.075)
Constant	2,168	***	(0.176)	2.677	***	(0.101)
No. observation	212			212		
Lalpha	2.107		(0.114)	3.287		(0.172)
(Pseudo) R²	0.154			0.307		

Significance level at 1 % (***), 5 % (**), and 10 % (*).

Robust standard errors in parentheses.

5 Conclusions

This paper seeks to make a first few steps towards an analytical understanding of OIPs and their underlying mechanism.

The success of initiatives launched online through OIPs is determined by several factors. What effectively leads to the success of projects is unexplored and the successful drivers are factors not yet investigated.

This study advances the extant knowledge in the OI research context. Firstly, it contributes to the current literature that recently started to explore the importance of platforms in the OI process. Second, this study shed some lights in the nascent stream of research that consider the knowledge-based perspective for OIPs.

The results of this study highlight the key role of the internal knowledge developed within the platforms in the success of initiatives. The internal knowledge at both the considered levels – i.e. backers and OIPs – has a positive impact on the initiatives' outcomes, thus supporting projects in obtaining superior results in term of ideas and backers.

This work offers some exploratory insights that hopefully could be useful for different actors. In particular, the study could be able to provide valid information for OIPs managers, innovation seekers, innovators (backers) and policy makers.

Platform manager should consider the importance of both backers and communities in explaining the success of projects. OIPs manager should improve the size and the quality of their communities, as well as favor the share of knowledge between backers and develop common activities. These managers should also support the members of the community to acquire more experiences through an active participation to different initiatives. These actions could be useful to have backers with more knowledge and larger – and also vibrant – OIPs.

Innovation seekers, whether companies or not (e.g. government or non-profit associations, etc.), should pay more attention to the characteristics of OIPs, especially to the communities and the experiences or skills of the backers. The choice of the platforms could be a significant element to consider when they launch the challenges.

Backers should acknowledge the importance of communities as loci where it is possible to collect an additional stock of knowledge. Furthermore, backers should acquire more experience in the OI mechanism with a more proactive participation.

Finally, policy makers could reflect on the important results in term of numbers of OIPs and in general of the OI tool. They should encourage the use of OIPs and they could favour the participation of public operators and government agencies in the OI system. Policy makers could foster interaction between the actors of the innovation ecosystem and support the OI mechanism through incentives.

References

- Ahn, J.M., Minshall, T. and Mortara, L., (2015) "Open innovation: a new classification and its impact on firm performance in innovative SMEs", *Journal of Innovation Management*, Vol.3, No.2, pp.33-54.

- Aquilani, B., Abbate, T., D'Amico, A. and Gatti, C., (2016 a) "Co-creare prodotti e processi con i clienti: i servizi degli Open Innovation Intermediaries (OII)", *Sinergie*, Vol.33, No.98, pp.311-329.
- Aquilani, B., Abbate, T. and Dominici, G., (2016b) "Choosing Open Innovation Intermediaries through their web-based platforms", *The International Journal of Digital Accounting Research*, Vol.16, pp.35-60.
- Battistella, C., and Nonino, F., (2012) "Open innovation web-based platforms: The impact of different forms of motivation on collaboration", *Innovation: Management, policy & practice*, Vol.14, No.4, pp.557-575.
- Battistella, C., and Nonino, F., (2013) "Exploring the impact of motivations on the attraction of innovation roles in open innovation web-based platforms", *Production Planning & Control*, Vol. 24, No.2/3, pp.226-245.
- Boland, R.J. and Tenkasi, R.V., (1995) "Perspective Making and Perspective Taking in Communities of Knowing" *Organization Science*, Vol.6, No.4, pp.350-372.
- Brown, J.S. and Duguid, P., (1991) "Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation", *Organization Science*, Vol.2, No.1, pp.40-57.
- Chesbrough, H.W., (2003a) *Open innovation the new imperative for creating and profiting from technology*, Harvard Business School Press, Boston.
- Chesbrough, H.W., (2003b) "Open Platform Innovation: Creating Value from Internal and External Innovation", *Intel Technology Journal*, Vol.7, No.3, pp.5-9.
- Cohen, W. and Levinthal, D., (1990) "Absorptive capacity: a new perspective on learning and innovation", *Administrative Science Quarterly*, Vol.35, No.1, pp.128-152.
- De Falco, S.E., Renzi, A., Orlando, B. and Cucari, N., (2017) "Open collaborative innovation and digital platforms", *Journal Production Planning & Control, The Management of Operations*, Vol.28, No.16, pp.1344-1353.
- De Silva, M., Howells, J., and Meyer, M., (2018), "Innovation intermediaries and collaboration: Knowledge-based practices and internal value creation", *Research Policy*, Vol. 47, No. 1, pp. 70-87.
- Di Pietro, F., Prencipe, A., and Majchrzak, A., (2018) "Crowd Equity Investors: An Underutilized Asset for Open Innovation in Startups", *California Management Review*, Vol.60, No.2, pp.43-70.
- Erickson, T. and Kellogg, W.A., (2003) *Knowledge Communities: Online Environments for Supporting Knowledge Management and its Social Context*, in ed. M.S. Ackerman et al.
- Frey, K., Lüthje, C. and Haag, S., (2011) "Whom Should Firms Attract to Open Innovation Platforms? The Role of Knowledge Diversity and Motivation", *Long Range Planning*, Vol.44, No.5/6, pp.397-420.
- Gassmann, O., Daiber, M., Enkel, E., (2011) "The role of intermediaries in cross-industry innovation processes", *R&D Management*, Vol.41, No.5, pp.457-469.
- Hargadon, A., (2003), *How Breakthroughs Happen: The Surprising Truth about how Companies Innovate*, Harvard Business Press, Boston.
- Howe, J., (2008). *Crowdsourcing. Why the power of the crowd is driving future of business*, Three Rivers Press, New York.
- Howells J., (2006) "Intermediation and the role of intermediaries in innovation", *Research Policy*, Vol.35, No.7, pp.715-728.
- Jeppesen, L.B. and Lakhani, K.R., (2010) "Marginality and Problem-Solving Effectiveness in Broadcast Search", *Organization Science*, Vol.21, No.5, pp.955-1123.
- Kathan, W., Matzler, K., Fuller, J., Hautz, J., and Hutter, K., (2014) "Open innovation in SMEs: a case study of a regional open innovation platform", *Problems and Perspectives in Management*, Vol.12, No.1, pp.161-171.

- Komito, L., (1998) "The Net as a foraging society: flexible communities", *Information Society*, Vol.14, No.2, pp.97-106.
- Kozinets, R.V., Hemetsberger, A., Schau, H.J., (2008) "The wisdom of consumer crowds: Collective Innovation in the Age of Networked Marketing", *Journal of Macromarketing*, Vol.28, No.4, pp.339-354.
- Kozinets, R.V., (1999), "E-Tribalized Marketing?: The Strategic Implications of Virtual Communities of Consumption", *European Management Journal*, Vol.17, No.3, pp.252-264.
- Liedtka, J., (1999) "Linking Competitive Advantage with Communities of Practice", *Journal of Management Inquiry*, Vol.8, No.1, pp.5-16.
- Lovett, M.C., Anderson, J.R., (1996), "History of success and current context in problem solving", *Cognitive Psychology*, Vol.31, No.2, pp.168-217.
- Lüthje, C., Herstatt, C., Von Hippel, E., (2005), "User-innovators and "local" information: the case of mountain biking", *Research Policy*, Vol.34, No.6, pp.951-965.
- Majchrzak, A., Cooper, L.P., Neece, O.E., (2004) "Knowledge reuse for innovation", *Management Science*, Vol.50, No.2, pp.174-188.
- Novick, L.R., (1988) "Analogical transfer, problem similarity, and expertise", *Journal of Experimental Psychology: Learning, Memory, and Cognition*, Vol.14, No.3, pp.510-520.
- Osterloh, M., Rota, S., (2007) "Open source software development just another case of collective invention?", *Research Policy*, Vol.36, No.2, pp.157-171.
- Randawa, K., Jossierand, E., Schweitzer, J., and Logue, D., (2017) "Knowledge collaboration between organizations and online communities: the role of open innovation intermediaries", *Journal of Knowledge Management*, Vol.21, No.6, pp.1293-1318.
- Rauter, R., Globocnik, D., Perl-Vorbach, E., and Baumgartner, R.J., (2018) "Open innovation and its effects on economic and sustainability innovation performance", *Journal of Innovation & Knowledge*, pp.1-8.
- Sawhney, M., Prandelli, E., Verona, G., (2003) The power of innomediatio, *MIT Sloan Management Review*, Vol.44, No.2, pp.77-82.
- Sieg, J.H., Wallin, M.W., and VonKrogh, G., (2010) "Managerial challenges in open innovation: a study of innovation intermediation in the chemical industry", *R&D Management*, Vol.40, No.3, pp.281-291.
- Spithoven, A., Vanhaverbeke, W., and Roijakkers, N., (2013) "Open innovation practices in SMEs and large enterprises", *Small Business Economics*, Vol.41, No.3, pp.537-562.
- Surowiecki, J., (2005) *The wisdom of crowds: Why the many are smarter than the few and how collective wisdom shapes business, economies, societies, and nations*, New York Doubleday&Co.
- Tran, Y., Hsuan, J., Mahnke, V., (2011) "How do innovation intermediaries add value? Insight from new product development in fashion markets", *R&D Management*, Vol.42, No.1, pp.80-92.
- Von Hippel, E., 2005. *Democratizing Innovation*, MIT Press, Cambridge.
- Von Krogh, G. and Von Hippel, E., (2006), *The Promise of Research on Open Source Software*, *Management Science*, Vol.52, No.7, pp.975-983.
- Winch, G.M., Courtney, R., (2007) "The organization of innovation brokers: An international review", *Technology Analysis & Strategic Management*, Vol.19, No.6, pp.747-763.
- West, J. and Bogers, M., (2014) "Leveraging External Sources of Innovation: A Review of Research on Open Innovation", *Journal of Product Innovation Management*, Vol.31, No.4, pp.814-831.
- West, J. and Lakhani, K., (2008) "Getting clear about communities in open innovation", *Industry & Innovation*, Vol.15, No.2, pp.223-31.

Citizen Participation in Smart Cities – Towards an User Engagement Protocol

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Abstract

Innovative concepts and technologies for citizen participation have become key components of Smart Cities concepts. Smartness of cities cannot be reduced anymore to IT infrastructures and communication networks, but needs to comprehend smart interaction between citizens too. Based on the new U_CODE approach for citizen participation in urban development, this paper presents User Engagement Protocols (UEP) that are able to concert the a broad variety of activities and contributors to urban co-design projects. In analogy to music scores where “protocols” for individual players are derived from a Master Score, specific UEP can be deduced for all stakeholders and user groups from a comprehensive choreography of the entire participation process. The paper presents the methodical steps that lead to the establishment of this master protocol, as well as to specific UEP for Citizens, Expert Planners, Authorities, or Faciliators. It demonstrates how U_CODE manages to coordinate co-creative activities of a multiplicity of participants with its new methodology and digital tools.

Keywords – Co-Design, Smart City, Public Participation, urban development, user engagement

Paper type – Academic Research Paper

1 Background

Smart Citizen Interaction Over the past years, innovative methods and technologies for citizen participation have become mandatory components of Smart Cities concepts (Piskorek et al 2015). With the, the smartness of cities cannot be reduced to IT infrastructures and communication networks, but needs to comprehend smart interaction

between citizens as well as smart governance mechanisms too (Kustra et al 2017). Instead of a technology-driven, technocratic view on Smart Cities, sociotechnical notions of smart citizenship and cities as based on democratic participation via digital media has come to the fore.

Demand of Citizen Participation Over the past decades, citizen engagement has turned out a major demand in many fields and disciplines, ranging from science, administration to urban planning and development (Selle 2014). As a specific field, Urban Planning and Design i.e. the creation of urban districts, compounds and neighbourhood has emerged as a field with high applicability of citizen engagement and participation (Münster et al 2017). Research and practice have established a variety of approaches to support the involvement of various stakeholders and user groups in the process of city-making, e.g. Planning Cell ors Design Charettes (Stelzle & Noennig 2017, 2019). Some cities have strongly pushed their activities in the field and started to implement solutions to enable broad participation as a key aspect of smart city development in areas such as economy, governance, environment, mobility, or housing (Griffinger 2007). While especially the interface between policy-makers and citizenship raises the demand for effective means of citizen participation, areas like mobility or living are touched similarly by the question: Who is involved in processes of urban development, what impacts do far-reaching decisions have on society and the individual?

Existing Shortcomings The existing approaches for citizen participation, however, face serious shortcomings. They suffer from *a) low reach* – as they are hardly capable of addressing audiences that are larger than 200...300 persons in a single event or campaign; *b) high costs* – as they impose relatively high costs due to need of facilitation by highly-skilled moderators as well as extensive preparation and post-editing by the process owners; *c) buerocratic spirit* – as they incline to raise administrative issues in spite of attractive creative tasks which are usually left for professional designers (Münster et al. 2017).

At the moment most cities run offline procedures for participation in urban development issues such as German zoning plan law (Bebauungsplanverfahren). As paper-based procedures, they require citizens to visit the city hall during office hours and leave written comments, which in turn need to be processed manually. By law, respective administrative information needs to be published via city bulletins which, however, few citizens read. Therefore, existing participation formats only have minimal impact – they do not provide for sufficient interaction with, and feedback from citizens.

U_CODE solution Most smart city publications assume that new digital communication and interaction technologies can help to create more liveable and participatory cities (Gorynski & Mikolajczyk 2019; McKinsey Global Institute 2018), including e.g. the German Federal Government's Smart City Charta (BBSR/BBR 2017). Still, there are only few solutions that address the above mentioned deficits (Münster et al 2017, Stelzle et al 2017).

In order to establish an entire new approach and quality in citizen participation in urban development, a consortium of European researchers and developers has created within a H2020 project (2016-2019) the Urban Collective Design Environment,

U_CODE. Complementing established formats like Planning Cells, Design Charettes, or World Cafés etc. we propose with U_CODE Urban Collective Design Environment a new way of citizen engagement in urban development, based on advanced tools and processes of digital co-creation. U_CODE systematically exploits the opportunities of digital means in order to achieve *a) wide outreach* up to a scale of massive participation due to web-based interaction processes and data platform, *b) low cost deployment* due to provision of easily replicable software and hardware solution, and *c) rich co-creation experiences* with innovative co-design tools based on Virtual Reality, Serious Gaming, and interactive design technologies (Stelzle et al 2018).

Key Challenge As key challenge U_CODE addresses the question: How to engage a large number of highly diverse participants in a coordinated creative activity? Its conceptual core therefore is a process methodology for massive urban co-creation, which is to ensure goal-oriented, coordinated collective activities in cooperation with mandated planners and decision-makers, that eventually leads to feasible and creative urban design propositions (Hofmann et al 2018). U_CODE supplies this process methodology with an entire suite of new tools that enable, among others:

- crowdsourcing of relevant information and background data,
- collective co-creation of design propositions,
- sentiment and discourse analysis of the ongoing project debates,
- public presentation, voting and feedback.

Level of Development / Output The output of the U_CODE project is a comprehensive toolset whose individual tools are conceptually and technically developed to prototype level. The method and process design has been tested and validated in lab environment with a so-called Dummy Test Bed (12/2017-03/2018), as well as specific co-design tools (VR, Multitouchtable, Online Co-Design Game) (2018-2019). Pilot applications of the entire process and toolset in real-world projects are planned for the final months of the project (Spring-Summer 2019).

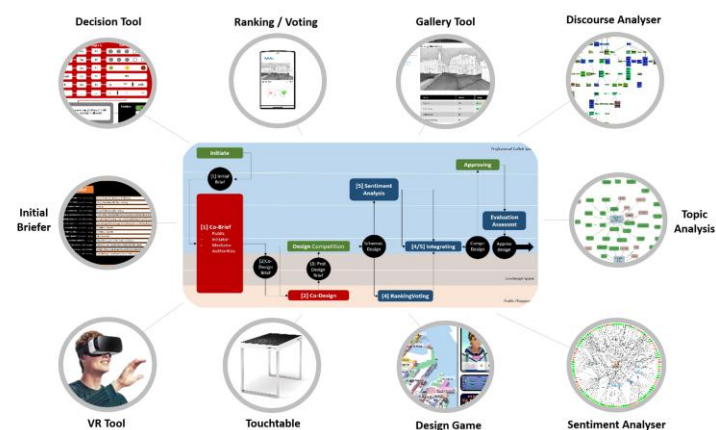


Fig. 3 U_CODE Process Methodology (centre) and accompanying tools (margins)

Engaging User Groups To devise a feasible and successful co-creation process, it is necessary 1) to specify the different users and stakeholders, and b) to precisely line out how they are supposed to contribute to the process. During the mid-term review of the U_CODE project (10/2018) it was recommended to establish a comprehensive User Engagement Protocol (UEP) as a key supplement for the technical tools and methodology. This paper is to address this demand.

Definition of User Group In the U_CODE context, following user groups were defined and described in detail elsewhere (Stelzle et al 2017): *Citizens* – the non-professional audience interested in, or related to, the planning, design, and development of their immediate or larger urban environment; *Planners* – professional planners and design experts mandated and responsible for urban design and planning work; *Authorities* – public institutions administering urban planning and development projects; *Project Initiator / Owner (PIO)* – persons or institutions with intrinsic interest in driving a project campaign, originators of a project idea; *SuperModerator (SuMo)* – Facilitator and Process Owner of a U_CODE campaign; expert consultant for U_CODE based projects.

User Engagement Protocol (UEP) The specific focus of this paper is to provide an outline for a UEP that is capable to concert the activities and contributions of a multiplicity of different stakeholders and user groups within U_CODE-based urban co-design campaigns. The project team recognised during the so-called Dummy Test Bed (12/2017-03/2018) that a precise operations manual is indispensable for conducting a smooth and successful co-design process. For each contributing user or participant an explicit and specific choreography needs to be issued that indicates what kind of activity, contribution, or input is to be delivered at what time with what means for what kind of output.

Analogy to Music Score A suitable analogy for the conceptualisation of such UEP are symphonic music scores which form the common basis for musicians as well as for conductors, allowing the successful performance (co-creation) of a complex piece of music. In concert practice, there usually exists a comprehensive Master Score outlined by the composer and annotated by the conductor, which the conductor monitors during live performance. From this master score, individual scores are derived for each single player or instrument, only showing this specific voice or role.

Similar to such scores, coordination documents need to be established a) to configure the overall process in accordance to project setup and context (Master Score), and b) to guide the individual contributions and activities of each user group and participant (specific UEP). These choreographic scores are to direct how Citizens, Expert Planners, Authorities, Facilitators etc. interact within a U_CODE process, how the various tools will be applied, and how the multiple activities and contributions will merge into meaningful co-creation.

2. Outline of User Engagement Protocol Process

Conceptual Steps The following paragraphs present the conceptual steps that lead to applicable UEPs. Whereas the first steps form a general synthesizer that – in accordance to project-specific context and requirements – defines a comprehensive co-design procedure to which concrete tools and activities are associated, the last step derives specific engagement protocols for each stakeholder or user group. The conceptual steps (a) ... (f) – which are explained in detail below – are linked by a backward logic.

In order to derive individual UEPs (f), it is necessary to determine the overall Master Score (e) beforehand. Such a comprehensive score can be composed from selected and configured tools (d) as well as from the overall process configuration, i.e. sequence of activities (c). The selection and configuration of tools and processes in turn are implied by the project setup and context (b). To explicate the implications and inferences of the project as clearly as possible, the project needs to be patterned in a structured format (a). A clear definition of the project setup and context is conditional for the stringent and quick definition of the necessary processes and tools.

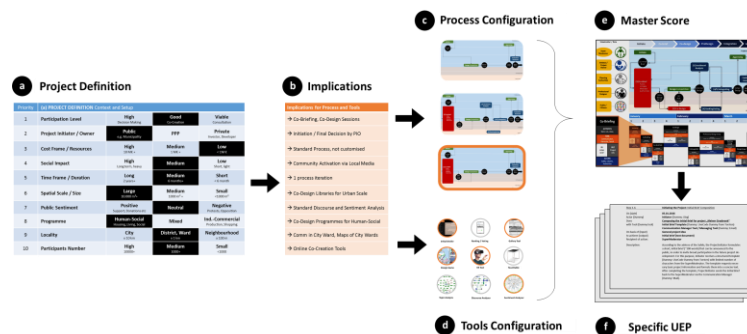


Fig. 2 Overview Conceptual Steps toward User Engagement Protocol

(a) *Project Definition*

In a first step, the project will be defined by a list of key parameters e.g. Targeted Participation Level, Cost Range, Expected Participants Number etc. With a structured questionnaire, the SuperModerator (SuMo) collects these information from the Project Initiator / Owner (PIO) or other sources. A prioritisation of the parameters helps to determine the influential decision making criteria for defining appropriate processes and tools in the succeeding steps.

Priority	(a) PROJECT DEFINITION Context and Setup			
1	Participation Level	High Decision Making	Good Co-Creation	Viable Consultation
2	Project Initiator / Owner	Public e.g. Municipality	PPP	Private Investor, Developer
3	Cost Frame / Resources	High 10 M€ +	Medium 1 M€ +	Low < 1M €
4	Social Impact	High Long term, heavy	Medium	Low Short, light
5	Time Frame / Duration	Long 2 years+	Medium 6 months+	Short < 6 month
6	Spatial Scale / Size	Large 10.000 m ² +	Medium 1000 m ² +	Small <1000 m ²
7	Public Sentiment	Positive Support, Donations etc	Neutral	Negative Protests, Opposition
8	Programme	Human-Social Housing, Living, Social	Mixed	Ind.-Commercial Production, Shopping
9	Locality	City x 10 km	District, Ward x 1 km	Neighbourhood x 100 m
10	Participants Number	High 10000+	Medium 1000+	Small <1000

Fig. 3 Overview Conceptual Steps toward User Engagement Protocol

(b) Implications

In a second step, essential implications for the upcoming definition of process and tool configuration will be drawn from the project description. To do so, IF-THEN schemes deduce inferences from the key parameters surveyed in step (a). An example: IF Participants Number is 1000+ THEN Online Co-Creation Tools need to be selected for the co-creation process.

Priority	(a) PROJECT DEFINITION Context and Setup				Implications for Process and Tools
1	Participation Level	High Decision Making	Good Co-Creation	Viable Consultation	→ Co-Briefing, Co-Design Sessions
2	Project Initiator / Owner	Public e.g. Municipality	PPP	Private Investor, Developer	→ Initiation / Final Decision by PID
3	Cost Frame / Resources	High 10 M€ +	Medium 1 M€ +	Low < 1M €	→ Standard Process, not customised
4	Social Impact	High Long term, heavy	Medium	Low Short, light	→ Community Activation via Local Media
5	Time Frame / Duration	Long 2 years+	Medium 6 months+	Short < 6 month	→ 1 process iteration
6	Spatial Scale / Size	Large 10.000 m ² +	Medium 1000 m ² +	Small <1000 m ²	→ Co-Design Libraries for Urban Scale
7	Public Sentiment	Positive Support, Donations etc	Neutral	Negative Protests, Opposition	→ Standard Discourse and Sentiment Analysis
8	Programme	Human-Social Housing, Living, Social	Mixed	Ind.-Commercial Production, Shopping	→ Co-Design Programmes for Human-Social
9	Locality	City x 10 km	District, Ward x 1 km	Neighbourhood x 100 m	→ Comm in City Ward, Maps of City Wards
10	Participants Number	High 10000+	Medium 1000+	Small <1000	→ Online Co-Creation Tools

Fig. 4 Implications for Tools and Processes

(c) Process Configuration

In this step, the overall process will be determined in accordance to the implications of (b) and (a). At the current state of development in the U_CODE project, this activity is carried out without a specific tool. In later stages of development, however, a specific software tool “Process Configurator” is envisioned to support this task. There are two options to establish the configuration:

Customising Processes With an appropriate Configurator Tool, it will be possible to design highly project-specific, customised processes. This, however, demands high skills

on the side of the SuperModerator (SuMo) as well as sufficient resources. Based on the so-called Minimal Viable Process (the base line process for good participation established by the U_CODE project, Stelzle et al 2018), suitable sequences and process structures can be configured e.g by providing feedback loops or multiple iteration of specific activities. Especially by process configuration, the key qualities of high-level participation processes can be controlled, such as: process transparency, divergence/convergence shifts, user-oriented communication, context adaptation.

Selecting Standard Processes In order to provide for a more quick and efficient form of process definition at the current state of development, and to sidestep complicate deliberation, U_CODE provides a menu of pre-set standard processes from which the most appropriate option can be selected by way of a questionnaire re. project context and setup pattern. Based on the Minimal Viable Process, a number of “easy select” standard process configurations are predefined for regular projects. However, in the middle run it is the aim for U_CODE to provide project-specific process designs instead of merely selecting predefined standard processes, in order to ensure higher quality and context-fit of the process configuration.

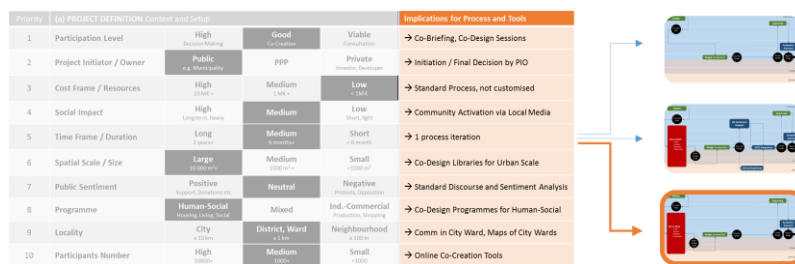


Fig. 5 Selecting a Standard Process according to project implications

(d) Tool Configuration

Similar to the step of Process Configuration (c), the Tool Configuration is based on implications drawn from step (b) and (a) too. There are two forms of tool configuration. *Tool Selection*: For regular projects, a standard selection of tools are prepared. In addition to these so-called Minimal Viable Tools (i.e. the toolset necessary to supply the Minimal Viable Process, Stelzle et al 2018), optional tools can be selected from an extended tool menu for inclusion in the overall process. *Tool Setting*: The tools themselves can be set up in accordance with project context and setup. Example: In terms of building typology or programme it would cause confusion if participants were able to select supermarkets in a project that aims for housing solutions. Here, a precise definition of component libraries, functional programs and design features is necessary to enable feasible and meaningful propositions. For regular projects, standard pre-sets of components and functionalities are prepared.

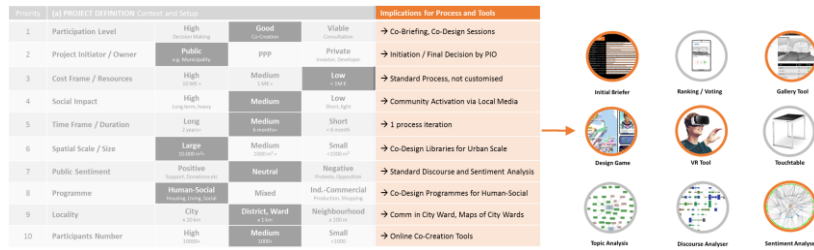


Fig. 6 Tool Selection according to project implications

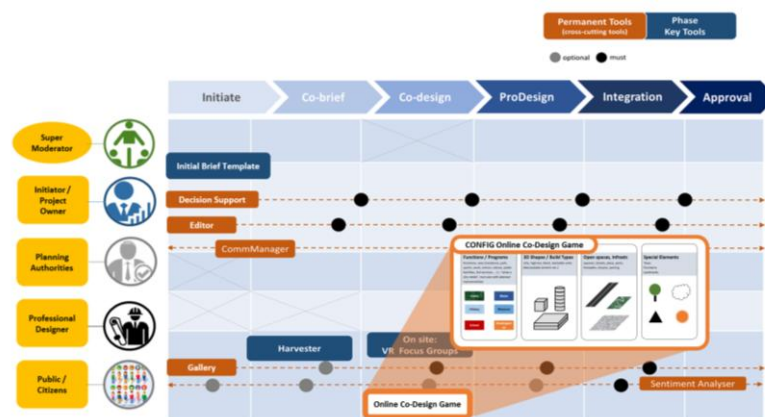


Fig. 7 Setting tools and components (highlighted: Online Co-Design Game)

(e) Compiling the Master Score

Integrating the outcomes of steps (c) and (d) and arranging all activities and processes along a feasible timeline, this step generates the overall choreography or “Protocol” for the entire process. Establishing this Master Score as well as monitoring the actually running process with view of this document is a key task of the SuperModerator (SuMo). This Master Score comprises all tools and timelines, as well as the roles and activities for all stakeholders and user groups: When they need to be involved, how long with which tools, and how the output of one activity forms a necessary input for another. At the current stage of development, there exists no specific digital tool for the creation of the Master Score within U_CODE. For further phases of development, however, the development of specific software application is envisioned to support this highly complex process step.

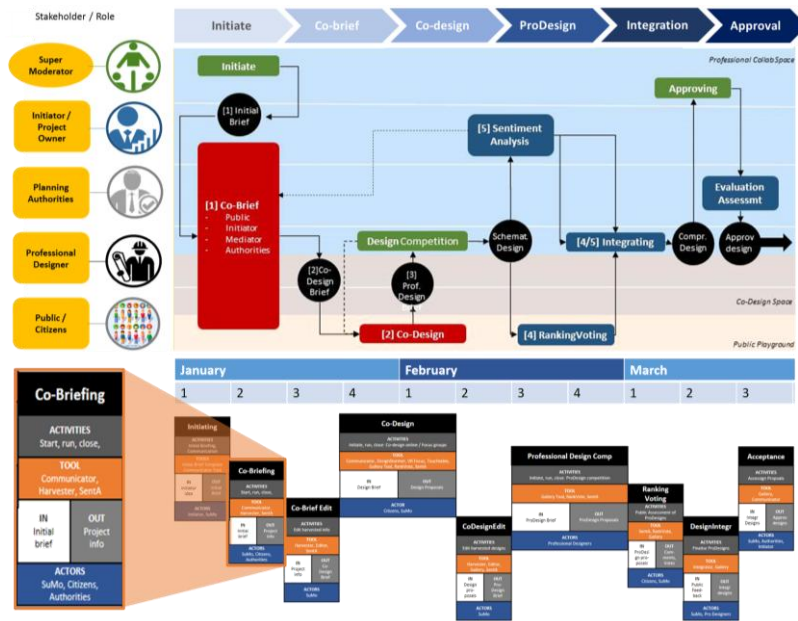


Fig. 8 Master Score: Process View (up), Operations Plan (down), highlighted: Co-Briefing Phase

(f) Specific User Engagement Protocols

From the comprehensive Master Score (e), specific User Engagement Protocols can be derived. These UEPs precisely determine for each participant or stakeholder group the individual activities, contributions and timelines. Presented in the form of Operation Manuals, they indicate who to work with at what stage of the process, and what the expected input and output are. Example: “As PIO, I need to search and contact a SuMo in month 1, inform him about size / program / scope of my project, and determine with him level of participation. The result we consolidate in an Initial Brief Document”. From the specific UEPs the SuMo in turn infers the necessary forms of communication and contacting for each stakeholder or user group (which, technically speaking, turn into UEP activities for the SuMo himself). For the creation of the UEPs, existing “Smart Flow” functionalities of the project management and platform solutions can be used that technical partners bring into the U_CODE project consortium. This allows for the automated generation of a large number of individual UEPs from an appropriately set up Master Score.

Step 1.4.	Initiating the Project: Initial Brief Composition
On (date)	05.01.2018
Actor (Dummy)	Initiator (Dummy: Jörg)
Does with Tool (Dummy tool)	Composing the Initial Brief for project „Kleiner Grasbrook“ Initial Brief Template (Dummy: LiveCode Dummy from Torsten) Communication Manager Tool / Messaging Tool (Dummy: Email)
On basis of (input)	General project idea
to achieve (output)	Initial brief (text document)
Recipient of action:	SuperModerator
Description:	According to the advices of the SuMo, the ProjectInitiator formulates a short, initial brief (~100 words) that can be announced to the public, in order to invite broad participation in the future project development. For this purpose, Initiator receives a structured template (Dummy: LiveCode Dummy from Torsten) with limited number of characters from the SuperModerator. The template requests necessary basic project information and formats them into a concise text. After completing the template, ProjectInitiator sends the Initial Brief back to the SuperModerator via the Communication Manager (Dummy: Mail).

Fig. 9 Specific UEP for Phase “Project Initiation” / Stakeholder “Initiator”

3. Conclusions

The UEP process presented in this paper allows for precisely scheduled interactions of multiple stakeholders and user groups in urban co-design projects based on the U_CODE approach. It results in comprehensive choreographies for an entire co-design campaign, as well as in user-specific operation manuals, clearly defining for each individual participant his / her role and form of contribution. The presented conceptual process was practically tested and validated in a so-called Dummy Test Bed (12/2017-03/2018). At that time, all tasks and steps were carried out manually. Currently (4/2019), a number of tools and processes can be processed via software and platform applications already. However, the complex tasks of configuring tools and processes, and deriving comprehensive operations manual for a large number of actors suggests to automate the entire process to the largest possible extent. For supporting especially the Super Moderator (SuMo) with appropriately automated routines, the project management functionalities of platform solutions brought into the project by U_CODE’s industrial partners (conject, aconex, Oracle) provide a promising outlook.

References

- BBSR/BBR (Hg.) (2017): Smart City Charta. Digitale Transformation in den Kommunen nachhaltig gestalten. Bundesinstitut für Bau-, Stadt- und Raumforschung; Deutschland. Stand: Mai 2017. Bonn: Bundesinstitut für Bau- Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumordnung (BBR).
- Gorynski, B.; Mikołajczyk, P. (2019): Smart City / Smart Region. Handlungsleitfaden für Praktiker*Innen. Mühlheim an der Ruhr: bee smart city Verlag. Online verfügbar unter <https://app.hubspot.com/documents/3372807/view/35692852?accessId=51c190>, zuletzt geprüft am 03.04.2019.

- Griffinger, R. (2007): Smart Cities. Ranking of European medium-sized cities. Vienna University of Technology. Online verfügbar unter http://www.smart-cities.eu/download/smart_cities_final_report.pdf, zuletzt geprüft am 15.04.2019.
- Hofmann, M.; Münster, S.; Noennig, J. R. (2018) Building blocks for a massive digital participation system in urban planning, IAPS 2018, Rome
- Holmer, T.; Noennig, J.R. (2017) Listening to the Crowd: Discourse Structure Analysis for Urban Design, in: Conference Proceedings GENEME 2017 Gemeinschaft in Neuen Medien
- Kustra, M.; Brodowicz, D.; Noennig, J.R. (2017) Smart City Sells – Business Models and Corporate Approaches on the Smart City Concept – in: Crabu, S.; Giardullo, P.; Miele, F.; Turrini, M. (Eds.) Sociotechnical Environments. Proceedings of the 6ths STS Italia Conference, pp. 211-230
- McKinsey Global Institute (Hg.) (2018): Smart Cities. Digital Solutions for a more livable future. Online verfügbar unter <https://www.mckinsey.com/~media/mckinsey/industries/capital%20projects%20and%20infrastructure/our%20insights/smart%20cities%20digital%20solutions%20for%20a%20more%20livable%20future/mgi-smart-cities-full-report.ashx>, zuletzt geprüft am 08.04.2019.
- Münster, S.; Faliou, B.; Georgi, C.; Heijne, K.; Klamert, K.; Noennig, J. R., et al. (2017) Implications and concepts for a massive digital participation system in urban planning, International Land Use Symposium 2017, Dresden
- Münster, S.; Georgi, C.; Heijne, K.; Klamert, K.; Noennig, J.; Pump, M.; Stelzle, B.; van der Meer, H. (2017) How to involve inhabitants in urban design planning by using digital tools? An overview on the state of the art, key challenges and promising approaches, in: 21st International Conference in Knowledge Based and Intelligent Information and Engineering Systems - KES2017, Elsevier: Procedia Computer Science
- Piskorek, K.; Barski, J.; Noennig, J. (2015) Creative Solutions for Smart Cities – the Syncity Approach, in: Proceedings of the International Forum for Knowledge Asset Dynamics IFKAD, Bari 2015
- Stelzle, B., Naumann, F.; Holmer, T.; Jannack, A., Noennig, J. (2018) A Minimal Viable Process and Tools for Massive Participation in Urban Development, in: Proceedings of the International Forum for Knowledge Asset Dynamics IFKAD, Delft 2018
- Holmer, T.; Noennig, J. (2018) Analysing Topics and Sentiments in Citizen Debates for Informing Urban Development, in: Proceedings of the International Forum for Knowledge Asset Dynamics IFKAD, Delft 2018
- Selle, K. (2014): Über Bürgerbeteiligung hinaus: Stadtentwicklung als Gemeinschaftsaufgabe? Analysen und Konzepte. Lemgo: Rohn (Edition Stadtentwicklung).
- Stelzle, B.; Noennig J. R. (2019) A Method for the Assessment of Public Participation in Urban Development, in: Urban Development Issues, vol. 61
- Stelzle, B.; Noennig, J.R.; Jannack, A. (2017) Co-Design and Co-Decision: Decision Making on Collaborative Design Platforms, in: 21st International Conference in Knowledge Based and Intelligent Information and Engineering Systems - KES2017, Elsevier: Procedia Computer Science
- Stelzle, B.; Noennig, J. (2017): A Database for Participation Methods in Urban Development. In: *Procedia Computer Science* 112, S. 2416–2425. DOI: 10.1016/j.procs.2017.08.173.

Common-Good DPM: a Tool for Co-evolving Business Models and Sustainable Development Models

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Abstract

Since technology, institutions and markets continuously change, business models are also dynamic configurations that evolve through micro- adaptations and/or disruptive changes. This dynamism enables economic resilience, that is, the (re)generation of system-level economic sustainability, mainly through the mechanism that in the entrepreneurship literature is called “creative destruction”. But what about social and environmental resilience? How, and under what conditions, can business model dynamics contribute to the (re)generation of environmental and social sustainability, as well? Even if business model (re)generation is today recognized as a key force to the resilience (and fragility) of social-ecological systems, we have scant understanding of how its actual contribution to sustainability could be assessed and maximized (Schaltegger & Wagner, 2011). This study contributes to addressing this challenge by developing the Common-Good DPM approach. This approach results from the cross-fertilization between Dynamic Performance Management (DPM), which is a system-thinking based method, the theory of the commons, and institutional theories. The Common-Good DPM approach is a sustainability-oriented tool for sense-making, monitoring, testing and designing around the dynamic link between business models and sustainable development models, thus leveraging business model evolution for sustainability transformations. The Common-Good DPM approach is conceived to concretely enable participatory and adaptive modelling, in which sustainability-relevant knowledge is collectively co-created through feedback based learning. In addition, the Common-Good DPM approach is data-driven, and may both enable and leverage effective big data management.

Keywords – Business model, Sustainability, Commons, Dynamic Performance Management, System Dynamics

Papert Type - Academic Research Paper (ongoing research)

1 Introduction

The concept of business model is a broad one, that allows for several possible definitions (Baden-Fuller & Mangematin, 2013; DaSilva & Trkman, 2014; Morris, Schindehutte, & Allen, 2005). In this study, we build upon Zott & Amit (2007) and Ricciardi, Zardini, & Rossignoli (2016), and we define the business model as the system of the key value-creation, value-distribution and value-capture interactions that enable an undertaking's economic sustainability (Furnari, 2015). For example, people use Google's free services, which in turn allow Google to collect users' data, which in turn are delivered to interested customers, thus enabling Google's economic sustainability: this is a synthesis of Google's business model.

This definition of business model is applicable not only to enterprises, firms and one-person undertakings, but also to public administration bodies (whose economic sustainability typically derives from public money, after specific political decisions and agreements) and non-profit organizations (whose economic sustainability may derive, for example, from donations). In this light, a business model is viable in that it sufficiently fits the undertaking's technological, institutional and market environments (e.g., the local labour market), and particularly the needs of its customers/payers and users/beneficiaries: two categories that in several business models do not overlap, like in the Google case.

Since technology, institutions and markets continuously change, business models are also dynamic configurations that evolve through micro- adaptations and/or disruptive changes (Ricciardi et al., 2016; Zott, Amit, & Massa, 2011). This dynamism enables economic resilience, that is, the (re)generation of system-level *economic* sustainability, mainly through the mechanism that in the entrepreneurship literature is called "creative destruction" (Chiles, Bluedorn, & Gupta, 2007).

But what about social and environmental resilience? How, and under what conditions, can business model dynamics contribute to the (re)generation of *environmental and social* sustainability, as well (Boons & Lüdeke-Freund, 2013)? Even if business model (re)generation is today recognized as a key force to the resilience (and fragility) of social-ecological systems (Berkes, Colding, & Folke, 2003; Cantino, Devalle, Cortese, Ricciardi, & Longo, 2017), we have scant understanding of how its actual contribution to sustainability could be assessed and maximized (Schaltegger & Wagner, 2011).

Merely measuring the extent to which a (new) business model is compatible and compliant with extant sustainability norms and expectations (Bocken, Short, Rana, & Evans, 2014) is not sufficient. Sustainability-related beliefs, norms and expectations often become obsolete and are soon replaced by new beliefs, norms and expectations, hopefully based on more advanced knowledge (like, for example, in the case of biofuels). Therefore, the assessment of business models' contribution to sustainability should be a process that adds to the extant body of knowledge, rather than merely conforming to it (Schaltegger, Hansen, & Lüdeke-Freund, 2016).

This study contributes to addressing this challenge by developing the *Common-Good DPM approach*.

2 Dynamic Performance Management

Dynamic Performance Management (DPM) is a method for adaptive and recursive system modelling (Bianchi, 2016) that allows the researcher to map a system's key resources (in terms of stocks), results (in terms of flows), performance drivers (in terms of ratios, usually expressing capabilities) and input variables (in terms of behavioural drivers and institutional/operational constraints) (see Figure 1).

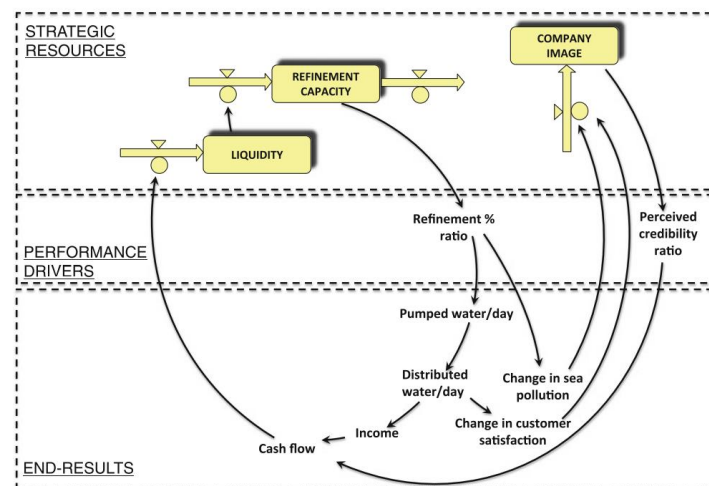


Figure 1- An instance of DPM modelling: a layer & arrow model of a water utility company.
Source: Bianchi (2016).

DPM is considered particularly interesting in that it allows to model not only linear cause-effect relationships, but also feedback effects, including virtuous cycles, vicious cycles and homeostatic loops (Sterman, 2000). That far, DPM has mainly taken the individual organization as the level of analysis: in this case, DPM modelling can provide an effective translation of a business model into a system of correlated resources, results, performance drivers and input variables (Cosenz, 2017). However, DPM can also be used to conduct system-level modelling. In this case, a DPM model can represent how a specific business model is embedded in, and interacts with, its social-ecological system. Therefore, DPM could be used for the assessment, simulation and design of a business model's system-level impact under specific inputs (Borgonovi, Bianchi, & Rivenbark, 2017). The possibility of including common resources and capabilities into the model, along with the resources and capabilities controlled by the individual firm, transforms DPM into a powerful tool to map the (re)generation (or destruction) of public value that results from the implementation of a certain business model.

Despite its potential, however, DPM has been quite overlooked by management scholars interested in sustainability issues that far. Indeed, DPM has been much more used to model dynamics at the single organization's level than at the system level. The reason for this underutilization is twofold, in our opinion.

The first reason is that studies leveraging DPM tend to (implicitly) adopt the resource-based view (RBV) as a theoretical lens (Peteraf, 1993); therefore, these studies typically assume that rent maximization is the key goal of the analysis, and the key resources to be included in the model are those resources that allow the organization to develop competitive advantage, such as internal competencies, customer base, or liquidity. It is not surprising then, in our opinion, that this approach is perceived as hardly adaptable to sustainability-focussing studies.

The second reason that has that far discouraged scholars from adopting DPM for sustainability-relating research has to do with the difficulties of participatory modelling when different and conflicting views and interests are at stake (Rossignoli, Ricciardi, & Bonomi, 2018). Defining DPM variables (key resources, results, performance drivers and inputs) and the relationships between variables is not a neutral process. DPM scholars claim that, due to the high levels of complexity addressed, DPM can be effective in supporting the (re)generation of public value only if all key stakeholders contribute to DPM modelling through participatory processes (Bianchi, Bovaird, & Loeffler, 2017), so that collective learning and progressive model fine-tuning are enabled (Ferraro, Etzion, & Gehman, 2015). However, governing these participatory processes is a challenging task that would require specific attention and solutions. In the absence of a DPM modelling protocol that successfully addresses these issues, it is not surprising that overwhelming pluralism, intractable conflicts and irreconcilable disagreements end up hindering an effective modelling process.

3 Complementing system dynamics with institutional theories and the theory of the commons

This study complements the DPM approach with two further conceptual tools that, in our opinion, allow scholars to overcome the two limitations of DPM modelling listed above: the theory of the commons, and institutional theories. The complementarity between system dynamics, the theory of the commons, and institutional theories is attracting increasing scholarly attention (Etzion, Gehman, Ferraro, & Avidan, 2017; Luna-Reyes & Gil-Garcia, 2011) and is a promising solution to address the role of business models (as systems of interactions) in sustainability transformations.

The theory of the commons proposes the common good as a key goal to governance and management action, and defines the common good as the social-ecological system's capability to (re)generate the critical resources that could be available for collective use on the part of a certain community, such as, for example, clean air or a tourist destination's reputation (Cantino et al., 2017). In addition, the theory of the commons investigates the governance and organizational factors that enable (or destroy) such common good. Therefore, the theory of the commons effectively complements the RBV lens in drawing the interplay between a business model and its social-ecological system's fragility, and provides DPM modelling with a sound and sustainability-oriented toolbox.

Institutional theories (Wooten & Hoffman, 2008), on the other hand, have a strong explanatory power for the dynamics of the relational space where a business model is

embedded in, particularly as for social expectations, legitimacy needs, façade behaviours, technological standards, mimetic imitation of reputed best practices, compliance, values and beliefs. Institutional theories provide sound conceptual tools for identifying BPM variables (especially inputs) that are key to behavioural architectures (Bianchi & Williams, 2015), and for modelling the relationships between BPM variables. In addition, institutional theories (and particularly the literature on institutional logics and organizational fields) can provide effective tools to manage the tensions between and across different sustainability logics (such as the charity logic and the environmentalist logic), thus enabling an effective protocol for DPM participatory modelling (Rossignoli et al., 2018).

4 Towards the Common-Good DPM approach

The Common-Good DPM approach that results from the cross-fertilization between DPM, the theory of the commons, and institutional theories, is therefore a sustainability-oriented tool for sense-making, monitoring, testing and designing around the dynamic link between business models and sustainable development models, thus leveraging business model evolution for sustainability transformations (Zollo, Cennamo, & Neumann, 2013).

In the Common-Good DPM approach, the typical framework including resources, performance drivers and results/flows is replicated at the level of the individual organization (thus representing its business model) and at the level of the commons, that is, the social-ecological system that (re)generates resources for collective use (see Figure 2). This allows scholars to map the interrelated cause-effect relationships between the business model and the system's (sustainable) development model.

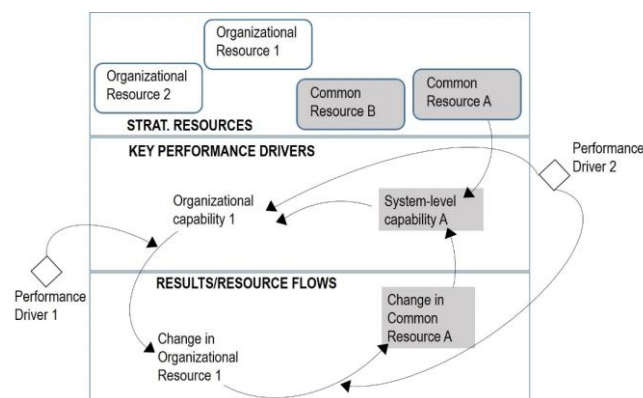


Figure 2- The typical structure of the proposed Common-Good DPM modelling, including both organizational-level and commons-level strategic resources, performance drivers/capabilities, and results/resource flows.

The Common-Good DPM approach is conceived to concretely enable participatory and adaptive modelling, in which sustainability-relevant knowledge is collectively co-

created through feedback based learning. In addition, the Common-Good DPM approach is data-driven, and may both enable and leverage effective big data management.

References

- Baden-Fuller, C., & Mangematin, V. (2013). Business models: A challenging agenda. *Strategic Organization*, 11(4), 418–427. <https://doi.org/10.1177/1476127013510112>
- Berkes, F., Colding, J., & Folke, C. (Eds.). (2003). *Navigating Social–Ecological Systems: Building Resilience for Complexity and Change*. Cambridge: Cambridge University Press.
- Bianchi, C. (2016). *Dynamic Performance Management*. Springer International Publishing.
- Bianchi, C., Bovaird, T., & Loeffler, E. (2017). Applying a Dynamic Performance Management Framework to Wicked Issues: How Coproduction Helps to Transform Young People’s Services in Surrey County Council, UK. *International Journal of Public Administration*, 40(10), 833–846. <https://doi.org/10.1080/01900692.2017.1280822>
- Bianchi, C., & Williams, D. W. (2015). Applying system dynamics modeling to foster a cause-and-effect perspective in dealing with behavioral distortions associated with a city’s performance measurement programs. *Public Performance and Management Review*, 38(3), 395–425. <https://doi.org/10.1080/15309576.2015.1006471>
- Bocken, N. M. P., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*.
- Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: state-of-the-art and steps towards a research agenda. *Journal of Cleaner Production*, 45, 9–19. <https://doi.org/10.1016/j.jclepro.2012.07.007>
- Borgonovi, E., Bianchi, C., & Rivenbark, W. C. (2017). Pursuing Community Resilience through Outcome-Based Public Policies: Challenges and Opportunities for the Design of Performance Management Systems. *Public Organization Review*, 1–6. <https://doi.org/10.1007/s11115-017-0395-1>
- Cantino, V., Devalle, A., Cortese, D., Ricciardi, F., & Longo, M. (2017). Place-based network organizations and embedded entrepreneurial learning: emerging paths to sustainability. *International Journal of Entrepreneurial Behavior and Research*, 23(3), 504–523. <https://doi.org/10.1108/IJEBR-12-2015-0303>
- Chiles, T. H., Bluedorn, a. C., & Gupta, V. K. (2007). Beyond creative destruction and entrepreneurial discovery: A radical Austrian approach to entrepreneurship. *Organization Studies*, 28(4), 467–493. <https://doi.org/10.1177/0170840606067996>
- Cosenz, F. (2017). Supporting start-up business model design through system dynamics modelling. *Management Decision*, 55(1), 57–80. <https://doi.org/10.1108/MD-06-2016-0395>
- DaSilva, C. M., & Trkman, P. (2014). Business Model: What It Is and What It Is Not. *Long Range Planning*, 47(6), 379–389. <https://doi.org/10.1016/j.lrp.2013.08.004>
- Etzion, D., Gehman, J., Ferraro, F., & Avidan, M. (2017). Unleashing sustainability transformations through robust action. *Journal of Cleaner Production*, 140, 167–178. <https://doi.org/10.1016/j.jclepro.2015.06.064>
- Ferraro, F., Etzion, D., & Gehman, J. (2015). Tackling Grand Challenges Pragmatically: Robust Action Revisited. *Organization Studies*, 36(3), 363–390. <https://doi.org/10.1177/0170840614563742>
- Furnari, S. (2015). A cognitive mapping approach to business models: Representing causal structures and mechanisms. *Advances in Strategic Management*. Cass Business School, City University London, London, United Kingdom. <https://doi.org/10.1108/S0742-332220150000033025>
- Luna-Reyes, L. F., & Gil-Garcia, J. R. (2011). Using institutional theory and dynamic simulation to

- understand complex e-Government phenomena. *Government Information Quarterly*, 28(3), 329–345. <https://doi.org/10.1016/j.giq.2010.08.007>
- Morris, M., Schindehutte, M., & Allen, J. (2005). The entrepreneur's business model: Toward a unified perspective. *Journal of Business Research*, 58(6), 726–735. <https://doi.org/10.1016/j.jbusres.2003.11.001>
- Peteraf, M. A. (1993). The cornerstones of competitive advantage: a resource-based view. *Strategic Management Journal*, 14(3), 179–191.
- Ricciardi, F., Zardini, A., & Rossignoli, C. (2016). Organizational dynamism and adaptive business model innovation: The triple paradox configuration. *Journal of Business Research*, 69(11), 5487–5493. <https://doi.org/10.1016/j.jbusres.2016.04.154>
- Rossignoli, C., Ricciardi, F., & Bonomi, S. (2018). Organizing for Commons-Enabling Decision-Making Under Conflicting Institutional Logics in Social Entrepreneurship. *Group Decision and Negotiation*, 27, 417–443. <https://doi.org/10.1007/s10726-018-9564-z>
- Schaltegger, S., Hansen, E. G., & Lüdeke-Freund, F. (2016). Business Models for Sustainability : Origins , Present Research , and Future Avenues. *Organization & Environment*, 29(1), 3–10. <https://doi.org/10.1177/1086026615599806>
- Schaltegger, S., & Wagner, M. (2011). Sustainable entrepreneurship and sustainability innovation: Categories and interactions. *Business Strategy and the Environment*, 20(4), 222–237. <https://doi.org/10.1002/bse.682>
- Sterman, J. (2000). *Business dynamics. Systems Thinking and modeling for a complex world*. Boston: Irwin/McGraw Hill.
- Wooten, M., & Hoffman, A. J. (2008). Organizational Fields: Past, Present, and Future. In R. Greenwood, C. Oliver, R. Suddaby, & K. Sahlin (Eds.), *Handbook of Organizational Institutionalism* (pp. 130–147). Sage Publications. <https://doi.org/10.4135/9781849200387>
- Zollo, M., Cennamo, C., & Neumann, K. (2013). Beyond What and Why: Understanding Organizational Evolution Towards Sustainable Enterprise Models. *Organization and Environment*, 26(3), 241–259. <https://doi.org/10.1177/1086026613496433>
- Zott, C., & Amit, R. (2007). Business model design and the performance of entrepreneurial firms. *Organization Science*, 18(2), 181–199.
- Zott, C., Amit, R., & Massa, L. (2011). The business model: Recent developments and future research. *Journal of Management*, 37(4), 1019–1042. <https://doi.org/10.1177/0149206311406265>

Investigating the Implications of Industry 4.0 Enabling Technologies on Sustainability

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Abstract

Despite their heterogeneity, Industry 4.0 enabling technologies have been recognized as a unique multi-faceted set of innovation that is able to provide disruptive innovation and define a new industrial paradigm, whose pervasiveness is experienced irrespective of sector, company size, or adopted business model. In this paper, we present the preliminary results of an analysis, based on case studies retrieved in extant literature on this topic, aimed at investigating whether and in which way Industry 4.0 enabling technologies impact on companies' sustainability, especially with respect to the environmental and social dimensions. The goal is to contribute to provide an overall view wherein the different Industry 4.0 technologies are analyzed in terms of their implications on the social and environmental dimensions of sustainability.

Keywords – Industry 4.0, sustainability, Global Reporting Initiative disclosure, case studies.

Paper type – Academic Research Paper

1 Introduction

The rapid improvement, in terms of cost, easiness of use, and performance, of sensors, actuators, information and communication apparatuses as well as the standardization of manufacturing systems (Weyer *et al.*, 2015) and interoperability (Liao *et al.*, 2017) allow

production processes to gain both flexibility and responsiveness. Such innovative technologies, which connect digital and physical systems, enable companies to carry on complex analyses and make real-time decisions so as to address market pressure and the fickleness of the environment wherein they operate (Gabriel and Pess, 2016).

These technologies have different fields of adoption and may be implemented independently of each other, however they have been recognized as a unique multifaceted set of innovation that act as a breakthrough for industrial ecosystems, irrespective of sector, size, or adopted business model. To stress their pervasiveness, the ability to carry on disruptive innovation and define a new industrial paradigm, they are often referred to as a whole by using the expressions “digital transformation” (Ustundang and Cevikcan, 2017), “fourth industrial revolution” (Schwab, 2017) or, more frequently, “Industry 4.0” enabling technologies.

Since the first adoption of the expression Industry 4.0 (Kagermann *et al.*, 2013), the attention devoted by scholars to this new industrial paradigm has rapidly grown, in both the technological and the business field (Kamble *et al.*, 2018). Nonetheless, even though sustainability is an inescapable topic of current debate among practitioners, scholars, and the wider public opinion, to our knowledge, the literature that investigates whether and to what extent Industry 4.0 is able to impact on sustainability is surprisingly scant, and does not depict a clear role of Industry 4.0 with respect to the three dimensions that define sustainability, i.e. economic, environmental, and social (Bonilla *et al.*, 2018; Kamble *et al.*, 2018; Stock *et al.*, 2018; Savastano *et al.*, 2019). For instance, the increased responsiveness of production systems might play a role in improving efficiency in terms of materials and energy required, as well as waste and emissions generated. On the other hand, the common opinion about the social impact of Industry 4.0 is often less optimistic. Innovative technologies will increase the demand of skilled workers in specific fields (such as robotics, or data analysis and integration), but might represent a challenge for the job market, by destroying jobs or at least requiring major conversion of medium- and poor-skilled workers (Lorenz *et al.*, 2015; Roblek *et al.*, 2016). Finally, the impact of Industry 4.0 might result problematic with respect to the economic dimension. The improved capability of large companies to offer very customized services will augment the power of such companies and favor the creation of few big multinational players, so causing an unfair distribution of profits among companies and, within each company, among stakeholders.

To our knowledge the only empirical study concerning the assessment of the influence of Industry 4.0 on the three pillars of sustainability is the one by Varela *et al.* (2019). Based on a literature review, they first identified the main contributions regarding the relation or influence of Industry 4.0 on the economic, environmental, and social dimension of sustainability. Then, based on the review results, Varela *et al.* formulated some hypotheses and tested them on a sample of Iberic companies. The result of the test showed a strong relation between Industry 4.0 and the three pillars of sustainability, with a strongest factorial weight for environmental sustainability (expressed in terms of energy consumption, circular economy and environmental practices with partners), followed by social sustainability (expressed in terms of salary remuneration, work conditions and

surrounding society), and economic sustainability (expressed in terms of profits, turnover and market share).

From the analysis of the literature, it emerges that the research has mostly considered the impact of specific technologies on sustainability rather than considering the new industrial paradigm as a whole, and has focused on single dimensions of sustainability rather than assuming a comprehensive perspective. The goal of this paper is then to contribute to develop an overall view of the implications due to the diverse Industry 4.0 technologies on the social and environmental dimensions of sustainability.

To this aim, we have investigated the literature on Industry 4.0 enabling technologies and their implications on sustainability, specifically focusing on case studies concerning Industry 4.0 technologies, which have been identified according to the methodology described in the next Section. Selected cases have been scrutinized against the topic specific standards and disclosures provided by Global Reporting Initiative (Section 3).

The analysis is in progress. Preliminary results, illustrated in Section 4, show that although Industry 4.0 enabling technologies have implication on both social and environmental dimensions, they mostly relate to the latter, in particular, to the topic Energy (GRI 302).

2 Methodology

The goal of the paper is to assess the implications deriving from the adoption of Industry 4.0 enabling technologies on the environmental and social dimensions of sustainability. To achieve such a goal we examined all the case studies dealing with the adoption of Industry 4.0 enabling technologies reported in Scopus in the period 2011-2018. We searched for papers that reported in the title, abstract or keywords, the expressions ‘Industry 4.0’ & ‘case stud*’ and also ‘Industry 4.0’ & ‘sustainability’. The search returned 352 (of which 345 into English) and 115 papers, respectively. As reported in Table 1, an analysis of the retrieved papers in both cases (‘Industry 4.0’ & ‘case stud*’ and ‘Industry 4.0’ & ‘Sustainability’) shows an exponential augment of papers, which tests the increasing interest towards the topics.

Table 1. Occurrence of retrieved paper per year, based on search key.

Year	‘Industry 4.0’ & ‘Sustainability’	‘Industry 4.0’ & ‘case stud*’
2018	72	206
2017	33	94
2016	5	35
2015	2	8
2014	3	2
Total	115	345

As reported in Table 2, the novelty of the topics is clearly stressed by the large number of papers related to conferences (conference papers or conference reviews are about half of the total number of papers). The topics are of interest of almost all

disciplines, engineering and computer science being those with larger occurrences (Table 3).

Only the papers written into English were considered. Duplications as well as studies different from case studies on Industry 4.0 enabling technologies were successively eliminated. Finally, among case studies, only those which discussed the implications of technology adoption on environmental and social sustainability consistently with what reported in the Sustainability Reporting Guidelines published by the Global Reporting Initiative (GRI), were further analyzed. GRI Sustainability Reporting Guidelines (GRI, 2016), a de facto standard in the field of sustainability reporting, include three universal standards applicable for every organization preparing a sustainability report as well as topic-specific standards used to report information on an organization's material impacts on economic topics (200 series), environmental topics (300 series) and social topics (400 series). For example, in the 300 series, GRI 301 deals with Materials, and includes the following specific disclosures, namely: Material used by weight and volume (301-1); Recycled input materials used (301-2); Reclaimed products and their packaging materials (301-3). The disclosures are associated with qualitative or quantitative indicators. We only considered the papers in which, even though not explicitly, disclosures associated to 300 and 400 series (environmental and social dimension of sustainability) were mentioned.

The analysis is in progress, so far we analyzed in details 15 cases.

Table 2. Retrieved papers by document type

Type	'Industry 4.0' & 'Sustainability'	'Industry 4.0' & 'case stud*'
Conference paper	42%	54%
Article	41%	32%
Conference review	7%	8%
Review	3%	1%
Book chapter	3%	3%
Article in press	3%	1%
Short survey	1%	0%
Others	1%	1%

Table 3. Retrieved papers by subject area

Subject area	'Industry 4.0' & 'Sustainability'	'Industry 4.0' & 'case stud*'
Engineering	72	216
Computer Science	47	187
Business, Management and Accounting	23	56
Environmental Science	20	20
Social Sciences	19	16
Decision Sciences	17	57
Energy	15	17
Mathematics	14	58
Chemical Engineering	7	12
Materials Science	6	15
Economics, Econometrics and Finance	3	8

Physics and Astronomy	3	20
Arts and Humanities	2	3
Biochemistry, Genetics and Molecular Biology	1	5
Chemistry	1	8
Earth and Planetary Sciences	1	2
Psychology	1	2
Others	2	3

Two (out of three) authors separately read the 15 papers to identify the technologies adopted as well the sustainability implications associated to their adoption. The technologies were classified according to the scheme provided by the Italian Ministry of Economic Development (<https://www.mise.gov.it/index.php/it/industria40>). Such a scheme identifies nine main categories of Industry 4.0 enabling technologies, namely collaborative robots, additive manufacturing, augmented reality, simulation, digital integration, industrial internet, cloud, cybersecurity and big data & analytics.

The sustainability implications were associated with each case where mentioned either in a textual form or by using indicators. Both qualitative (textual descriptions) and quantitative (indicators) information was collected by the two authors. Successively, the two authors read the papers again to verify the completeness of their lists. The lists so obtained were then compared. No consistency index was used to compare the lists, as considerations were almost always consistent.

Once the technologies and the implications were identified, the list were analyzed and discussed, to identify the most frequently studied technologies, the most frequently cited sustainability implications as well as possible correlations among technologies and sustainability implications.

3 Analysis and discussion

A description of the cases so far analysed is reported in Table 4.

Table 4. Cases description.

Case study	Description
SMALL Factory (Bedolla <i>et al.</i> , 2017)	Reproduction of a smart factory for educational purposes in a laboratory environment, in terms of both hardware and software, so as to integrate traditional manufacturing processes and new technologies according to the Industry 4.0 paradigm
Intelligent bandsaw monitoring system (Bagheri <i>et al.</i> , 2015)	Three bandsaw machines have been setup at different geographical locations and connected, configured and controlled by a 5-level Cyber-Physical System architecture
Augmented reality for virtual user manual (De Amicis <i>et al.</i> , 2018)	Assembly of a simple scale model of a car assisted by an augmented reality animation device
Technology for Ambient-Assisted Living Manufacturing (Gregori <i>et al.</i> , 2017)	Development of an assistive working environment that favors human-machine interaction and social sustainability, considering human needs within the design phase
Device Data Ingestion for Industrial Big Data Platforms (Ji <i>et al.</i> , 2016)	Heterogeneous device data ingestion model (synchronization, slicing, splitting and indexing) for an industrial big data platform of two Chinese companies

Case study	Description
Blockchain-enabled emission trading scheme (Khaqqi <i>et al.</i> , 2018)	Use of an open blockchain platform, Multichain, as the platform to publish bids and offers of a reputation-based emission trading system
Topology optimization for an automotive dashboard (Mantovani <i>et al.</i> , 2017)	Topology Optimization (TO) methods applied to design an aluminum sport car dashboard in view of weight reduction with torsional and bending stiffness targets
From mechatronic to Cyber-Physical Systems (Penas <i>et al.</i> , 2017)	Implementation of the extension of mechatronic systems to cyber-physical systems in a manufacturing industrial case study (tablets production)
Smart grids and urban drainage systems (Poonpakdee and Koivaniit, 2018)	Effect of systems architectures, centralized systems, and decentralized systems, to the accuracy of global aggregation
EOS P700 selective laser syntering machine (Qin <i>et al.</i> , 2017)	Service orientated Internet of Things framework focusing on the energy consumption modelling in the additive manufacturing process for reducing the power usage during production
Deep Digital Maintenance (Rødseth <i>et al.</i> , 2017)	Development of a new maintenance model called deep digital maintenance (DDM) that enables integrated planning where maintenance and production planning can be more integrated
Intelligent Mining Engineering Systems (Rylnikova <i>et al.</i> , 2017)	Robotized technologies, machinery and mechanisms rooted on artificial intelligence, and mining and transport system automatic controls applied to underground mine production areas
Digital Twin Data Modeling of an industrial component (Schroeder <i>et al.</i> , 2016)	Modeling and simulation of a digital twin for an industrial valve embedding information related to the whole life-cycle of that product
Virtual Engineering Factory (Shafiq <i>et al.</i> , 2016)	Assimilation of virtual engineering objects (VEO), virtual engineering processes (VEP), and virtual engineering factories (VEF) to provide a real-time, intelligent, monitoring scheme and for support decision making
Prefabricated components for eco-solidarity architecture (Sferra, 2017)	Process innovation for construction material sector, based on Industry 4.0, in view of adopting pre-fabricated components for environmentally and socially sustainable emergency architecture

As to the Industry 4.0 enabling technology, the analysis shows (Figure 1) a predominance of cases on Internet of Things (10 cases) and Big Data & Analytics (5 cases). No case deals with cybersecurity. Internet of Things is usually adopted with other technologies, in particular Simulation and Big Data & Analytics. The Cloud is always mentioned with other technologies. Virtual Reality is the sole technology never discussed (in the analysed cases) with other technologies.

From the set of cases included in the analysis, it emerges that the adoption of Industry 4.0 enabling technologies most frequently is mentioned in association with environmental implications. Specifically, as shown by Figure 2, the most mentioned topic of the environmental dimension is Energy (GRI 302), followed by Materials (GRI 301), Emissions (GRI 305), and Water (GRI 302), and Effluents and Waste (GRI 306). Only three social implications are mentioned: the one having most occurrences is Occupational Health and Safety (GRI 403), whereas less common are the implications cited with respect to Training and Education (GRI 404) and Customer Health and Safety (GRI 416).

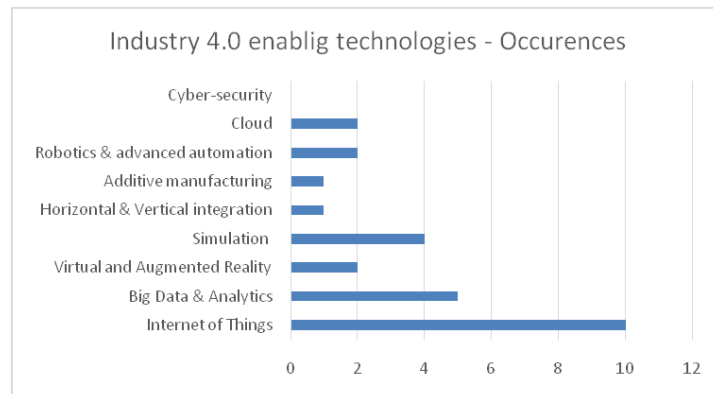


Figure 1. Occurrences of Industry 4.0 enabling technologies within the selected cases.

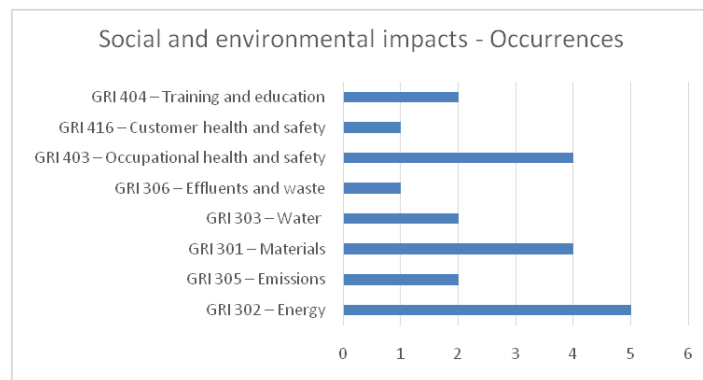


Figure 2. Occurrences of social and environmental impacts within the selected cases.

We also tried to find out possible associations among technologies and environmental and social implications (Table 5).

Based on the small set of cases that have been included in this preliminary analysis, we observe that the implications of technology adoption on environmental and social technologies are distributed. Internet of Things seems to have most implications on Occupational health and safety (GRI 403) and Energy (GRI 302), whereas less frequent are the implication on the other sustainability topics; Big Data & Analytics is in the half of cases associated with the Materials topic (GRI 301). Implications of Simulation are equally distributed between environmental and social dimensions, whereas Robotics & advanced automation is mostly related to the environmental dimension.

Table 5. Associations between Industry 4.0 enabling technologies and environmental and social implications, according to Global Reporting Initiative standards.

	Internet of Things	Big Data & Analytics	Virtual and Augmented Reality	Simulation	Horizontal & Vertical integration	Additive manufacturing	Robotics & advanced automation	Cloud	Cyber-security
GRI 301 – Materials	1	3					1		
GRI 302 – Energy	3	1		1		1	1		
GRI 303 – Water	1			1			1		
GRI 305 – Emissions	1	1			1		1		
GRI 306 – Effluents and waste	1			1					
GRI 403 – Occupational health and safety	4	1		2			1	2	
GRI 404 – Training and education	1		1	1					
GRI 416 – Customer Health and Safety	1								

4 Conclusions

The paper illustrates some preliminary results of an analysis aimed at exploring the adoption of Industry 4.0 enabling technologies and its implication on the social and environmental dimensions of sustainability. The analysis of extant literature shows that the attention devoted to Industry 4.0 has rapidly flourished. However, to our knowledge most research focused on specific technologies whereas an analysis of all Industry 4.0 enabling technologies and their impact on the environmental and social dimensions of sustainability have been so far overlooked.

In the attempt to contribute to fill such a gap, we examined case studies on Industry 4.0 enabling technologies, as presented in the literature, and tried to assess the implications of their adoption on the environmental and social dimensions of sustainability. The analysis is still in progress, as only 15 of the selected cases were analysed in details. Preliminary results shows the predominant technologies (*i.e.* Internet of Things and Big Data & Analytics), the technologies most frequently adopted in combination with others, and the occurrences of the implications on sustainability expressed consistently with GRI disclosures. Once the analysis will be completed, the resulting framework will illustrate possible associations among technologies and their sustainability implications.

References

- Bagheri, B., Yang, S., Kao, H.A., & Lee, J. (2015). Cyber-physical systems architecture for self-aware machines in industry 4.0 environment. *IFAC-PapersOnLine*, 48(3), 1622-1627.
- Bedolla, J.S., D'Antonio, G., & Chiabert, P. (2017). A novel approach for teaching IT tools within Learning Factories. *Procedia Manufacturing*, 9, 175-181

- Bonilla, S., Silva, H., Terra da Silva, M., Franco Gonçalves, R., & Sacomano, J. (2018). Industry 4.0 and Sustainability Implications: A Scenario-Based Analysis of the Impacts and Challenges. *Sustainability* 10(10), 3740.
- De Amicis, R., Ceruti, A., Francia, D., Frizziero, L., & Simões, B. (2018). Augmented Reality for virtual user manual. *International Journal on Interactive Design and Manufacturing (IJIDeM)*, 12(2), 689-697.
- Gabriel, M., & Pessl, E. (2016). Industry 4.0 and sustainability impacts: critical discussion of sustainability aspects with a special focus on future of work and ecological consequences. *Annals of the Faculty of Engineering Hunedoara-International Journal of Engineering*, 14(2).
- Gregori, F., Papetti, A., Pandolfi, M., Peruzzini, M., & Germani, M. (2017). Digital manufacturing systems: a framework to improve social sustainability of a production site. *Procedia CIRP*, 63, 436-442.
- GRI (2016). Consolidated set of GRI sustainability reporting standards. Available: <https://www.globalreporting.org/standards/gri-standards-download-center/?g=ae2e23b8-4958-455c-a9df-ac372d6ed9a8> (access: 18 April 2019).
- Ji, C., Shao, Q., Sun, J., Liu, S., Pan, L., Wu, L., & Yang, C. (2016). Device data ingestion for industrial big data platforms with a case study. *Sensors*, 16(3), 279.
- Kagermann, H., Wahlster, W., & Helbig, J. (2013). *Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0*. Report, the Industrie 4.0 Working Group of Acatech.
- Kamble S.S, Gunasekaran A., & Gawankar S.A. (2018). Sustainable Industry 4.0 framework: A systematic literature review identifying the current trends and future perspectives. *Process Safety and Environmental Protection* 117, 408-425.
- Khaqqi, K.N., Sikorski, J.J., Hadinoto, K., & Kraft, M. (2018). Incorporating seller/buyer reputation-based system in blockchain-enabled emission trading application. *Applied Energy*, 209, 8-19.
- Liao, Y., Ramos, L.F.P., Saturno, M., Deschamps, F., Loures, E.D.F.R., & Szejka, A.L. (2017). The Role of Interoperability in The Fourth Industrial Revolution Era. *IFAC-PapersOnLine*, 50(1), 12434-12439.
- Lorenz, M., Ruessmann, M., Strack, R., Lueth, K., & Bolle, M. (2015). *Man and machine in Industry 4.0: how will technology transform the industrial workforce through 2025?* Boston Consulting Group, <http://www.bcg.it/documents/file197250.pdf> (last access: 15 January 2019).
- Mantovani, S., Presti, I.L., Cavazzoni, L., & Baldini, A. (2017). Influence of manufacturing constraints on the topology optimization of an automotive dashboard. *Procedia Manufacturing*, 11, 1700-1708.
- Penas, O., Plateaux, R., Patalano, S., & Hammadi, M. (2017). Multi-scale approach from mechatronic to Cyber-Physical Systems for the design of manufacturing systems. *Computers in Industry*, 86, 52-69.
- Poonpakdee, P., & Koiwanit, J. (2018). Accuracy of distributed systems towards industry 4.0: Smart grids and urban drainage systems case studies. *International Journal (Toronto, Ont.)*, 14(43), 70-76.
- Qin J., Liu Y., Grosvenor R. (2017). A Framework of Energy Consumption Modelling for Additive Manufacturing Using Internet of Things. 50th CIRP Conference on Manufacturing Systems, *Procedia CIRP* (63). 307-312.
- Roblek, V., Meško, M., and Krapež, A. (2016). A complex view of industry 4.0. *Sage Open* 6(2), 2158244016653987.
- Rødseth, H., Schjølberg, P., & Marhaug, A. (2017). Deep digital maintenance. *Advances in Manufacturing*, 5(4), 299-310.

- Rylnikova, M., Radchenko, D., & Klebanov, D. (2017). Intelligent mining engineering systems in the structure of Industry 4.0. In *E3S Web of Conferences* (Vol. 21, p. 01032). EDP Sciences.
- Savastano, M., Amendola, C., Bellini, F., & D'Ascenzo, F. (2019). Contextual Impacts on Industrial Processes Brought by the Digital Transformation of Manufacturing: A Systematic Review. *Sustainability* 11(3), 891.
- Schroeder, G.N., Steinmetz, C., Pereira, C.E., & Espindola, D.B. (2016). Digital twin data modeling with automationML and a communication methodology for data exchange. *IFAC-PapersOnLine*, 49(30), 12-17.
- Schwab, K. (2017). *The fourth industrial revolution*. Currency.
- Sferra A.S., 2017, Emergency: innovative prefabricated construction components for an eco-solidarity architecture, *Techne*, 14, pp.330-336.
- Shafiq, S.I., Sanin, C., Szczerbicki, E., & Toro, C. (2016). Virtual engineering factory: Creating experience base for industry 4.0. *Cybernetics and Systems*, 47(1-2), 32-47.
- Stock T., Obenaus M., Kunz S., Kohl H. (2018). Industry 4.0 as enabler for a sustainable development: A qualitative assessment of its ecological and social potential. *Process Safety and Environmental Protection* 118, 254-267.
- Ustundag, A., & Cevikcan, E. (2017). *Industry 4.0: managing the digital transformation*. Springer.
- Varela, L., Araújo, A., Ávila, P., Castro, H., & Putnik, G. (2019). Evaluation of the Relation between Lean Manufacturing, Industry 4.0, and Sustainability. *Sustainability*, 11(5), 1439.
- Weyer, S., Schmitt, M., Ohmer, M., and Gorecky, D. (2015). Towards Industry 4.0-Standardization as the crucial challenge for highly modular, multi-vendor production systems. *Ifac-Papersonline*, 48(3), 579-584.

Digital Platform Diffusion in Entrepreneurship Centre: Preliminary Evidences from the Italian Contamination Lab Network

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Abstract

Our investigation proposes a preliminary analysis on the diffusion of digital technologies in Entrepreneurship centers as emerging mechanisms to deliver entrepreneurial activities. Our research question is: how entrepreneurship research centres (Italian Contamination Labs) are adopting digital technologies to support the variety of entrepreneurial activities they deliver? An explorative study of 12 Entrepreneurship centers named “Contamination Labs (CLabs)” is conducted. Empirical evidence will provide evidence about the role that Digital technologies could play in supporting and enhancing the processes that the Italian Contamination Labs could play (e.g. presenting their own programmes and activities) and their indirect role (e.g. undertake joint programmes/activities with other faculties) in promoting enterprise and entrepreneurship activities of the academic entrepreneurs.

Keywords – Digital technologies, Entrepreneurship center, Contamination lab, Entrepreneurship education, Academic entrepreneurship.

Peper Type - Academic Research Paper

1. Introduction and Research aim

Extant research suggests that entrepreneurship centres (Cassia et al., 2013; Maas and Jones, 2017) can play an important role in stimulating entrepreneurship activities within Higher Education Institutions (Finkle et al. 2006, 2013, Nelles and Vorley, 2011), and in increasing the visibility of entrepreneurship as a profession and as a field of study (Fisher et al., 2011; Cassia et al., 2013). According to Siegel and Wright (2015) the establishment and growth of entrepreneurship centres is an emerging perspective of academic entrepreneurship, that includes a wider social and economic benefit to the University ecosystem overcoming the traditional goal of economic revenue from research commercialization. The goals of entrepreneurship centres vary significantly between new firm creation, researching market opportunities, developing enterprising and entrepreneurship skills among students and staff, and contributing to the capitalization of knowledge (Del-Palacio et al. 2008). In Italian Universities, in 2012 the MIUR Italian Ministry of University and Research financed the Contamination Lab, a places where University's students will be involved entrepreneurship education activities such as idea generation, business games and in business plan competitions (for example E-capital business plan competition) and idea challenge proposed by companies. Huffman and Quigley (2002) and Russell et al. (2008) note that business plan competitions provide a mechanism for new business start-up and for encouraging entrepreneurial ideas, talents and potential. Der Foo et al. (2005) noted their role in team building and utilising new technologies. Activities such as business skills development, team-building, mentoring, judges' feedback and networking represent core activities of an effective business planning competition (Russell et al., 2008). Streeter et al. (2002) and Atchison and Gotlieb (2004) identify that such competitions offer the opportunity to develop both generic skills and entrepreneurial mindset and business knowledge competencies.

In parallel to this evolution, another interesting phenomenon is the rapid acceleration of digital technologies (such as social media, internet of things, MOOCs, 3D printing, Big Data, etc..) that are reshaping society globally (Nambisan et al., 2017). Across various studies, the notion of "digital platform" has gained considerable traction when addressing such managerial challenges of digitisation (Gawer & Cusumano, 2014). Digital technologies are opening up fascinating innovation opportunities for entrepreneurs (Yoo et al., 2010; Cohen et al, 2017, Urbinati et al., 2017) and can become the dominant source for innovation also in entrepreneurship centre. Despite the relevance of both fields, to our best knowledge surprisingly few studies have focused on the analysis of digital and smart technologies in the whole spectrums of entrepreneurship centres activities and processes and this justify the paper's aim. This research gap is more evident in Italy where the launching of the entrepreneurship center for student's education are still in infancy. The MIUR Italian Ministry of University and Research launched in 2012 a first competitive call for asking the Italian Universities to propose some projects to activate the so called "Contamination Lab" as Virtual and Physical environment where students with different background could be involved into entrepreneurial learning activities to promote their entrepreneurial awareness and innovative ability.

With the aim to cover this gap, our investigation proposes a preliminary analysis on the diffusion of digital technologies in the Italian Contamination Lab (CLab) launched as Entrepreneurship centers within the Universities to deliver entrepreneurial activities for Universities' students. Our research question is: *how entrepreneurship research centres (Italian Contamination Labs) are adopting digital platforms to support the variety of entrepreneurial activities they deliver?*

In the attempt to provide and answer to this question an explorative study of 12 Entrepreneurship centers named "*Contamination Labs (CLabs)*" is conducted taking in consideration the active CLabs located in North, Centre and South of Italy Universities. Findings will provide some preliminary insights about the strategic role of CLab in terms of creating the so called "entrepreneurship and sense of initiative "competence among all the students. Moreover, the analysis will focus on the adoption of the digital technologies inside the CLab to sustain and foster the processes and activities toward the achievement of the University's third mission aim.

The remaining of the paper is organised as follows. Section 2 briefly introduce the background around the key concept of Entrepreneurship research centres and Digital Technologies. Section 3 introduces the research methodology. Section 4 presents the preliminary findings. Section 5 discusses and concludes the paper.

2. Research Methodology

Fifteen case studies of the Contamination Labs financed by the Italian Ministry of University and Research in the 2017 – 2020 were firstly identified and analysed. Among this in the period of observation, just 12 were active. The collection of data was obtained between October 2018 and December 2018 and the active targeted sample was chosen from the comprehensive list of the Contamination lab (CLab) belonging to the Italian network of Contamination lab managed by the University of Cagliari (Italy).

2.1 Research context

A CLab is a physical environment where students are involved in the development of an entrepreneurial mindset, creativity and innovation through the adoption of learning strategies typical of the Entrepreneurship education. The laboratory involves all the University's students with different backgrounds (Business, Humanities, Social science, Science, Engineering, Biology, arts etc..) through innovative extra-curricular activities within a learning program having a duration of six months. The founding values of the CLabs are interdisciplinarity and contamination among different experiences, background and competences through new learning models and the development of innovation projects with an entrepreneurial and social vocation, in close collaboration with the territory. The National Program for Research foresees a strengthening of the investment in the Contamination Labs (CLab), intended as places of contamination between university students and graduate students of different disciplines. CLab entrepreneurial learning activities are part of the students' curriculum as an optional course, specifically, attendance to structured courses and seminars can worth as ECTS (European Credit

Transfer and Accumulation System). The scientific committee of each CLab decide the criteria for evaluating students' performance, considering not only the knowledge acquired but also the objective reached, the student's attitude in the group and the respect of the timeline for the project works development. The Italian CLab Network is the network connecting all the CLabs managed by the University of Cagliari contamination Lab (<http://clabitalia.it/>).

2.2 Data collection and analysis

12 Italian CLabs have been analysed. All the CLab chief (Coordinator) in the list were firstly contacted by e-mail and with positive respondents a skype call was agreed to collect further details about their mission, process, and activities. Moreover, a web survey has been prepared to address the main questions related to the types and intensity of adoption of digital technologies. The survey is divided in three sections. The first is a general section, where question about the governance structure of the CLabs are formulated (university of affiliation, number of employees, types of managerial structure, typologies of activities performed. In the second section respondents are required to indicate the types of digital technologies adopted and the related impact, and also which technologies will be strategically adopted in the future. Digital technologies had been listed based on authors' elaboration of digital artefact, platform and infrastructure concepts by Nambisan (2017). A final section asks respondents to indicate barriers and constraints to the adoption of digital technologies in their daily activities. A phone or face to face interview was agreed in January 2019 to finalise the data analysis.

3. Findings

In 2016, 17 Contamination labs has been launched by 16 Italian Universities starting from a competitive call at national level involving all the Universities. Among those CLabs, at the time of the survey, 12 were operative and they had already started the educational activities. So far, our analysis will comprise the whole set of the active contamination labs in Italy. The main idea behind the CLab is to create a place where: 1) it is possible to foster cooperation among students, entrepreneurs and academics; 2) students, entrepreneurs and academics share knowledge and create new understandings and work together to form plans of action (co-learning); 3) students set their own agendas and then act to carry out the action with the help of entrepreneurs and academics; 4) students are embedded into entrepreneurial culture; 5) teachers and mentor show the best practice in entrepreneurship and innovation in the creation of new businesses; and 6) students learn to manage all stages of the knowledge transfer process to support organic growth within the high technology sector for set up a start-up.

The whole CLab sample provided answer to the online survey. The table 1 presents the description of the CLabs' sample. The list of CLab shows an equal distribution among north (4), center (2) and south (5) Italy. The total funded amount is 4.1MI Euros. The entrepreneurial program of each CLabs is strictly guided by the MIUR (Italian Ministry of University and Research) according to the general recommendation off the

European Union in terms of Entrepreneurial Competences development at all levels of education. In some cases, every year two educational programs are launched in parallel with the 2 semesters within the CLabs, in other cases one program is managed. For this reason, big differences in term of number of trained students as reported in Table 1.

Table 1 - Contamination Labs

CLAB Code	Location	Year of launching	Number editions activated	N. of the students Participating to the CLab
Clab 1	South	2017	2	120
Clab 2	North	2017	2	130
Clab 3	South	2014	5	500
Clab 4	South	2017	2	90
Clab 5	Center	2013	6	536
Clab 6	South	2014	16	640
Clab 7	Center	2013	5	60
Clab 8	South	2017	3	120
Clab 9	North	2017	2	200
Clab 10	North	2013	6	580
Clab 11	North	2018	2	60
Clab 12	North	2017	2	80

Academic entrepreneurship implies specific activities to make the university more entrepreneurial. Among these, the entrepreneurship centres can play the role of intermediary between researchers and industries, providing opportunities to enhance the social and economic impact on the territory. Then, we can also count activities such as the creation of spinoffs and startups, the engagement of local communities through events and workshops, entrepreneurial education activities, the organizations of business plan competitions and, finally, contracts with industries and public administrations.

We asked each CLab which of those activities are considered as the most strategic in the present and which they supposed to be strategic in the immediate future. Right now, the most strategic activity expressed by Clabs is entrepreneurial education with an average score of 4.50 followed by intermediation activities (with 4.33). On the contrary, the less strategic initiatives promoted by the CLabs are the management of intellectual property right and hackathon. This is in line with the general aim and mission of the CLab.

When we look into the prospective strategic activities CLabs aim to plan, the most relevant one still remains entrepreneurial education (with 4.67). This is reasonable as literature demonstrated how education is the most powerful tool to train young people and to guide them in the achievement at first of an entrepreneurial mindset and awareness. If we move to the deltas between present and future strategic activities, research contracts with external actors and startup/spinoff creation are the two activities that count the largest difference. This means that CLabs are considering strengthening those two areas of activities. This result is coherent with the fact that the CLabs are financed just for three year by the MIUR and that they are looking for becoming sustainable in the long period to become permanent research centers for entrepreneurship to accomplish the third mission aim.

Table 2 - Strategic activities importance in the present (now) and in the future (in 3 years)

	Intermediation activities			Hackathon			Intellectual property			Spinoff/Startup			Local community			Entrepreneurial Education			Business plan competition			Research contract		
	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ
Clab 1	5	5	=	4	4	=	4	4	=	4	5	↑	4	4	=	5	5	=	5	5	=	5	5	=
Clab 2	4	4	=	4	4	=	3	4	↑	3	4	↑	4	4	=	4	4	=	3	3	=	4	4	=
Clab 3	5	5	=	3	3	=	4	3	↓	4	4	=	4	5	↑	4	4	=	4	4	=	2	3	↑
Clab 4	4	4	=	4	3	↓	3	3	=	4	5	↑	4	5	↑	4	5	↑	5	4	↓	4	5	↑
Clab 5	4	4	=	3	4	↑	3	4	↑	5	5	=	5	5	=	5	5	=	4	4	=	5	5	=
Clab 6	4	4	=	3	4	↑	3	4	↑	5	5	=	5	5	=	4	5	↑	5	5	=	4	5	↑
Clab 7	4	4	=	2	3	↑	1	2	↑	2	3	↑	3	4	↑	5	5	=	3	4	↑	3	3	=
Clab 8	4	4	=	3	3	=	2	2	=	4	4	=	3	4	↑	4	4	=	4	4	=	2	3	↑
Clab 9	4	5	↑	1	1	=	3	3	=	5	5	=	4	4	=	4	4	=	3	3	=	5	5	=
Clab 10	4	4	=	5	5	=	2	2	=	4	5	↑	4	4	=	5	5	=	3	3	=	3	4	↑
Clab 11	5	5	=	4	4	=	3	3	=	4	5	↑	4	5	↑	5	5	=	3	4	↑	4	5	↑
Clab 12	5	5	=	3	3	=	3	3	=	2	3	↑	3	3	=	5	5	=	2	3	↑	3	3	=
Average	4,33	4,42	0,08	3,25	3,42	0,17	2,83	3,08	0,25	3,83	4,42	0,58	3,92	4,33	0,42	4,50	4,67	0,17	3,67	3,83	0,17	3,67	4,17	0,50

Digital technologies are mainly used for promotional purpose (see table 3). Social media is the most adopted technologies, with an average score of 4.33. Digital platform, with 3.17, is the second most used digital technologies. In general, CLabs make little use of digital technologies for their daily activities. If we analyse future strategies, there is a general consensus about the intention to adopt e-learning technologies to improve students' participation in the general course related to knowledge about the global future trends, basic knowledge on business management and Business planning. MOOC, indeed, is the technologies with the highest delta when comparing actual and future declaration of digital technologies adoption.

This evidence could be explained by the fact that in this first phase of activities CLabs are more focused on the development and management of the entrepreneurial learning activities to facilitate the generation of students' business ideas.

Table 3 - Adoption of digital technologies

	MOOC			Social Media			3d printer			Big data analytics			Intelligent App			Intelligent things			Digital twins			Digital platform			AR and VR			Blockchain		
	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ	now	in 3 year	Δ
Clab 1	3	5	↑	4	5	↑	2	4	↑	2	3	↑	3	4	↑	2	3	↑	2	2	=	4	5	↑	3	3	=	2	4	↑
Clab 2	4	4	=	4	4	=	2	4	↑	3	4	↑	3	4	↑	2	3	↑	2	3	↑	3	4	↑	2	3	↑	2	3	↑
Clab 3	1	3	↑	4	4	=	3	3	=	3	3	=	2	2	=	2	2	=	2	2	=	2	2	=	1	1	=	1	1	=
Clab 4	2	4	↑	4	5	↑	2	2	=	3	3	=	3	4	↑	3	3	=	4	4	=	3	4	↑	2	3	↑	2	3	↑
Clab 5	2	3	↑	5	5	=	3	3	=	3	4	↑	4	4	=	3	4	↑	3	4	↑	4	5	↑	3	4	↑	3	4	↑
Clab 6	2	3	↑	5	5	=	3	3	=	3	3	=	3	5	↑	4	5	↑	2	4	↑	5	5	=	4	5	↑	3	5	↑
Clab 7	1	3	↑	5	5	=	1	3	↑	1	2	↑	1	2	↑	1	2	↑	1	1	=	2	1	↓	1	2	↑	1	2	↑
Clab 8	1	2	↑	4	3	↓	2	2	=	2	2	=	2	3	↑	2	3	↑	2	2	=	3	3	=	2	3	↑	2	3	↑
Clab 9	2	3	↑	3	5	↑	3	3	=	3	3	=	2	3	↑	2	3	↑	2	3	↑	2	3	↑	3	3	=	3	3	=
Clab 10	1	2	↑	4	4	=	1	2	↑	2	3	↑	3	3	=	3	3	=	2	3	↑	3	3	=	2	3	↑	2	3	↑
Clab 11	3	4	↑	5	5	=	3	3	=	2	3	↑	1	4	↑	1	3	↑	1	3	↑	3	4	↑	3	4	↑	2	3	↑
Clab 12	1	1	=	5	5	=	1	1	=	4	5	↑	4	5	↑	3	3	=	4	5	↑	2	4	↑	2	4	↑	1	1	=
Average	1,92	3,08	1,17	4,33	4,58	0,25	2,17	2,92	0,75	2,58	3,33	0,75	2,58	3,58	1,00	2,42	3,17	0,75	2,17	2,83	0,67	3,17	3,67	0,50	2,33	3,17	0,83	2,00	2,92	0,92

Table 4 - Impact of Digital Technologies on activities carried out by the CLabs

	DI	DP	DA	DI	DP	DA	DI	DP	DA	DI	DP	DA	DI	DP	DA	DI	DP	DA	DI	DP	DA	DI	DP	DA
Clab 1	3	2	2	1	2	1	1	2	1	3	3	1	3	2	1	3	3	2	3	2	2	3	2	2
Clab 2	3	1	1	3	1	1	1	1	1	2	1	1	3	1	1	2	1	1	1	1	3	1	1	1
Clab 3	2	2	1	1	1	1	2	2	1	2	2	1	3	2	1	1	1	1	3	2	1	1	1	1
Clab 4	2	2	3	3	2	2	2	3	3	3	3	3	3	2	3	3	3	2	3	2	3	3	2	3
Clab 5	2	2	2	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	3	3	3	2	3	3
Clab 6	2	2	2	1	2	2	1	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	2
Clab 7	2	0	0	2	0	0	0	0	0	0	0	0	2	0	0	2	0	0	2	0	0	2	0	0
Clab 8	2	2	0	0	0	0	1	2	0	3	3	0	2	2	0	3	3	0	3	3	0	0	2	0
Clab 9	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	2	1	1	1	1	1	2	1	1
Clab 10	1	0	0	1	2	2	0	0	0	0	2	2	1	0	1	1	2	2	0	0	0	0	1	2
Clab 11	2	1	1	2	2	2	2	1	2	3	2	2	3	1	1	3	1	3	1	1	1	1	2	2
Clab 12	3	2	1	0	0	1	1	2	1	1	1	1	2	1	1	2	2	1	2	2	1	2	2	1
Average	2,08	1,42	1,17	1,50	1,33	1,33	1,25	1,67	1,33	2,08	2,00	1,50	2,33	1,33	1,17	2,17	1,75	1,42	2,08	1,58	1,25	1,75	1,58	1,50

DI: digital infrastructure (e.g.: social media, MOOC)

DP: digital platform (e.g.: IoT, 3D, Big Data)

DA: digital artifact (e.g.: AR, VR, blockchain)

Furthermore, we surveyed the level of impact of each digital technology families on the activities CLabs organize and manage (table 4). We categorized three digital technology families to make the survey easier to be filled by the interviewed CLab Chief and /or CLab project managers. We grouped technologies such as social media and MOOC in DI (digital infrastructure); technologies like IoT, 3D printer, Big Data, Intelligent app in DP (digital platform); and finally, technologies as augmented and virtual reality, blockchain in DA (digital artefact). In the questionnaire, it was asked to indicate the impact of the digital technology families on the activities based on a 4 – point scale: no impact at all (0), low impact (1), medium impact (2), high impact (3). In general, the impact appears to be low or with no impact at all. Few CLabs adopt strategically some digital technologies while some CLabs do not use at all any digital technologies or they do not rely any impact on their activities. Digital infrastructures present the highest rate of impact, especially on intermediation activities, spinoff and startup activities, local community engagement activities, entrepreneurial education activities and business plan competition activities. This is probably due to the fact that social media is a technology included in this family, and as previously showed, social media is the most used technologies bay CLabs.

What are the strategic activities carried on by the CLabs, and are the digital technologies adopted to facilitate such activities? The picture that emerged from this section reports a medium capacity of CLabs to strategically involve external actors in their activities, and a medium ability to promote new venture creations among their students. Moreover, as a sort of validation of the previous analysis, managers of CLabs declare a medium use of digital technologies to engage and inspire new entrepreneurs as a result of their activities.

The last section of the questionnaire asks CLabs to report barriers and constraints in relation to the ability of a CLab to operate and the easy of adoption of digital technologies. The most cited criticalities to solve their missions and scopes are difficulties when involving internal professors and technicians in the CLabs activities and the great heterogeneity of the class appears to be a limit when evaluating the general involvement of the students.

Table 5 - Strategic activities of CLabs

	The Clab has strategic collaboration contracts with firms	The Clab collaborates with firms and institution	The Clab is able to engage citizens and external actors in its activities	The Clab is able to retain ex students	The Clab is able to promote new venture creation by the Clab's students	The Clab is able to involve researchers and technicians in new venture creation activities	The educational activities are performed thanks to the most powerful available technologies	The Clab is able to offer digital technologies facilities to startupper and entrepreneurs	The Clab is able to create knowledge sharing mechanisms thanks to the adoption of digital technologies
Clab 1	4	4	3	4	3	2	5	4	4
Clab 2	4	4	3	3	2	1	3	3	3
Clab 3	4	4	3	2	4	1	4	3	3
Clab 4	3	3	4	4	4	3	4	4	4
Clab 5	4	4	4	5	5	3	3	4	4
Clab 6	2	2	2	3	3	3	3	3	3
Clab 7	3	4	3	4	2	2	2	2	2
Clab 8	3	3	4	4	3	2	3	3	3
Clab 9	4	4	3	4	4	2	4	3	3
Clab 10	4	4	4	2	2	3	4	2	2
Clab 11	2	4	4	5	4	3	4	3	4
Clab 12	5	4	3	1	2	1	3	2	2
Average	3,50	3,67	3,33	3,42	3,17	2,17	3,50	3,00	3,08

What about the adoption of digital technologies? CLabs declare that the most critical barriers is the cultural one. Digital technologies are not so much diffused regularly in the daily activities of the university they belong to. And this aspect creates high constraints for the adoption of technologies to support students in their activities.

4. Discussions and Conclusions

Empirical evidence will provide evidence about the possibilities and constraints of digital technologies for the entrepreneurship centre's goals, governance and processes to better understand the challenges posed by the digital revolution to the activities of the centre. CLabs surveyed declare a low level of adoption of digital technologies. If social media such as facebook are widely adopted, such social media serve just as promotion tools of the CLab activities. Technologies like blockchains, big data, 3D printers are poorly adopted. Surprisingly, MOOC are totally not adopted neither considered as strategic. The strategic vision for the future changes a little bit, since such technologies are view as important for the sustainability of the centre, but cultural and time constraints are evidenced as the more important barriers to the adoption of the digital technologies.

There is the need to know more about what entrepreneurship or enterprise education actually "is" when implemented in practice and the real challenge could be to embed this type of course in the Universities' curriculum. This is problematic because the entrepreneurial approach to teaching entrepreneurship is the antithesis of traditional approaches to teaching. Academic assessment processes evaluate and test knowledge and skill rather than behaviour, therefore widening the assessment process to accommodate behaviour is the real challenge for academic institutions, although it is a challenge that is beginning to be undertaken.

Academic policy and decision makers need to be convinced of the value in offering such courses before they can be inserted into mainstream programmes. Arguably course developers will need to employ their own entrepreneurship behaviours to establish such programmes in mainstream academia.

CLabs sought to introduce entrepreneurship education into the science, medicine and engineering faculties, adopting the approach of encouraging the development of enterprise attributes and competencies rather than focussing on business start-up but also to other dimensions such as employability, social entrepreneurship, academic entrepreneurship and intrapreneurship. By adopting this “enterprise for life” approach C Lab formula emphasised the value of an entrepreneurial attitude and enterprising behaviour to enrich people’s lives and to contribute to social change.

The assumptions of CLab formula were built starting from the main issues, objectives, methods and evaluation analysed in other context, with the aim to cover the gap existing in Italian University system in this field. The guidelines of CLab are:

- Entrepreneurs and academicians have a great deal of knowledge and experience to share with others (theoretical and practical), some of which will be of value to students who wish to start an entrepreneurial career;
- Students of different disciplines have a knowledge and experience to share in a common space;
- The collaborative and co-learning environment is necessary for encouraging this exchange of information;
- Involving students, entrepreneurs and academicians in the process of education should be a solution leading to effective learning of entrepreneurial knowledge, skills and behaviours;
- The safe environment of c Lab is supportive and allows collaboration among students, entrepreneurs and academicians with the aim to encourage the acquiring of entrepreneurial behaviours;
- teaching and training programmes for entrepreneurship in all schools are provided;
- the use of business plans as a pedagogical tool for preparing future entrepreneurs;
- “innovative methods” that include game simulations; video and filming; role models or guest speakers; business plan creation; and project works, games and competitions, setting of real small business ventures, workshops, presentations and study visits public symposia and awareness campaigns, dissemination of research results to the community; students’ consulting projects with local entrepreneurs, technology transfer activities, incubation services;
- the students’ self-assessment of the business idea and its feasibility, creativity and the written presentation are used as evaluation tools.

Research implications regard the potential role that Digital technologies could play in supporting and enhancing the processes that the Italian Contamination Labs could play (e.g. presenting their own programmes and activities) and their indirect role (e.g. undertake joint programmes/activities with other faculties) in promoting enterprise and entrepreneurship activities of the academic entrepreneurs.

Practical implications will concern insights for the entrepreneurship centre governance body involved into the guidance of processes such as entrepreneurial competence development, knowledge transfer and innovation in the university ecosystem and social engagement through the utilization of the digital technologies.

Limitations of the study and future research. The main limitation regards the fact that the study has been realised just at the beginning of the first edition for each CLabs. A new survey will be launched at the end of June 2019 when each CLab will close the current on-going edition. This will allow to compare the results.

References

- Atchison, M. and Gotlieb, P. (2004), "Innovation and the future of cooperative education", in Coll, R. and Eames, C. (Eds), *International Handbook for Cooperative Education: An International Perspective of the Theory, Research and Practice of Work-integrated Learning*, World Association for Cooperative Education, Boston, MA, pp. 261-9.
- Cassia, L., De Massis, A., & Meoli, M. (2014). Entrepreneurship research centers around the world: research orientation, knowledge transfer and performance. *Journal of Technology Transfer*, 39, (3), 376–392.
- Cohen, B., Amorós, J.E., Lundy, L., 2017. The generative potential of emerging technology to support startups and new ecosystems. *Bus. Horiz.* 60 (6), 741–745.
- del-Palacio, I., Sole, F., & Batista-Foguet, J. M. (2008). University entrepreneurship centres as service businesses. *The Service Industries Journal*, 28(7), 939-951.
- Der Foo, M., Wong, P. K., & Ong, A. (2005). Do others think you have a viable business idea? Team diversity and judges' evaluation of ideas in a business plan competition. *Journal of Business Venturing*, 20(3), 385-402.
- Finkle, T. A., Kuratko, D. F., & Goldsby, M. G. (2006). An examination of entrepreneurship centers in the United States: A national survey. *Journal of Small Business Management*, 44 (2), 184–206.
- Finkle, T. A., Menzies, T. V., Kuratko, D. F. & Goldsby, M. G. (2013). An examination of the financial challenges of entrepreneurship centers throughout the world. *Journal of Small Business and Entrepreneurship*, 26(1), 67–85.
- Fischer, E., Reuber, A.R., 2011. Social interaction via new social media: (how) can interactions on Twitter affect effectual thinking and behavior? *J. Bus. Ventur.* 26 (1), 1–18.
- Gawer, A., & Cusumano, M. A. (2014). Industry platforms and ecosystem innovation. *Journal of Product Innovation Management*, 31(3), 417-433.
- Huffman, D. and Quigley, J.M. (2002), "The role of university in attracting high tech entrepreneurship: a Silicon Valley tale", *The Annals of Regional Science*, Vol. 36 No. 3, pp. 403-19
- Maas G., and Jones, P. *Entrepreneurship Centres: Global Perspectives on their Contributions to Higher Education Institutions* (pp. 11-16). Palgrave Macmillan.
- Nambisan, S. (2017). Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship. *Entrepreneurship Theory and Practice*, 41(6), 1029-1055.
- Nelles, J., & Vorley, T. (2011). Entrepreneurial architecture: A blueprint for entrepreneurial universities. *Canadian Journal of Administrative Sciences*, 28(3), 341-353
- Russell, R., Atchison, M. and Brooks, R. (2008), "Business plan competitions in tertiary institutions: encouraging entrepreneurship education", *Journal of Higher Education Policy and Management*, Vol. 30 No. 2, pp. 123-38.
- Siegel, D. S., & Wright, M. (2015). Academic entrepreneurship: time for a rethink?. *British Journal of Management*, 26(4), 582-595.
- Streeter, D.H., Jaquette, J.P. and Hovis, K. (2002), "University-wide entrepreneurship education: alternative models and current trends", working paper, Department of Applied Economics and Management, Cornell University, Ithaca, NY

- Urbinati, A., Chiaroni, D., Chiesa, V., & Frattini, F. (2017). The role of digital technologies in the innovation process. In 24th Innovation and Product Development Management Conference (pp. 1-10).
- Yoo, Y., 2010. Computing in everyday life: a call for research on experiential computing. MIS Q. 34 (2), 213.

Business Model and Sustainability: the State of the Art

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Abstract

Our paper consist of a literature review about business model research in academia, which represents a premise to identify the main topics, as well as the evolution of the studies.

As for the methodology, we used EBSCO database, searching for academic papers having “business model” in the title and in the abstract published from 1975 until now.

This paper contributes to the literature in two ways. First, it provides a wide analysis of the extant literature on business models. Besides the classification by main topics, we aim to outline the trend of these studies over time.

Moreover, by this review we propose to understand how much literature has already investigated, and to identify new roots for future research on empirical and practical application of business model in business studies.

Our work is the first step of a project. In order to contribute to previous literature, we propose to view corporate business models as the crossroads of different disciplines, as management and accounting and finance are. Further developments of our research, actually, could concern the study of the characteristics of sustainable business models applied by firms, in order to select which key factors of firms’ business model positively affect their performance and their value.

Keywords – Business model, Sustainability, literature review.

Paper type – Academic Research Paper

1 Introduction

Business Model (BM) has been widely investigated by academic literature. This is a well-known event, especially in recent years.

According to Wirtz et al. (2016), a BM is an aggregated representation of the relevant activities of a company. It describes how marketable information, products and/or services are generated by means of a company's value-added component. In addition to the architecture of value creation, strategic as well as customer and market components are taken into consideration, in order to achieve the superordinate goal of generating, or rather, securing the competitive advantage. To fulfill this latter purpose, a current business model should always be critically regarded from a dynamic perspective, thus within the consciousness that there may be the need for business model evolution or business model innovation, due to internal or external changes over time. In line with Baden-Fuller and Morgan's (2010) suggestion to interpret business models in a systematic way, we suggest that all the existing conceptualization made by literature, especially strategic management literature can co-exist, as they supplement each other and can open their boundaries to other stream of research, such the accounting literature and financial literature. This can be a contribution that is voted to fill the gap in literature about the effectiveness of a BM, the profitability of a BM, the sustainability of a BM, the capability of a BM to produce dynamic capabilities. In few word, to answer the question about what BM is beneficial to firms.

The business model approach can be viewed as activity systems that cover internal and external activities in which firms are (Zott and Amit, 2010). As regards BM, several accruals emerge from extant literature, about the definition, the topic, the perspective of analysis (field of research), its taxonomy, and its effect on competitive advantage of firms, giving the fact that the comprehension of BM is still lacking (what a BM is, what it is not, its boundaries, how to create a good BM, its description, its characteristic and its effective reflections on firm performance).

These are the main questions still unanswered by literature (Teece, 2010). In order to better understand how much literature has already unveiled and how much it is still far to be found out, we provide a structured literature review on business model, to clarify the research topic on BM and its future roots and to reply our research questions:

RQ1: Which are the focus of the literature on business model?

RQ2: How has the research on business model evolved over the time?

RQ3: what are the future developments of the research?

The contribution of this paper is not only to provide a literature review, as a simple portrait of the current state of the art about BM research, but also to focus on its theoretical perspectives and lacks, so to be able to understand what we have actually learned about it and which are the existing gaps in literature, also empirical one. So this work to our intention is a dynamic recognition of existing literature on this theme, wondering the BM utility as a tool to use BM in practice and the future developments from an academic perspective.

The paper is organized as follows. In the next section, we describe the evolution of the researches on business model. In paragraph 3 we will describe the research methodology that we have applied. In paragraph 4 we will provide the results obtained in our research. We last present the discussion and the conclusions.

2 The academic history of business model

The BM term has been receiving growing attention from managerial academic researchers, as a management tool to gain performance and capture value. The wide use researchers made of its application lead to non-unique and heterogeneous comprehension of the effective and concrete meaning of the term BM.

At the beginning (early Sixteens') of the scientific research, the term BM was associated to information technology, that is the way firms built up business processes and made information and functional/operative processes, from an engineering perspective (operative system modelling). Only in Seventies' literature have been started to associate the term BM to managerial and strategic issues within the behaviour of firms, in order to address the research to put BM in a holistic and organic managerial framework. So, BM has been intended as a managerial tool to obtain performance (Konczal, 1975). Meaning that BM started to be viewed as the architecture of firms to behave and to capture value, and from a theoretical perspective to be examined into several and different components.

Until the end of 1990's, in literature, scholars put their attention to single and static aspect of BM (structure, activities, and purposes). In the meanwhile, from the earlier 2000s', literature has devoted progressively more attention to a dynamic picture of a BM (business model dynamics), concluding that firm can obtain competitive advantage through business model innovation or reinvention (Voelpel et al., 2004), rather than a simple change or incremental improvement in a stated BM (Demil and Lecocq, 2010).

Starting from the 2000s', literature has been progressively focusing on the strategic aspect of business models, since it was clear that BM are the ways to build an organization. As technological development over time and the creation of electronic business were established, the same BM received more and more attention from a managerial and strategic perspective. As BM differentiation was introduced, it was possible to understand the strategic orientation of firms to gain competitive advantage on the market. At the same time, the association of BM to technological development makes easier to analyse the innovation processes undertaken by firms. In this way, the differentiation of BM made possible to establish different components relevant at a strategic level, and to theorize about the strategic perspective of BM (Chesbrough and Rosenbloom, 2002).

Amit and Zott, actually, in 2001, in their seminal work on e-commerce, tried to define the business model concept, in order to generate an integrated model of value creation on the firms by combining strategic management literature with other theoretical perspective about firms' theory and innovation theory. The same Hedman and Kalling who in 2002

explain the theoretical foundations of business model in different organizational theories combined with strategic process perspective.

Over time, BM has been progressively associated to the development of e-commerce and renewal technology (Cavalcante et al., 2011) and became an abstraction which identifies the representation of the company and its strategy. So, in this period the BM was linked to the strategy of a company up to starting that BM is an important phase of the behaviour of a company between its strategic planning and the action (Casaneus-Masanell and Ricart, 2010).

In very recent years, BM have becoming a depiction of the way firms do formulate their value proposition in order to implement their financial performance, so to represent the enhancing of the strategy about customers and the general environment. The value proposition, according to Haslam et al., 2015, has three components: the value creation, the value capturing and the value manipulating, which affect the three phases of the firms' behaviour (planning, action and control) by the leading functions (planning, organization, control and feed-back). Starting from the seminal work of Chesbrough (2007) and of Zott e Amit (2008), academic researchers have started to view BM as a factor affecting the value proposition of firms.

Along with the development of technology, authors focused their attention on the market domain of technology, so that firms can understand the viable ways of gaining rents belonging to technological change (Amit and Zott, 2001). In such approach, several elements become relevant to define the value creation and capturing process of firms, so that firm may pay attention to different components/functions of a BM to pursue the going concern principle. For instance, external institutional and environmental and several internal factors can affect BM creation towards the stakeholder *plethora* (customers, financial lenders, suppliers, competitors, markets). It is necessary to move from the concept of BM, to its components and functions. Several authors have faced this issue in different high technology sectors. As for the elements of a BM, Wirtz et al. (2016) depict several internal and external elements that put together lead a firm to gain competitive advantage. Among internal resources, the most important is the strategy through which management and corporate governance define the long term objective to maintain competitive advantage (competitive strategy). Another internal resource is represented by human resource (knowledge, capabilities, competencies of human resource within organization). Above these the "leadership capabilities" are the most important organizational competencies. Leadership and culture have been determined by Chesbrough (2010) for playing important role in embracing new business model and leading the change to the new model. Among internal resources, Authors also include the revenue model and financial structure of firms as an important component to define a BM.

The external component are mainly the market structure, the firms' stakeholders policy (management), the networking capabilities of firms, industry. It should be the case to add institutional and regulator factors which can affect the structure of BM.

3 Research Methodology

This article applies a structured literature review methodology, which allows to analyze a great number of articles and to identify relevant characteristics in a specific research field, in order to understand the main topics and the future developments on it (Paoloni and Demartini, 2016).

3.1 Selection of articles

We retrieve data from EBSCO database on December 2018, for the period starting 1975. We chose EBSCO because it is widely used in the literature and allows us to be confident to the quality of the publications. We selected articles having “business model” both in the title and in the abstract. We obtained 1212 articles. Then we introduces some filters, selecting only papers published on academic journals and only publications available in pdf. At the end of the selecting process, we obtained 429 articles.

3.2 Defining the analytical framework

We read the title, the abstract and the keywords of the selected articles to be sure that they are relevant. After this analysis we removed 16 articles that are off topic. After reading the titles, the abstract and the keywords of all the relevant articles (413 manuscripts), the authors defined the analytical framework that is composed by these two classifications:

- A. Article focus
 - 1. framework;
 - 2. BM innovation;
 - 3. BM and sustainability;
 - 4. BM and value;
 - 5. BM and disclosure;
 - 6. Other.
- B. Research method
 - 1. narrative;
 - 2. literature review;
 - 3. qualitative;
 - 4. quantitative;
 - 5. mixed.

In order to classify papers and to understand their focus, we did not use a software, but a manual approach by reading the abstracts.

An advantage of this approach over a computer-aided analysis is that humans can better judge the meaning of words and phrases within a context. A disadvantage is that a manual approach is less cost-effective and flexible. Furthermore, the classification entails the use of a personal judgment that could affect the results. To reduce the risk of the bias, authors worked together to identify the main classes and to classify abstracts.

Another problem is that, by reading only titles, keywords and abstracts, the team of researchers may have neglected some relevant information required to carry out a complete classification according to the analytical framework. For instance, in some cases, abstracts do not always provide details on the methodology applied by authors but only give some generic information.

As regards the article focus, the purpose of this classification is to identify the specific topic of articles to gain insights the topics of existing literature in order to reply to research questions.

As we said, the different topics identified by the authors are the following.

Framework: includes those articles that analyze the characteristics and the components of BM, in order to define a framework of it. Some of these studies propose a classification about different BM (Kortmann et al., 2016; Yao et al., 2018).

Sometimes, the articles refer to particular sectors, the most recent studies have often focused on innovative high-tech sector (Muñoz and Cohen, 2018; Remane et al., 2017; Spieth et al., 2018), the internet industry (Guo et al., 2017; Spiegel et al., 2016), the circular economy (Manninen et al., 2018; Ranta et al., 2018; Urbinati et al., 2017), and the energy sector (Bidmon and Knab, 2018; Poudineh et al., 2017).

BM innovation: includes those articles that analyze the changes and the evolutions of the BM to keep innovative, to ensure business growth and to create and capture value.

Some of these studies propose tools and procedures to guarantee innovative and growing BM (Futterer et al., 2018; García-Gutiérrez et al., 2016; Prendeville et al., 2017; Winterhalter et al., 2017); others investigate the motivations and effects of innovation (Comberg et al., 2017; Rayna et al., 2016) and others the choices that must be made to innovate a BM (Broekhuizen et al., 2018; Johnson et al., 2008).

BM and sustainability: includes those studies that examine the characteristics that BM must have to be sustainable and reduce negative impacts on the environment.

Some studies propose a classification of sustainable BM (Yip and Bocken, 2018); others analyze the critical factors for the transition from traditional BM to sustainable BM (Long et al., 2018; Pal et al., 2018); others, finally, suggest some strategies to implement sustainable BM (Ribeiro et al., 2018; Rauter et al., 2017).

In this category, we classified also all the articles that study the innovation finalized to improve the sustainability of the firm. Recent studies, in fact, recognize that business contributions to sustainable development are founded in new business models (Roome et al., 2016) and in transformation of previous traditional models (Stubbs and Cocklin, 2008).

BM and value: includes few researches which analyze the effects of BM on company performance (Haggège et al., 2017; Wei et al., 2017), on its reputation (Ma and Osiyevskyy, 2017) and its value (Guo et al., 2017).

BM and disclosure: includes few researches examining the disclosure made by companies on their BM (Bagnoli and Redigolo, 2016), the different reports that can be used to disseminate information on BM (Lassini et al., 2016; Mellone et al., 2016; Michalak et al., 2017) or the effects of the BM disclosure (Haslam et al., 2015).

Other: it is a residual category that includes all those articles that do not belong, to our opinion, to the previous categories. In “Other”, we also include articles related to BM research, namely the literature reviews that address all the previously outlined topics and the special issue editorials specifically dedicated to BM.

From the above classification, it can be deduced that topics n. 1) and 2) (framework and innovation) can be inserted in the field of management. The topics n. 3, especially with reference to CSR aspects, n.4 and n.5 (value and disclosure) can be included in the field of accounting and performance.

As about the research method, it is possible to distinguish the following:

narrative: theoretical articles without quantitative analysis;

literature review: narrative articles dedicated to the review of extant literature;

qualitative: articles with qualitative analysis through case study, experiments, survey or interview;

quantitative: manuscripts with empirical analysis based on information obtained from databases, financial statements or other reports;

mixed: articles that applied multiple methods (for instance literature review and case study).

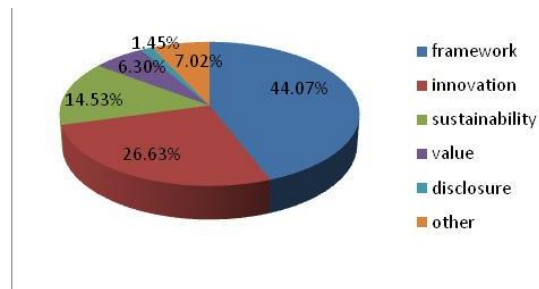
4. Results

This section provides the descriptive results of our research.

The analysis of the abstracts allowed us to examine the different articles, identifying for each of them the prevailing topic. The results of this survey are shown in the following table and graph.

Table 1: articles focus

Topic	N.	%
framework	182	44,07%
innovation	110	26,63%
sustainability	60	14,53%
value	26	6,30%
disclosure	6	1,45%
other	29	7,02%
Total	413	100,00%



Graph 1: articles focus

Table and graph 1 highlight that most researches have focused their attention on the development of a framework for BM, sometimes investigating their characteristics for specific business industries (D'Souza, 2016; Riehle, 2012; Stal, 2018), sometimes their components (Da Silva, 2013; Ranta, 2018; Sachsenhofer, 2016) and proposing different classification for BM (Chjatterjee, 2013; Hahn, 2018; Krech, 2015).

Articles on innovation examine the changes of the BM needed to guarantee the competitiveness and the business growth (Comberg, 2017; Ebel, 2016; Gebauer, 2017), sometimes analyzing the effects on the market (Rayna, 2016) or on the innovation of the same company (Iivari, 2015).

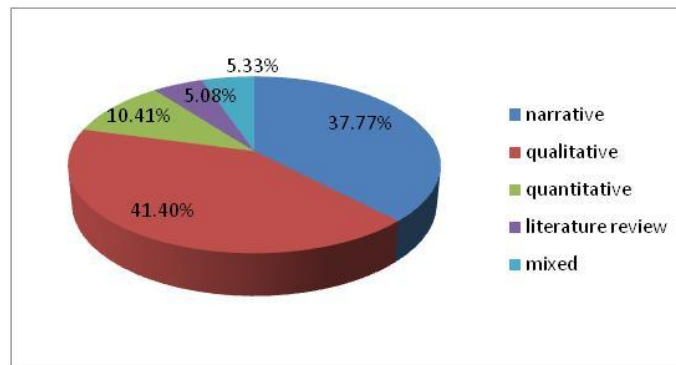
Previous researches that investigated the theme of sustainability among BM focused their attention on sustainability-oriented BM, with better social and environmental impacts. Among this category, some studies combine innovation and sustainability, testing the possibility of replacing the traditional BM pollutants with sustainable BM, in order to identify of successful BM also analyzing social impacts (Carayannis et al., 2015; Gauthier, 2016; Richter, 2013; Roome, 2016; Zhao, 2018).

Just few researches focused their attention on accounting field and in particular on the topics value and disclosure. Articles on value examined, generally through empirical analysis, the correlation between BM and firm value and performance (Anwar, 2018; Brenes, 2016; Gerasymenko, 2015). Papers on disclosure analyze the information that companies voluntary provide on their BM (Melloni, 2016; Michalak, 2017).

Table and graph 2 show the different methodology adopted by the articles of our research.

Table 2: articles methodology

Method	N.	%
narrative	156	37,77%
qualitative	171	41,40%
quantitative	43	10,41%
literature review	21	5,08%
mixed	22	5,33%
Total	413	100,00%

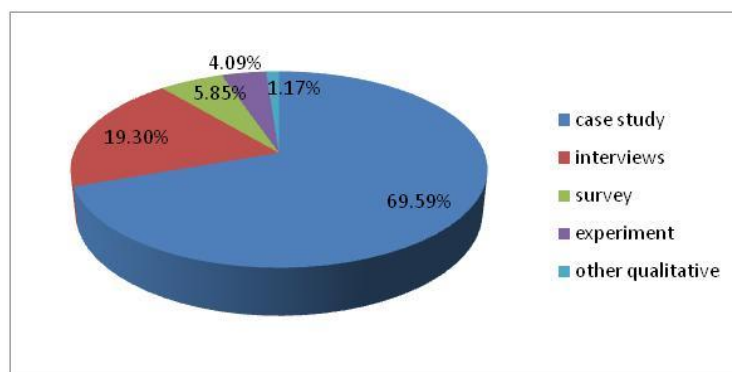


Graph 2: articles methodology

The previous table and graph show that more than 40% of our sample adopt a qualitative research approach. Among this group, we can distinguish the following methods:

Table 3: qualitative methodology

Qualitative	N.	%
case study	119	69,59%
interviews	33	19,30%
survey	10	5,85%
experiment	7	4,09%
other qualitative	2	1,17%
Total	171	100,00%



Graph 3: qualitative methodology

As regards exclusively the empirical research and the case studies, we examined the geographical area of the research (regardless of the author's nationality), distinguishing between:

1. North America (Canada, USA);
2. South America (Brazil, Patagonia);
3. UK;
4. North Europe (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Netherlands, Scandinavian countries, Switzerland);
5. South and East Europe (Italy, Spain, Portugal, Estonia);
6. Asia (China, Hong Kong, Korea, India, Indonesia, Japan, Pakistan, Philippines, Singapore, Taiwan);
7. Oceania (Australia, New Zealand);
8. Mixed.

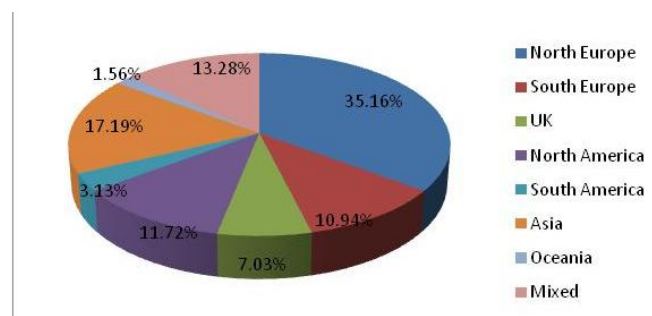
No study was found for Africa. It is important to note that in some abstract (n. 34) there was no information on the country of the research.

The country of research allow us to identify the places more investigated and the new areas that could be subject to investigation.

The following table and graph shows the results of the analysis.

Table 4: geographical area of the research

Country	N.	%
North Europe	45	35,16%
South Europe	14	10,94%
UK	9	7,03%
North America	15	11,72%
South America	4	3,13%
Asia	22	17,19%
Oceania	2	1,56%
Mixed	17	13,28%
Total	128	100,00%



Graph 4: geographical area of the research

As we can see from the above table and diagram, only few researches have been carried out in developing countries (Bittencourt, 2016; Brenes, 2016; Dembek, 2018; Gabriel, 2016; Jamasb, 2018; Mason, 2017; Matos, 2013), in most cases, papers analyzed developed countries, and in particular Europe (53,13%). Some studies propose a comparative analysis between developing and developed countries (Bolis, 2017; Havemo, 2018; Maniora, 2017).

5 Discussion and conclusions

Our research shows that business model has been widely investigated by literature especially in recent years with a growth of the number of articles concerning this issue.

Our paper is focused on a structured review of the main literature extant on this topic, assessing which are gaps and limits and potential development of the research on BM. We addressed our work through three research question arising from the research methodology.

As for RQ1 and RQ2, we note that at the beginning of the period, most of researches is settled on management field, with a high percentage of articles on framework (40,07%, n.182 see table 1) and innovation of BM (26,63%, n.110 see table 1). Most of the literature indeed took a look of BM from a management perspective to understand how BM were influenced by strategy. Among this mainstream scholars, they took care to investigate different business models for different sectors, especially high-tech ones.

In recent years, scholars have also addressed their study following different theoretical settings, also combining CSR, value and corporate disclosure issues.

From the qualitative approach we adopted, it emerges that great part of literature is devoted to a mere depiction of BM (structure, management, design).

Other scholars have focused on the internal and external characteristics of a BM considering that the BM originates from the internal components of the company, especially the organization, but at least theoretically it involves the whole environment and it affects the market, too. Other researchers gave us an interesting insight on barriers and inertia due to the change in the BM.

The most used by scholars is the qualitative approach to case studies, which also to our opinion is the most useful to investigate by an inductive approach the phenomena related to BM.

More than 50% of papers analyze Euro-zone; the reason why it could represent an interesting question to answer to for future.

So, the overall conclusion of the previous two questions is for a general persisting gap also from an empirical and managerial perspective.

About RQ3, very poor and rare literature has faced factors affecting the evolution and the change of BM research in specific sectors and, above all, in the most innovative companies that continuously change and adapt their BM, to capture growth and value. Another emerging issue for future research is the identification of the variables which affect the BM evolution and adaptation to become over time, sustainable BM. We refer, both internal, as human resources, knowledge storage and management, firm size and

business industry, and external, as institutions, composition of market and so on. In this way, by the help of case studies, it could be possible to learn inductively the variables which affect the behavior of firms.

To do this, literature should examine if cultural and institutional factors (stakeholder pressures, environmental uncertainty, national culture, world bank indicators etc.), and internal organizational value (sustainable activities, ESG score, organizational culture and values, management style, organizational structure, etc.) are associated to sustainable business model.

The empirical literature gaps concern also the effects on financial performance of BM in accounting perspective. BM and accounting is still representing a glass ceiling in the literature. Few scholars in fact have intended the BM as a tool that can affect the financial performance of companies, mainly through its disclosure. No one has ever considered the BM as an aspect of corporate disclosure, while at the political level several organizations have tried to intend BM as a tool to give disclosure to stakeholders.

Since Rasmussen (2007) gave us a framework of BM within the theories of firms, scholars should undertake the study of BM as a determinant of corporate financial performance.

Starting from the intuition of Pedersen et al. (2018), who analyzed the relationship between Business model evolution and innovation, corporate sustainability and organizational value, we smell profitable avenues to understand if sustainable business model are effectively perceived as value creator.

Finally, we must conclude for some limitation of the paper. First, we used only a source (EBSCO); for future, we will employ other database to enlarge our article sample. Moreover, we structured the literature as a personal judgment. Furthermore, reading only the titles, keywords and abstracts is not sufficient to provide all the detailed required to complete the analytical framework and the classification.

References

- Amit, R., & Zott, C. 2001. Value creation in e-business. *Strategic Management Journal*, 22: 493-520.
- Amit, R., & Zott, C. 2002. Value drivers of e-commerce business models. In M. A. Hitt, R. Amit, C. Lucier, & R. D. Nixon (Eds.), *Creating value: Winners in the new business environment*: 15-47. Oxford, UK: Blackwell.
- Bagnoli, C., Redigolo, G. Business model in IPO prospectuses: insights from Italian Innovation Companies. *Journal of Management & Governance*. 2016, Vol. 20 Issue 2, 261-294.
- Bidmon, C.M., Knab, S.F. The three roles of business models in societal transitions: New linkages between business model and transition research. *Journal of Cleaner Production*. 2018, Vol. 178, 903-916.
- Carayannis, E.G., Sindakis, S. and Walter, C. (2015), "Business model innovation as lever of organizational sustainability", *The Journal of Technology Transfer*, Vol. 40, No. 1, pp. 85–104.
- Cavalcante S., Kesting P., Ulhøi J., Business model dynamics and innovation: (re)establishing the missing linkages. *Management Decision*. 2011, Vol. 49 Issue 8, 1327-1342.

- Chesbrough H., R.S. Rosenbloom. The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change*, 11 (3) (2002)
- Chesbrough, H., Business model innovation: it's not just about technology anymore. *Strategy & Leadership*. 2007, Vol. 35 Issue 6, p12-17.
- Demil B., X. Lecocq. Business Model Evolution: In Search of Dynamic Consistency. *Long Range Planning*, 43 (2010) pp. 227-246.
- García-Gutiérrez, I., Martínez-Borreguero, F.J. The Innovation Pivot Framework: Fostering Business Model Innovation in Startups. *Research Technology Management*. 2016, Vol. 59 Issue 5, 48-56.
- Guo, L., Wei, Y.S., Sharma, R., Rong, K. Investigating e-business models' value retention for start-ups: The moderating role of venture capital investment intensity. *International Journal of Production Economics*. 2017, Vol. 186, 33-45.
- Haggège, M., Gauthier, C., Rüling, C.C. Business model performance: five key drivers. *Journal of Business Strategy*. 2017, Vol. 38 Issue 2, 6-15.
- Haslam, C., Tsitsianis, N., Andersson, T., Gleadle, P. Accounting for Business Models: Increasing the Visibility of Stakeholders. *Journal of Business Models*. 2015, Vol. 3 Issue 1, 62-80.
- Hedman J, Kalling T (2002) The business model: a means to comprehend the management and business context of information and communication technology. In: *Proceedings of the 10th European conference on information systems*.
- Johnson, M. W., Christensen, C. C., & Kagermann, H. 2008. Reinventing your business model. *Harvard Business Review*, 86(12): 50-59.
- Konczal, E.F., Computer models are for managers, not mathematicians. *Management Review*. Apr75, Vol. 64 Issue 4, 46-49.
- Kortmann, S. and Piller, F. Open Business Models and Closed-Loop Value Chains: redefining the firm-consumer relationship. *California Management Review*. 2016, Vol. 58 Issue 3, 88-108.
- Lassini, U., Lionzo, A., Rossignoli, F. Does business model affect accounting choices? An empirical analysis of European listed companies. *Journal of Management & Governance*. 2016, Vol. 20 Issue 2, 229-260.
- Ma, Q.A. and Osiyevskyy O. Maximizing the strategic value of corporate reputation: a business model perspective. *Strategy & Leadership*. 2017, Vol. 45 Issue 4, 24-32.
- Mellone G., R. Stacchezzini, A. Lai. The tone of business model disclosure: an impression management analysis of the integrated reports. *Journal of Management & Governance*. 20(2) (2016).
- Michalak, J., Rimmel, G., Beusch, P., Jonäll, K. Business Model Disclosures in Corporate Reports. *Journal of Business Models*. 2017, Vol. 5 Issue 1, 51-73.
- Muñoz, P., Cohen, B. A Compass for Navigating Sharing Economy Business Models. . *California Management Review*. 2018, Vol. 61 Issue 1, 114-147.
- Paoloni P., Demartini P. Women in management: perspectives on a decade of research (2005-2015) *Palgrave Communication*, 2016. Available at: <http://dx.doi.org/10.1057/palcomms.2016.94>.
- Poudineh, R., Rubino, A. Business model for cross-border interconnections in the Mediterranean basin. *Energy Policy*. 2017, Vol. 107, 96-108.
- Ranta, V. Aarikka-Stenroos, L., Mäkinen, S.J. Creating value in the circular economy: A structured multiple-case analysis of business models. *Journal of Cleaner Production*. 2018, Vol. 201, 988-1000.
- Remane, G., Hanelt, A., Nickerson, R.C., Kolbe, L.M. Discovering digital business models in traditional industries. *Journal of Business Strategy*. 2017, Vol. 38 Issue 2, 41-51.
- Spiegel, O., Abbassi, P., Zylka, M.P., Schlagwein, D., Fischbach, K., Schoder, D. Business model development, founders' social capital and the success of early stage internet start-ups: a mixed-method study. *Information Systems Journal*. 2016, Vol. 26 Issue 5, 421-449.

- Spieth, P., Meissner Née Schuchert, S., Business model innovation alliances: how to open business models for cooperation. *International Journal of Innovation Management*. 2018, Vol. 22 Issue 4, 1-26.
- Stubbs W. and C. Cocklin. Conceptualizing a “Sustainability Business Model”. *Organization & Environment*. 21 (2) (2008).
- Teece, D. J. 2010. Business models, business strategy and innovation. *Long Range Planning*, 43: 172-194.
- Urbinati, A., Chiaroni, D., Chiesa, V. Towards a new taxonomy of circular economy business models. *Journal of Cleaner Production*. 2017, Vol. 168, 487-498.
- Voelpel, M. Leibold, E.B. Tekie. The wheel of business model reinvention: how to reshape your business model to leapfrog competitors. *Journal of Change Management*, 4 (3) (2004), pp. 259-276.
- Wei, Z., Song, X., Wang, D. Manufacturing flexibility, business model design, and firm performance. *International Journal of Production Economics*. 2017, Vol. 193, 87-97.
- Wirtz, B.W., Pistoia, A., Ullrich S., Göttel, V., Business Models: Origin, Development and Future Research Perspectives. *Long Range Planning*. 2016, Vol. 49 Issue 1, 36-54.
- Yao, X., Zhong, P., Zhang, X., Zhu, L. Business model design for the carbon capture utilization and storage (CCUS) project in China. *Energy Policy*. 2018, Vol. 121, 519-533.
- Yip, A., Bocken, N., Sustainable business model archetypes for the banking industry. *Journal of Cleaner Production*. 2018, Vol. 174, 150-169.
- Zott, C., & Amit, R. 2010. Designing your future business model: An activity system perspective. *Long Range Planning*, 43: 216-226
- Zott, C., & Amit, R. 2008. The fit between product market strategy and business model: Implications for firm performance. *Strategic Management Journal*, 29: 1-26.

The Mediation Effect of Corporate Social Responsibility and Strategic Knowledge Management on the Relationship between Sustainable Intangible Capital and Performance

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Abstract

The dynamic environment that firms face forces them to respond quickly and flexibly to market changes in order to survive the competition. Proof of this is the call from different political, economic, social and academic institutions to companies to increase their efforts in the social and environmental fields, through the development of three essential pillars: economic, social and environmental (Triple Bottom Line).

Based on these ideas and with the purpose of linking the management of sustainable intangible assets with the performance of the firm, in this research we define sustainable intangible capital as the set of knowledge that a company can take advantage of to carry out an economic, social and environmental management that allows it to achieve competitive advantages.

Although in recent times intangible assets are considered the basic factor of production, it is necessary to show that the mere possession of them will not guarantee a superior performance. For that reason, the objective of this work is to analyse the dynamic role that the corporate social responsibility and the strategic knowledge management exert in the relationship between sustainable intellectual capital and firm performance.

To analyse the objective proposed, three hypotheses were proposed, which were tested using a quantitative methodology based on PLS on 120 Spanish hotels with three or more stars.

Findings do not support H1, which indicates that sustainable intangible capital does not influence hotel's performance in a significant way. On the contrary, the mediating hypotheses H2 and H3 have been supported, showing that corporate social responsibility and strategic knowledge management exert as mediator dynamic capabilities and a multiple mediation effect exists. This means that those capabilities create the values, the philosophy and the necessary foundations for sustainable intangible capital to influence on performance from a significant point of view.

With this research theoretical and practical contributions are made.

Keywords – Sustainable Intangible Capital, Strategic Knowledge Management, Corporate Social Responsibility, Performance.

Paper type – Academic Research Paper

1 Introduction

In the literature, we find more and more works in which the fields related to intangible assets, corporate social responsibility (CSR) and performance (PFM) are linked (Chang & Chen, 2012; Huang & Kung, 2011). However, in this research we intend to go a step further. Although in recent times intangible assets are considered the basic factor of production, it is necessary to show that the mere possession of them will not guarantee a superior performance. For that reason, based on the *resource-based view* of the firm (Collis & Montgomery, 1995; Peteraf, 1993; Rumelt, 1984) and the *theory of stakeholders* (Waddock & Graves, 1997a, 1997b), in this paper we highlight the role of CSR and the strategic knowledge management (SKM) as the dynamic capabilities which are necessary for a SIC to lead a greater firm PFM. So far, we have not found works in the literature that, in a holistic way, incorporate these variables as well as the relationships proposed.

Consequently, the objective of this work is to analyse the dynamic role that the CSR and the SKM exert as a mediator variables in the relationship between SIC and PFM.

To achieve the proposed objective, we analyse the tourism sector and, more specifically, the hotel sector. The fact that (1) Spain is the second most visited destination in the world behind France (OMT, 2018); (2) the literature of social responsibility in the hotel sector is characterized by its scarcity (Peña et al., 2019; Bohdanowicz & Zientara, 2009; Holcomb, Upchurch & Okumus, 2007); (3) and the strong impact that this sector causes in both, natural and social environment, justify the choice of hotel industry.

This work makes several theoretical and managerial contributions which will be exposed in the last section of the paper.

2 Literature review

2.1 Sustainable intangible capital and performance

Sustainability issues have been increasingly incorporated into the specialized literature on the management of intangibles, mainly from the environmental field. Proof of this is the proliferation of works such as Delgado-Verde et al. (2014), Chang & Chen (2012), Huang & Kung (2011), López-Gamero, et al. (2011) or Claver-Cortés, et al. (2007), which focus on the green intellectual capital, and try to identify and classify the 'green' or environmental intangibles that companies have, analysing the positive links between them and competitive advantages, as well as green innovations and CSR. However, considering only the environmental aspects within the company's set of intangible assets, takes us

away from the sustainability approach proposed by the Triple Bottom Line (TBL): economic, social and environmental issues.

In order to cover this existing gap in the literature, in this paper we make an effort to define SIC under the TBL approach. To this end, based on the work of López-Gamero et al. (2011) and considering the philosophy of the TBL, we define SIC as the set of knowledge that a company can take advantage of to carry out an economic, social and environmental management that allows it to achieve competitive advantages. From this definition, we can break down SIC into three main dimensions: (1) Environmental intangible capital: constituted by those intangibles from human, structural and relational capital linked to the conservation and management of natural resources. In the case of hotels, this dimension plays a very important role because it is highly linked to the quality of the tourism product (Benavides-Velasco, Quintana-García & Marchante-Lara, 2014); (2) Economic intangible capital: constituted by those intangibles from human, structural and relational capital linked to the generation of prosperity at different levels of society and the profitability of economic activity (GRI, 2011). From the hotels point of view, this dimension is also very important because it positively influences the organizational confidence and the perception of the consumers, being critical to differentiate the products and services of the competitors (Benavides-Velasco, Quintana-García & Marchante-Lara, 2014); (3) Social intangible capital: constituted by those intangibles from human, structural and relational capital linked to the impact that the company has on the social system in which it operates and in which employees, customers and society in general are included (GRI, 2011). In the hotel sector, the consideration of this dimension is essential, due to the strong impact that this sector causes in its social environment.

The strategic nature of SIC, coming from its heterogeneity, specificity, difficulty to be imitated and transferred, will lead companies that possess it to have a higher performance or competitive advantages (Peteraf, 1993; Barney, 1991). In the same way, Bontis, Janošević & Dženopoljac (2015) and Kim et al. (2012), point out the degree to which intangible assets affect the financial results of hotel companies. Nemec Rudez & Mihalic (2007) highlight the new opportunities that knowledge assets offer to the hotel sector, while Engström, Westnes & Westnes (2003) consider intangible assets as the key resources and drivers of organizational performance and the creation of value in the hotel sector.

For all the above, we formulate the first hypothesis.

H1: Hotel's SIC positively influences its PFM.

2.2 The mediator role of CSR in the SIC-PFM link

Surroca, Tribó & Waddock (2010) highlight the potential of the *resource-based view* as an analytical tool to study the relationship between CSR and the financial result through mutual connection with the resources of the company. Within these resources, intangibles such as innovation capacity, human capital, reputation and culture, can contribute highly to improve the results obtained with CSR actions, through: (1) the incorporation of more responsible attributes within products and services (redesign, packaging, inputs, etc.); (2) the introduction of commitment-based human resource

practices (advanced training, participation in teams and empowerment); (3) the development of a good reputation for social responsibility (improves relationships with stakeholders) (Castelo Branco & Lima Rodrigues, 2006); (4) the rise of a humanistic culture (promotes employees seeking solutions to reduce the impact of the company on the natural environment).

Moreover, Garay & Font (2012) consider that hosting SMEs have important competitive reasons to act responsibly and, precisely, the study by Holcomb, Upchurch & Odumus (2007) supports this idea, as their results showed that leading hotels such as Hilton, Accor or Marriott adopt the integration of social and environmental objectives in their operations and use them as a basis for the development of unique competitive advantages.

These arguments, together with the fact that several empirical studies highlight the existence of a positive interaction between the dimensions of intellectual capital and CSR activities (Castelo Branco & Lima Rodrigues, 2006; Renneboog, Horst & Zhang, 2008), leads us to formulate the following hypothesis:

H2: Hotel's CSR acts as a mediating capability between its SIC and PFM.

2.3 The mediator role of SKM in the SIC-PFM link

A SKM plan should contain a set of major initiatives that must be undertaken to achieve economic, social and environmental goals. In this task, following Dayan et al. (2017), who consider that knowledge management is a factor for the formulation and implementation of organization strategy, we consider that a SKM process would include the existence of a knowledge vision and diagnosis, together with the formulation of knowledge strategies and the existence of an infrastructure to support their implementation.

Regarding the vision and diagnosis phase, it is necessary to instil a vision of knowledge that emphasise knowledge creation as an activity and build an appropriate context for the creation and transfer of sustainable knowledge flows between all members of the firm. A diagnosis will reveal the strengths and weaknesses of the hotel's sustainable intangibles. The strategic diagnosis must be followed by the formulation of a knowledge strategy which should focus, on the one hand, on the creation of sustainable intangibles and, on the other hand, on making these intangibles visible to the internal and external stakeholders of the hotel. This will increase the credibility of the hotel in terms of sustainability and strengthen the relationship between SIC and PFM. Once the knowledge strategy has been formulated, it will be necessary to provide the company with mechanisms that enable its efficient application. Among them: a humanistic culture, human resource practices, organisational design and technological platform. These ideas lead us to formulate the third hypothesis:

H3: Hotel's SKM acts as a mediating capability between its SIC and PFM.

Figure 1 shows the developed model and the hypotheses proposed.

3 Methodology

The population under study comprised 1000 Spanish hotels with three or more stars included in two databases: SABI (Iberian Balance Sheet Analysis System) and Turespaña. A questionnaire addressed both, to the CEO and the Human Resources Manager of the hotel sent through post and e-mail was used to collect information. A total number of 120 questionnaires considered valid were collected, which means covering 12% of the population. To check non-response bias a Student's t-test was used, indicating no significant differences for means comparison based on the control variable 'category' between the hotels which did not answer the questionnaire and those which did.

The relationships proposed in the hypotheses were tested using a variance-based structural equation modelling based on Partial Least Squares (PLS).

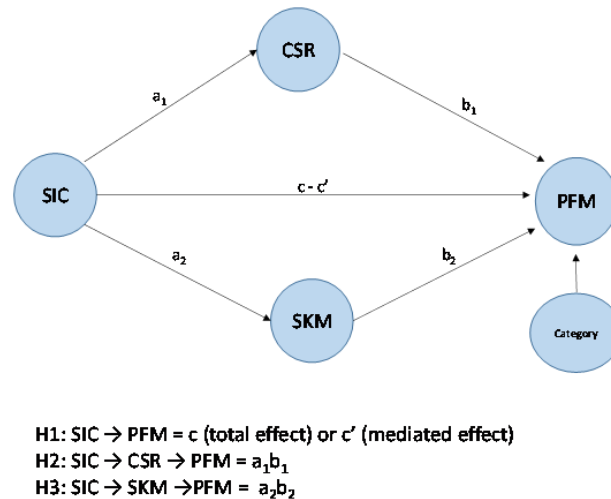


Figure 1: Model proposed

Measures

Sustainable intangible capital. This variable was considered as a second-order construct made up of two first-order formative constructs: Green Intangible Capital (GIC) and Social and Economic Intangible Capital (SEIC). On the one hand, GIC was measured by means of a seven-point Likert scale with seven items, taking as a reference and adapting the measures provided in the studies carried out by Chang & Chen (2012) and Huang & Kung (2011). On the other hand, SEIC was measured through a seven-point Likert scale with 14 items, taking as a reference and adapting the measures coming from the study of Subramaniam & Youndt (2005).

Performance. This variable was treated as a second-order construct shaped by two first-order reflective constructs: Environmental Performance (EP) and Hotel Performance (HP). EP was measured by means of a seven-point Likert scale with five items, using the

measures included in the studies of Paillé et al. (2014) and Chow & Chen (2012). To measure HP, perception measures were used based on Gibson & Birkinshaw (2004).

Corporate social responsibility. This variable was considered a second-order construct made up of two first-order reflective constructs: Employee and Customer Social Responsibility (ECSR) and Environment and Society Social Responsibility (ESSR). Both of them were measured through a seven-point Likert scale using the measures obtained from the studies of Bai & Chang (2015), Chang & Chen (2012) and Turker (2009). ECSR was measured by seven items, while ESSR was measured by four items.

Strategic knowledge management. This variable was treated as a first-order construct which comprised seven formative indicators. These indicators derive from the insights developed within a multiple-case study undertaken previously (Hill & Birkinshaw, 2014) and adapted from the paper of Claver et al. (2018). All of them were measured by means of a seven-point Likert scale.

Control variable. Category of the hotel (three, four or five stars hotel) was used as control variable in order to monitor possible alternative explanations for the relationships proposed.

4 Findings

The PLS methodology does not allow calculations directly on the second-order constructs. For that reason, for the treatment of multidimensional constructs we use the *two-stage approach*, using the '*latent variable scores*' or aggregated scores (Wright et al., 2012). Once the final model was designed (figures 2 and 3), we proceeded to evaluate it following the three main stages for the evaluation of the models in PLS. We have used the Smart PLS3 software.



Figure 2. Model with total effect

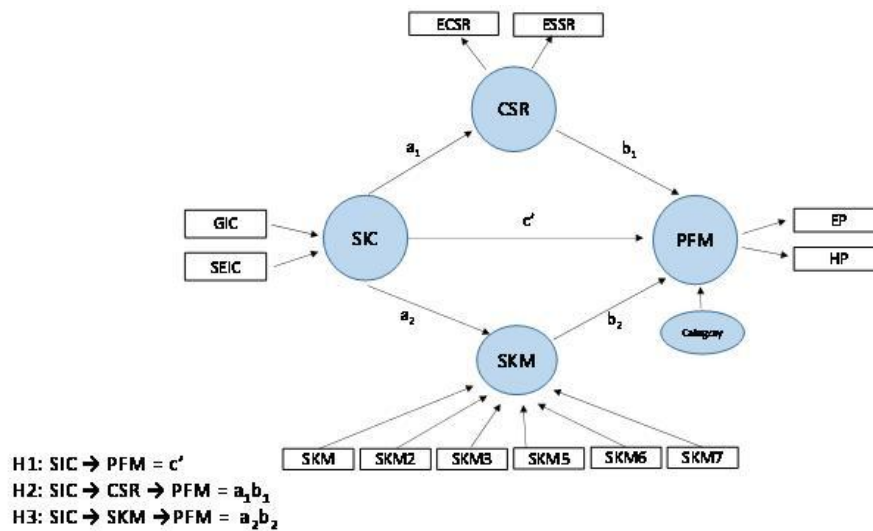


Figure 3. Model with a two-path mediated effect

4.1 Global model assessment

The most commonly used measure to evaluate the global fit of the model is the SRMR (standardized root mean square residual) index. According to Hu and Bentler (1998), for a good fit of the model, the SRMR index should be less than 0.08. In our model, the SRMR index is 0.073, which indicates a good global fit of the proposed model.

4.2 Measurement model assessment

The proposed model is constituted by both reflective (Mode A) and formative constructs (Mode B) and, in the context of PLS, the evaluation of each of them is done differently.

Reflective constructs assessment (Mode A): PFM and CSR

The individual reliability of indicators was evaluated through the value of their loadings (λ). According to the literature, these loadings should exceed the value of 0,7 ($\lambda > 0,7$). As we can observe in table 1, all loads exceeded the value of 0,7.

Construct's reliability is evaluated by means of Cronbach's α index and the composite reliability index. Both of them should exceed the critical value of 0,7 in every variable. The existence of convergent validity is verified through the examination of the extracted mean variance (AVE), which should be situated above 0,5 (Fornell & Lacker, 1981). Table 1 shows all these values and all of them are above the critical values of 0,7 and 0,5 respectively.

Finally, discriminant validity is evaluated through the Heterotrait-Monotrait Ratio (HTMT), which has a threshold of 0,85 (Kline, 2011). From table 1, we can observe that the data confirm the existence of discriminant validity.

Table 1. Measurement model assessment (Mode A)

Loadings (λ)		
	PFM	CSR
ESSR		0,778
ECSR		0,887
HP	0,869	
EP	0,831	

Construct reliability and convergent validity coefficients			
	Cronbach α	Composite reliability	AVE
PFM	0,817	0,839	0,722
CSR	0,773	0,821	0,697

Discriminant validity coefficients (HTMT)		
	Category	PFM
PFM	0,295	
CSR	0,262	0,737

Formative constructs assessment (Mode B): SIC and SKM

Firstly, it is necessary to analyze the potential multicollinearity between the indicators, which was analyzed from the Variance Inflation Factor (VIF), which should be < 3.3 . It was observed that one of them (SKM4) had a value of $VIF > 3.3$. For that reason, this indicator was eliminated and the SKM construct was made up of six indicators instead of the seven that initially formed it. After the elimination of SMK4, the remaining indicators showed VIF values < 3.3 , thus fulfilling all of them with the established requirement and confirming that there is no multicollinearity between them (see table 2).

Secondly, weights and their significance are analyzed. In order to assess the significance of the coefficients, the non-parametric bootstrapping technique of 5.000 samples was used to obtain the t statistics and the confidence intervals. According to the theory, all weights should be positive and have a p value < 0.05 to be significant. Table 2 shows that all weights are positive and, except for the one corresponding to the SKM2 indicator, they are all significant. However, according to Chin (1998), eliminating an indicator could decrease the information to explain a construct, so we do not eliminate this indicator in order not to leave the SKM construct with only five indicators.

Table 2. Measurement model assessment (Mode B)

Multicollineality analysis

	VIF
SEIC	1,110
GIC	1,110
SKM1	2,007
SKM2	1,848
SKM3	2,781
SKM5	2,666
SKM6	3,123
SKM7	3,057
Category	1,000

Weights assessment and significance

	Weight	p-value	Confidence intervals		Significance
			5.0%	95.0%	
SEIC→SIC	0,763***	0,000	0,537	0,964	YES
GIC→SIC	0,449**	0,003	0,108	0,690	YES
SKM1→SKM	0,489***	0,000	0,201	0,731	YES
SKM2→SKM	-0,035	0,371	-0,210	0,138	NO
SKM3→SKM	0,180**	0,006	0,071	0,414	YES
SKM5→SKM	0,101**	0,009	0,134	0,304	YES
SKM6→SKM	0,434**	0,002	0,142	0,713	YES
SKM7→SKM	0,181**	0,006	0,105	0,455	YES
Category	1,000		1,000	1,000	

p**<0,01 (significant at 99,99%), p***<0,001 (significant at 99,999%)

4.3 Structural model assessment

We firstly evaluated the possible co-linearity problems. According to Hair et al. (2014), there will be signs of co-linearity when the VIF > 5. Because in our model all the values do not exceed the value of 5, we can confirm that co-linearity problems do not exist. Table 3 shows the VIF, f^2 and Q^2 values.

Table 3. VIF, f^2 and Q^2 values

VIF values

	SKM	CSR	PFM
SIC	1,000	1,000	1,472
SKM			2,611
CSR			2,842
Category			1,104

f^2 values

	SKM	PFM	CSR
SIC	0,246	0,029	0,386
SKM		0,153	
CSR		0,133	
Category		0,014	

Q^2 values

	Q^2
SKM	0,099
PFM	0,233
CSR	0,178

A second analysis focused on the algebraic sign, magnitude, and significance of the path coefficients which show the estimates of structural model relationships (see table 4).

Table 4. Path coefficients and significance

			Confidence intervals		
	Weight	p-value	5.0%	95.0%	Significance
Model with total effect					
SIC→ PFM (c)	0,198	0,062	-0,011	0,153	NO
Category→PFM	0,095	0,086	-0,014	0,213	NO
Model with a two-path mediated effect					
SIC→ PFM (c')	-0,129	0,094	-0,293	0,030	NO
SIC→ CSR (a ₁)	0,528***	0,000	0,422	0,633	YES
SIC→ SKM (a ₂)	0,444***	0,000	0,291	0,608	YES
CSR→PFM (b ₁)	0,236***	0,004	0,017	0,457	YES
SKM→PFM (b ₂)	0,456***	0,000	0,217	0,658	YES
Category→PFM	0,095	0,086	-0,014	0,213	NO

p**<0,01 (significant at 99,99%), p***<0,001 (significant at 99,999%)

As we can observe from table 4, in the model with total effect (figure 2), the direct effects corresponding to the relationships Category→ PFM and SIC→ PFM (c) are not significant. These results show that, on the one hand, the hotel category, although the path coefficient is positive, does not exert a significant influence on the PFM of the hotels. On the other hand, H1 proposed a positive relationship between SIC and PFM and, although the path coefficient (c) is positive, the relationship is not significant. Therefore, H1 cannot be confirmed.

From the same table 4, in the model with a two-path mediated effect (figure 3), we can observe that four of the six direct effects turned out to be significant. However, it has been found that, when introducing the mediating variables CSR and SKM, the path coefficient (c') is negative, contrary to that stipulated in our H1.

The third analysis had to do with the assessment of the value of R^2 . According to the theory, R^2 value should be between 0 and 1. In our work, the values of R^2 for SKM, PFM and CSR were of 0,197, 0,400 and 0,278 respectively, which indicates that almost 20% of the variance of SKM was explained by SIC, 40% of the variance of PFM was explained by SIC, SKM and CSR, and 27.8% of the variance of CSR was explained by SIC.

The fourth analysis consisted in the assessment of the sizes of the effects f^2 . Table 3 shows the values of f^2 obtained for our study and, as observed, the exogenous variable that contributes most to explain the endogenous variable PFM, is the variable SKM. The greatest effect of f^2 is found in the relationship between SIC and CSR.

Finally, the structural model was also evaluated using the Stone-Geisser test Q^2 through a blindfolding procedure (Chin, 1998). A Q^2 greater than zero implies that the model has predictive relevance. The findings in table 3 confirm that the proposed model has predictive relevance for all dependent variables.

4.4 Mediation analysis

According to the proposed model (figure 3), H2 and H3 represent mediation hypotheses. Table 5 shows that the indirect effects are highly significant. It means that, on the one hand, CSR is a mediating variable between SIC and PFM, so H2 is accepted (a_1b_1). On the other hand, H3 (a_2b_2) –which reflects the mediating effect that SKM has in the relationship between SIC and PFM– was accepted.

Variance Accounted For (VAF)¹ was calculated to know whether mediation is partial or total. VAF < 0,8 indicates that the mediation is partial and VAF > 0,8 means that there is a full mediation. In our study, because VAF value is 1,65, we can say that the mediation is full.

Table 5. Mediating effect test

Total effect of SIC on PFM (c)		Direct effect of SIC on PFM (c')		Indirect effect of SIC on PFM	Confidence intervals	
Path coefficient	p-value	Path coefficient	p-value		5%	95%
0,198 (ns)	0,062	-0,129 (ns)	0,094	H2= $a_1b_1 = 0,125^{***}$	0,006	0,252
				H3= $a_2b_2 = 0,202^{***}$	0,083	0,342

***p<0.001

5 Discussion and conclusions

The need for hotels to behave as intelligent organizations to face the continuous challenges imposed by their environment, has led us to analyse whether the CSR and SKM behave as dynamic mediating capabilities in the relationship between SIC and PFM, constituting this as the main objective of our investigation. To reach it, three hypotheses were formulated, which were contrasted using the quantitative methodology of PLS. Findings shed light on the following aspects:

H1 proposed that hotel's SIC positively influenced its PFM. According to the results and contrary to what is expected, H1 cannot be supported, because the direct effect of SIC on PFM (c) is not significant. However, these results are in line with the approaches of Bontis, Janošević & Dženopoljac (2015), which point out that, although conceptually the impact of intangible assets on PFM is obvious and logical, in practice this relationship cannot be fully confirmed in all sectors. Their research shows that investment in intellectual capital is not always adequately capitalized. Under this premise, findings show that we cannot expect the effects of the exploitation of the SIC to automatically appear on hotel's PFM.

H2 and H3 proposed that CSR and SKM acted as a mediating capabilities between hotel's SIC and hotel's PFM. Findings show that, as we proposed in the model, the mediating hypotheses H2 and H3 have been supported, showing that a multiple mediation effect exists. On the one hand, hotels with a good reputation for social responsibility can improve relations with external stakeholders. For that reason, we think that this attracting the best employees, increasing their motivation, loyalty and commitment to the company (Castelo Branco & Lima Rodrigues, 2006). On the other hand, the start-up of activities to manage the intangible assets and the formulation of knowledge strategies emerge as a set of major initiatives that must be undertaken to achieve economic, social and environmental goals. This means that the dynamic capabilities CSR and SKM create the values, the philosophy and the necessary foundations for SIC to influence on PFM from a significant point of view.

¹ VAF= (Indirect effect)/(Total effect)

Contributions

This research has theoretical and practical contributions. From a theoretical point of view, firstly, it offers a definition of SIC from the TBL perspective, breaking down SIC into three dimensions (environmental, economic and social intangible capital). This way of defining SIC is novel, because it does not integrate only the green or environmental aspects. Secondly, with this paper we have gone a step further in the relationship between intangibles and performance. Until now, most of the works showed a direct and positive relationship between both variables. However, findings show that the simple possession of intangibles does not guarantee a superior performance. Thus, CSR and SKM capabilities have proven to be especially useful in setting the necessary values and offering the right climate for the company's sustainable intangibles to adequately capitalize its performance. Thirdly, with this work we shed light on a sector in which the literature linking SIC-CSR-SKM-PFM can be described today as scarce.

From a practical point of view, managers should know the three components of SIC, as well as the best way to exploit them, in order that this translates into a greater performance of the hotel or the establishment of competitive advantages from sustainable aspects. For that reason, managers should pay special attention to the creation of a SIC supported by a set of values from CSR and SKM, which provide these intangibles with the necessary infrastructure to positively influence the PFM of the hotels.

Limitations and further research

This research presents a main limitation, which derives from the fact of offering only a vision of the relationship between SIC and PFM from the hotel sector, making the results obtained cannot be generalized to the rest of the sectors of the economy. Therefore, it is our contention that extending our study to firms outside hotel industry could result in new and complementary insights.

References

- Bai, X., & Chang, J. (2015). Corporate social responsibility and firm performance: the mediating role of marketing competence and the moderating role of market environment. *Asia Pacific Journal of Management*, 32(2), 505-530.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.
- Benavides-Velasco, C., Quintana-García, C., & Marchante-Lara, M. (2014). Total quality management, corporate social responsibility and performance in the hotel industry. *International Journal of Hospitality Management*, 41(August), 77-87.
- Bohdanowicz, P., & Zientara, P. (2009). Hotel companies' contribution to improving the quality of life of local communities and the well-being of their employees. *Tourism and Hospitality Research*, 9(2), 147-158.
- Bontis, N., Janošević, S., & Dženopoljac, V. (2015). Intellectual capital in Serbia's hotel industry. *International Journal of Contemporary Hospitality Management*, 27(6), 1365-1384.
- Castelo Branco, M., & Lima Rodrigues, L. (2006). Corporate social responsibility and resource-based perspectives. *Journal of Business Ethics*, 69(3), 111-132.

- Chang, C. H., & Chen, Y. S. (2012). The determinants of green intellectual capital. *Management Decision*, 50(1), 74-94.
- Chin, W.W. (1998). The partial least squares approach to structural equation modelling. *Modern Methods for Business Research*, 295(2), 295-336.
- Chow, W., & Chen, Y. (2012). Corporate sustainable development: testing a new scale based on mainland Chinese context. *Journal of Business Ethics*, 105(4), 519-533.
- Claver-Cortés, E., López-Gamero, M.D., Molina-Azorín, J.F., & Zaragoza-Sáez, P. (2007). Intellectual and environmental capital. *Journal of Intellectual Capital*, 8(1), 171-82.
- Claver-Cortés, E., Zaragoza-Sáez, P., Úbeda-García, M., Marco-Lajara, B., & García-Lillo, F. (2018). Strategic knowledge management in subsidiaries and MNC performance. The role of the relational context. *Journal of Knowledge Management*, 22(5), 1153-1175.
- Collis, D.J., & Montgomery, C.A. (1995). Competing on resources: strategy in the 1990. *Harvard Business Review*, July-August, 118-128.
- Dayan, R., Heisig, P., & Matos, F. (2017). Knowledge management as a factor for the formulation and implementation of organization strategy. *Journal of Knowledge Management*, 21(2), 308-329.
- Delgado-Verde, M., Amores-Salvadó, J., Martín-de Castro, G., & Navas-López, J.E. (2014). Green intellectual capital and environmental product innovation: the mediating role of green social capital. *Knowledge Management Research & Practice*, 12(3), 261-275.
- Engström, T., Westnes, P., & Westnes, F. (2003). Evaluating intellectual capital in the hotel industry. *Journal of Intellectual Capital*, 4(3), 287-303.
- Fornell, C. & Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.
- Garay, L., & Font, X. (2012). Doing good to do well? Corporate social responsibility reasons, practices and impacts in small and medium accommodation enterprises. *International Journal of Hospitality Management*, 31(2), 329-337.
- Gibson, C.B. & Birkinshaw, J. (2004). The antecedents, consequences and mediating role of organizational ambidexterity. *Academy Management Journal*, 47(2), 209-226.
- GRI (2011). *Sustainability Reporting Guidelines*. 3.1 version. Global Reporting Initiative, Amsterdam, The Netherlands.
- Hair, F.Jr, Sarstedt, M., Hopkins, L., & Kuppelwieser, V. (2014). Partial least squares structural equation modeling (PLS-SEM). An emerging tool in business research. *European Business Review*, 26(2), 106-121.
- Hill, S.A., & Birkinshaw, J. (2014). Ambidexterity and survival in corporate venture units. *Journal of Management*, 40(7), 1899-1931.
- Holcomb, J. L., Upchurch, R. S., & Okumus, F. (2007). Corporate social responsibility: what are top hotel companies reporting? *International Journal of Contemporary Hospitality Management*, 19(6), 461-475.
- Hu, L.T., & Bentler, P.M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods*, 3(4), 424.
- Huang, C. L., & Kung, F. H. (2011). Environmental consciousness and intellectual capital management: evidence from Taiwan's manufacturing industry. *Management Decision*, 49(9), 1405-1425.
- Kim, T., Kim, W. Park, S., Lee, G., & Jee, B. (2012). Intellectual capital and business performance: what structural relationships do they have in upper-upscale hotels? *International Journal of Tourism Research*, 14(4), 391-408.
- Kline, R. B. (2011). *Convergence of structural equation modeling and multilevel modeling*. The Sage Handbook of Innovation in Social Research Methods. Chapter 26.

- López-Gamero, M. D., Zaragoza-Sáez, P., Claver-Cortés, E., & Molina-Azorín, J. F. (2011). Sustainable development and intangibles: building sustainable intellectual capital. *Business Strategy and the Environment*, 20(1), 18-37.
- Nemec Rudez, H., & Mihalic, T. (2007). Intellectual capital in the hotel industry: a case study from Slovenia. *International Journal of Hospitality Management*, 6(1), 188-199.
- OMT-Organización Mundial del Turismo (2018). *Panorama OMT del turismo internacional 2017*. UNWTO.
- Paillé, P., Chen, Y., Boiral, O., & Jin, J. (2014). The impact of human resource management on environmental performance: An employee-level study. *Journal of Business Ethics*, 121(3), 451-466.
- Peña, D., Guevara, A., Fraiz, J. A., & Botero, C. M. (2019). Prácticas de responsabilidad social empresarial en el sector hotelero. Estudio de casos en la ciudad de Santa Marta, Colombia. *Cuadernos de Gestión*, 19(1), 175-202.
- Peteraf, M. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14(3), 179-191.
- Renneboog, L., Horst, J., & Zhang, C. (2008). Socially responsible investments: institutional aspects, performance, and investor behaviour. *Journal of Banking and Finance*, 32(9), 1723-1742.
- Rumelt, R. (1984). Towards a strategic theory of the firm", in Lamb, R. (ed.), *Competitive Strategic Management*, Prentice Hall, New Jersey, pp. 556-570.
- Subramaniam, M., & Youndt, MA. (2005). The influence of intellectual capital on the nature of innovative capabilities. *Academy of Management Journal*, 48(3), 450-464.
- Surroca, J., Tribó, J., & Waddock, S. (2010). Corporate responsibility and financial performance: The role of intangible resources. *Strategic Management Journal*, 31(5), 463-490.
- Turker, D. (2009). Measuring corporate social responsibility: A scale development study. *Journal of Business Ethics*, 85(4), 411-427.
- Waddock, S.A., & Graves, S.B. (1997a). The corporate social performance-financial performance link. *Strategic Management Journal*, 18(4), 303-319.
- Waddock, S.A., & Graves, S.B. (1997b). Quality of management and quality of stakeholder relationships: are they synonymous? *Business and Society*, 36(3), 250-279.
- Wright, R. T., Campbell, D. E., Thatcher, J. B., & Roberts, N. H. (2012). Operationalizing Multidimensional Constructs in Structural Equation Modeling: Recommendations for IS Research. *CAIS*, 30(23), 367-412.

Advanced 5G technologies impact on knowledge sharing, knowledge ecosystems related to Multi Business Model Innovation

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Abstract

Integration of advanced 5G technologies in future business models will enable businesses to offer new disruptive, virtual and persuasive business models (BM's) that business community and society have never seen before. With this comes new and disruptive ways to download, see, sense, generate, capture, deliver, receive and share knowledge between BM's, humans and machines. Advanced, changed and new approaches to knowledge sharing in multi Business Model Innovation (MBMI) will hereby be a reality. These approaches to knowledge and knowledge sharing will play important role in future business model ecosystems (BMES) "life" and "sustainability". Future Knowledge based Business Model Ecosystem (KBMES) will enable creation of BM's operating within real time, anywhere, with anybody and with anything. They will be operating proactive and not just reactive – and they will be formed persuasive to knowledge creation, capturing, delivery, receiving and consumption.

The paper investigates some of our first investigations on these 5G knowledge based business models and systems. The paper examine how advanced 5G MBMI technologies will impact knowledge sharing and knowledge generation in multi business model innovation (MBMI) in the future. The paper present a conceptual framework on how to facilitate knowledge sharing in MBMI with advanced 5G technologies for the purpose of "creating, capturing and delivering BM's to KBMES with high quality, effectiveness and efficiency in a time where the "life" of BM's continuously diminishes and demands change in realtime.

Keywords – Multi Business Model Innovation Knowledge Home, 5G, MBM Knowledge sharing, Knowledge based Business Model Ecosystems, Multi Business Model Innovation, Sensing Business Models

Paper type – Academic Research Paper

1 Introduction

One main challenge of 5G and the related digitization of MBMI is modeling BM's related to humans, machines and business partners real time behavior and cognitive processes. Related to MBMI processes - How can humans, machines and BM's behavior and "cognitive processes" be transformed into logical expressions? Logical expressions that can be digitized and automated. There seems hardly any research in this field related to MBMI – but the technology – now 5G, AI, Robotics, Machine learning, Virtual Reality are all offering their capabilities to the Business Model Community.

5G is by many experts claim to be a different technology based business platform and business operating and intending to operate in the future 5G technology based BMES seems to be very optimistic as they invest heavily in 5G. 5G technology is however today still under early testing and businesses are preparing with a mixture of resignation and anticipation – but they seem to be convinced that this revolutionary 5G technology will open new great BM opportunities. The new 5G based BM's are expected to capture value from a widespread adoption of the Internet of Things (IoT).

Future 5G and related technologies will bring a wave of new BM service due to massive digitalization of services in an integrated physical, digital and virtual world. This will require novel Knowledge based BMs (KBM) and new KBMES based on a different Business mindset – pushing Businesses to really think, act and do on behalf of knowledge exchange and sharing in integrated physical, digital and virtual KBMES. Massive numbers of connected devices as seen in figure 1 will provide and demand data that will be transformed to knowledge that humans, machines and businesses can value from.

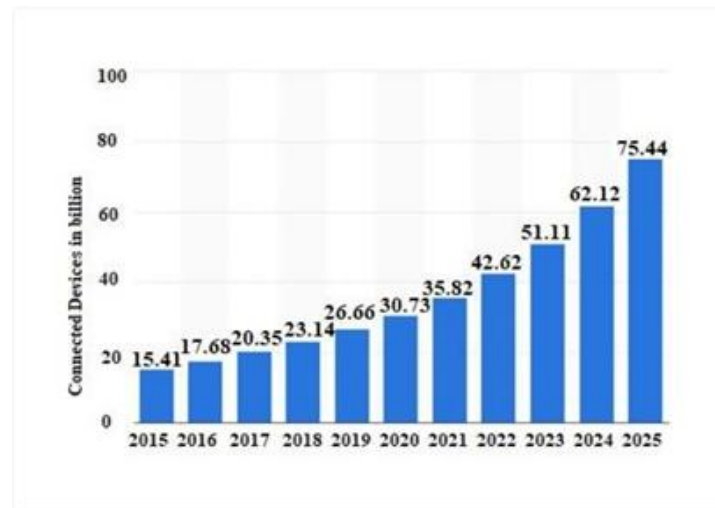


Figure 1. Estimated connected devices in Billion 2015 – 2025 [Tanwer 2018]

5G Digitalization of Multi Business Model Innovation (MBMI) is the enhancement associated with the application of digital technology in all aspects of MBMI, the MBMI Process and the single Business Model's (BM) requirement along its lifetime circle. This

together with big data analytics will affect all areas of a BM's life and lead to new ways of working, communicating, operating, cooperating, collecting and sharing knowledge between BM's, in MBMI processes and Business Model Ecosystem (BMES) (Lindgren 2018).

For the business, it is about gaining business knowledge advantage on behalf of information delivered by digitized BM's, MBMI and BM's operations in the aim of achieving greater efficiency, higher MBMI intelligence, better profit, harvesting other values, gaining agility and not least developing its competences – either it is technologies, Human Resources, Organizational Systems or Culture.

Businesses have always adapted and changed their BM's with the changing times, but with the influx of 5G technologies combined with mobile-, cloud based- and social big data analytics the speed of change will be able to accelerate with a pace at which today's businesses will be highly challenge. They need to evolve their BM's to KBM and they need to change their clockspeed (Fine 1998) to which they innovate, transform, operate, and strategically manage their BM's on behalf of knowledge. So, each business can if they “KNOW HOW” - build its own co-operational and financial arrangements of its BM's to achieve its strategic visions, missions, goals and strategic plans. The aim is to find a way or a model

How to handle MBMI knowledge to value the MBMI process and support the MBMI process in a more advanced way than previously supported by the new 5G advanced sensor technologies and related AI, Machine Learning, libraries of MBM and BM archetypes and Multi Business Model pattern analysis.

2 Design/research methodology.

This paper report on our first findings and preliminary experiment carried out in a cross-interdisciplinary CGC research group. The research is inspired and related to the investigation of a “MBMI knowledge home” [Prasad 2016] and “MBMI brain framework” [Valter 2018] concept that is expected to be able to facilitate advanced MBMI processes, sensing and persuasive business models in a near future.

The research center MBIT/CTIF Global Capsule began in 2007 to explore “knowing” on how a Business Model (BM) look like and is constructed [Amit 2010] [Zott 2011] [Foss 2015][Lindgren 2018]. In 2013 CGC Research center's researcher got th generic BM construction – The Business Model Cube [Lindgren 2018) accepted as a standard under the umbrella of the OMG standardization system and this framework is used to carry out the experiments within 30 established B-labs worldwide.

In 2016 MBIT/CGC began to experiment in the first B-labs with MBMI's technology to support “downloading”, “seeing” and “sensing” capabilities in Technological Business Model Innovation teams. With support of these technologies, MBIT/CGC wanted to come closer to finding out

How a BM really is constructed?

How a BM really look like? Feel? Sound? Smell? and taste? through the “lenses” of Cognitive Automation, intelligence to information and knowledge intensive processes of MBMI.

Further CGC Research group wanted to find out

How would BM’s look like if advanced technologies and related advanced knowledge sharing could support human and machines to “see” and “sense” BM’s and BM’s knowledge?

The prime endeavor of CGC research intended to have a profound MBMI infrastructure and MBMI knowledge home, which uses concurrent and futuristic technologies and concepts to on board and to enhance the seeding, nurturing, flourishing, and reaping stages of MBMIs in businesses and research. The conceptual model as shown in figure 1 consist of four parts, the Human Intermediary; the Machine Intermediary; Business Models Patterns Analysis and the Knowledge based Business Model Ecosystem. Each of the four parts describes separately the proposed MBM archetypes for each part and gives when possible case examples from our case research and database. The intent with this increased conceptual model is to add parts we found important in our further research and provide an overview in combination with knowledge and insight in the possibilities with digitalization of the business model concept. The term BM is used as a digital representative of the BM’s and the conceptual model’s intent in our first experiments to limited to a digital representative version of the BM’s and further businesses that has a Multi Business Model Approach [Lindgren 2018].

3 The Conceptual Model Design of a MBMI Knowledge Home and Brain.

The conceptual model consists of the human intermediary part, which represents all the interaction between the business reality and the BM with any human being. The arrows mark with red in figure 2 shows the possible interactions in the human intermediary BM interaction section.

Human Intermediary Business Model Interaction

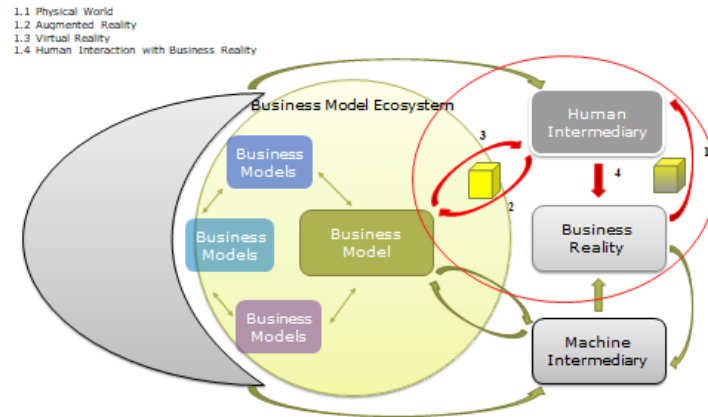


Figure 2.: Human Intermediary Business Model Interaction inspired from [Valter 2018].

Regarding the types of Archetype two and three in the human intermediary business model section, we have shown the interaction archetypes patterns and described these within in an earlier articles [Lindgren 2018]. The human intermediary BM's archetypes are concentrated on the human, as intermediary between the business reality and the BM. The interaction archetypes patterns within the human intermediary business model section displayed are solely concentrated on the interaction archetypes patterns between the human and the BM.

Secondly, the conceptual model consists of the machine intermediary section, which represents the interactions between the business reality and the BM through any machine. The arrows marked with red in figure 3 show the possible interactions

Machine Intermediary Business Model Interaction

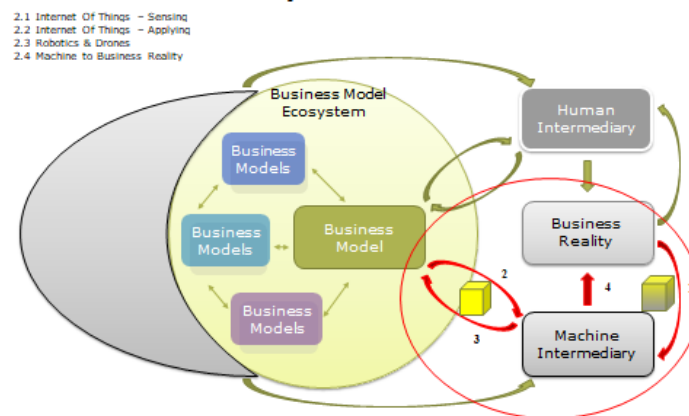


Figure 3.: Machine Intermediary Business Model Interaction inspired from [Valter 2018]

Archetype one and four in the machine intermediary BM's interaction section in figure 3 have the Interaction archetypes patterns described in common in (Valter 2018), while the machine intermediary BM's interaction archetypes are concentrated on the machine as intermediary between the business reality and the business model, the interaction archetypes in the machine intermediary BM interaction section solely concentrated on the interaction archetypes patterns between the machine and the business reality.

Thirdly, the conceptual model consists of the artificial intelligence and deep learning section, which represents the interaction between deep learning patterns analysis, the business model, the human and the machine. Figure 4 show the possible interactions.

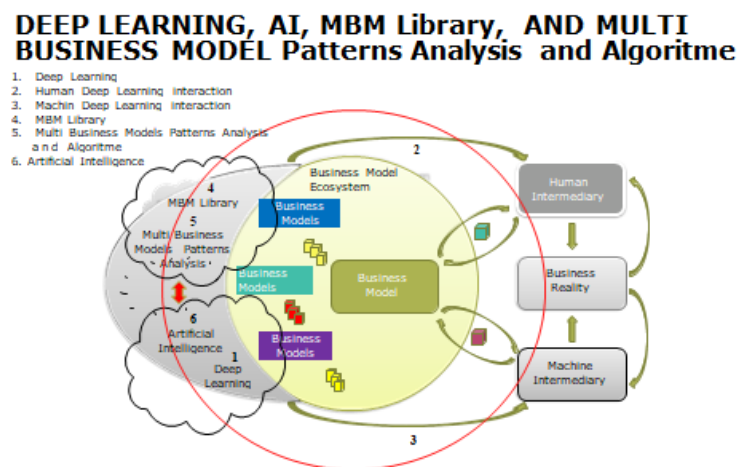


Figure 4.: Business Models Patterns Analysis with Artificial Intelligence and Deep Learning combined with a Multi Business Model Library inspired from [Valter 2018].

Interaction Archetype patterns one, two and three are described in more details in (Valter 2018). In this paper we decide to split up AI and Deep learning and add one more part to the model – a Multi Business Model Library. The Multi Business Model Library consist of all existing known Business model Arche Types and combination of BM's in the business. The Multi Business Model library continuously adapts new types or even archetypes of BM's and combination of BM's – "BM archetype stored in the Knowledge Home or what we call the Business "Multi Business Model Innovation Brain" as we show in figure 5.

Multi Business Model Innovation Brain interaction supported by AI, Deep Learning, Multi Business Model Patterns Analysis and Multi Business Model Library

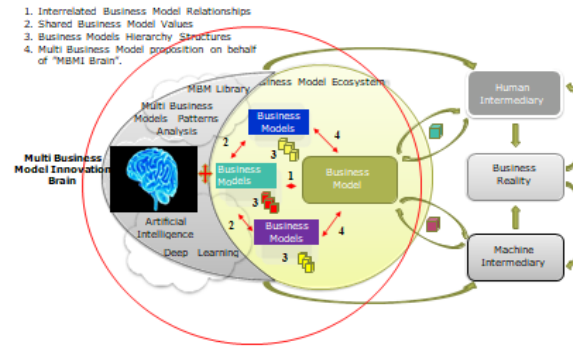


Figure 5. Multi Business Model Innovation Brain Interaction with Human and Machines Lindgren 2019

The BMES interrelated BM interaction with the business Multi Business Model Innovation Brain represents the relationships between the BM's and BMES. BMES Interrelated Archetypes one, two and three are described in table 1.

Table 1.: BMES Interrelated BM Interaction Archetypes inspired from (Valter 2018)

Business Model Ecosystem Interrelated Business Model Interaction Archetypes	Description
<p>Archetype one: Interrelated Business Model Relationships</p>	<p>This is where the relationships between the business models are defined. As a simplified case example, a movie theater's BM and the BM of the parking lot in front of the movie theater are connected since the same customer uses both services and a big change in one of the BM's would affect the other BM, like if the parking fee is raised considerably, the customers would be more likely to find another movie theater.</p>
<p>Archetype two: Shared Business Model Values</p>	<p>This is where the shared BM values are defined. As a simplified case example, if a Business measures the customer satisfactions at one sales locations by having two buttons, one happy smiley and one angry smiley, then this aggregated knowledge over time would potentially be a shared knowledge between multiple BM's, since several BM's could potentially have effect on that value, which would make it a shared value and shared knowledge.</p>
<p>Archetype three: Business Models Hierarchy Structures</p>	<p>This is where the BM's hierarchy structures are defined, where the lowest level is all the businesses and their relationships to fulfill a BM, higher levels consist purely logical grouping of lower levels.</p>

4 Cases on Collaborative knowledge sharing and generation in MBMI

We turn now to unwrapping 4 elected but very actual KBMES in - Smart City, Autonomous Cars, Manufacturing and Health Care KBMES to show how Collaborative

Knowledge sharing and generation in MBMI can take place in a future world with 5 G technologies.

4.1. KBMES Case 1 - 5G Business Models in Smart Cities

5G will serve as the foundation for small-cell networks that will power the next generation of wireless network infrastructure in Smart Cities. 5G will upgrade human experience as it connect virtually everything and anybody at home and in all vertical and horizontal BMES.



Figure 6 5G in Smart Cities Adapted from T-mobile Youtube video [T-mobile]

5G will “power” everything from Smart Grid, utilities to Emergency, Smart Parking, realtime respond to natural floods. The connectivity and computing capacity that 5G enables will make smart cities a reality, as businesses can adopt the new technologies for smart city knowledge solutions. The major impediment to moving the smart city from the theoretical to the practical is the sheer speed and bandwidth to handle the amount of data generated by IoT and process it in to knowledge within real time. If this can be solve then all types of devises will be sending and sharing all types of data and knowledge to each other and to humans and businesses. However this requires a strong high speed relations based “backbone”. As Debra Amidon (Amidon 2008) claimed already in 2008 the real superhighways to “Knowledge Zones” will be extremely important – but the knowledge to where “relations” or as she called it “the superhighways” will be more important. This will be exemplified in everything and will bring us into the next era of the knowledge economy. Knowledge will become the main BM to most Businesses.

The cost savings that 5G knowledge is expected to generate to Smart Cities will be a huge. Smart city solutions applied to the management of vehicle traffic and electrical grids alone could produce \$160 billion in benefits and savings will be gained through reductions in energy usage, less traffic congestion and savings on fuel costs. This means that commute times will lessen, public safety will improve and significant smart grid efficiencies will be realized. For instance, in a smart city with 5G, there are several knowledge layers that can be added to something as simple as a smart streetlight with video cameras or gunshot detection sensor that will give information to public safety officials and machines so that they can respond faster. Video analytics can be quickly assessed and AI can be added on top of that to make the Smart city a safer place to live.

This will trigger much more BM's where income and other values will come from sharing knowledge and direct cost saving.

Millimeter wave 5G zones will emerge into Smart Cities, which will also allow for some new KBM's to be implemented - many of which have to do with public, private and business safety. 5G BM involving robots and drones can help with public safety. First knowledge responders – either machines or humans - can benefit from low-latency 5G video cameras and IOT devices spread around Smart Cities. 5G-connected ambulance can move freely through a Smart City by being connected to a network communicating “backbone” with traffic signals, and can also communicate with doctors at the hospital's trauma center en route. Who will pay for these benefits or values? Maybe not in beforehand but when the coincidence happens then businesses, humans and even machines will be willing to pay to get earlier to value fulfillment. The time perspective of KBM's becomes one of the very important value propositions in the future KBMES of a Smart City and it will not just be about “saving time but paying for time”.

4.2. KBMES Case 2 – 5G Business Models in Autonomous Car

There will be 23 million autonomous vehicles on US roads by 2035. It will represent \$25B decline in the individual insurance premium over the same period – in other words a disruption of the insurance BMES is expected – and not just in US but World Wide. Insurance providers need therefore to find new BM which will force them into KBMES they have not operated in before from 1) insuring against cyber threat, ransomware insurance, hacking insurance, etc. 2) insuring for autonomous vehicle liability from algorithm defect, software bugs, etc. 3) insuring autonomous and V2X infrastructure. According to and inspired by Professor Neeli Prasad ITU, San Jose California [Prasad 2019].

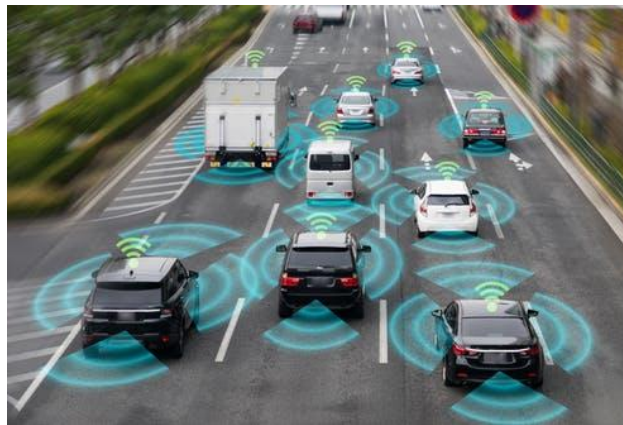


Figure 7.: Autonomous Vehicles adapted from Qualcomm presentation marts 2017

Connected autonomous vehicles require a massive network ecosystem for information and knowledge to flow, be processed and analyzed in only seconds. 5G moves the construction of smart traffic from the theoretical to the practical by underpinned the speed

and data flexibility of 5G. Smart traffic that can completely transform traffic systems and where ride sharing - due to Know How of where the vehicles and the customer are - will replace traditional transportation options. MIT found that New York City traffic could be reduced by 75 percent by ride sharing. Autonomous Vehicles and the algorithms that power them can create new efficiencies throughout all aspects of traffic life." Cost saving and efficiency are the main benefits and profit potentials at first sight – but many more are just ready to evolve. This is where businesses have to dig in – a kind of horizontal diversified Disruptive Multi Business Model Innovation evolution.

5G means also that the use of artificial intelligence to analyze the massive amounts of data being collected in and outside the autonomous vehicles will be possible – but importantly effective and efficient - to capture automatically and further process to useful and attractive knowledge. A number of BM's will be possible to reach out to – some that have never been profitable to invest in before. That can be

- controlling some kind of gate or barriers in the traffic
- controlling the infrastructure of road services
- controlling machines that sweep the roads

As cars become embedded with billions of sensors and become connected the car in itself becomes a browser [Prasad 2019]. This means that if users and customers accept it, there will be large BM potentials to penetrate these browser data inside and around the autonomous cars.

4.3. KBMES Case 3 - Manufacturing Businesses and circular economy 5G BM's

By 2020 IOT experts estimate that there will be 20 billion IOT devices connected world wide (Prasad 2019). In manufacturing BMES this means embedded devices in products, production and along business manufacturing processes. Plastic waste and recycling of plastic will be one BMES area, which will be able to take advantage of this development. Use of plastic in manufacturing businesses and the following waste plastic is a very hot topic to businesses and society today. For plenty of American and European businesses, recycling has been practically second nature. However it's now mandated by law in cities such as New York, San Diego, Pittsburgh, and Seattle, where apartment buildings, office spaces, restaurants must recycle plastics, cans, cardboard and glass. Unless their owners want to face a fine, they have to take care of and document recycling. In future the manufacturers have to help and support in this matter – otherwise they will not be chosen or be able to become/stay as supplier. Herein lay a billion Dollar Business - in a horizontal related KBMES that can provide a secure backbone system to track and trace the plastic, but also find out to sort and identify the different types of plastic. The technological business model innovation (TBMI) challenge would probably demand several knowledge partners to create and capture the BM's.

In European countries, recycling plastic is becoming more and more natural to do and even in cities - where it is not required by law - recycling is becoming mainstream. The challenge though, is that while recycling has become trendy it is also becoming harder to do. Firstly one of the biggest importer of recycled materials, especially for the US, China

stopped accepting most foreign recyclables just recently - as part of an effort to crack down on the China's pollution. As a result of this ban, the global recycling system has been crumbling, and plenty of cities in the US are now struggling to figure out what to do with their recycled goods- hereunder plastic. The global recycle BMES spans the globe and contributes to a \$200 billion BMES – but they are challenge on sorting the different types of plastic and it makes it very difficult to recycle plastic into new plastic that can be re used again. If this BMES could be transformed into a KBMES the potential business of this could be very attractive



Picture 1.: A worker sorts used plastic bottles at a plastics recycling mill in Wuhan of Hubei Province, China, in 2008. Adapted by |Getty Images

Recycling plastics also ensures that this waste doesn't go into landfills or incinerators. Burning plastic can be bad for the environment, because toxic emissions are released into the air in the process. Burning plastic, specifically, is known to release highly toxic compounds, called dioxins. But recycling is also expensive and time-consuming. It requires a tremendous amount of water and energy, in addition to money and effort to build the proper infrastructure. Due to the falling costs of oil prices, virgin plastic is actually cheaper to make than using recycled plastic and materials. Several businesses nevertheless are facing new very strict laws of recycling plastics, which means most manufacturing businesses have to take care and have to know how to recycle plastics used in their products or to protect their products differently by other types of packing material through transportation and handling. If these businesses want to prevent receiving a fine they have to build a KBMES together to document to the authorities, where the plastic is – anytime and anywhere. Herein lays both KBM's to help the manufacturing businesses but also the public businesses that want to track the plastic waste origin and manufacturer.

5G will by establishing these KBMES be able to push the recycling and the circular economy from a linear perspective/practice to a real circular practice by some new KBM's and KBMES. Hereby manufacturer products effectively and efficiently could be tracked to secure and control that they really handle and recycle their products and productions waste. Products impact to environment, humans and nature could hereby be

visualized physically, digitally and virtually in complete new ways. This would open a whole new agenda of knowledge based digitalized circular economy manufacturing– but only if 5G operator can provide reliable, trust full, secure and high capacity 5G networks and systems together with advanced sensor, navigation and communication technology.

4.4. KBMES Case 4 - Healthcare BMES and 5G BM's

Many Health care businesses especially public Hospitals have very large difficulties to run their business especially in these years when more advanced and more expensive health care treatments are turning up. One example is The Region Central Denmark who runs one of Denmarks largest health care businesses spread out on 11 destinations.

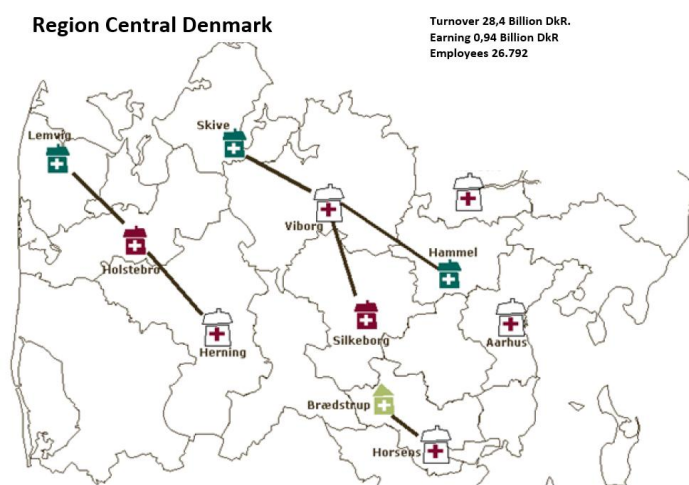


Figure 8.: Region Central Denmark's Health Care Business departments

Region Central Denmark is very interested in investing in 5G technology but finds it very difficult to calculate the business case of implementing 5G technologies. The cost savings that 5G is expected to generate to Health Care businesses and systems according to white paper from Accenture need heavy investment. 5G Health Care solutions applied to the management of Health Care logistics and health care medical consumption could produce billions in benefits and cost savings through increase productivity, better use of expensive health care technology, reductions in energy usage, increase in security of using medicine. However, the investment and documentation of the benefits while operating are much too high to commence this technology investment and innovation process for Region Central Denmark Business. Herein lays large potential of KBM's to those business that can create KBM's that can fulfill these demands. However different KBM typologies have to be created as a classical supplier customer BM would not release the potential. A KBM typology showing continuously the saving of cost and harvesting of other values would be possible solution. Different knowledge partners – including businesses from financial BMES's could release the BM potential.

5 Discussion

Today the MBMI supporting tools and environments for developing new persuasive and virtual BM's are limited and mostly non-digital in nature. The original proposed conceptual model, [Valter 2018] [Lindgren 2019], combined with the case examples in this paper is a first attempt in creating a conceptualized overview of the knowledge, insight and possibilities that lie within the digitalization of the MBMI concept and approach combined with a MBMI Knowledge Home/ Brain. The conceptual model has seven key sections interesting for knowledge society:

1. "Human Intermediary MBM Interaction"
2. "Machine Intermediary MBM Interaction"
3. "BMES Interrelated MBM Interaction"
4. "MBMI's patterns analysis"
5. "Artificial Intelligence"
6. "Deep Learning"
7. "MBM Library"

The "Human Intermediary Business Model Interaction" have four-different archetypes, which are describing the human as intermediary between the business reality and the BM or combination of more BM's.

Secondly, at the Interaction archetypes patterns in relation to the case examples:

1. "The Physical World", human computer interaction case example
2. "Augmented Reality", augmented reality case examples
3. "Virtual Reality", virtual reality case example

which are describing the interaction archetypes patterns between the human and the BM.

At the second section "Machine Intermediary Business Model Interaction", firstly we have the four-different archetypes, which are describing the machine as intermediary between the business reality and the BM. Secondly, we look at the interaction archetypes patterns in relation to the case examples:

1. "Internet of Things Sensing", monitoring case example
2. "Internet of Things Applying", applying case example
3. "Robotics & Drones" autonomous car case example

which are describing the interaction archetypes patterns between the machine and the business reality.

At the third section "Business Models patterns analysis with Artificial Intelligence and Deep Learning", we look at the three interaction archetypes patterns in relation to the case examples:

1. "Artificial Intelligence on Business Models and Ecosystems", cancer classification case example
2. "Artificial Intelligence to Human Intermediary", decision-making support case example [16]
3. "Artificial Intelligence to Machine Intermediary", No cases were found here.

which are describing the interaction archetypes patterns between artificial intelligence and the BM; human intermediary; machine intermediary.

Though, we fully recognize that further research would have the possibility to extent this model with different archetypes of artificial intelligence for MBMI and generation of new archetypes of BM's we already take the opportunity to add a Multi Business Model Library as a kind of "Knowledge Home for different BM's archetypes and constructions learned and adapted from business interaction with BMES's. On behalf of AI, deep learning, Multi Business Model library and Multi Business Model patterns analysis business can commence to build the foundation of a MBMI Brain as shown in figure 5.

Finally, at the last section "BMES Interrelated MBMI", we were currently not able to find any suitable case examples in relation to the BMES interrelated to BM's relationship archetypes:

1. "Interrelated BM Relationships"
2. "Shared BM Values"
3. "BM's Hierarchy Structures"

However, when persuasive and virtual business models grow, this will push the development of AI and Virtual Reality even more, together with the need and possibility to have machines taking over more part of the BM operations and MBMI.

6. Conclusions

Advanced technologies are and will be increasingly integrated in BM's and MBMI in the near future. This will create a new generation of BMs. These BMs can potentially be operated and innovated in different physically, digitally and virtually layers of MBMI and BMES's and will hereby create a completely new knowledge agenda and practice of MBMI interaction on behalf of Knowledge homes for MBMI – A MBMI Brain - with humans, machines and businesses interacting in new and different ways than what we have been able to do and know about until today.

The paper combined a conceptual model for a MBMI Brain with case examples/illustrations to show future MBMI Knowledge operation. The paper describes the conceptual relationships between the humans, machines and BM's and KBMES's embedded and interacting with advanced 5G and other technologies. The paper adds to previous developed research on Multi Business Model Library adapting knowledge from all known Business Model archetypes and learning from new BM archetypes that the business innovate and develop. Hereby it is possible to form the platform of a Multi Business Model Innovation Brain.

Ideally, we would have used concrete papers with MBMI empirical cases implementing each archetype in the proposed conceptual model. However, very early in the literature review it became apparent that such case does not currently exist, furthermore it seems that the current body of MBMI knowledge is very limited in regards of exploring the use of digital technology to support or enhance the MBMI process. Therefore we widened the scope of the literature review to other KBMES, where the use

of the technologies in the conceptual model is more intensely used in the quest to fulfil their goals and then relate that to the conceptual model instead.

Since our research with help of the proposed MBMI conceptual model has identified several key areas where the current conceptual body of the MBMI Brain needs to be extended, we decided to include a separate section for further research. On behalf of this knowledge we added a “MBM library model” to the model along with splitting up AI and Deep Learning.

7. Further Research

In our review of the current MBMI literature and the previous proposed conceptual MBMI Brain framework we found a gap in current body of knowledge, even in the current understanding of the MBMI process. It has not been investigated to its full extent yet. Therefore, we propose a further study, supported by the current technology and MBMI Knowledge, in understanding the MBMI environment and the success factors, before extending the MBMI process with any further digitalization factors. We propose to use the output of the previously suggested study in conjunction with the proposed MBMI Brain model and extend the MBMI process with further digitalization in the areas of interaction archetypes and interaction archetypes patterns as proposed in the the conceptual model. We will further investigate the impact of the exponential growth of these BM’s and advanced MBMI technologies discussed in our future research at the new CGC MBMI and Technology research lab.

References

- Amidon Debra (2008) The Superhighways to Knowledge Zones
- Andersen, G. K., Flarup, J., & Lindgren, P. (2018). *Business Model Innovation Coaching in a three dimensional continuum*. Paper presented at the The 6th Global Wireless Summit (GWS - 2018), Thailand.
- Fine Charles (1998) Clockspeed: Winning Industry Control in the Age of Temporary Advantage Sloan School of Management
- Foss N. J. and T. Saebi, Business Model Innovation: The Organizational Dimension. OUP Oxford, 2015.
- Gassmann O. Karolin Frankenberger, Michaela Csik (2015) The Business Model Navigator 55 Models
- That Will Revolutionise Your Business FT Publishing Financial Times
- Gartner. (2018). Top 10 Strategic Technology Trends for 2018: A Gartner Trend Insight Report. Retrieved from <https://www.gartner.com/doc/3865406/top--strategic-technology-trends>
- Järvia Kati, Argyro Almpantopoulou, Paavo Ritala (2018) Organization of knowledge ecosystems: Prefigurative and partial for <https://doi.org/10.1016/j.respol.2018.05.007> Elsevier
- Lindgren P., “Multi Business Model Innovation in a World of 5G: What Will Persuasive Business Models Look Like in a World of 5G?,” *Wirel. Pers. Commun.*, vol. 88, no. 1, pp. 79– 84, May 2016.
- Lindgren, P. (2018). *The Multi Business Model Innovation Approach: Part 1 The Multi Business*

- Model Approach* (1 ed. Vol. 244). River Publishers Lange Geer 44 2611 PW Delft The Netherlands:
River Publishers.
- Lindgren P., Per Valter and Ramjee Prasad (2019) "Digitizing Human Behavior with wireless sensors in Biogas 2020 Technological Business Model Innovation challenges" *Journal of Personal Wireless Communication* Springer Verlag.
- Lindgren P. (2018) *Advanced Business Model Innovation supported by AI and Deep Learning* *Journal of Wireless Personal Communication* Springer Verlag
- Kumar A. and P. Lindgren, "Perceptive realisation of the hepta-dimensional business modelling framework through ambient environmental attributes for the end-to-end digitilisation," in *2017 Global Wireless Summit (GWS)*, 2017, pp. 225–229.
- Prasad R., "Knowledge home," in *2016 International Conference on Advanced Computer Science and Information Systems (ICACSIS)*, 2016, pp. 33–38.
- Prasad R., "Human Bond Communication," *Wireless. Pers. Communication Springer*
- Prasad R. and L. P. Ligthart, *Towards Future Technologies for Business Ecosystem Innovation*. River Publishers, 2018.
- Prasad Neeli (2019) Presentation at the CGC research workshop at CGC research Lab 5th of April 2019
- Shrivastava, P. *Knowledge Ecology: Knowledge Ecosystems for Business Education and Training*. Retrieved from <http://www.facstaff.bucknell.edu/shrivast/KnowledgeEcology.html>
- Valter P., P. Lindgren, and R. Prasad (2018) "Advanced Business Model Innovation Supported by Artificial Intelligence and Deep Learning," *Wirel. Pers. Commun.*, vol. 100, no. 1, pp. 97–111, May 2018.
- Valter, P., Lindgren, P., and Prasad R. (2018) The consequences of artificial intelligence and deep learning in a world of persuasive business models. *IEEE Aerospace and Electronic Systems Magazine*, 33, 80-88.
- and future research," *IESE Bus. Sch.-Univ. Navar.*, pp. 1–43, 2010.
- Tanweer Alam (2018) *A Reliable Communication Framework and Its Use in Internet of Things (IoT)*
- Taran Y., H. Boer, and P. Lindgren, "A Business Model Innovation Typology," *Decis. Sci.*, vol. 46, no. 2, pp. 301–331, Apr. 2015.
- T-mobile - <https://www.youtube.com/watch?v=sfS253I3GOQ>
- Zott C., R. Amit, and L. Massa, "The business model: Theoretical roots, recent developments.

Innovative Web accessibility instruments as tourism marketing tools: the case of Sila National Park

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Abstract

Today, the evolution of Information and Communications Technologies (ICTs) and the widespread use of mobile devices are pushing tourists to a continuous interaction among themselves and with service providers during every stage of the holiday experience. Therefore, the DMOs – the bodies responsible for tourism development and the tourist companies – must offer through the Web an increasing number of services, even in situ ones. Some of them have the aim of improving destinations' accessibility by means of geolocation marketing strategies.

The aim of our research is to show how the GPS geolocation of points of interest can become an instrument to promote destinations and to enhance their accessibility together with tourists' levels of satisfaction – improving tourist flows in a specific area through structured information.

Keywords – geolocation marketing, web accessibility, Google maps, GPS geo-location, Strava, Wikiloc

Type of paper: Academic research

1 Introduction

Today the Web is one of the most effective means of communication and promotion, and electronic marketing is rapidly transforming the way organizations communicate and operate (Ferrari, 2015). In tourism, customers are increasingly using the Internet for information and support (Buhalis and Law, 2008; Buhalis and O'Connor, 2005; Buhalis et al., 2011; Leung and Law, 2007; Navío-Marco et al., 2018). The Web is no longer merely a tool for promotion and commercial distribution: it is also a way to offer supporting and facilitating services during the trip.

Because of the evolution of Information and Communications Technologies (ICTs), the widespread use of smartphones and other mobile devices, and the increasing offer of Wi-Fi facilities, tourists can interact not only with service infrastructures in the destination but also with other people, obtaining and sharing information during every stage of the holiday experience (Baggio and Scaglione, 2017, 2018a and 2018b). Therefore, the DMOs and the tourist companies must offer through the Web an increasing number of services (Bai, 2015). Some of them have the aim of improving destinations' accessibility by means of geolocation marketing strategies (Florez and Aguilar, 2012; Palos-Sanchez et al., 2018; Salazar, 2005).

The aim of our research is to show how the GPS geolocation of points of interest can become an instrument to promote destinations and to enhance their accessibility, improving tourist flows in a specific area through structured information coming from Google Maps, Google My Business and other interpretive applications.

The object of this analysis is the area called Sila Grande – a part of Sila National Park that is a large mountainous area of Calabria, in Southern Italy. The research aims to understand which are the mountain trails Apps mostly used by tourists and in which ways visitors manage to share the maps created by themselves and the information gathered during the excursions on the trails. The purpose is to understand how tourists use the Apps to share and to get user generated contents and what kind of contents they are interested in. A distinction will therefore be made between purely tourist content (such as photos) and information useful for visitors' safety and security or helpful to improve the management of the park (like, for example, updated in real time situations of the trails, reporting of critical issues, such as landslides, avalanche snow or other types of disaster).

Furthermore, we would like to check whether the presence of the signal and therefore the possibility of using the Apps is a stimulus to visits, favouring tourism development.

The findings of the research could be useful information for park and DMOs managers. They could help to understand if increasing the accessibility of an area in terms of number of traceable and passable tracks and points of interest can enhance a destination's tourism competitiveness. Besides the findings of their research could be a starting point to study users' generated contests and their effects in experiential and marketing terms.

2 Literature review

2.1 Evolution in the tourism sector thanks to ICTs

Nowadays ICTs have substantially changed interpersonal communication also thanks to the spread of mobile devices (Benckendorff et al., 2014; Baggio and Scaglione, 2017; Yoo and Gretzel, 2016; Xiang et al., 2014). In tourism they represent a challenge and an opportunity for enterprises and operators, asking for important innovations in marketing and management systems. In fact, ICTs have totally changed the way in which destinations and firms offer experiences to visitors and consumers enjoy them. Today these experiences are increasingly mediated by ICTs, which have transformed the way

tourists program and live their holidays (Buhalis and Law, 2008; Buhalis and O'Connor, 2005; Buhalis et al., 2011; Frew, 2000; Leung and Law, 2007; Navío-Marco et al., 2018).

Thus, technological innovations had a deep impact in tourism industry in terms of both demand's and offer's transformations, especially regarding the increasing amount of information today available. Information has increased customers' power and independence, reducing contemporary that of enterprises, especially in the distribution sector (Buhalis and Jun, 2011). Moreover, the increasing popularity of social networks, user generated contents, reviews, rating web sites and blogs have enabled consumers to obtain without both costs and efforts a great amount of useful shared information before, during and after the holiday (Buhalis and Law, 2008; Gretzel and Yoo, 2013; Wang et al., 2014; Xiang et al., 2015). The result is that tourists communicate more and more with each other and co-create their own experiences with other tourists and local communities by means of ICTs, becoming out-and-out prosumers (McCabe et al., 2012; Navío-Marco et al., 2018; Tussyadiah and Fesenmaier, 2009; Wang et al., 2012; Yovcheva et al., 2013). During the tourist experience they can access to an increasing number of dynamic information and services (Neuhofer et al., 2015).

2.2 Geolocation marketing strategies

Geolocation marketing is considered part of mobile marketing. The last one is the set of marketing strategies that uses any device or mobile phone network (Florez and Aguilar, 2012; Palos-Sanchez et al., 2018; Ružić et al., 2012; Salazar, 2005). Geolocation marketing is a marketing instrument based on the use of GPS (Global Position System) technologies that puts consumers' geographical location in connection with their behaviour. Companies use this information for promotional purposes. For consumers, on the other hand, geolocation is a social networks' tool to encourage socialization (Palos-Sanchez et al., 2018). In the last decades, the development of geolocation has been strongly promoted by the growing popularity of social networks (Palos-Sanchez et al., 2018). That's how the so-called social geolocation and location-based social networks come up (LBSNs) (Buhalis and Sinarta, 2019; Beltrán, 2011; Zhao et al., 2012). In this case social networks users can check-in in a location and share location-related information (for example photographs, descriptions of places and activities in which they are involved).

Today tourists increasingly use mobile tourism applications (Blaser, 2015) in every different type of destination and during many diversified experience (museums and heritage visits, outdoor recreation and parks visits, trails, etc.). During their trip they need in-destination specific information (Slivar, 2018), whose quality could have important effects on the whole experience. This kind of information is different from the ones collected before the holiday, because they supply tourists with practical information but also tools to immerse themselves in the local atmosphere and in the trip experience. This is possible also because of the connections with local residents and other tourists. During the experience, they need information in three different stages (Klantel et al., 2004): the first one is the orientation phase (visitors acquire familiarity with the destination), the second one is the movement phase (visitors find the right way) and the last one is the

information perception phase (tourists have reached the searched attractions, absorbing information about them). They have numerous both on and offline sources of information. Among the online sources: tourist information and DMOs' web sites, social networks, tourist mobile applications, location-based offers sent to mobile devices by visitors and many others. Inside a natural protected area visitors require a guiding system and in-destination specific information. Today they are normally provided by electronic maps, GPS and multimedia technology. They offer a guide together with a real-time positioning and the possibility to share information and access LBS (Location Based Services) (Meng et al., 2014). Due to the rising use of mobile devices and the lowering number of parks rangers and guides, mobile guides are becoming indispensable for parks managers as tools for monitoring, interpretation and education (Nielsen, 2012).

3 Methodology

Our research consists in collecting tourist check-ins on geolocation Applications (such as Google Maps or specific tracks Apps).

In addition, the study includes in-depth interviews with 15 operators: Park guides (4), tour operators (4), managers of associations operating in the trekking and mountain biking (5), Park staff (2).

Table 1 shows the main subjects of the interviews.

Table 1 Main subjects of the interviews

Q1: What is the main tourists interest when they arrive in Sila Grande?
Q2: Do spending the night-tourists represent a good percentage?
Q3: Are they tourists that usually visit parks?
Q4: Are tourists returning?
Q5: Can tourists explore independently or do they always need guides?
Q6: Are tourists for most Italian ones or foreigners?
Q7: Which one is the longest trail in matter of travelling time?
Q8: Are these tourists interested in geolocation?
Q9: Do they usually download information material on their devices before the arrival (e.g. Trail maps)?
Q10: Then, do they upload data on the web?
Q11: Between mountain bikers and hikers, which one of them is more frequent in this area?
Q12: What kind of service would you offer in these areas?
Q13: Do tourists try to get information about the main attractions even before their arrival? How do they get them?
Q14: Which apps do they use and which sites do they visit?
Q15: How do guides intercept tourists?

The results of the interviews have been elaborated through a content analysis, which permitted to identify two key themes: behaviour during the visit (Theme 1) and use of geolocation Apps, social networks, GPS, electronic maps and similar supports (Theme 2).

In the second part of the research the main Apps and platforms that use GPS for the geolocation of users are analysed. In this research, since the area is in high mountain, the focus is on the collection of data on trails. Therefore the object is the route between the POIs and the not POIs.

The Apps that could be used in the area were scanned. In this study we considered: Wikiloc, Osm and Maps, View Ranger and Strava. These Apps have been chosen on the basis of the interviews results, the study of the literature and our professional experience. Besides, the recordings that are visible on the pages/place of Facebook have been listed in order to get even more general data.

4 Findings

The information collected through the interviews are useful to identify who are the tourists visiting Sila Grande (Theme 1).

In Table 2 you can find the answers to the questions Q1-Q11. The answers to the other questions, that are related to more in-depth issues, are presented later.

Table 2 Respondents' answers

	Q1 ¹	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
R1	trekking	yes	yes	yes	no guide	Italians	9 hours	yes	yes	yes	trekking
R2	trekking	yes	yes	yes	no guide	Italians	8 hours	yes	yes	yes	trekking
R3	info	yes	yes	no	guide	Italians	11 hours	yes	yes	yes	trekking
R4	maps	no	yes	yes	no guide	Italians	107 km	yes	yes	yes	trekking
R5	trekking	yes	no	yes	no guide	Italians	10 hours	yes	yes	yes	trekking
R6	maps	no	yes	yes	no guide	Italians	11 hours	yes	yes	yes	trekking
R7	food	no	yes	yes	no guide	Italians	12 hours	yes	yes	yes	trekking
R8	guide	yes	yes	no	guide	50-50	11 hours	yes	yes	yes	trekking
R9	trekking	yes	yes	yes	guide	Italians	9 hours	yes	yes	yes	trekking
R10	info	yes	yes	yes	no guide	Italians	9 hours	yes	yes	yes	trekking
R11	food	yes	yes	yes	no guide	Italians	11 hours	yes	yes	yes	trekking
R12	maps	no	yes	no	no guide	Italians	10 hours	yes	yes	yes	trekking

¹ Q: question, R: respondent

R13	info	yes	yes	yes	no guide	50-50	70 km	yes	yes	yes	trekking
R14	bikes	yes	no	no	no guide	Italians	105 km	yes	yes	yes	trekking
R15	bikes	yes	yes	yes	no guide	Italians	105 km	yes	yes	yes	trekking

About the question Q1, the interviewees stated that visitors' main interests are: trekking routes ("trekking", 4/15 answers), general information on the place ("info", 3/15 answers), map recovery maps of the place ("maps", 3/15 answers), taste the typical dishes ("food", 2/15), assistance and rental of mountain bikes ("bike" 2/15). Only one of the interviewee out of 15 declared that tourists are looking for an environmental guide ("guide" 1/15).

To Q2, 73.3% of respondents stated that the tourists who stay overnight are in good percentage, considering the proximity to a built-up area with an urban agglomeration that exceeds 100,000 inhabitants. The percentage of tourists who stay overnight is considered quite high (over 30%) by over the 60% of respondents.

To Q3 86.7% of the interviewees stated that they are tourists who regularly visit parks.

To Q4 73.3% of the interviewees replied that they are returning tourists and they often repeat the travel or excursion after a year or more.

To Q5 the respondents answered that in most of the cases tourists do not need to be accompanied by guides ("no guide", 12 / 15 answers).

About tourists' provenance, all the respondents agreed that unfortunately only a minority of tourists are foreigners. An interviewed (R#15) estimated this percentage at 35% all during the year and 50% during summer, that is the peak season in the area. Many people (12 among the interviewees) hope that this segment will grow in the future. Furthermore, the answers to Q6 show that the majority of tourists are Italian (86.7%). To Q7 some failed to quantify a route in terms of time, also because a peculiarity of the place is that the trails intersect each other. From Q8 to Q10 they all responded positively ("yes").

The answers to Q11 underline the fact that trekking is the prevailing interest among hikers. The identikit of the trails visitor is: a trekking expert (as all interviewees said), often a regular visitor (especially if he/she lives in the region) and in some cases he/she is also a biker. However, biking enthusiasts still represent a minority of visitors, as there are no services focused on their needs, an operator (R# 14) explained.

As to the last questions (Q12-Q15), we received different types of answers, suggesting the need to increase the range of services offered in the area to become more competitive. One respondent (R#1) told us that "he would offer mobility services, and therefore transport from the POI to the accommodation." Another (R#10) suggested that "bikers are rising and could reach trekking hikers' segment in the future. Having bike assistance services could be very useful." Furthermore another respondent (R#13) told that "in a territory where mobility is lacking, and sustainable mobility does too, a solution to reach some places could be car sharing." The same interviewed also highlighted that "some tourists also ask to operators or info points for paper maps, perhaps in the event that there are no GPS signals or the phones turn off."

The answer to Q13 by the respondent R#7 was: “Tourists from other regions are more demanding because they know how they should be welcomed. Local tourists are less informed about the territory”.

Regarding the Q15, they told us that guides intercept tourists in different ways, “on the net” (R#13) and “even in other places in Italy where excursions are made” (R#1). In addition R#10 explained that “The social networks are useful to bring together demand and supply, tourists and guides, then there is an interchange of tourists between the various Calabrian parks and in addition there are infopoints where they can be oriented and meet guides.”

In conclusion, the interviews allowed us to know better the tourists’ behaviour during the visits, also with reference to the use of the Apps. It results that Strava is the mostly used App in this area. It turns out to be considered more complete comparing to the others, also because it allows users to upload photos associated with the specific geographical coordinates of a place. Most of the respondents (70%) explained that hikers and bikers use specific Apps. At the beginning of this study we considered also other Apps, such as View Ranger, Osm, Maps Apps and the Facebook local place registration tool. Though, through this work, it was found out that these Apps are more useful for travellers in the broad sense rather than for trekking and biking hikers.

In light of the results of the in-depth interviews, it resulted clear that the two segments of typical users that emerged (trekking and biking lovers) use specific GPS Apps. These Apps – known also as ‘sport trackers’ in jargon – are the most advanced ones in terms of software; they may even link to other tools in order to achieve a better performance. In conclusion, the Apps considered in the analysis were: Strava and Wikiloc and in addition the Facebook local place registration tool. From the answers of the tourist operators it was revealed that only the half of the whole trail network of the Sila National Park (that offers a total of 600 kilometres of trails) is drawn by the two Apps together. Therefore, it is easy to understand that there is still a great work to do in order to increase the accessibility of the area in terms of geolocation.

In the second part of the research, related to the Theme 2, the main Apps and platforms that use GPS for geolocation of users were analysed.

In Table 3 are shown the three main Apps used for the survey (Facebook, Wikiloc and Strava), inserting the POIs deemed most suitable (always through the search on Apps and platforms). The selection and choice of these three Apps was based on the answers to the interviews, as well as on preliminary informal meetings with some stakeholders, which showed how these are the most used by the type of public under consideration in that area.

On the three Apps considered it was noticed that only Lake Cecita, Monte Botte Donato, the refuge of Monte Curcio, Lake Ampollino, the Cupone and Lake Arvo have check-ins on Facebook. Instead, on the other two Apps a considerable number of trails is included. Among those ones that do not have check-ins on Facebook, the following POIs stand out for the high number of trails: Lake Ariamacina, Serra Ripollata, Zarella, Cozzo del Principe, and Monte Volpintesta. These places are the most known and visited by tourists and users of the two Apps. Despite this, it can also be noticed that the POIs that

are not been checked-in on Facebook have trails on the other two Apps. Even though the Cupone is 6th in a ranking for the number of check-ins on Facebook, it owns the 1st place in terms of number of trails, considering only Wikiloc and Strava.

From the data observable in Table 3, more information is perceivable.

The respective positions in the map in Figure 1 are connected to the 18 dots in the table.

Table 3 Recordings in Facebook, Wikiloc and Strava in the area of interest

	POI	FACEBOOK	WIKILOC	STRAVA
1	MOUNTAIN BOTTE DONATO	3732 VISITS	11 TRAILS	24 TRAILS
2	REFUGE MOUNTAIN CURCIO	3642 VISITS	6 TRAILS	7 TRAILS
3	MOUNTAINS OF PORCINA	NOT FOUND	1 TRAIL	0 TRAILS
4	MOUNTAIN SERRA STELLA	NOT FOUND	3 TRAILS	0 TRAILS
5	MOUNTAIN CARLO MAGNO	NOT FOUND	0 TRAILS	0 TRAILS
6	MOUNTAIN TIMPONE BRUNO	NOT FOUND	1 TRAIL	0 TRAILS
7	MOUNTAIN VOLTINTESTA	NOT FOUND	1 TRAIL	4 TRAILS
8	MOUNTAIN PETTINASCURA	NOT FOUND	0 TRAILS	2 TRAILS
9	MOUNTAIN ZIGOMARRO	NOT FOUND	1 TRAIL	0 TRAILS
10	COZZO DEL PRINCIPE	NOT FOUND	2 TRAILS	2 TRAILS
11	SERRA RIPOLLATA	NOT FOUND	5 TRAILS	5 TRAILS
12	CUPONE	1311 VISITS	28 TRAILS	16 TRAILS
13	ZARELLA	NOT FOUND	4 TRAILS	3 TRAILS
14	LAKE CECITA	20.139 VISITS	10 TRAILS	3 TRAILS
15	LAKE ARVO	1.626 VISITS	8 TRAILS	1 TRAIL
16	LAKE AMPOLLINO	12.040 VISITS	13 TRAILS	6 TRAILS
17	LAKE ARIAMACINA	NOT FOUND	11 TRAILS	0 TRAILS
18	MACCHIA FRAGA	NOT FOUND	1 TRAIL	0 TRAILS

Google was used in order to create Figure 1, but two locations were missing: “Serra Stella” (POI 6) and “Macchia Fraga” (POI 18). Serra Stella can be found only through Strava, while Macchia Fraga is a wooden area – which means that Google GPS cannot find or define it – and it can be found only through Wikiloc. On the net, sport track Apps and GPS maps replace real life cartographers.

The POIs reported in all three Apps are six:

- Mountain Botte Donato
- Refuge Mountain Curcio
- Mountain Cupone
- Lake Cecita
- Lake Arvo
- Lake Ampollino

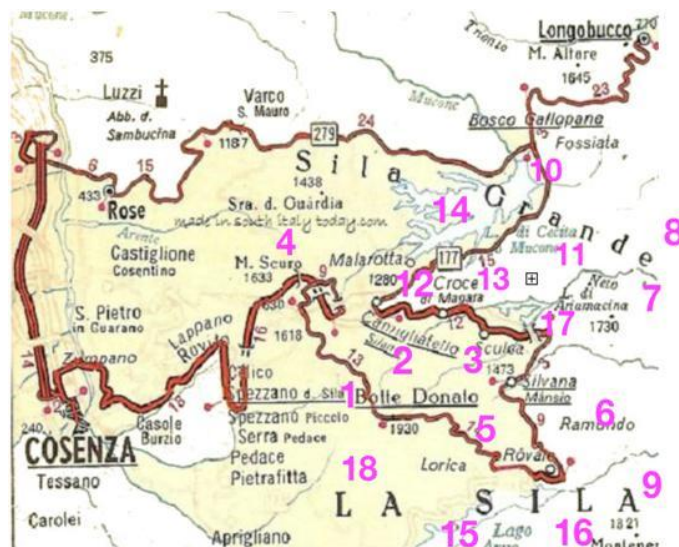


Figure 1 - Map of considered POIs in the Sila Grande

The place where a greater number of check-ins was carried out is Lake Cecita, which is one of the most popular places in the area. It is also where almost all of the main events of Sila Grande take place. The second one is Mountain Botte Donato, which is the highest peak of the Sila (altitude 1928 meters). In third position there is the refuge of Mountain Curcio, associated with a hospitality activity.

Regarding the number of check-ins registered individually by the Apps, Mountain Botte Donato is the first POI on Strava and on Facebook, while as far as Wikiloc is concerned, the primacy is an ex aequo between Mountain Botte Donato and Lake Ariamacina with 11 marked trails.

There are three areas with only one marked trail: Timpone Bruno, Zigomarro and the wood of Macchia Fraga. These ones can't be found even using the Google Maps satellite. Macchia Fraga is a wood, therefore one of those places where the GPS signal can hardly get.

5 Discussion and conclusions

The findings of the research show that the visitors of the area can be divided into two main segments, trekking and biking lovers. Both of them use specific geolocation Apps. The Apps play an important role from a social point of view in order to exchange information and share experiences with other tourists. Of course, they are also very useful to find specific information, also useful real-time news.

The results of the research regarding for example Macchia Fraga POI leads to the conclusion that if a place is not identified by the "Mountain View Giant" (Google), it could be difficult to consider it a tourist resource. In fact it is not accessible to users and travellers and this does not allow a complete trip to be planned. As a consequence we can say that if the GPS systems are not used at their full potential could create information asymmetries. These asymmetries are the opposite of the service that they should perform, that is the mapping an entire area.

An important aspect to consider in evaluating the findings of the research is that Calabria, the region where the research was carried out, has a great gap in terms of infrastructures compared to the rest of Italy and Europe (Ance, 2018; ISTAT, 2011). Therefore, the same research in another area would probably have allowed to verify the use of a greater number of Apps and the identification of a major number of POIs and recorded tracks.

The Apps and platforms that use GPS for user geolocation could represent the future of tourism marketing (Baggio and Scaglione, 2018a). They could become important marketing tools for local firms and destination management organizations. In fact they are only ones that can monitor tourists and track their movements. In addition, visitors can be intercepted during their holidays, offering them services and facilities. There are really interesting scenarios for marketers and enterprises, who could take advantage of these possibilities to propose visitors the most varied range of services in different moments and places.

Furthermore, the most used Apps work also as social networks, where users can exchange information, upload contents and also meet other tourists and enjoy parts of the holiday together. Focusing on the social network aspect, Facebook has been – albeit in a latent manner – the first social media to envelope the possibility of letting others know that a person is in a given place at a specific time. This gives the Internet's user, often subject to the vanity of being able to say "I was there", a tool to witness his/her presence in a place.

But Apps are also tools to improve the accessibility in tourism terms of specific areas and destinations. In fact, in a marketing strategy by creating checkpoints it is possible to trace the position of tourists or users in wild areas, offering services and increasing their safety in case of dangerous situations. This could be a way to monitor visitors, understand the critical points and offer services and support in case of need, for example creating checkpoint totems to contact relief.

References

- Ance (2018) Le infrastrutture per la competitività del Mezzogiorno. Report.
- Baggio, R. and Scaglione, M. (2017) Strategic Visitor Flows (SVF) analysis using mobile data. In Schegg, R. and Stangl, B. (Eds), *Information and Communication Technologies in Tourism 2017* (pp. 145-157). Springer, Cham.
- Baggio, R. and Scaglione, M. (2018a) Destination Attractions System and Strategic Visitor Flows. In *International Conference on Web Engineering* (pp. 227-237). Springer, Cham.
- Baggio, R. and Scaglione, M. (2018b) "Strategic visitor flows and destination management organization", *Information Technology and Tourism*, Vol.18, No.1-4, pp. 29-42.
- Bai, H. (2015) An examination of customers' adoption of restaurant search mobile applications. Doctoral dissertation. Auckland University of Technology.
- Beltrán, L. G. (2011) La geolocalización social como herramienta de innovación empresarial en el desarrollo de los destinos turísticos. Seminario Internacional Renovación y Reestructuración de Destinos Turísticos Consolidados del Litoral. Universidad de Alicante, Instituto Universitario de Investigaciones Turísticas.
- Blaser, M. K. (2015) Opportunities of an Interpretive Application for Self-guided Tourism within the National Park System.
- Buhalis, D. and Jun, S. H. (2011) E-tourism. Contemporary tourism reviews. Retrieved from http://www.goodfellowpublishers.com/free_files/fileEtourism.pdf
- Buhalis, D. and Law, R. (2008) "Progress in information technology and tourism management: 20 years on and 10 years after the internet - the state of eTourism research", *Tourism Management*, Vol.29, No. 4, pp. 609–623.
- Buhalis, D. and O'Connor, P. (2005) "Information communication technology revolutionizing tourism", *Tourism Recreation Research*, Vol. 30, No. 3, pp. 7–16.
- Buhalis, D. and Sinarta, Y. (2019) "Real-time co-creation and nowness service: lessons from tourism and hospitality", *Journal of Travel and Tourism Marketing*, Vol. 36, No. 5, pp. 563-582.
- Buhalis, D., Leung, D. and Law, R. (2011) eTourism: critical information and communication technologies for tourism destinations. *Destination Marketing and Management: Theories and Applications*, pp.205–224.
- Ferrari, S. (2015) Marketing Strategies in the age of Web 3.0, in Issa, T. and Isaías, P. (Eds.) *Artificial Intelligence Technologies and the Evolution of Web 3*. Hershey, Pennsylvania (USA): IGI Global, pp. 292-309.
- Florez, S. Y. V. and Aguilar, L. J. (2012) Tendencias en Geolocalización para el 2012. Madrid.
- Gretzel, U. and Yoo, K. H. (2013) Premises and promises of social media marketing in tourism. *The Routledge handbook of tourism marketing*, pp.491-504.
- ISTAT (2011) Atlante statistico territoriale delle infrastrutture. Report.
- Klante, P., Krösche, J. and Boll, S. (2004) Accessights - a multimodal location-aware mobile tourist information system. In *international conference on computers helping people with special needs(icchp)*, Springer-verlag, Paris, France, pp.187-294
- Leung, R. and Law, R. (2007) Analyzing research collaborations of information technology publications in leading hospitality and tourism journals: 1986–2005. *Information and Communication Technologies in Tourism*, pp.547–556.
- McCabe, S., Sharples, M. and Foster, C. (2012, October) "Stakeholder engagement in the design of scenarios of technology-enhanced tourism services", *Tourism Management Perspectives*, Vol.4, pp.36– 44.

- Meng, D., Xinyuan, H. and Mingsheng, Y. (2014) "Mobile Guiding System for Parks Based on Highly Precision Electronic Map", *International Journal of Multimedia and Ubiquitous Engineering*, Vol.9, No.8, pp. 221-232.
- Navío-Marco, J., Ruiz-Gómez, L. M. and Sevilla-Sevilla, C. (2018) "Progress in information technology and tourism management: 30 years on and 20 years after the internet-Revisiting Buhalis and Law's landmark study about eTourism", *Tourism Management*, Vol. 69, pp.460-470.
- Neuhofer, B., Buhalis, D. and Ladkin, A. (2015) Technology as a catalyst of change: enablers and barriers of the tourist experience and their consequences. In *Information and communication technologies in tourism 2015* (pp. 789-802). Springer, Cham.
- Palos-Sanchez, P., Saura, J. R., Reyes-Menendez, A. and Esquivel, I. V. (2018) "Users acceptance of location-based marketing apps in tourism sector: An exploratory analysis", *Journal of Spatial and Organizational Dynamics*, Vol., No.3, pp.258-270.
- Salazar, N. B. (2005) "Tourism and glocalization "local" tour guiding", *Annals of Tourism Research*, Vol. 32, No.3, pp.628–646.
- Tussyadiah, I. P. and Fesenmaier, D. R. (2009) "Mediating the tourist experiences: Access to places via shared videos", *Annals of Tourism Research*, Vol.36, No.1, pp.24–40.
- Wang, D., Park, S. and Fesenmaier, D. R. (2012) "The role of smartphones in mediating the touristic experience", *Journal of Travel Research*, Vol.51, No.4, pp. 371–387.
- Wang, D., Xiang, Z. and Fesenmaier, D. R. (2014) "Adapting to the mobile world: A model of smartphone use", *Annals of Tourism Research*, Vol.48, pp.11–26.
- Xiang, Z., Wang, D., O'Leary, J. T. and Fesenmaier, D. R. (2015) "Adapting to the internet: trends in travelers' use of the web for trip planning", *Journal of Travel Research*, Vol.54, No.4, pp. 511-527.
- Yoo, K. H. and Gretzel, U. (2016) The role of information and communication technologies (ICTs) in marketing tourism experiences. In *The Handbook of Managing and Marketing Tourism Experiences* (pp. 409-428). Emerald Group Publishing Limited.
- Yovcheva, Z., Buhalis, D. and Gatzidis, C. (2013) Engineering augmented tourism experiences. In L. Cantoni and Z. Xiang (Eds.), *Information and communication technologies in tourism 2012* (pp. 24–35). Springer, Vienna.
- Zhao, L., Lu, Y. and Gupta, S. (2012) "Disclosure intention of location-related information in location-based social network services", *International Journal of Electronic Commerce*, Vol.16, No. 4, pp. 53-90.

A Business Model for Sustainable Tourism Experiences: Evidence from Albergo Diffuso

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Abstract

The rapid evolution of tourist demand pushes the tourism sector to innovate and to meet the requests of the most demanding customers, generating innovative and higher quality services based on authenticity. This is the philosophy of the innovative hospitality system called Albergo Diffuso (AD). The typicality of this new form of hospitality concerns services linked to the authenticity of the territory. This way, tourists, like temporary residents, can fully immerse themselves in the culture of the territory they are visiting. We aim to identify the business model of the AD that has influenced the development of sustainable tourism through the regeneration of historic villages and the recovery of cultural and territorial heritage. We used an exploratory analysis based on a multi-case. We analysed 19 ADs. An open questionnaire was administered to the managers. The questionnaire was then supported by a short interview with the manager. Our results confirm that the Albergo Diffuso is very appreciated by tourists and emphasize how this innovative model is leading a reversal of the current tourism business logics. The results show that the main factor of success is the experience that tourists experience in the territory, understood as a combination of local cultural traditions and knowledge. The key success factors of the operators' business models are the local area, its products and its best quality traditions but these are not sufficient to guarantee the sustainability of the AD model: solid management skills are also required. The ability to retain customers, invest in staff training and extensive communication channels are strategic management tools that companies must use efficiently to achieve success. This study identifies the main characteristics of business model of AD, pointing out how the rediscovery of the territory and its authenticity (socio-cultural and environmental), involvement and relationships with local communities are the key factors for the creation of a competitive advantage. It is critical for decision makers to know how own business is structured and which aspect are more appreciated by customers.

Keywords – Albergo Diffuso, Sustainability, Business Model Innovation, Tourism Experience, authenticity

Paper type – Academic Research Paper

1 Introduction

In recent decades, tourism demand has rapidly evolved into a form of conscious tourism geared towards deepening original values and personalized enjoyment. A generation of tourists has emerged characterized by greater experience, culture and a more lively critical and choice ability. They seek authenticity and perceive holidays as an opportunity to learn and increase their knowledge; they want to immerse themselves in the culture of places. They are always looking for new, original, unique destinations (Silberberg 1995). Finally, this new generation wants to experience together, to create friendship networks, to create bonds and to feel part of a community (Richards 2007). On the path of this change, the introduction of new accommodation formulas seems to be the best reaction to relaunch the tourist offer. In addition to traditional accommodation facilities, in fact, new forms of hospitality are becoming increasingly important, focusing on the revaluation of the territories and the enhancement of typical products. This is the philosophy of the innovative business of the Albergo Diffuso (AD), that is a structure that offers its guests rooms and / or apartments located not in the same building, as in the classic hotels, but in different buildings, within a hamlet.

The AD is proposed as a philosophical approach to authentic experience, to become a quality brand made in Italy, able to:

- launch sustainable development in the area;
- collect the needs of ever-widening market segments, relying on flexible solutions;
- act as a valid instrument for seasonal adjustment of the offer;
- promote each place in a unique and original way.

Authenticity is becoming the keystone of new generation tourism (Salamone, 1997). In the international debate, authenticity means "experience" or tangible "things" (Wang 1999). The AD seems to possess both characteristics of authenticity since it is located in a perfectly preserved hamlet with significant architectural features, the apartments are in historic buildings, and the rooms are furnished taking care to maintain the original historical period unchanged.

Moreover, what distinguishes the Albergo Diffuso from other forms of hospitality is the relational and experiential system, which involves the tourist so much that it becomes a "temporary resident" (Dall'Ara 2010).

Innovation is a crucial moment, which increases competitiveness and allows companies to develop (Williamson 1965). Innovation can concern either a new product or service or a new production system (Porter, 1990; Crossan & Apaydin, 2010).

The AD is innovative with respect to a traditional hotel both in terms of services provided and in terms of organizational system. Respect the first aspect, AD provides an integrated service, in a systemic logic with the surrounding environment. The services are closely linked to the natural, architectural and relational resources present in the area. To the traditional service, connected to hospitality, therefore accommodation, breakfast, specific hotel services, plus the services connected to the historical, artistic aspect of the architectural heritage present in the village. In addition, these are joined by participation in the life of the village and involvement in the traditional activities of the community.

These services are unique and are closely linked to the village that the tourist has chosen to visit. The activities side by side are closely connected with the cultural or naturalistic aspect that the tourist wishes to discover and learn about. Cultural curiosity is the first driver that encourages tourists to book an Albergo Diffuso in a village with specific artistic and architectural features, and the lively community and activities in the village represent the competitive advantage (Porter and Kramer 2007). The other innovative aspect is the organizational system (Senge, 1990). In the Albergo Diffuso the management performs a very complex function, since it does not have to manage only traditional presences and services, but must manage the entire village, in an integrated system. This means that the management must have superior knowledge, relating to the historical and cultural heritage, must be inserted in the community, must have knowledge of the natural and architectural heritage, must motivate the customers, and ensure unforgettable experiences. The management is not the owner of all the apartments, but there may be different owners, therefore it must also be able to manage the offer, guaranteeing the same high quality of services. For this reason, the AD represents an innovation in the tourism sector. Our study therefore focuses on the analysis of the Business Model Innovation (BMI) of the AD, in order to observe its peculiarity. A BM represents a general and holistic understanding of how an organization creates value through its activities and processes, involving several actors in its value chain and creating various interdependencies and dynamics with stakeholders (Massa & Tucci, 2013; Normann & Ramirez, 1992). For an innovative form of hospitality, like the AD, it is interesting to know what are the key success factors.

Thanks to this analysis, we will highlight the peculiarities of the AD and the main factors that generate value for the management but also for the territory. To conduct our research, we adopted a questionnaire as the main tool of analysis, and the following research question have been formulated:

- *R.Q.1: what are the key success factors of AD BMs?*

The paper is structured as follows: the next section illustrates the theoretical background of the AD and the BMI framework. The methodological design is presented in Section 3, while Section 4 offers a reading of the results achieved and the discussion. In the last section, conclusions and future research are presented.

2 Theoretical Background

2.1 Albergo Diffuso origin and current studies

The Albergo Diffuso concept appears for the first time, in Italy, in 1982, within a project planned by Leonardo Zanier, "Comeglians Pilot Project". In the 80s, after the term "Albergo Diffuso" came out, it was followed by other attempts of conversion of buildings, such as in Friuli (Sauri in 1982) and in other parts of the country; in Emilia Romagna, in Cal d'Enza around 1984, and in the small town of Vitulano, in the province of Benevento in 1987.

In these first attempts to create "Albergo Diffuso" model, the main objective was to use empty buildings and abandoned houses, to animate small village and to enhance artistic and significant sites with innovative marketing logic oriented to the experience, closely linked to the land (Dall'Ara, 2010). Only in the last 10-15 years, we can see the results and the effect, of this new model of hospitality, on the territory. The interest in the AD of many scholars of various disciplines has increased. At the beginning scholars were focused on the aspects and conditions for creating AD and its regulation (Droli 2013, Dall'Ara e Morandi, 2010; Paniccchia 2012). Later some studies focused on sustainability aspects, showing how AD can be considered a new sustainability-oriented hospitality model (Paniccchia and Leoni, 2017; Vallone, Orlandini and Cecchetti, 2013; Romolini, Fissi & Gori, 2017; Cucaria, Wankowicz, & De Falco 2019). Other contributions focused on a new model of competitiveness (Monge, Cattaneo, and Scilla 2015; Giampiccoli, Melville Saayman & Sean Jugmohan 2016). Others scholars began to see AD as a new model to preserve the traditional heritage (Silvestrelli, 2011; Vallone and Veglio 2018).

2.2 The AD Business Model Innovation

A business model is a conceptual tool to help understand how a firm does business and can be used for analysis, comparison and performance assessment, management, communication, and innovation (Zott et al, 2011; Osterwalder and Pigneur, 2005). Business models are interested in how the firm defines its competitive strategy by designing the product or service it offers to its market; how to pay for it, how much it costs to produce; how it differs from other competitor by the value proposition, and how the firm integrates its value chain with that of another firm in a network of values (Rasmussen, 2007). The quality of management is key because they determine the success of the business model through their capabilities, ability to acquire, combine and utilise valuable resources in ways that deliver a value proposition to customers.

Literature presents various perspectives on the business model. For some scholars business models are used to describe holistically "how a firm does business" (Zott and Amit, 2010; Beattie and Smith 2013). For others, the model explains how the firm will convert resources and capacity into economic value. (Teece, 2010). More specifically, Osterwalder and Pigneur, (2010) describe a business model as a series of elements: the value proposition (offering of products / services, customer segments, customer relations), activities, resources, partners, distribution channels (eg creation and delivery of value) and cost structure and income model (ie acquisition of value). Richardson (2008) proposes a consolidated view of the components of a business model such as: the value proposition (ie the offer and the target customer segment), the value creation and delivery system and the acquisition of the system value. Zott and Amit (2010) take an activity-based perspective, including the selection of activities ("what"), the structure of the activity system ("how") and who carries out the activities ("who").

The BM could be an important and additional tool of analysis in the tourism issue. (Hjalager & Madsen 2018). Studying the Ad business model means understanding which are the key factors, the decisive partners, which are its competitors; how it generates

value for the territory; which are the most relevant services, most sought after by customers; how important knowledge of places is; how important activities related to experience are. How it generates value.

This information can be used by management to better define its value proposition and better understand its potential and what are the limits of this new activity.

To be more precise, the value generation mainly occurs in a value network, which includes suppliers, partners, distribution channels and coalitions that extend the company's resources. In a BM there is a so-called "focal" organisation that manages value-added relations with a plethora of actors, who become strategic in the dynamic and interdependent process of value creation for the whole community. The collaboration between firms and other key stakeholders is very important and "value is no longer created by firms acting autonomously, but by firms acting together with parties external to the firm through informal arrangements or formal alliances" (Bocken, et al, 2014).

3 Methodology

The research focuses on AD located in Italy. Italy is a regionally administered country, with a general national legislative corpus for hotels, but in which each region decides to what extent the general criteria stated in national laws should apply to local needs in term of classification of hotel and characteristics of AD. In order to analyse the features of AD business model, a questionnaire-based survey was conducted among a sample of 19 AD businesses located in Italy. The sampling list was drawn from the National Association Alberghi Diffusi. In detail, the initial sample of 56 AD represented the whole universe and the questionnaire was sent by e-mail to all the accommodation facilities. A description of the research aims, a compilation guide and a link to an online questionnaire were sent to all the respondents. The compilation period was about 1 month, with several requests made by telephone in order to solicit the answers. The final sample was composed of 19 agritourism businesses, which corresponded to a response rate of 33%; this compares favourably with rates reported in previous online surveys among tourism and hospitality operators. The questionnaire included questions in the following areas of research: company profile, key financial data, type of services offered, type of customers, involvement of family/external managers, and key activities. Answers included both opened and closed questions, as well as a ten-point Likert scale. In addition, free spaces were given to the operators to write any additional comments about their experience with AD.

3.1 Sample

The sample is composed of 19 predominantly "young" AD, as they are mainly managed by the first generation of owners. These are companies average present on market by 8 years. Normally, the owner and the manager of the accommodation structure is the same. They are predominantly women, with degree and an age between 45 and 55. Also their role in AD was investigated, and the results are shown in Table 1.

Table 1. Role covered in AD.

Role Covered	Percentage
Management and coordination activities	11%
Operating activities	11%
Both	78%
Total	100%

The number of employees is on average between 6 and 10, although 35% of the sample has a number of employees between 1 and 5. The number of employees has remained unchanged over the last three years.

4 Results and Discussion

In order to answer the R.Q *what are the key success factors of AD BMs?*, we used the questionnaire responses and depicted the 9 key success factors identified by Osterwalder and by Osterwalder and Pigneur.

4.1 Key Activities

In order to identify the architecture of the companies and their network of partners (process management and key value drivers), we have compiled a list of activities that are carried out by the AD and we have asked to express an opinion in terms of key factor.

Table 2. Main AD activities and ranking.

Main AD Activities	Evaluation	Ranking
Relationship with the territory	7,67	1
Tradition and characteristics of territory	7,67	1
Service customization	7,33	2
Being an integral part of a historic village	7,00	3
Excursions and nature trails	6,83	4
Promotion	6,67	5
Human resources training	6,50	6
Target of customer	6,33	7
Denomination AD	6,17	8
Organization of guided tours	5,50	9
The diversification of the offer	4,83	10
The offer of complementary services	4,50	11
Cost leadership	4,33	12
The sale of agricultural products of the territory	3,60	13
Educational activities and learning workshops	3,17	14

Analysing this table, it emerges that the activities known as key success factors and considered as particularly relevant for the value creation, are represented by:

- the strong relationship with the territory and the natural environment, also highlighted by the offering of excursions and nature trails, discovering of history of the village and tradition;
- the ability to customize the service offered.

4.2 Partner Network

At the moment, the sample declared not to have key supplier partners; some AD are beginning to tighten collaborations regarding territorial revaluation projects with local institution (museum, etc).

4.3 Key Resources

The resources considered strategic by the respondents in order to run the AD are represented by the cultural and territory heritage and the human and financial resources to support the investments required to conserve the authenticity of the place.

A total of respondents declared that the manager's knowledge and the safeguard of the cultural heritage of village, carrying on the traditions, are the peculiarities that can make the difference in the business of the ADs.

From a financial point of view, it emerges a considerable involvement of the owners, indeed the key financial resources are mainly represented by financing of the owners, followed by the bank loans. Only 2% declared the use public sources and European fund.

4.4 Cost and Revenue Structure

Analysing the cost composition it emerged how the cost structure is represented mainly by the cost of personnel, the raw materials, the cleaning, energy and tax.

The percentage of annual average costs is between 50% and 70% of the company's turnover.

From the revenue point of view, the average turnover of the last three years (2016–2018) lower than 200,000 euros. Only 2% of the sample declared a turnover higher than 300,000 euros. This result confirms the limited development of AD in terms of revenues flows.

4.5 Value Proposition

We also investigated the perceived needs and the features behind the customer behaviour choice.

In particularly, it emerges that the elements perceived as the most important to address customer's behaviour are the maintain of an high and constant quality of service, the enhancing of the territory and the compliance with quality and certification standards.

4.6 Client Segments

To identify the customer composition we firstly distinguished three clusters by age: the first one is represented by young (18–35 years) customers; the second one by families (with parents and children) and the third one by customers over 65.

Analysing the customer composition, it emerges that the sample works with 27% of young customers, with 56% of families and with 17% of customers over 65 years. The foreign customers account for the 62% of the total. This highlights how the AD is particularly appreciated by foreigners who have the desire to immerse themselves in the Italian tradition and life style.

4.7 Client Relationships

The perception of the importance of maintaining and improving relations with customers was also investigated. The total of the sample declared they invested in activities to increase customer loyalty.

Discounts, compliments and promotional activities are some of the most used tool to maintain and improve customer loyalty. The capability to improve customer loyalty can, as well as communicating value and raising awareness for the safeguard of the environment, increase the well-being, not only of the AD owner, but also of the local community.

4.8 Distribution Channels

With distribution channels we point out the instruments used to communicate with customers.

The web site and social network are the digital communication channels used by the total of the sample. Some ADs have developed App.

5 Conclusions

From this first analysis, the business model seems to give some interesting information on this innovative form of hospitality. In fact, there are great differences with traditional models and innovative key factors. For the AD, the key factor for success is the link with the territory, being an integral part of a historic village.

This model in fact is perceived as the prerogative of a particular market segment for new tourists that are looking for innovation, innovative vacations that are also expressed in the choice of non-traditional accommodation but original and sustainable.

We examine the AD business model, focusing on the characteristics to be attractive and on the reasons that push tourists to choose it as a destination for their holidays.

Moreover, the internal employees are recognized as key partners and key resources; they support the core business and the key activities.

Another key factor is represented by the financing sources, mainly characterized by the owner's investments, showing the will to strengthen the economic development and support the durability of the business.

To improve value proposition, some actions of increasing the service offer have been implemented, generating customer satisfaction and enhancing the relationship with the territory and the community.

Finally, the ADs are aware of their customer segmentation, showing a prevalence of foreign clients.

Practical implications could be addressed to implement adequate policies for the development of AD as an instrument for the sustainability of the rural community. In fact the AD can change the economic development of a land. It can be seen as a model for preventing the depopulation of rural settings and for recovering abandoned villages.

This study could be very interesting for management to understand its potentiality and to be more attractive and competitive.

From the theoretical point of view, this study contributes to the national and international debate on peculiarities of AD.

References

- Abbate, T., Presenza, A., and Viassone, M., (2017) The development of sustainable tourism through market-based sources of innovation in the "albergo diffuso". *Mercati & Competitività*. Vol. 3, 41-60.
- Beattie, V., Smith S., (2013), Value creation and business models: refocusing the intellectual capital debate, *The British Accounting Review*, 45, (4), 243-254.
- Bocken, N.M.P.; Short, S.W.; Rana, P.; Evans, S. (2014), A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, 65, 42–56.
- Crossan M.M., e Apaydin M., (2010), A multi-dimensional frame work of organizational innovation: a systematic review of the literature. *Journal of Management Studies*, 47, pp. 1154-1191.
- Cucaria, N., Wankowiczb, E. Esposito De Falco S., (2019) Rural tourism and Albergo Diffuso: A case study for sustainable land-use Planning. *Land Use Policy*. Vol. 82, pp. 105–119
- Dall'Ara, G., (2010) Manuale dell'albergo diffuso. L'idea, la gestione, il marketing dell'ospitalità diffusa: L'idea, la gestione, il marketing dell'ospitalità diffusa. FrancoAngeli.
- Droli, M., 2013. Il management delle opportunità imprenditoriali "a chilometro-zero": buone prassi per l'innovazione d'impresa nell'Albergo Diffuso. In XXV Convegno Annuale Di Sinergie L'innovazione per La Competitività Delle Imprese, pp. 97–112.
- Giampiccoli A., Melville Saayman & Sean Jugmohan, 2016, Are 'Albergo Diffuso' and community-based tourism the answers to community development in South Africa? *Development Southern Africa*, 33 (2016), pp. 548-561.
- Hjalager, A. M., & Madsen, E. L. (2018). Business Model Innovation in Tourism: Opportunities and Challenges. *The SAGE Handbook of Tourism Management*, 373.
- Massa, L.; Tucci, C.L. (2013), Business Model Innovation. In *The Oxford Handbook of Innovation Management*; Oxford University Press: New York, NY, USA,; pp. 420–441.
- Monge f., Cattaneo D., Scilla A., 2015, The widespread hotel: new hotel model for business tourist, *Journal of investment and management*, 4 (2015), pp. 69-76.
- Normann, R.; Ramirez, R. (1992), From value chain to value constellation: Designing interactive strategy. *Harvard Business Review*, 71, 65–77.
- Osterwalder, A., Pigneur, Y., (2005), Clarifying business models: origins, Present, and future of the concept. In *Communications of the Association for Information Systems*, 15 (May)
- Osterwalder, A. and Pigneur, Y., (2010) *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. New Jersey, Wiley.

- Paniccia, P., 2012. Nuovi fermenti di sviluppo sostenibile nel turismo: l'esempio dell'"albergo diffuso". Tra borghi storici, residenze d'epoca e antichi casali rurali. *ImpresaProgetto Electron. J. Manag.* 1, 1–26.
- Paniccia, P., Leoni, L., (2017), Co-evolution in tourism: the case of Albergo Diffuso. *Current Issues in Tourism*, 0, 1–28.
- Porter M., (1990), *The competitive advantage of nations*. London, England: Mcmillan.
- Porter M.E. e Kramer M.R. 2007, *Strategia e società*. "Il punto di incontro tra il vantaggio competitivo e la corporate social responsibility", in *Harward Business Review Italia*, n. 1, Vol. 2.
- Rasmussen B., (2007), *Business Models and the Theory of the Firm*, Working Paper, Victoria University of Technology, Melbourne, Australia .
- Richardson J., (2008), The business model: an integrative framework for strategy execution, *Strategic Change*, 17 (5–6) (2008), pp. 133-144.
- Richards G. (2007) "Introduction: Global Trends in Cultural Tourism", in Richards G. (edited by) *Cultural Tourism. Global and Local Perspective*, The Haworth Press, New York, pp. 1-24.
- Rickly-Boyd, J. M. (2012). Through the magic of authentic reproduction: Tourists' perceptions of authenticity in a pioneer village. In *Journal of Heritage Tourism*, 7(2), 127-144.
- Romolini, A., Fissi, S., Gori, E., 2017. Integrating territory regeneration, culture and sustainable tourism. The Italian albergo diffuso model of hospitality. *Tourism Management Perspective*. (22), 67–72.
- Salamone, F.A. (1997). Authenticity in Tourism: The San Angel Inns. In *Annals of Tourism Research*, 24, 305-321.
- Senge P., 1990, *The fifth discipline. The art and practice of the learning organization*, Doubleday Dell Publishing Group, Inc.
- Silberberg T. (1995) Cultural tourism and business opportunities for museums and heritage sites, in "Tourism Management", 16, pp. 361-365.
- Silvestrelli P., 2011, Valorizzazione del patrimonio culturale e sviluppo dell'Albergo diffuso": interdipendenze e sinergie, *Il Capitale culturale*, 2, 253-274.
- Sheehan, L., and Presenza, A., (2012) Albergo Diffuso": "A Sustainable Tourism Innovation or Niche Accommodation?". In *International Forum on Knowledge Asset Dynamics*.
- Teece D., (2010), *Business Models, Business Strategy and Innovation, Long Range Planning*, 43 (2–3), pp. 172-194
- Vallone, C., Orlandini, P., Cecchetti, R., 2013. Sustainability and innovation in tourism services: The Albergo Diffuso case study. *Eurasian Journal of Social Science* 1(2), 21–34.
- Vallone C., Veglio V., (2019), Albergo Diffuso and Customers Perception. What Makes the Difference in terms of services excellence? *Tourism Analysis*, summer, Vol. 4.
- Wang N., 1999, Rethinking authenticity in tourism experience, *Annals of Tourism Research*, Vol. 26, n.2, pp. 349-370.
- Williamson O.E., 1965, Innovation and market structure, *Journal of Political Economy*, Vol. 73 n. 1, pp. 67-73
- Zott, C., Amit, R., and Massa, L., (2011) The Business Model: Theoretical Roots, Recent Development, and Future Research. *Journal of Management*, 37(4), 1019-1042.
- Zott, C., Amit R., (2010), Business model design: an activity system perspective *Long Range Planning*, 43 (2/3) , pp. 216-226

Factors Influencing the Creative Process in Culinary Innovations: a Comparison between Starred-Chefs and Chefs in Training

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Abstract

The paper intends to examine factors that mainly influence the creative process of celebrity chefs and culinary students. By using primary data obtained through an ad-hoc survey built by reviewing prominent literature focused on creativity and innovation in the haute cuisine context, we performed a discriminant analysis to compare the two different groups. Findings provide a better understanding of the origins and the main factors that drive creativity in haute cuisine. Outcomes of this study highlight the main differences that separate chefs in training from top chefs in terms of their creativity. Theoretical implications contribute to shed light on how creativity is influenced by both individual features and environmental/social components. Practical implications suggest which set of managerial capabilities chefs in training and, in turn, professional high schools of cooking have to develop in order to stimulate and sustain creativity in their educational programs. The study contributes to the academic debate on creativity and innovation in haute cuisine context, by suggesting key factors that effectively stimulate actions and behaviours leading to a continuous flow of novel and useful ideas.

Keywords – chef, haute cuisine, culinary innovation, creativity, cooking skills, students.

Paper type – Academic Research Paper

1 Introduction

Managing creativity to generate, develop and improve innovation is the key managerial challenge in today's economy and a critical determinant of firms' success and long-term survival (Anderson et al., 2014). Firms are forced to be creative and to introduce innovative products/solutions to ensure sustained competitive advantage (Lampel et al., 2000). Studies argue that creative ideas are effectively precursors of innovation (e.g., George, 2007). Creativity is variously influenced by three within-individual components: domain-relevant skills, creativity-relevant processes and task motivation (Amabile, 1988). Individuals are mostly creative when they feel motivated by passion, enjoyment, satisfaction, and challenge of the work (Amabile, 1988). Although individual creativity is the most relevant element for innovation activities, creativity may be seen as a particular confluence of a variety of components, so that is highest when an "intrinsically motivated person with high domain expertise and high skill in creative thinking works in an environment in supports for creativity" (Amabile, 2012, p. 3). However, the surrounding environment – i.e., the work or social environment – represents a component outside the individual that can be conceived as obstacle or stimulus to creativity (Amabile, 2012). Thus, it results relevant to understand how environmental conditions interact with individual characteristics to foster (or to discourage) creativity.

To deepen knowledge on creativity and innovation, the haute cuisine context is here investigated. In this context, creativity and innovation play a critical role due the reason that chefs are under pressure to generate original dishes, menus and proposals for customers seeking extraordinary gastronomic experiences. The haute cuisine is also characterized by increasing competitiveness (Stierand and Dörfler, 2012; Svejenova et al., 2010; Albors-Garrigos et al., 2013). Additionally, innovation has been identified as a significant impulse that can allow the development of an inimitable competitive advantage for chefs (Presenza et al., 2017). In effect, haute cuisine chefs can be observed as the benchmark for other sectors of activity. They are described as being "extraordinary chefs" (Stierand and Lynch, 2008), since they image and develop new ideas and/or combinations of existing ingredients, design and apply new processes, develop culinary scientific approaches, exploit talent and experiment continuously (Harrington and Ottenbacher, 2013; Messeni Petruzzelli and Savino, 2014; Vargas-Sanchez and López-Guzman, 2015; Presenza et al., 2017).

Such considerations imply that most of the success of haute cuisine restaurants is strongly linked to the chefs' creativity, by recognizing that heterogeneous components – both within and outside the individual – have an impact on their creative processes (Svejenova et al., 2010). However, there is considerable controversy surrounding the factors of creativity and innovation in haute cuisine context. It follows that a better understanding of those factors is strongly required.

The paper seeks to understand those factors that influence the creativity performance of top chefs, by investigating both within-individual components and social/environmental components. It performs a comparison between starred chefs and chef in training. Indeed, while the former have already gained success due to their ability

to be creative and innovative, the latter lack experience and are not subject to the pressures arising from a real work context. In turn, a comparison between the former and the latter allow to isolate factors related to experience and external conditions from factors related to chefs' personal characteristics.

The empirical analysis is based on a quantitative analysis. One hundred thirty-two questionnaires have been collected from Italian Michelin Stars Chefs and the same number of students attending professional high schools of cooking. Findings highlight the main factors and the origins of creativity in haute cuisine and emphasize the differences that separate chefs in training to top chefs.

The remaining of the paper is organized as follows. In Section 2, we review the relevant literature on creativity and innovation in the haute cuisine. In section 3, we describe the research methodology, by presenting the context of the study. In Section 4, we advance the key findings. Finally, in Section 5, we discuss the study and outline theoretical and managerial implications, by suggesting research avenues.

2 Literature review

Creativity is observed as a foundation of value creation in organizations (Amabile et al., 1996). Studies focused on the creativity concept argue that creative ideas are precursors of innovation (e.g., George, 2007). Creativity has been conceptualized as the generation of ideas that the socio-cultural environment judges as both useful and novel (Amabile et al., 1996, p. 1155). Differently, originality of ideas is judged on how extreme and unrealistic ideas are effectively perceived and whether they came at the right or wrong time (Amabile, 1996). In this respect, "new useless ideas and old useful ideas are not creative" (Bouty and Gomez, 2013, p. 5). Creativity can occur at different stages of innovation activities and with regard to a large variety of topics, from products and services, to processes, structures, work tools, and social progress (George, 2007). The creativity is influenced by three within-individual components: (i) domain-relevant skills (i.e., expertise, knowledge, technical skills, intelligence, etc.), (ii) creativity-relevant processes (i.e., cognitive style, personality process characteristics that are conducive to novel thinking, risk-taking, and taking new perspectives on problems), and (iii) task motivation (i.e., intrinsic motivation to engage in the activity out of passion, personal sense of challenge, enjoyment) (Amabile, 1996). Individuals are most creative when they feel motivated mainly by the passion, interest, enjoyment, satisfaction, and challenge of the work (Amabile, 1988). However, creativity needs of a necessary confluence of all components and, in particular, should be highest when an intrinsically motivated person with high domain expertise and high skill in creative thinking works in an environment high in supports for creativity (Amabile, 2012). In fact, while individual creativity is the most relevant element for organizational innovation, "it is not, by itself sufficient" (Amabile, 1988, p. 125). Beyond the individual components, the surrounding environment, generally work or social environment, represents a component outside the individual that can be observed as obstacles or as stimulants to creativity (Amabile, 2012). Thus, the outside component contemplates all of the extrinsic motivators and

factors that have been revealed to undermine or foster intrinsic motivation. For example, factors are the following: sense of positive challenge at work, top-management support to innovation processes, mechanisms for developing new ideas/solutions, mechanisms of sharing ideas and knowledge across organizational functions, etc. Research has distinguished two generic types of creativity: the everyday creativity inherent to the average person (Richards, 2007), and the creative genius linked to talents in certain fields (Simonton, 1997). In this perspective, haute cuisine is an example of creative and cultural industries where creative production plays a key role for firms' competitive advantage (Svejenova et al., 2010; Messeni Petruzzelli and Savino, 2015). In 2010, United Nations Educational, Scientific Cultural Organization (UNESCO) formally acknowledged haute cuisine as part of the creative and cultural industries by adding the French gastronomic meal to its "Representative List of the Intangible Cultural Heritage of Humanity" (UNESCO, 2010). In haute cuisine, the necessity of linking creativity, innovation and competitive advantage is becoming more relevant because creativity is strongly observed as determinant to develop appropriate and desirable products and obtain the highest levels of distinction. Lampel et al. (2000) assert that creativity in gastronomy can be used to introduce novelty for product differentiation and/or to develop a market innovation that may defy current norms and practices. New dishes and menu proposals are the concrete result of novel, original and atypical combinations, where old ingredients and innovative or familiar methods/techniques are expertly mixed in order to generate new proposals and unusual recipes that are constantly changing, and require working very long, intuitively and often anti-social hours (Capdevila et al., 2015). The creativity is primarily the result of hard work and study related to materials, tools, and techniques. The peculiarity is substituting, combining, adapting, rearranging and modifying ingredients of a dish and typically cooking several versions of it (Svejenova et al., 2010). Creativity in haute cuisine is extremely iterative and fluid. It requires efforts to screen, test, and validate activities and processes. The screening activity consists of the selection of criteria, such as product quality, seasonality, fit with the personal style of cooking, costs, pricing strategy, balance of the dish itself and fit with the rest of the menu, maintenance of standards, etc. Finally, testing, experimentation and validation are iterative activities that result in accumulating knowledge and determine the value based on customer acceptance. Several factors can influence the process of nurturing creativity in the haute cuisine context. Certain of these factors are directly connected to the chef, while others are related to the ecosystem in which the chef exists (Ottenbacher and Harrington, 2007; Pedersen, 2012; Vargas-Sanchez and López-Guzman, 2015). Chefs make use of personal experience, methods and techniques, as well as competences and capabilities to generate the idea for a new dish in their mind and utilize tacit knowledge to produce it. The development of new dishes, recipes and menus requires intuitive thinking, technical knowledge, cooking techniques, going beyond the rules and accepted processes, experimenting and searching for the best or better ingredients, making adjustments based on experimental results, and accepting mistakes and failures. These realities of creativity mean that successful products have to be continually improved by considering the chef's knowledge, accumulated experiences, and complementary technical skills (Ottenbacher and

Harrington, 2007). Albors-Garrigos et al. (2013, p. 2) assert that “these chefs usually have their own space and time for creativity and rely on networking with an extensive social context”, by underscoring the importance of external sources for obtaining information and inspiration that lead to innovative activities. Among the plethora of sources, most often cited is the involvement and interaction with customers (listening to their needs/preferences) as well as restaurant staff, colleagues, and suppliers of raw materials and ingredients (Bockelmann and Braun, 2014; Paris and Lang, 2015). Feedback can be obtained from presentations at gastronomy and culinary conferences, exhibitions and trade fairs as well as collaborating with scientists resulting in new textures and combinations of ingredients.

3 Methodology

3.1. Research setting

The research setting is the Italian haute cuisine, as defined by the Michelin Red Guide. The success of fine-dining restaurants is defined according to the restaurants' ratings by major guidebooks (Rao et al. 2003). Of these different guidebooks, the famous Michelin Red Guide is internationally acknowledged as the most thorough (Ottenbacher and Harrington, 2010), and is recognized as one of the most important culinary book (Bouty and Gomez, 2013). It is a series of annual publications addressing tourism and gastronomy, and represents the largest global benchmark for assessing the quality of restaurants (Di Stefano et al., 2015). The Michelin Guide provides a well-written description of each restaurant and a variety of other symbols to give readers insights into an establishment's ambiance, type of cuisine, specialty dishes, wine list, complementary services, etc.

Obtaining a Michelin star rating is a sign of creativity, quality and innovation, and it is considered one of the top achievements a chef can attain. The star symbols judge only what is on the plate, meaning quality of products, mastering of flavours and cooking, personality of the cuisine, value for the money and consistency of what the restaurant offers to its customers both throughout the menu and the year. Michelin star ratings are valued by the most relevant stakeholders, by including restaurant owners, customers and critics (Durand et al., 2007). The number of stars awarded assesses the chef's quality of craftsmanship (Svejenova et al., 2010). For this reason, the Michelin rating (expressed on a one- to three-star scale) can affect the reputation and economic well-being of a restaurant (Woodward and Stierand, 2014). Stars are given to the restaurant and not to the chef. However, the success of the restaurant depends largely on the chef's work. Hence, when a chef leaves a restaurant, the stars are “suspended” until the next examination by the Michelin experts. A major criterion for awarding stars to a restaurant is “renewal” - the ability to offer creative and new recipes on a regular basis. The study of Michelin star chefs is therefore akin to focusing on chefs who have engaged in frequent innovation as part of their professional success.

3.2. Research setting

To achieve research objective, an online survey targeting Michelin starred chefs and chefs in training was performed. A self-administrated questionnaire has been developed to examine the main components linked to individual and social/work environment that influence the creativity and innovation processes. It is based on and inspired by the study of Vargas-Sanchez and Lopez-Guzman (2015). To enhance external validity, the questionnaire was pretested by one Italian three-starred Michelin Chef (in two separated informal meetings ranging from 20 to 40 min) and four academic experts in the field of culinary industry. The survey was addressed to the chef of each Michelin starred restaurant and to the Managers of Chef Schools, with a detailed cover letter explaining the purpose of the study. The analysis was conducted over the period January 2016 to September 2017. The sample was composed of 132 Italian Michelin starred chefs. As the 2016 Guide includes 334 starred chefs (<http://www.scattidigusto.it/2015/12/10/guida-michelin-2016-tutte-le-stelle-dei-migliori-ristoranti-italia/http://www.scattidigusto.it/2015/12/10/guida-michelin-2016-tutte-le-stelle-dei-migliori-ristoranti-italia/>), the sample covers 39.52% of the entire population, of whom 88% are male. The number of the stars is represented as follows: 83% one star; 11% two stars; 6% three stars. Then, we contacted the Managers of Gastronomic Schools located in two Italian Regions to involve the same number of chef in training.

3.3. Measures

The study performs a discriminant analysis (DA). This is a statistical procedure, which allows to classify cases in separate categories (to which they belong) on the basis of a set of predictors/items and to assess how well the independent variables separate the categories in the classification. It is a linear combination of the selected items with the assumptions that predictors are normally distributed and that the covariance matrices for the predictors within each of the groups are equal.

With the analysis, the study aims at testing whether the set of predictors allows to correctly identify starred chefs and chefs in training and which factors make the difference between the two groups to understand the role of experience. DA linearly combines the predictors to estimate a discriminant function, that yields a discriminant score z , based upon the predictors' variables x_i , and the estimated coefficients α_i .

To assess the goodness of the analysis we rely on the Box's M test, that assess whether the covariances are equal across groups, and on the Wilks' Lambda (or U statistic) tests discrimination between groups. The latter is related to the analysis of variance; we check for the individual Wilks' Lambda for each of the predictors in the discriminant function and tests whether there are significant differences in the predictor's means between the groups. The p-value follows an F distribution. The Wilks' Lambda for the overall function indicate whether there are significant differences in the group means for the discriminant function; in this case the p-value is drawn from a Chi-square distribution

4 Results

Table 1 shows the standardized coefficient estimates for the discriminant function, which do not depend on the measurement unit, but coefficients with large absolute values correspond to the variables with greater discriminating ability. The most important predictor that allows one to discriminate between starred chefs and chefs in training refers to those who fight the imitation risk through a periodic reinvention and anticipating concurrent and adapting their supply (q5_3). It has the highest discriminant score and the largest positive impact followed by the item that accounts for the chefs who consider essential their experience with clients (q3_5) and by chefs who consider their participation at events, congresses etc. as important (q1_11). Instead, those who strongly believe that it is imperative to test a new product (q3_4) and who believe that the creative process is spontaneous and informal (q2_1), and that in creating new products they often start by trying to improve existing products (q1_9) have a negative sign and reduce the discriminant score.

From the group centroids – i.e., the means of the discriminant score for each of the two groups (Starred Chefs=-0.858; Chefs in training = 1.042) – we can understand that higher positive discriminant scores increase the probability to be classified into the student group since the average value for the student is positive while it is negative for the starred chefs.

Table 1. Standardized discriminant coefficients

Predictors		Function
Items	Codes	
As a technique for the generation of new ideas and products I use the combination, mixture, and fusion of ideas	q1_6	-.219
As a technique for the generation of new ideas and products I use analogy and camouflage	q1_7	.205
As a technique for the generation of new ideas and products I try to identify alternative uses	q1_8	-.039
As a technique for the generation of new ideas and products I use the analysis of areas for improvement of existing products	q1_9	-.298
Training, experience and learning are fundamental in our case	q1_10	.009
Participation in professional events (fairs, competitions, conferences, congresses, etc.) is very important	q1_11	.333
I have created a repository of ideas that I systematically improve	q1_12	-.092
The creative process and the generation of new ideas is spontaneous or informal, with ideas that can arise at any time	q2_1	-.389
The creative process and the generation of new ideas is of a systematic or formal character, that is subject to a method, rules, and a periodicity	q2_2	-.256
The creative process and the generation of new ideas is an individual process, which is influenced by personal characteristics such as my emotional state, curiosity, observation	q2_3	.320
The creative process and the generation of new ideas is the result of a collective effort, i.e., a team work in which we deliberately seek interaction with customers, employees,	q2_4	.325

other cultures (e.g., through travels), approaching the concept of co-creation		
In the process of transforming ideas into gastronomic products, I give priority to the economic sustainability of the new product by controlling costs	q3_1	.129
In the process of transforming ideas into gastronomic products, I prioritize the availability of necessary techniques (processing, storage, etc.)	q3_2	.245
In the process of transforming ideas into gastronomic products, I prioritize the relationship with suppliers	q3_3	-.166
In the process of transforming ideas into gastronomic products, testing new products through trial and error is imperative	q3_4	-.536
In the process of transforming ideas into gastronomic products, the accumulated memory (through learning and experience) on clients and their behaviour is a key factor	q3_5	.387
In the process of transforming ideas into gastronomic products, adapting to the circumstances of the moment (for example, crisis) is of primary importance when it comes to inserting a new product in the menu	q3_6	.300
In the configuration of a gastronomic experience, the business model (for example, the type of restaurant) is the determining factor	q4_1	.020
In the configuration of a gastronomic experience, the profile/personality of the entrepreneur is the determining factor	q4_2	-.157
In the configuration of a gastronomic experience, the profile/personality of the chef is the determining factor	q4_3	-.251
Imitation doesn't make me particularly worried, since not everything is imitable, such as skills in using a techniques or the personal touch in the kitchen	q5_1	-.019
Imitation doesn't make me particularly worried, since originality and differentiation of my gastronomic offering are obstacles to imitation	q5_2	-.238
I fight the risk of imitation through periodic reinvention, anticipation of competition and adaptation of my offering from time to time	q5_3	.628
I fight imitation by paying attention to customer relationship, strengthening his/her emotional component, also through his/her gastronomic education	q5_4	-.049

The classification results in Table 2 show the correctly classified cases: 85.8% of starred chefs are correctly classified, while 77.4% of chefs in training are correctly classified. Overall, 82% of the cases were correctly classified.

Table 2. Classification Results

	Predicted Group Memberships		Total
	<i>Starred Chefs</i>	<i>Chefs in training</i>	
<i>Starred Chefs</i>	97	16	113
<i>Chefs in training</i>	21	72	93
<i>Starred Chefs</i>	85.8%	14.2%	100%
<i>Chefs in training</i>	22.6%	77.4%	100%

The Box's M test shows that the covariance matrices are not equal, while the Wilks' Lambda test for the function as a whole displays that the overall discriminating power of the DF is good. The Wilks' Lambda for each of the predictors in the discriminant function tell us that not all of the predictors are relevant to discriminate between the two groups (Table 3). This test tells which variables contribute a significant amount of prediction to help separate the groups (in bold). Results strengthen the findings obtained with the standardized coefficients (Table 4) and add that an important difference between the two groups is due to the thinking that, during the transformation process, it is important to adapt to the current situation (e.g. the economic crisis) (q3_6) and that, in the imitation process, not everything is reproducible (q5_1).

The canonical correlation is the square root of the ratio between variability between and total variability is 0.69. The eigenvalue is the ratio between variances between and variance within groups (the larger the better) is 0.903.

Table 3. Wilks' Lambda for the single predictors

Predictors		Wilks' Lambda	F	df1	df2	Sig.
Items	Codes					
As a technique for the generation of new ideas and products I use the combination, mixture, and fusion of ideas	q1_6	.985	3.034	1	204	.083
As a technique for the generation of new ideas and products I use analogy and camouflage	q1_7	.989	2.290	1	204	.132
As a technique for the generation of new ideas and products I try to identify alternative uses	q1_8	1.000	.013	1	204	.909
As a technique for the generation of new ideas and products I use the analysis of areas for improvement of existing products	q1_9	.988	2.551	1	204	.112
Training, experience and learning are fundamental in our case	q1_10	.994	1.326	1	204	.251
Participation in professional events (fairs, competitions, conferences, congresses, etc.) is very important	q1_11	.960	8.497	1	204	.004
I have created a repository of ideas that I systematically improve	q1_12	.999	.274	1	204	.601
The creative process and the generation of new ideas is spontaneous or informal, with ideas that can arise at any time	q2_1	.879	28.025	1	204	.000
The creative process and the generation of new ideas is of a systematic or formal character, that is subject to a method, rules, and a periodicity	q2_2	.996	.838	1	204	.361
The creative process and the generation of new ideas is an individual process, which is influenced by personal characteristics such as my emotional state, curiosity, observation	q2_3	.995	1.020	1	204	.314
The creative process and the generation of new ideas is the result of a collective effort, i.e., a team work in which we deliberately seek interaction with customers, employees, other cultures (e.g., through travels), approaching the concept of co-creation	q2_4	.966	7.214	1	204	.008
In the process of transforming ideas into gastronomic products, I give priority to the economic sustainability of the new product by controlling costs	q3_1	.957	9.216	1	204	.003
In the process of transforming ideas into gastronomic products, I prioritize the availability of necessary techniques (processing, storage, etc.)	q3_2	.999	.183	1	204	.669
In the process of transforming ideas into gastronomic products, I prioritize the relationship with suppliers	q3_3	.970	6.411	1	204	.012
In the process of transforming ideas into gastronomic products, testing new products through trial and error is	q3_4	.917	18.372	1	204	.000

imperative						
In the process of transforming ideas into gastronomic products, the accumulated memory (through learning and experience) on clients and their behaviour is a key factor	q3_5	.983	3.532	1	204	.062
In the process of transforming ideas into gastronomic products, adapting to the circumstances of the moment (for example, crisis) is of primary importance when it comes to inserting a new product in the menu	q3_6	.932	14.953	1	204	.000
In the configuration of a gastronomic experience, the business model (for example, the type of restaurant) is the determining factor	q4_1	.966	7.258	1	204	.008
In the configuration of a gastronomic experience, the profile/personality of the entrepreneur is the determining factor	q4_2	.999	.238	1	204	.626
In the configuration of a gastronomic experience, the profile/personality of the chef is the determining factor	q4_3	.994	1.163	1	204	.282
Imitation doesn't make me particularly worried, since not everything is imitable, such as skills in using a techniques or the personal touch in the kitchen	q5_1	.940	13.049	1	204	.000
Imitation doesn't make me particularly worried, since originality and differentiation of my gastronomic offering are obstacles to imitation	q5_2	.969	6.576	1	204	.011
I fight the risk of imitation through periodic reinvention, anticipation of competition and adaptation of my offering from time to time	q5_3	.895	23.896	1	204	.000
I fight imitation by paying attention to customer relationship, strengthening his/her emotional component, also through his/her gastronomic education	q5_4	.987	2.657	1	204	.105

Table 4. Descriptive statistics for the predictors

Predictors		Starred Chefs		Chefs in training		Pooled Sample	
Items	Codes	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
As a technique for the generation of new ideas and products I use the combination, mixture, and fusion of ideas	q1_6	4.16	.941	3.91	1.080	4.05	1.011
As a technique for the generation of new ideas and products I use analogy and camouflage	q1_7	2.75	1.184	3.00	1.152	2.86	1.173
As a technique for the generation of new ideas and products I try to identify alternative uses	q1_8	3.77	1.000	3.75	1.158	3.76	1.071
As a technique for the generation of new ideas and products I use the analysis of areas for improvement of existing products	q1_9	4.02	.973	3.80	1.017	3.92	.997
Training, experience and learning are fundamental in our case	q1_10	4.73	.655	4.61	.860	4.68	.755
Participation in professional events (fairs, competitions, conferences, congresses, etc.) is very important	q1_11	3.83	1.060	4.24	.902	4.01	1.010
I have created a repository of ideas that I systematically improve	q1_12	3.88	1.127	3.80	1.059	3.84	1.095
The creative process and the generation of new ideas is spontaneous or informal, with ideas that can arise at any time	q2_1	4.40	.959	3.63	1.111	4.05	1.096
The creative process and the generation of new ideas is of a systematic or formal character, that is subject to a method, rules, and a periodicity	q2_2	2.84	1.293	3.00	1.180	2.91	1.242

The creative process and the generation of new ideas is an individual process, which is influenced by personal characteristics such as my emotional state, curiosity, observation	q2_3	4.02	1.009	3.86	1.230	3.95	1.114
The creative process and the generation of new ideas is the result of a collective effort, i.e., a team work in which we deliberately seek interaction with customers, employees, other cultures (e.g., through travels), approaching the concept of co-creation	q2_4	4.01	1.065	4.38	.859	4.17	.992
In the process of transforming ideas into gastronomic products, I give priority to the economic sustainability of the new product by controlling costs	q3_1	3.38	1.212	3.86	1.017	3.60	1.151
In the process of transforming ideas into gastronomic products, I prioritize the availability of necessary techniques (processing, storage, etc.)	q3_2	3.86	1.109	3.92	1.106	3.89	1.105
In the process of transforming ideas into gastronomic products, I prioritize the relationship with suppliers	q3_3	4.29	.913	3.95	1.046	4.14	.988
In the process of transforming ideas into gastronomic products, testing new products through trial and error is imperative	q3_4	4.31	.955	3.68	1.162	4.02	1.097
In the process of transforming ideas into gastronomic products, the accumulated memory (through learning and experience) on clients and their behaviour is a key factor	q3_5	4.13	.959	4.38	.884	4.24	.931
In the process of transforming ideas into gastronomic products, adapting to the circumstances of the moment (for example, crisis) is of primary importance when it comes to inserting a new product in the menu	q3_6	3.21	1.257	3.86	1.119	3.50	1.237
In the configuration of a gastronomic experience, the business model (for example, the type of restaurant) is the determining factor	q4_1	3.43	1.260	3.86	.951	3.63	1.148
In the configuration of a gastronomic experience, the profile/personality of the entrepreneur is the determining factor	q4_2	3.84	1.115	3.91	1.018	3.87	1.070
In the configuration of a gastronomic experience, the profile/personality of the chef is the determining factor	q4_3	4.27	.869	4.13	1.066	4.21	.963
Imitation doesn't make me particularly worried, since not everything is imitable, such as skills in using a techniques or the personal touch in the kitchen	q5_1	4.27	.957	3.70	1.325	4.01	1.171
Imitation doesn't make me particularly worried, since originality and differentiation of my gastronomic offering are obstacles to imitation	q5_2	3.89	1.105	3.48	1.185	3.71	1.157
I fight the risk of imitation through periodic reinvention, anticipation of competition and adaptation of my offering from time to time	q5_3	3.14	1.315	3.96	1.021	3.51	1.256
I fight imitation by paying attention to customer relationship, strengthening his/her emotional component, also through his/her gastronomic education	q5_4	3.77	1.173	4.02	1.011	3.88	1.107

5 Discussion and conclusion

The study has explored the theoretical concept of creativity in the haute cuisine context. More specifically, it has empirically investigated the different factors that affect the creativity of top-chefs and chefs in training. Mainly, the comparison between these two groups of chefs has allowed us to isolate and distinguish between within-individual and social/environmental factors affecting creativity. Indeed, while a personal attitude towards creativity is likely to be present also in chefs in training, the latter differ from top-chefs since they miss experience in cooking and in facing the challenging conditions of a real work context. In turn, by comparing the two groups, this study has highlighted whether and which external (i.e., organizational and competitive) conditions affect creativity, along with individual skills and personal attitudes.

The empirical findings have underlined that the factors affecting the creativity of these two different groups are indeed diverse. The within-individual and environmental/social components assume a different relevance for top-chefs and for chefs in training. Specifically, the main difference is linked to the problems of the imitation risk that becomes particularly pressing for top-chefs. In this respect, top-chefs have to orient their energies, efforts and competencies to the search, combination and proposal of innovative offerings and experiences for their customers. New and old ingredients, new and traditional methods, continuous experimentation, novelty, sensory and experiential contents assume a critical role in the activities oriented to face the competitors. In line with Lampel et al. (2000), the creation of a new product/proposal results from the effort of searching and recombining those elements giving distinctiveness.

Other relevant difference is related to the experience with customers, observed as a relevant external source to innovate. Top-chefs underline that interactions and relationships with customers are necessary to acquire ideas, improve dishes and menu proposals, define quality services and create a sensory atmosphere/environment.

Additionally, the investigated groups assign different relevance to event participations. For top-chefs, events are observed as a useful moment of confirmation of their reputation, image and notoriety. Differently, chefs in training underline that events are a suitable opportunity to meet top-chefs and learn new culinary methods/techniques. This group highlights that the creative process is essentially spontaneous and informal, moving from the idea that the passion and motivation of chefs are key factors to develop new dishes and new methods.

The study contributes to existing literature in two ways. It extends knowledge regarding how creativity is influenced by different factors in cultural and creative industries. More specifically, in the restaurant sector and broader hospitality industry, creativity is increasingly attracting the interest of scholars because it is recognized as crucial determinant for maintaining a strong positioning in the market that must be sustained over time. As noted, creativity is the single most important factor contributing to the innovative outcomes of firms and the only necessary component of innovations (Stierand and Dorfler, 2012). Additionally, the study contributes to the academic debate on creativity and innovation in haute cuisine context, by suggesting key factors that

effectively stimulate actions and behaviours leading to a continuous flow of novel and useful ideas. Moreover, it empirically identifies factors that have a significant influence on the generation of creative ideas in the haute cuisine. These findings are aligned with those of Amabile (1983, 1996) who, in other settings, finds that the creative process is affected by within-individual components (i.e., experience, intuition, tacit knowing, sensitivity, etc.) and the surrounding environment (i.e., collaborators, customers, etc.).

The results of this research can also help us drawing some relevant managerial implications. Firstly, we should consider creativity and innovation from a strategic point of view. In fact, the creativity and innovation process has to be managed efficiently in order to develop successful and differentiated outcomes by anticipating direct/indirect competitors and to preserve novel dishes, culinary proposals and services from the imitations. Secondly, the results of our study stress the critical role of training and education in the formation of culinary skills and competencies. In addition, they suggest the opportunity to develop a set of managerial capabilities on which chefs in training and, of consequence, professional high schools of cooking have to stimulate and sustain concretely different creativity paths in their educational programs. In fact, creativity seems to flow more easily and concretely when it is stimulated and separated from the pressures of the workplace (Albors-Garrigos et al., 2013).

The study has also some limitations that might provide insights for further research. The analysis is effectively limited to the Michelin Star Chefs and chefs in training in Italy. Therefore, further research on haute cuisine and professional high schools in various countries could be useful to understand the geographic generalizability of the observed patterns and findings and to avoid size bias. Additional research could also include other hospitality sectors and the broader creative and cultural industry in order to assess the generalizability across industries as to what stimulates creativity and innovation processes and, consequently, the success of organizations in these settings.

References

- Albors-Garrigos, J., Barreto, V., Garcia-Segovia, P., Martinez-Monzo, J. and Hervás-Oliver, J. L. (2013), "Creativity and innovation patterns of haute cuisine chefs", *Journal of Culinary Science & Technology*, Vol. 11 No. 1, pp. 19-35.
- Amabile, T. M. (1983), "Social psychology of creativity: A componential conceptualization", *Journal of Personality and Social Psychology*, Vol. 45 No. 2, pp. 997-1013.
- Amabile, T. M. (1988), "A model of creativity and innovation in organizations", *Research in Organizational Behaviour*, Vol. 10 No. 1, pp. 123-167.
- Amabile, T. M. (1996), *Creativity in context*, Westview Press, Boulder, CO.
- Amabile, T. M. (2012), "Componential Theory of Creativity." Working Paper 12-096, Harvard Business School Press, Boston, MA.
- Anderson, N., Potočník, K. and Zhou, J. (2014), "Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework", *Journal of management*, Vol. 40 No. 5, pp. 1297-1333.
- Bockelmann, L. and Braun, A. (2014), "An Individual Perspective on Open Innovation Capabilities in the Context of Haute Cuisine", paper presented at the Druid Society Conference, 16-18 June, Copenhagen, Sweden, available at:

http://druid8.sit.aau.dk/acc_papers/pqa69332kg08ihfey5gvxafo8yvn.pdf (accessed March 2, 2016).

- Bouty, I., Gomez, M.L. (2013), "Creativity in Haute Cuisine: Strategic Knowledge and Practice in Gourmet Kitchens", *Journal of Culinary Science & Technology*, Vol.11 No. 1, pp. 80-95.
- Capdevila, I., Cohendet, P. and Simon, L. (2015), "Establishing New Codes for Creativity through Haute Cuisine", *Technology Innovation Management Review*, Vol. 5 No. 7, pp. 36-44.
- Di Stefano, G., King, A.A. and Verona, G. (2015), "Sanctioning in the wild: rational calculus and retributive instincts in gourmet cuisine", *Academy of Management Journal*, Vol. 58 No. 3, pp. 906-931.
- Durand, R., Rao, H. and Monin, P. (2007), "Code and Conduct in French Cuisine: Impact of Code Changes on External Evaluations", *Strategic Management Journal*, Vol. 28 No. 5, pp. 455-472.
- George, J.M. (2007), "Creativity in organization", *Academy of Management Annals*, Vol. 1 No.1, pp. 439-477.
- Harrington, R.J. and Ottenbacher, M.C. (2013), "Managing the Culinary Innovation Process: The Case of New Product Development", *Journal of Culinary Science & Technology*, Vol. 11 No. 1, pp. 4-18.
- Lampel, J., Lant, T. and Shamsie, J. (2000), "Balancing Act: Learning from Organizational Practices in Cultural Industries", *Organization Science*, Vol. 11 No. 3, pp. 263-269.
- Messeni Petruzzelli, A. and Savino (2015), "Reinterpreting tradition to innovate: the case of Italian haute cuisine", *Industry and Innovation*, Vol. 22 No. 8, pp. 677-702.
- Messeni Petruzzelli, A. and Savino, T. (2014), "Search, Recombination, and Innovation: Lessons from Haute Cuisine", *Long Range Planning*, Vol. 47 No. 4, pp. 224-238.
- Ottenbacher, M.C. and Harrington, R.J. (2007), "The Innovation Development Process of Michelin-Starred Chefs", *International Journal of Contemporary Hospitality Management*, Vol. 19 No. 6, pp. 444-460.
- Ottenbacher, M.C. and Harrington, R.J. (2010), "Strategies for achieving success for innovative versus incremental new services", *Journal of Services Marketing*, Vol. 24 No. 1, pp. 3-15.
- Paris, T. and Lang, G. (2015), "Managing Collective Processes in the Creative Industries: Insight from Perfumery and Haute Cuisine", *Global Business and Organizational Excellence*, Vol. 35 No. 1, pp. 67-76.
- Presenza, A., Abbate, T., Casali, G. L. and Perano, M. (2017), "An innovative approach to the intellectual property in haute cuisine", *International Journal of Hospitality Management*, Vol. 65 No. 1, pp. 81-88.
- Rao, H., Monin, P. and Durand, R. (2003), "Institutional Change in Toque Ville: Nouvelle Cuisine as an Identity Movement in French Gastronomy", *American Journal of Sociology*, Vol. 108 No. 4, pp. 795-843.
- Richards, R. (2007), "Everyday creativity: Our hidden potential", in Richards, R. (Ed.), *Everyday creativity and new views of human nature*, American Psychological Association Press, Washington, DC, pp. 25-54.
- Simonton, D. K. (1997), "Creative productivity: A predictive and explanatory model of career trajectories and landmarks." *Psychological Review* 104: 66-89.
- Stierand, M. and Dorfler, V. (2012), "Reflecting on a phenomenological study of creativity and innovation in haute cuisine", *International Journal of Contemporary Hospitality Management*, Vol. 24 No. 6, pp. 946-957.
- Stierand, M. and Lynch, P. (2008), "The Art of Culinary Innovations", *Tourism and Hospitality Research*, Vol. 8 No. 4, pp. 337-350.
- Svejenova, S., Planellas, M. and Vives, L. (2010), "An Individual Business Model in the Making: a Chef's Quest for Creative Freedom", *Long Range Planning*, Vol. 43 No. 2-3, pp. 408-430.

- United Nations Educational, Scientific Cultural Organization (UNESCO) (2010), “The gastronomic meal of the French”, available at: <http://www.unesco.org/culture/ich/en/RL/00437> (accessed 2 October 2018).
- Vargas-Sanchez, A. and Lopez-Guzman, T. (2015), “Contemporary management and innovation: Learning from the gastronomy sector”, *Journal of Food, Agriculture & Environment*, Vol. 13 No. 1, pp. 132-138.
- Woodward, K. and Stierand, M. (2014), “Stars war: Conflicts between chefs and restaurant guides”, in Pantelidis, I. (Ed.), *The handbook of hospitality*, Sage, London, pp. 227-236.

Sustainable Business Model Archetypes in Tourism

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Abstract

Interest for sustainability issues is rising in the business strategy and management disciplines. At the same time, sustainability-related practices are actualized by companies within economic, social, and environmental perspectives. For instance, enterprises working in the tourism industry are moving towards sustainability objectives, such as preservation of biodiversity and inclusive value creation.

The aim of this research is thus to develop a framework based on sustainable business model archetypes, to be applied in tourism industry. The research question is: Which sustainable business model archetypes could be developed and implemented by tourism enterprises and how?

At first, three archetype-based frameworks are compared to identify how a sustainable approach could be developed and adopted on the basis of company dimension and industry. Afterwards, a systematic literature review is conducted to collect examples of sustainable business model in tourism, with a special focus on practices oriented to business model innovation.

The research shows how former studies provide practices according to the three different lines of sustainability (i.e. economic, social, and environmental). The results display a variety of possible initiatives that may be adopted by tourism enterprises. Indeed, the study provides a new set of archetypes for sustainable business model innovation in tourism industry. As such, the paper contributes to the existent knowledge on sustainable business model by classifying and analysing actual chances of business model implementation from the sustainability viewpoint. The new set could be useful to both practitioners and academics in designing innovative paths for sustainable concrete enactments. Moreover, it offers the ground archetype-based framework for tourism management researchers to be tested in future studies.

Keywords – Sustainable business model, tourism sustainability, triple bottom line.

Paper type – Academic Research Paper

1 Introduction

Over last years, sustainability-related issues have entered in managerial studies with growing attention. For instance, according to Scopus database, papers on sustainable business models have more than quadrupled over the last five years. Nonetheless, tourism research has oriented its interest on sustainability from a macro perspective at large, i.e. considering a territorial development focus, rather than investigating the role of tourism enterprises in implementing sustainable practices. In particular, few studies (e.g., Jaafar and Maideen, 2012; Melissen et al., 2016) have deepened the knowledge on how sustainable business models may take form within tourism business context. Such studies highlight the difficulties that tourism enterprises face in considering sustainability according to the Triple Bottom Line, i.e. by attributing relevance to sustainable corporate performance on economic, environmental and social levels at the same time. Nevertheless, interest of tourists in the application of sustainable practices is growing (Buffa et al., 2018). Despite that, few studies (Mihalič et al., 2012; Høgevoid et al., 2015) consider the three aspects at the same time and very few studies (Battistella et al., 2018) clearly define specific applicative practices to obtain the Triple Bottom Line.

The aim of this study is to outline typical archetypes for sustainable business models in tourism. The archetypes describe “groupings of mechanisms and solutions that may contribute to building up the business model for sustainability” (Bocken et al., 2014: p. 42). Their goal is to facilitate the development of sustainable business models into the enterprises’ practices, and so far, some studies have adopted such tool for applying it into diverse contexts, such as global corporations (Ritala et al., 2018) and banks (Yip and Bocken, 2018).

The research question therefore is: *Which sustainable business model archetypes could be developed and implemented by tourism enterprises and how?*

Starting from the sustainable business model archetypes and importing recent literature on tourism sustainable business model, we detect and adapt examples of practices from tourism management area and we define specific sustainable business model archetypes in tourism. The final purpose is indeed to compose an updated set of archetypes for designing sustainable business models of tourism enterprises.

2 Materials and methods

2.1 Methodology overview

Following the methodological instructions in Yip and Bocken (2018), who studied the sustainable business model archetypes for the banking industry, we followed the next steps:

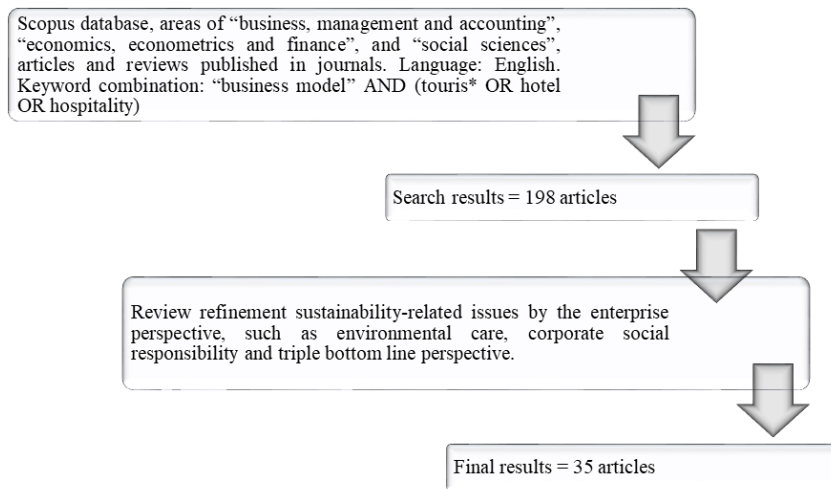
- From an initial literature review, we identified the studies adopting the archetype-based framework of sustainable business model.
- A systematic literature review was conducted according to methodological instructions by Jesson et al. (2011) in order to retrieve a collection of sustainable business models in tourism.
- Examples from business practice were collected from past studies to develop a new set of sustainable business model archetypes for tourism. The proposed set was drawn on the basis of the ones by Bocken et al. (2014), Ritala et al. (2018) and Yip and Bocken (2018) in order to enhance the comparability among existent frameworks and the reliability of the projected new one.
- Finally, practices were grouped to compose the set of archetypes, to be discussed in the final part of the paper.

2.2 The systematic literature review process on sustainable business model and practices in tourism

A systematic literature review was conducted according to methodological instructions by Jesson et al. (2011), with specification of a review protocol and of inclusion/exclusion criteria in order to guarantee the systematicity of the process. The review employed Scopus database, with selection within the areas of “business, management and accounting”, “economics, econometrics and finance”, and “social sciences”. Only articles and reviews published in journals in English were retained.

In order to collect the practices into the archetype-based framework, the search orientation dealt with studies on business models in tourism enterprises. For this reason, the research was developed with the keyword combination: “business model” AND (touris* OR hotel OR hospitality). The result was a collection of 198 articles retrieved by Scopus at the date of 7th October 2018. Articles were scanned in order to look for sustainability-related issues by the enterprise perspective, such as environmental care, corporate social responsibility and triple bottom line perspective. Articles solely based on destination management, public policies and regional development were excluded, since not coherent with the topic. By the methodological point of view, the review is functional to design a set of archetypes derived by previous review stream and dealing with the specific business area of tourism activities. The review led to a final group of 35 articles.

The following figure (Figure 1) sums up the systematic review process. Results are presented in the next section.



Source: own elaboration

Figure 1 – The systematic review process

3 Literature review

3.1 The archetype-based framework for sustainable business model

The first objective of the literature review was to collect studies focused on sustainable business model. Here, the attention was driven to archetypes of sustainable business models, which could be helpful to support the design of the framework on sustainable business model even in a sector (i.e., tourism), which is different from the ones entailed in former studies. By the methodological point of view, the choice to focus on archetype-based framework only is functional, as the archetype-based framework by Bocken et al. (2014) and its following revisions and applications are drawn on past studies. This review process led to a final group of 3 articles, more specifically: the one by Bocken et al. (2014), who firstly outlined a framework based on the archetypes of sustainable business model, and two following applications, namely the study by Ritala et al. (2018) on large corporations and Yip and Bocken (2018) on banking industry. The following table compares the results of the three studies

Table 1 – The archetypes for sustainable business model

	Bocken et al. (2014)	Ritala et al. (2018)	Yip and Bocken (2018)
Technological/ Environmental	Maximise material and energy efficiency	Maximise material and energy efficiency	Maximize material and energy efficiency
	Create value from “waste”	Closing resource loops	
	Substitute with renewables and natural processes	Substitute with renewables and natural processes	
			<i>Substitute with digital processes</i>
Social	Deliver functionality rather than ownership	Deliver functionality rather than ownership	
	Adopt a stewardship role	Adopt a stewardship role	Adopt a stewardship role
	Encourage sufficiency	Encourage sufficiency	Encourage sufficiency
			<i>Inclusive value creation</i>
Organisational/ Economical	Re-purpose the business for society/environment	Repurpose for society/environment	Repurpose for society/environment
	Develop scale-up solutions	Develop sustainable scale-up solutions	
		<i>Inclusive value creation</i>	
			<i>Resilience in loan granting</i>
			<i>Sustainable financial products</i>

Source: own elaboration on Bocken et al. (2014), Ritala et al. (2018), Yip and Bocken (2018)

The founders of sustainable business model archetypes (Bocken et al., 2014) identified technological, social and organizational higher-level groupings, confirmed in the study by Yip and Bocken (2018). On the contrary, Ritala et al. (2018) categorized archetypes by environmental, social, and economical groupings, since the study considered the major innovation types as group criterium.

Moving towards the in-depth examination of the sustainable business model architecture by archetypes, as regards the technological/environmental grouping, “maximise material and energy efficiency” is common among the three studies and concerns the optimization of resources used. Ritala et al. (2018) substituted “Create value from ‘waste’” with “Closing resource loop”, in order to underline the reuse of products and materials, an archetype that was not entailed in the case of banking industry (Yip and Bocken, 2018). In the same study, the archetype “Substitute with renewables and natural processes” was turned into “Substitute with digital process” given the features of the service sector.

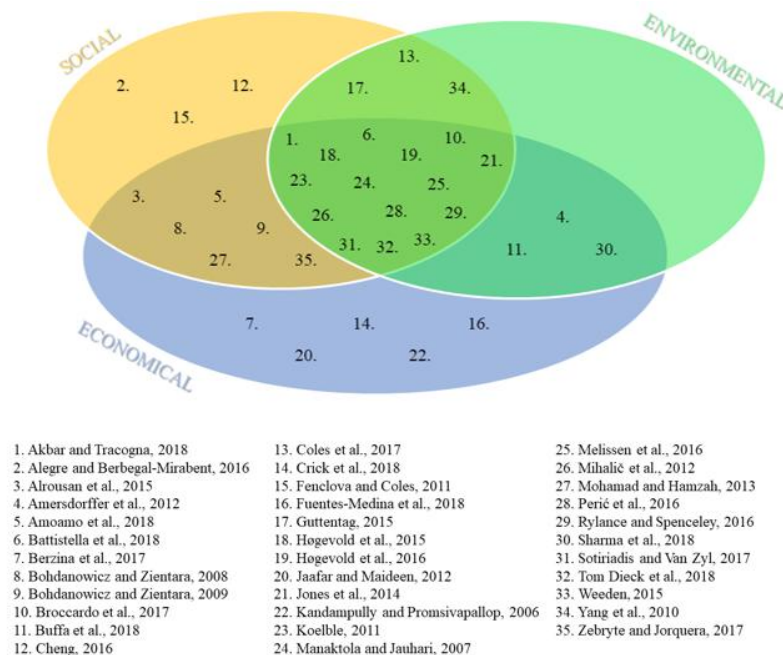
Regarding the social grouping, two archetypes “adopt a stewardship role”, i.e. referred to business responsibility/commitment to social and environmental issues, and

“encourage sufficiency”, i.e. reduced consumption by users/consumers, are common among the three studies. Ritala et al. (2018) adhere to the same typology by Bocken et al. 2014., while Yip and Bocken (2018) do not envisage “Deliver functionality rather than ownership” and add “Inclusive value creation”.

Interestingly, Ritala et al. (2018) consider “Inclusive value creation” archetype in the economical grouping, since they ascribe the meaning of sharing resources. The archetype “repurpose for society/environment” is common, since it expresses the business model innovation towards the prioritization of social and environmental benefits. “Develop scale-up solutions” is revised into “develop sustainable scale up solutions” in Ritala et al. (2018), in order to underline the delivery of sustainable alternatives at scale to maximize sustainability benefits. As regards organizational grouping in the banking industry in Yip and Bocken (2018), “Develop scale-up solutions” is lacking, whereas “Resilience in loan granting” and “Sustainable financial products” archetypes are added.

3.2 The results of the systematic literature review

The systematic literature review retrieved a group of 35 articles dealing with sustainability-related aspects of business models for tourism enterprises. The following figure (Figure 2) maps resulting studies according to their positioning within the sustainable business model.



Source: own elaboration

Figure 2 – The sustainable business model map in tourism literature

The map shows as almost the half of the selected papers (15 out of 35) consider the sustainable business model and related practices within a Triple Bottom Line framework, i.e. from the perspective of economical, environmental and social sustainability at the same time. All the papers were published from 2006 on, and in the last three years mostly (2016: 6 papers; 2017: 5 papers; 2018: 8 papers). This fact reflects the relatively recent development of the analysis on business model innovation towards sustainability.

The map is functional to identify reported business practices and group them in the new set of sustainable business model archetypes for tourism enterprises. Indeed, next section presents the outlined framework derived from the literature review.

4 Results

4.1 The outlined framework of sustainable business model archetypes in tourism

With the support of literature on tourism and business models, it is possible to outline a framework for the discourse on sustainable business model in tourism enterprises. The following Table 2 illustrates the overview on the sustainable business model archetypes. For each grouping of archetypes, it follows the detailed description of each one.

Table 2 – The sustainable business model archetypes in tourism enterprises

Grouping	Archetypes for SBM in tourism	Practices
Technological/ Environmental	Maximise material and energy efficiency	Energy saving with sensors and adjusting systems
		Energy saving with advanced alert systems
		Reduction of material use or transport
		Producing or using own resources
	Closing resource loops	Recycling
		Waste management
	Substitute with renewable energy sources and ecological products	Production with renewables
		Use and consumption from renewables
Social	Substitute with digital processes	Environmentally friendly products
		Digital process from users and consumers
		Use of social and web media
		IT safety
	Deliver functionality rather than ownership	Shared spaces
		Shared mobility
		Peer-to-peer Shared goods and services
		Training
	Adopt a stewardship role	Green protection and conservation
		Social protection
		Promotion of green and social measures
		Green and social events
		Ethics and transparency

Grouping	Archetypes for SBM in tourism	Practices
Organisational/ Economical	Encourage sufficiency	Education
		Capacity building
		Green activities for stakeholders
		Community involvement
	Promote inclusive value creation and community benefits	Communication
		Social entrepreneurship
		Charity support
		Openness to local community
	Re-purpose the business for society/environment	Activities for disadvantaged population (disabled, schools, etc.)
		Activities for workers
		Community-based enterprise
		Green and social strategy
	Develop collaborative approach	Reporting and communication
		Certifications
		Activities for employees benefits
		Responsible suppliers
	Provide sustainable quality services	Open innovation
		Cooperation with local community
		Cooperation with other actors, also public
		Cooperation with supply network and partners
		Cooperation with tourism partners
		Green cooperation
		Quality offer and services
		Quality staff
		Quality suppliers
		Customers programs

Source: own elaboration

4.2 The technological/environmental archetypes

More in detail, the technological archetypes of Bocken et al. (2014) have been revised acknowledging that tourism enterprises mostly deal with service provision rather than manufacturing activities. As such, to maximise material and energy efficiency is still clue for them, as well as the substitution with renewable energy sources. Indeed, energy saving with sensors and adjusting systems may take place through the use of energy-saving and LED light bulbs, water-saving showers and heating adjusting systems (Battistella et al., 2018; Høgevoid et al. 2015; Jones et al. 2014; Manaktola and Jauhari 2007; Melissen et al 2015; Sharma et al 2018). Advanced alert systems, as the case of water leakage, contribute to the maximise efficiency as well (Manaktola and Jauhari, 2007; Sharma et al., 2018). Moreover, the reduction of material use or transport, including building insulation or green construction standards (Buffa et al., 2018; Jones et al., 2014; Rylance

and Spenceley, 2016) and the production and the optimization of the usage of own resources (Broccardo et al., 2017; Sotiriadis and Van Zyl, 2017) are included as examples of business practices in this archetype. The production, use and consumption with/from renewables (Battistella et al., 2018; Buffa et al., 2018; Coles et al., 2017; Høgevold et al., 2015; Melissen et al., 2015; Mihalič et al., 2012; Yang et al., 2010), as well as the use of environmentally friendly products, such as cleansers (Høgevold et al., 2015; Jones et al., 2014; Manaktola and Jauhari, 2007; Sharma et al., 2018), compose the archetype “substitute with renewable energy sources and ecological products”. The archetype “closing resource loops” groups practices related to recycling activities and programs, as well as waste management, diffusely emerging from past studies (Battistella et al., 2018; Broccardo et al., 2017; Buffa et al., 2018; Coles et al., 2017; Høgevold et al., 2015; Jones et al., 2014; Manaktola and Jauhari 2007; Mihalič et al., 2012; Sharma et al 2018; Weeden 2015; Yang et al., 2010).

Taking inspiration by Yip and Bocken (2018), another archetype has been added: substitute with digital processes. Indeed, the use of digital management tools may allow an evolution towards technological, and thus environmental, sustainability. Examples are taken from practices on the use of social and web media (Akbar and Tracogna, 2018; Amersdorffer et al., 2012; Coles et al., 2017; Guttentag, 2015; Sotiriadis and Van Zyl, 2017; Tom Dieck et al., 2018), IT safety (Perić et al., 2016) and digital processes from users and consumers, such as the user-generated contents (Amersdorffer et al, 2012).

4.3 The social archetypes

Social archetypes by Bocken et al. (2014) could be applied to sustainable business models in tourism enterprises as well, with the inclusion of an archetype related to the inclusive value creation similarly to the case of Yip and Bocken (2018) referred to bank industry. More in details, to deliver functionality rather than ownership covers a group of practices, such as the sharing of spaces, shared mobility and peer-to-peer goods/services share (Battistella et al., 2018; Bohdanowicz and Zientara, 2008, 2009; Cheng, 2016; Guttentag, 2015; Sotiriadis and Van Zyl, 2017). To adopt a stewardship role in sustainable tourism practices may take several form, such as training programs, activities aimed at green protection and conservation, at social protection, at prompting ethical and transparent actions (Amoamo et al., 2018; Battistella et al., 2018; Bohdanowicz and Zientara, 2008; 2009; Broccardo et al., 2017; Buffa et al., 2018; Coles et al., 2017; Høgevold et al., 2015, 2016; Jones et al., 2014; Koelble, 2011; Mihalič et al., 2012; Mohamad and Hamzah, 2013; Tom Dieck et al., 2018; Yang et al., 2010). It could also be conveyed through the promotion of green and social events, for instance based on local culture (Koelble, 2011; Mihalič et al., 2012). Encourage sufficiency leverage sustainability through practices related to education, capacity building, green activities for stakeholders, and communication (Alrousan et al., 2015; Battistella et al., 2018; Bohdanowicz and Zientara, 2008, 2009; Høgevold et al., 2015; Manaktola and Jauhari, 2007; Mihalič et al., 2012; Mohamad and Hamzah, 2013; Perić et al., 2016; Weeden, 2015). In particular, it takes place with the involvement of the community and its empowerment towards sustainable actions as well (Høgevold et al., 2015; Koelble, 2011;

Mohamad and Hamzah, 2013; Rylance and Spenceley, 2016). Finally, the archetype “promote inclusive value creation and community benefits” groups examples related to practices of social entrepreneurship, charity support, activities for disadvantaged people and workers, such as forms of tourism social enterprises, donations and sponsorships, philanthropic activities (Alegre et Berbegal-Mirabent, 2016; Alrousan et al., 2015; Amoamo et al., 2018; Battistella et al., 2018; Bohdanowicz and Zientara, 2008, 2009; Fenclova and Coles, 2011; Høgevoid et al., 2015; Jones et al., 2014; Koelble, 2011; Melissen et al., 2015; Weeden, 2015; Yang et al., 2010; Zebryte and Jorquera, 2017). Moreover, openness to local community appears to be as particularly relevant in the tourism business context, providing examples such as the improvement of social security, the satisfaction of residents with tourism development and provision of facilities to residents (Battistella et al., 2018; Bohdanowicz and Zientara, 2008, 2009; Jones et al., 2014; Koelble, 2011; Mihalič et al., 2012; Rylance and Spenceley, 2016; Yang et al., 2010; Zebryte and Jorquera 2017).

4.4 The organisational/economical archetypes

Organisational archetypes are the ones presenting more differences compared to the original archetype-based framework by Bocken et al. (2014) and its latter applications (Ritala et al., 2018; Yip and Bocken, 2018). Indeed, on one hand to re-purpose the business for society/environment still plays a key role in determining an organizational implementation of the sustainable business model. For instance, tourist services may be delivered by community-based tourism enterprises (Amoamo et al., 2018; Jaafar and Maideen, 2012; Mohamad and Hamzah 2013), and may entail a green and social strategy and reporting (Broccardo et al., 2017; Buffa et al., 2018; Crick et al., 2018; Høgevoid et al., 2015, 2016; Jones et al 2014; Mihalič et al., 2012; Sharma et al., 2018). Enterprises may adopt environmental- and/or social-focused certificates/labels (Alrousan et al., 2015; Battistella et al., 2018; Bohdanowicz and Zientara, 2008, 2009; Høgevoid et al., 2015; Jones et al., 2014; Manaktola and Jauhari, 2007; Mihalič et al., 2012; Perić et al., 2016; Rylance and Spenceley, 2016; Sharma et al., 2018; Tom Dieck et al., 2018), provide benefits to employees (Alrousan et al., 2015; Battistella et al., 2018; Bohdanowicz and Zientara, 2008, 2009; Crick et al. 2018; Høgevoid et al., 2015, 2016; Jones et al., 2014; Manaktola and Jauhari 2007; Melissen et al., 2015; Mihalič et al., 2012; Rylance and Spenceley, 2016; Sharma et al., 2018) and choose responsible suppliers (Bohdanowicz and Zientara, 2008, 2009; Høgevoid et al., 2015; Jones et al., 2014; Manaktola and Jauhari, 2007).

On the other hand, the development of collaborative approach, as well as the provision of sustainable quality services are essential for leveraging sustainability in the business models of tourism enterprises. The archetype “develop collaborative approach” is newly inserted in the framework and groups examples, such as open innovation, cooperation with several stakeholders as local community, supply network, partners and also includes environment-based green cooperation (Akbar and Tracogna, 2018; Amersdorffer et al., 2012; Battistella et al., 2018; Berzina et al., 2017; Høgevoid et al., 2015; Kandampully and Promsivapallop, 2006; Manaktola and Jauhari, 2007; Melissen et

al., 2015; Mihalič et al., 2012; Rylance and Spenceley, 2016; Sharma et al., 2018; Sotiriadis and Van Zyl, 2017; Tom Dieck et al., 2018; Zebryte and Jorquera, 2017). Another archetype is proposed in the outlined framework, namely “provide sustainable quality services”. This archetype includes the provision of quality offer and services, highly-qualified staff, high-quality and fresh procurement of food (Alrousan et al., 2015; Battistella et al., 2018; Broccardo et al., 2017; Fuentes-Medina et al., 2018; Høgevoid et al., 2015; Koelble, 2011; Mihalič et al., 2012; Weeden, 2015). The archetype also considers customer programs aiming at customer fidelity and satisfaction (Alrousan et al., 2015; Battistella et al., 2018; Mihalič et al., 2012).

5 Discussion and conclusions

This section discusses the results in light of the peculiarities of sustainability in tourism and suggests future research directions in the field of sustainable business models in tourism. Services and servitization are rising attention of companies seeking to increase their competitiveness by moving towards a service-based business model. This implies a rising importance of re-assessing their business models.

This paper looked into tourism as one of the main industries where service is fundamental and where the companies and the tourists themselves consider the sustainable tourism for businesses a key role. The different nature of the service industry conducted the adaptation of the original archetypes by Bocken et al. (2014). In particular, tourism is characterised by:

- Direct customer contact is key; therefore, the archetypes cannot forget the key role of the customer to obtain social and environmental benefits as the role of tourism businesses can play in influencing the behaviour of tourists/guests is high.
- Value is created by a range of activities involving a number of stakeholders. As sustainable tourism is a multi-stakeholder issue, whose aim is to stimulate the balanced exploitation of natural resources at the local level and to limit the social and environmental impacts, many archetypes (e.g. “encourage sufficiency”) are strongly based on a strong community and local involvement.
- The businesses operating in the tourism sector mainly consist of SMEs. Their impact, although less significant if considered individually, are significant at the local level, particularly considering the cumulative effects produced by tourism businesses in a specific area. This impacts on archetypes such as “Promote inclusive value creation and community benefits” where the local aspect of the activities is the focus.

The research aims at contributing to the knowledge on sustainable business models by looking for solutions that could be delivered to tourism enterprises. The paper contribution is a revised set of archetypes of sustainable business models in tourism that categorizes the business models in the specific industry, that can facilitate a systematic and deeper analysis of sustainable tourism practices and that can be used to measure from the tourist point of view the most satisfactory archetypes and to help companies to inspire and facilitate the innovation process for sustainable business models in the future.

Coherently with the objectives of the study, the identification of archetypes of sustainable business model for tourism enterprises could support both researchers and enterprises in implementing sustainability. From the academic point of view, the research attempts to reduce the knowledge gap on sustainable business models, in tourism contexts especially. From the managerial point of view, the research proposes an initial set of solutions that could be adopted and implemented in real corporate environments.

This research has the following limitations. Firstly, the archetypes are developed through historical information and examples from literature review. As a result, it is necessary to add a practice view by means of interviews or questionnaires. Then this research focuses on the tourism industry that the results may not be relevant to other industries. Further studies may look at testing and implementing the proposed framework through both quantitative and qualitative methods, in order to strengthen the solutions for building up sustainable business models in tourism enterprises. Finally, we did not take a long-term view of possible transformations of the industry or of the sustainability in the industry, therefore the archetypes are related to the as-is situation and not to possible radical innovations.

References

- Akbar, Y. H. and Tracogna A., (2018) "The sharing economy and the future of the hotel industry: Transaction cost theory and platform economics", *International Journal of Hospitality Management*, Vol. 71, pp. 91-101.
- Alegre, I. and Berbegal-Mirabent, J., (2016) "Social innovation success factors: hospitality and tourism social enterprises", *International Journal of Contemporary Hospitality Management*, Vol. 28, No. 6, pp. 1155-1176.
- Alrouسان, R. M., Bader, M. A. and Abuamoud, I., (2015) "Stakeholders approach in influencing corporate social responsibility: A case study at two hotels in Jordan", *International Journal of Tourism Policy*, Vol. 6, No. 1, pp. 17-28.
- Amersdorffer, D., Bauhuber, F. and Oellrich, J., (2012) "The economic and cultural aspects of the social web: Implications for the tourism industry", *Journal of Vacation Marketing*, Vol. 18, No. 3, pp. 175-184.
- Amoamo, M., Ruckstuhl, K. and Ruwhiu, D., (2018) "Balancing Indigenous Values Through Diverse Economies: A Case Study of Māori Ecotourism", *Tourism Planning and Development*, Vol. 15, No. 5, pp. 478-495.
- Battistella, C., Cagnina, M. R., Cicero, L. and Preghenella, N., (2018) "Sustainable business models of SMEs: Challenges in yacht tourism sector", *Sustainability (Switzerland)*, Vol. 10, No. 10, pp. 1-20.
- Berzina, K., Medne, I. and Tsoy, M., (2017) "Tourism enterprise cooperation specifics: Comparative study of Riga and Novosibirsk travel agencies", *European Research Studies Journal*, Vol. 20, No. 3, pp. 974-988.
- Bocken, N. M., Short, S. W., Rana, P. and Evans, S., (2014) "A literature and practice review to develop sustainable business model archetypes", *Journal of cleaner production*, Vol. 65, pp. 42-56.
- Bohdanowicz, P. and Zientara, P., (2009) "Hotel Companies' Contribution to Improving the Quality of Life of Local Communities and the Well-Being of Their Employees", *Tourism and Hospitality Research*, Vol. 9, No. 2, pp. 147-158.

- Bohdanowicz, P. and Zientara, P., (2008), "Corporate social responsibility in hospitality: Issues and implications. A case study of Scandic", *Scandinavian Journal of Hospitality and Tourism*, Vol. 8, No. 4, pp. 271-293.
- Broccardo, L., Culasso, F. and Truant, E., (2017) "Unlocking value creation using an agritourism business model", *Sustainability (Switzerland)*, Vol. 9, No. 9, pp. 1-26.
- Buffa, F., Franch, M. and Rizio, D., (2018) "Environmental management practices for sustainable business models in small and medium sized hotel enterprises", *Journal of Cleaner Production*, Vol. 194, pp. 656-664.
- Cheng, M., (2016) "Sharing economy: A review and agenda for future research", *International Journal of Hospitality Management*, Vol. 57, pp. 60-70.
- Coles, T., Warren, N., Borden, D. S. and Dinan, C., (2017) "Business models among SMTEs: identifying attitudes to environmental costs and their implications for sustainable tourism", *Journal of Sustainable Tourism*, Vol. 25, No. 4, pp. 471-488.
- Crick, D., Chaudhry, S. and Crick, J. M., (2018) "Risks/rewards and an evolving business model: A case study of a small lifestyle business in the UK tourism sector", *Qualitative Market Research*, Vol. 21, No. 2, pp. 143-165.
- Fenclova, E. and Coles, T., (2011) "Charitable Partnerships among Travel and Tourism Businesses: Perspectives from Low-Fares Airlines", *International Journal of Tourism Research*, Vol. 13, No. 4, pp. 337-354.
- Fuentes-Medina, M. L., Hernández-Estárico, E. and Morini-Marrero, S., (2018) "Study of the critical success factors of emblematic hotels through the analysis of content of online opinions: The case of the Spanish Tourist Paradors", *European Journal of Management and Business Economics*, Vol. 27, No. 1, pp. 42-65.
- Guttentag, D., (2015) "Airbnb: disruptive innovation and the rise of an informal tourism accommodation sector", *Current Issues in Tourism*, Vol. 18, No. 12, pp. 1192-1217.
- Høgevoid, N. M., Svensson, G. and Padin, C., (2015) "A sustainable business model in services: An assessment and validation", *International Journal of Quality and Service Sciences*, Vol. 7, No. 1, pp. 17-33.
- Høgevoid, N. M., Svensson, G., Padin, C. and Dos Santos, M. (2016) "A comparison of sustainable business models between goods and service industries: Similarities and differences", *International Journal of Business Excellence*, Vol. 10, pp. 20-36.
- Jaafar, M. and Maideen S.A., (2012) "Ecotourism-related products and activities, and the economic sustainability of small and medium island chalets", *Tourism Management*, Vol. 33, No. 3, pp. 683-691.
- Jesson, J., Matheson, L. and Lacey, F. M., (2011) *Doing your literature review: Traditional and systematic techniques*, Sage.
- Jones, P., Hillier, D. and Comfort, D., (2014) "Sustainability in the global hotel industry", *International Journal of Contemporary Hospitality Management*, Vol. 26, No. 1, pp. 5-17.
- Kandampully, J. and Promsivapallop, P., (2006) "Service networks: A framework to match customer needs, service offer, and operational activities", *Journal of Hospitality and Leisure Marketing*, Vol. 13, No. 3-4, pp. 103-119.
- Koelble, T.A., (2011) "Ecology, economy and empowerment: Eco-tourism and the game lodge industry in South Africa", *Business and Politics*, Vol. 13, No. 1, pp. 13-24.
- Manaktola, K., Jauhari, V., (2007) "Exploring consumer attitude and behaviour towards green practices in the lodging industry in India", *International Journal of Contemporary Hospitality Management*, Vol. 19, No. 5, pp. 364-377.
- Melissen, F., Cavagnaro, E., Damen, M. and Düweke, A. (2016) "Is the hotel industry prepared to face the challenge of sustainable development?", *Journal of Vacation Marketing*, Vol. 22, No. 3, pp. 227-238.

- Mihalič, T., Žabkar, V., and Cvelbar, L.K. (2012) "A hotel sustainability business model: Evidence from Slovenia", *Journal of Sustainable Tourism*, Vol. 20, No. 5, pp. 701-719.
- Mohamad, N. H., and Hamzah, A. (2013) "Tourism cooperative for scaling up community-based tourism", *Worldwide Hospitality and Tourism Themes*, Vol. 5, No. 4, pp. 315-328.
- Perić, M., Vitezić, V. and Mekinc, J. (2016) "Conceptualising innovative business models for sustainable sport tourism", *International Journal of Sustainable Development and Planning*, Vol. 11, No. 3, pp. 469-482.
- Ritala, P., Huotari, P., Bocken, N., Albareda, L. and Puumalainen, K., (2018) "Sustainable business model adoption among S&P 500 firms: A longitudinal content analysis study", *Journal of Cleaner Production*, Vol. 170, pp. 216-226.
- Rylance, A. and Spenceley, A. (2016) "Applying inclusive business approaches to nature-based tourism in Namibia and South Africa", *Tourism*, Vol. 64, No. 4, pp. 371-383.
- Sharma, R., Yadav, D., and Sharma, M. (2018) "An insight into green practices followed in the Indian hotel industry", *African Journal of Hospitality, Tourism and Leisure*, Vol. 7, No. 1., pp. 1-9.
- Sotiriadis, M. and Van Zyl, C. (2017) "Sharing economy in the hospitality industry: Analysis, suggested strategies and avenues for future research", *Tourismos*, Vol. 12, No. 1, pp. 148-170.
- Tom Dieck, M.C., Fountoulaki, P., and Jung, T.H. (2018) "Tourism distribution channels in European island destinations", *International Journal of Contemporary Hospitality Management*, Vol. 30, No. 1, pp. 326-342.
- Weeden, C. (2015) "Legitimization through corporate philanthropy: A cruise case study", *Tourism in Marine Environments*, Vol. 10, No. 3-4, pp. 201-210.
- Yang, Z., Cai, J. and Sliuzas, R. (2010) "Agro-tourism enterprises as a form of multi-functional urban agriculture for peri-urban development in China", *Habitat International*, Vol. 34, No. 4, pp. 374-385.
- Yip, A. W. and Bocken, N. M., (2018) "Sustainable business model archetypes for the banking industry", *Journal of Cleaner Production*, Vol. 174, pp. 150-169.
- Zebryte, I. and Jorquera, H. (2017) "Chilean tourism sector "B Corporations": evidence of social entrepreneurship and innovation", *International Journal of Entrepreneurial Behaviour and Research*, Vol. 23, No. 6, pp. 866-879.

The Bottom-Up Approach and PPPs as Key-Drivers in the Creation of Sustainable Tourism Products: Evidence from a Community Destination

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Abstract

The paper discusses the bottom-up approach and PPPs in the creation of sustainable tourism products, with reference to projects managing the natural resources and protected areas of a typical community destination in northern Italy. We introduce the aims and features of a Reserves Network (RN) and analyse (1) whether and how stakeholder collaboration on projects aimed at conserving and valorising the destination's landscape and environment stimulate the creation of sustainable tourism initiatives; (2) the roles played by public and private actors in the definition of the projects; (3) if the projects' contribution - if any - to the destination's economic, social, and environmental sustainability.

The paper illustrates the results of a survey of 167 local stakeholders and 9 phone interviews with DMO members. We reconstruct the profiles of public and private stakeholders through multiple correspondence analysis and use content analysis to investigate the link between the RN and the development of sustainable tourism products.

The stakeholders recognise the RN's role, both in the creation of sustainable tourism products and in fostering/enabling local development. Differences, however, emerge between public and private actors regarding the economic, environmental and social sustainability of the RN projects.

The originality of the research lies in its managerial implications and contribution to the theoretical background.

Keywords – stakeholder engagement, collaboration, public private partnerships, sustainable tourism, Reserves Network

Paper type – Academic Research Paper

1 Introduction

The quest for innovation is a key challenge for tourism destinations seeking to increase their competitiveness (Hjalager, 2010; Carlisle et al., 2013) and is particularly complex for community destinations, i.e. territories in which the tourism offer depends on the collaboration of numerous stakeholders (Murphy 1985 and 1988; Murphy and Murphy, 2004; Beeton, 2006). In these territories private and public actors, as well as the local communities, are involved, with different roles and power, in decision-making processes regarding the development of the local tourism chain (Martini and Buffa, 2015). Natural resources are vital to this process, and are essential to the authenticity of the tourism offer. The tourism products offered by a particular community destination thus depend on the will and ability of its different stakeholders to coordinate their activities in ways that generate value not only for individual businesses, but for the destination as a whole (Simpson, 2008; Hung et al., 2011; Beritelli et al., 2016).

This paper presents the main results of our research, which focussed on the projects managing the natural resources and protected areas of a typical community destination. The main research questions are:

- Does stakeholder collaboration on projects aimed at conserving and valorising a destination's landscape and environment stimulate the creation of sustainable tourism initiatives?
- What roles do public and private actors play in the definition of the projects?
- Do the projects contribute to the economic, social, and environmental sustainability of the destination?

The area of research is the Reserves Network (RN), a new approach introduced in Trentino (Italy) to manage Natura 2000 areas. Our research highlights that, when local stakeholders actively participate in projects from the planning phase onwards, an RN becomes an effective natural resource management strategy. The stakeholders involved recognise the role of the RN, both in the creation of sustainable tourism products and in fostering local development. Differences, however, emerge between public and private actors in relation to the economic, environmental and social sustainability of the RN projects.

In the light of the empirical evidence, we discuss the opportunity offered by 'bottom-up' projects supported by private and public actors to effectively create value for the destination while also promoting sustainable tourism.

The paper is divided into four main sections. The following section illustrates the key points that emerge from the literature review in relation to the bottom-up approach and public private partnerships (PPP) in community-based destinations. The third section describes our fieldwork methods, and the fourth presents and discusses the most significant empirical evidence. In the final section, we highlight the managerial implications of our findings, and indicate further potential avenues of research.

2 Community based tourism, bottom-up approach and PPPs: a theoretical overview

As already mentioned, one of the main characteristics of community destinations is the presence of numerous (public and private) actors who play various roles in the definition of the territory's tourism offer. This complexity necessitates - on the one hand - the effective management of the actors involved, encouraging and enabling them to participate in specific development projects, and - on the other - the identification of an entity to coordinate the various activities and to mediate between the diverse interests, demands and expectations of the individual actors (Beritelli et al., 2016). To meet these challenges, the literature proposes the adoption of decisional processes based on *stakeholder consultation and participation* (Haywood, 1988; Simmons, 1994; Reid, 2004). Such strategies are crucial when important environmental decisions, which will entail the transformation of natural capital, are being made (Fennel and Dowling, 2003; Reed, 2008; Erkus-Ozturk and Eraydin, 2010), or when the historical/cultural patrimony of the destination is going to be impacted (Aas et al., 2005; Landorf, 2009). Participation ensures a broader, more responsible analysis of the economic consequences of development, and greater control over the ecological and socio-cultural aspects of sustainability for operators and local residents (Joppe 1996; Cooper and Wanhill, 1997; Timothy, 1999; Timothy and Tosun, 2003; Hwang et al., 2012).

The leading role of the local community is, of course, fundamental to any bottom-up approach. As underlined by Matarrita-Cascante et al. (2010, p. 738) "at the community level, formal and informal social mechanisms have a stronger capacity to promote the adoption of commonly desired values and attitudes. A community-level approach allows for the design of policies and practices sensitive to the opportunities, constraints and uniquenesses inherent to particular places (Bridger & Luloff, 1999; Cole, 2006; Maser & Kirk, 1996; Tosun & Timothy, 2003). Among such opportunities are goals associated with sustainability."

The decisions made by local communities involve a broad participatory process which, on the one hand, has the above mentioned advantages, but, on the other, requires the skilful coordination and harmonizing of interests and objectives which may seem - at least initially - to diverge considerably (Reggers et al., 2016). Bottom-up participatory processes can, therefore, take longer to achieve their goals than do the classic mechanisms grounded in hierarchical and/or market structures (Bieger et al., 2007).

While community involvement is undoubtedly essential for the development of participatory development projects, the presence of an effective coordinating - and guiding - entity is equally vital (Sakata and Prideuax, 2013). The bottom-up approach to sustainable development works well when there is broad community participation and dynamic social interaction (Matarrita-Cascante et al., 2010). Moreover, it has been shown that an initiative is much more likely to continue after the project which launched it has ended, when local people and their knowledge are deeply involved in the planning and implementation of the initial project (Pretty and Frank, 2000). In community destinations, therefore, the importance of the local community as a whole, and of the relationships

between individual (public and private) actors, is clearly evident. With regards to public-private partnerships (PPP) in community destinations, however, the data is not entirely unequivocal. Recent research emphasizes the strength of these relations, highlighting the contribution of PPPs' to the socio-economic development and valorisation of natural resources in the territories in which they have been operating (Ngilangwa et al., 2018). A study by Thiyane et al. (2018) reaches similar conclusions pointing to ways in which the involvement of PPP in development projects has been of socio-economic benefit in community destinations. De Almeida et al. (2018), who analyse the contribution of PPP to the development of sustainable tourism models in some protected areas in Brazil, concur.

Frost and Laing (2018), however, arrive at different conclusions: their research points to serious failures in the management - by PPP - of nature-based tourist attractions in Australia.

The above analyses clearly demonstrate the importance of local community, and both public and private sector, involvement in the valorisation of the territories investigated. Equally evident, however, is the extent to which the success of development projects depends on the specificities of each context.

3 Methodology

3.1 Area of study

The area of research is the Reserves Network (RN), established in Trentino (Northeast Italy) by the regional government to manage Natura 2000 areas. RNs were set up by the European project LIFE11/NAT/IT/000187 "TEN - Trentino Ecological Network" in order to create an ecological network within the territory. Most of the area covered falls under the Natura 2000 scheme, but it also includes a few locally protected areas (not part of either a national or a regional park) that are expected to benefit from the uniform management of the RN and the interconnection zones between the Natura 2000 areas.

The RN is not a newly protected area: within it, existing Natura 2000 areas are managed and enhanced in new ways, with a particular focus on the socio-economic dimensions of nature conservation and a bottom-up approach grounded in local stakeholder participation, responsible subsidiarity and integration between conservation policies and local sustainable development. Within the RN, the Natura 2000 conservation policy is explicitly linked to agriculture and tourism, integrating nature conservation measures and socio-economic development projects. The network is therefore not only concerned with defining direct measures for the protection of biodiversity - the maintenance of local economic activities (agriculture and handicrafts) and their integration with sustainable tourism is also an important focus.

Municipalities or other local governments set up the RN voluntarily and are responsible for its management, while the regional government directs management policies, and is responsible for auditing, and the relationship with the European Union.

3.2 Sample and data analysis

The field research was carried out in 2017 in five of the ten Trentino RNs. The research combined quantitative and qualitative methods. The first stage (qualitative analysis) consisted of face-to-face interviews with the coordinators of the five RNs. Our main objective was to identify the principal stakeholders involved in the creation of the RNs - both those whose approach was positive (proactive and collaborative) and those who adopted a critical approach (whether simply passively unenthusiastic about, or actively opposed to, the creation of the RNs, and who had, in some way, influenced and/or slowed the process). In this first phase, we also investigated the main activities, projects and initiatives promoted by the RNs to preserve and valorise the territory and the extent to which stakeholders had collaborated in their realisation. The collection of this information enabled us to plan the two subsequent research steps, analysed in this paper:

- The second stage (quantitative analysis) involved the local stakeholders identified in the previous research phase. We designed an online questionnaire and sent it to all the stakeholders identified as important by the RN coordinators, with the exception of the DMO directors, with whom we conducted ad hoc interviews (see *infra*). The online questionnaire was sent to the 167 stakeholders named by the RN coordinators, and 110 were returned to us (response rate 65.9%). The online survey collected data and information on the three topics upon which we have chosen to focus: the ways in which local stakeholders participated; their opinions of/satisfaction with the RN; their perception of the opportunities for and/or limitations on the territories' socio-economic development.
- The third research stage (qualitative analysis) was carried out through interviews with members of the DMOs in the territories containing RNs (9 phone interviews). We investigated the ways (if any) in which the tourist sector and the RNs were collaborating, and enquired into the former's perceptions of the opportunities and/or limitations linked to their RN in relation to the development of innovative sustainable tourism products.

The quantitative data collected in the second research stage was analysed as follows:

- a) Through a descriptive statistical analysis of the responses at the aggregate level ($n = 110$) and then a focus on the stakeholders involved in at least one of the RN projects. We observed the stakeholder participation in each type of project those primarily aimed at valorising natural resources *vs* those mainly focused on creating tourism products); participation in the different phases of the projects (i.e., planning *vs* realization); the type of stakeholder involved (public *vs* private actors).
- b) Using multiple correspondence analysis (MCA) to investigate the differences between public and private actors with regard to *a*) the type of project, and the project phase, in which stakeholders are involved; *b*) agreement on the contributions of RNs in terms of economic, social and environmental sustainability; *c*) the importance given to specific activities/aims of the RN.

Content analysis was used to analyse the interviews carried out with the DMOs in order to understand whether collaboration, involvement and agreement with certain RN

aims are considered to the development and sustainability of the tourism offer. This phase is still ongoing; in the next section we present our initial findings.

4 Main research results

4.1 RN projects and stakeholder involvement

Most (90%) of the (110) respondents to the questionnaire had participated in at least one RN project. About half of them were involved in nature conservation projects (local plant and animal biodiversity, preservation and restoration of habitat); more than 40% had taken part in projects related to the creation/restoration of paths, environmental education, organization of events/exhibitions for local residents, or guided tours to natural/artistic/cultural resources. Interest was also shown in the valorisation of local products and environmental education activities in schools (see Table 1).

Table 1 - RN projects in which stakeholders participated

Projects	Stakeholder participation	
	Yes (%)	No (%)
Nature conservation (local plant and animal biodiversity, preservation and restoration of habitat)	49.5	50.5
Creation/restoration of paths	43.4	56.6
Environmental education	41.4	58.6
Organization of events/exhibitions for local residents	41.4	58.6
Organization of guided tours to natural/artistic/cultural resource	39.4%	60.6
Promotion of local products	32.3	67.7
Organization of environmental education activities in schools	28.3	71.7
Valorisation of agriculture	26.3	73.7
Initiatives aimed at de-seasonalising tourism	23.2	76.8
Sustainable transport	22.2	77.8
Commercial development	5.1	94.9
Development of handicraft sector	3.0	97.0

Most of the stakeholders were involved in both the planning and the implementation stages of the projects, that is, they were active in the key decisional processes (Table 2).

Table 2 - Stakeholder involvement in RN projects

Project phases	%
Stakeholders involved in both the planning and the implementation of the activities	51.8
Stakeholders involved only in the planning	30.9
Stakeholders involved only in the implementation	5.5
Stakeholder not involved in any of the phases but had undertaken certain operation	1.8
Stakeholder never participated in a project	10.0

The MCA revealed an initial result which gives us an answer to the main research question i.e. the roles played by (public and private) actors in the RN projects. 56.6% of the questionnaire respondents were private stakeholders (this category includes actors involved in tourism, agriculture, industry, trade, handicrafts and support services for the private sector); 33.3% were from the public sector; 10.1% were students and/or pensioners. The analyses which follow focus specifically on the two predominant categories - private and public actors (n= 89) - illustrating their various profiles, which differ with regard to both the roles they played and their opinions on the RN contribution to the economic, social, and environmental sustainability of the destination.

4.2 Public and private stakeholder profiles

The MCA reveals a greater involvement of private actors in activities related to the valorisation of natural resources, whether conservation (nature preservation, path restoration), the valorisation of local products, or initiatives to promote de-seasonalization. There was also a certain involvement in sustainable mobility projects. In all of the above, private stakeholders were particularly involved at the planning stages (see Figure 1).

Public stakeholders, on the other hand, were more involved in educational activities (both in the community and in schools) and in the organisation of events (directed at both the local community and tourists). In all of the above, the public actors were involved in both the planning and the implementation stages of the projects/initiatives.

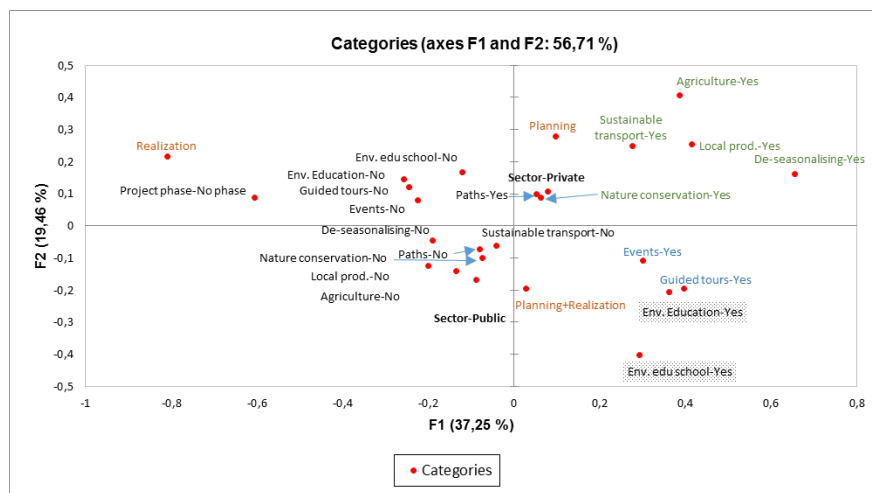


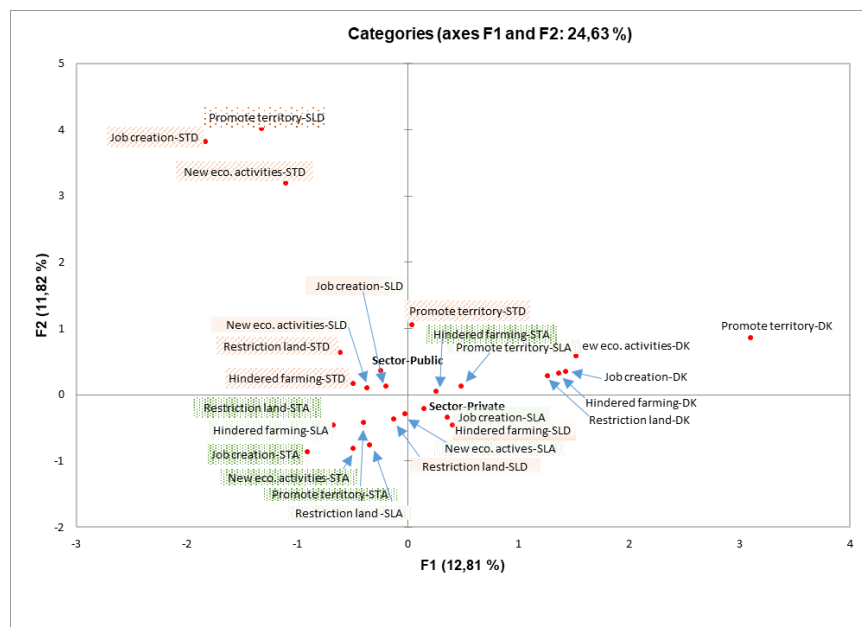
Figure 1 - Role and involvement of private and public stakeholders

Our research investigated if - in the opinion of the public and private actors - the establishment of the RN was increasing opportunities for socio-economic and environmental development and/or growth in the territory and for the local population. The MCA reveals that, as might be expected, the stakeholders vary in their opinions. In some cases (particularly in relation to the economic impact, *see below*), the public sector

seems to be more “cautious/timid” in its evaluation of the RN as a tool for the promotion and/or development of the territory, while private actors have higher expectations.

Figure 2 shows that the private sector is in general agreement that the RN has contributed - at least to some extent (slightly agree) - to the creation of jobs and the development/promotion of the territory. This group also believes that the RN has stimulated the creation of new economic activities (e.g. B&Bs, ‘agriturs’, outlets for the sale of local products, etc). However, private actors also agree more strongly than their public counterparts that the strict environmental regulations imposed within the RN have been an obstacle to (both arable and livestock) agriculture.

The public sector, however, seems to be more sceptical. As Figure 2 reveals, “slightly disagree” is its most common response.



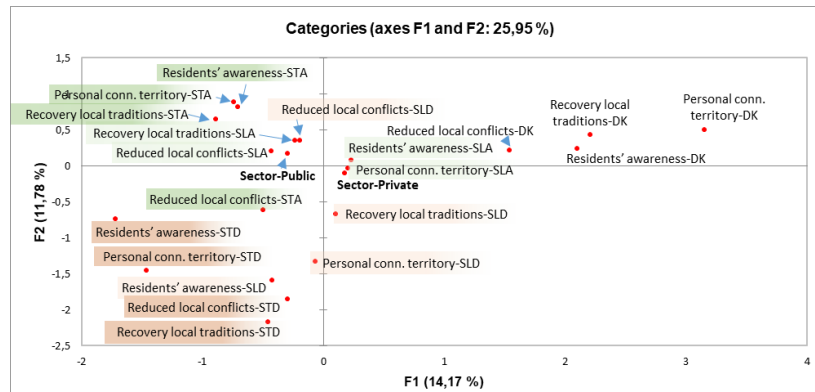
Note: STA (strongly agree), SLA (slightly agree), SLD (slightly disagree), STD (strongly disagree), DK (do not know).

Figure 2 - The economic dimension

The MCA on the social dimension of the RN (see Figure 3) shows that public and private actors agree that the RN has increased community awareness of local environmental conservation, their own connection to their territory, and the importance of maintaining/rediscovers local traditions. Local stakeholders also believe that the RN has helped to decrease local conflicts. Within the public sector there is a greater tendency (than among private actors) to regard the RN as having had a noticeable impact on local society.

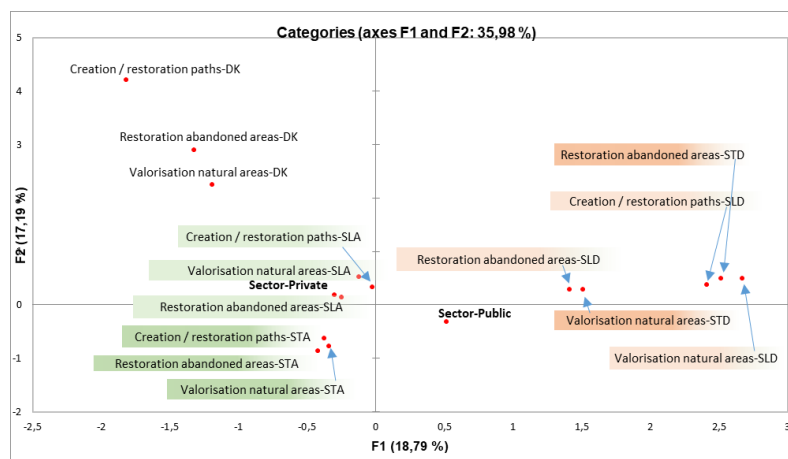
The MCA of the environmental dimension (Figure 4), in contrast, reveals that private stakeholders are more inclined (than those in the public sector) to accord importance to

the role of the RN. They tend to believe that the RN has enabled the requalification of abandoned/degraded areas, the creation or restoration of paths, and the valorisation of areas of particular natural value.



Note: STA (strongly agree), SLA (slightly agree), SLD (slightly disagree), STD (strongly disagree), DK (do not know).

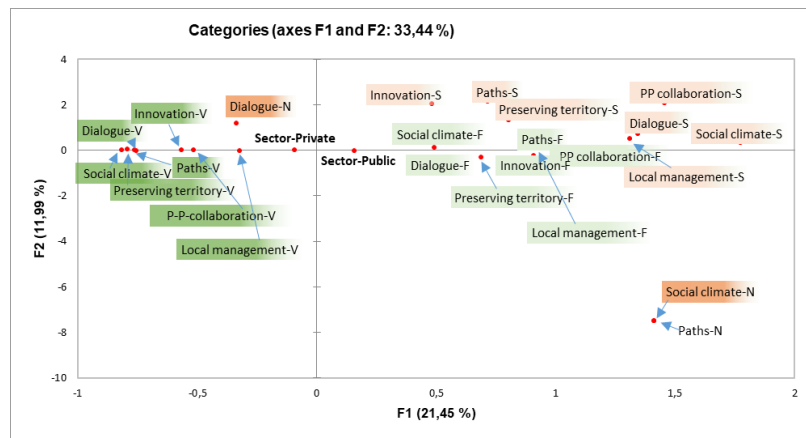
Figure 3 - The social dimension



Note: STA (strongly agree), SLA (slightly agree), SLD (slightly disagree), STD (strongly disagree), DK (do not know).

Figure 4 - The environmental dimension

And lastly, the MCA of the variables related to the objectives associated with the creation of the RN (Figure 5) shows that these objectives were shared by all the local actors (with private stakeholders evincing the greater conviction). Aspects to which actors were sensitive included: the management of protected areas; stimuli for the innovation and identification/creation of new economic activities; opportunities to facilitate interaction between the various productive sectors; the improvement of the social climate through participation in collaborative projects/activities; territorial conservation; increased collaboration between public and private actors.



Note: V (very), F (fairly), S (slightly), N (no).

Figure 5 - Aims and Importance

Local stakeholder enthusiasm about the benefits and opportunities linked to the establishment of the RN is confirmed by an initial comparison with the content analysis of the interviews conducted with the directors of the relevant DMOs. Our specific intention is to investigate whether the findings of the quantitative analysis tally with what we are told by the actors involved in the organisations whose *raison d'être* is the development of local tourism. In this preliminary phase of the analysis, we have considered only the statistical measures of term frequency (represented in the word cloud in Figure 6) and the Tf/Idf (term frequency - inverse document frequency).

The results, examining the Tf/Idf measure, confirm that the DMO directors associate the RN with sustainability, and thus with the opportunity to organise related projects/activities – in some cases, the directors referred specifically to the existence of the territory's natural park (Parco Adamello Brenta). They also associate the RN with the contribution that it can make to *a)* the integration of activities within the local tourist offer and *b)* facilitating intracommunity cooperation.

Table 3 - Frequency and Tf/Idf of the content analysis

Word*	Frequency (%)	Tf/Idf
RN	18.83	0
projects	7.69	0
consortium	7.43	0.8109
activities	7.16	0
DMO	6.37	0.2513
sustainability	5.04	0
park	3.71	1.0986
topic/issue	3.18	0.1178
territory	2.92	0.2513
tourism offer	2.65	0.4055
stakeholders	2.39	0.4055
collaboration	2.39	0.4055

Note: For pragmatic reasons, Table 3 reports the list of top frequent words extracted from interviews.

activities and products). The fact that local actors are now acquiring these competences is likely to facilitate the future development of activities related to environmental education/interpretation (Skanavis and Giannoulis, 2009) which are becoming increasingly popular among some segments of the tourism demand.

With regard to the theoretical background, our findings confirm the importance of the involvement of local actors, right from the planning phase. This is borne out by our analysis of the projects and initiatives promoted by the RNs and appears to offer hope that these initiatives will prove resilient over time (Pretty and Frank, 2000). The research reveals constructive relationships between public and private actors which support the economic, social and environmental development of the territory. The establishment of the RNs proves to be an example of good bottom-up managerial practice, and is line with the positive experiences of the efficacy of PPPs reported in the literature (De Almeida et al., 2018; Ngilangwa et al., 2018; Thiyane et al., 2018).

In the light of the evidence and the implications that emerge from it, we believe that our research – while limited to one destination only - demonstrates elements of originality. Aware that this RN is - to date - unique in Italy, we nevertheless intend to extend our research to investigate whether or not the present results are confirmed by the experiences of other community destinations which have adopted the bottom-up approach to the management of natural resources.

Acknowledgement

The data presented in the paper come from a study (commissioned by the Province of Trento and conducted by the University of Trento) which examines the socio-economic impact of the Trentino RNs. The research is linked to the European project LIFE11/NAT/IT/000187 "TEN" - Trentino Ecological Network (D2 action).

References

- Aas, C., Ladkin, A. and Fletcher, J., (2005) "Stakeholder collaboration and heritage management", *Annals of Tourism Research*, Vol. 32, pp. 28-48.
- Beeton, S., (2006) *Community development through tourism*, Landlinks Press, Collingwood.
- Beritelli, P., Bieger, T. and Laesser, C., (2007) "Destination Governance: using Corporate Governance Theories as a foundation for effective destination management", *Journal of Travel Research*, Vol. 46, No. 1, pp. 96-107.
- Beritelli, P., Buffa, F. and Martini, U., (2016) "Logics and interlocking directorships in a multi-stakeholder system", *Journal of Destination Marketing & Management*, Vol. 5, No. 2, pp. 107-116.
- Bridger, J., and Luloff, A.E., (1999), "Toward an interactional approach to sustainable community development", *Journal of Rural Studies*, Vol. 15, No. 4, pp. 377-387.
- Carlisle, S., Kunc, M., Jones, E. and Tiffin, S., (2013) "Supporting innovation for tourism development through multi-stakeholder approaches", *Tourism Management*, Vol. 35, pp. 59-69.
- Cole, S., (2006) "Information and empowerment: The keys to achieving sustainable tourism", *Journal of Sustainable Tourism*, Vol. 14, No. 6, pp. 629-644.

- Cooper, C., Wanhill, S., (Eds.) (1997) *Tourism development: Environmental and community issues*, Wiley: Chichester, UK.
- De Almeida Cunha, A., Cristina Magro-Lindenkamp, T. and McCool, S.F., (2018) *Tourism and protected areas in Brazil*. Nova Science Pub Inc.
- Erkus-Ozturk, H. and Eraydin, A., (2010) "Environmental governance for sustainable tourism development", *Tourism Management*, Vol. 31, pp. 113-124.
- Fennel, D.A. and Dowling, R.K., (2003) *Ecotourism policy and planning: Stakeholders, management and governance*. In Fennel D.A. and Dowling R.K. (Eds), *Ecotourism policy and planning*, CAB International: Wallingford, UK.
- Frost, W. and Laing, J., (2018) "Public-private partnerships for nature-based tourist attractions" *Journal of Sustainable Tourism*, Vol. 26, No. 6, pp. 942-956.
- Haywood, K.M., (1988) "Responsible and responsive tourism planning in the community", *Tourism Management*, Vol. 9, pp. 105-118.
- Hjalager, A.-M., (2010) "A Review of Innovation Research in Tourism", *Tourism Management*, Vol. 31, pp. 1-12.
- Hung, K., Sirakaya-Turk, E. and Ingram, L. J., (2011) "Testing the efficacy of an integrative model for community participation", *Journal of Travel Research*, Vol. 50, No. 3, pp. 276-288.
- Hwang, D., Stewart, W.P. and Dong-wan Ko, D., (2012) "Community behaviour and sustainable rural tourism development", *Journal of Travel Research*, Vol. 51, pp. 328-341.
- Joppe, M., (1996) "Sustainable community tourism development revisited", *Tourism Management*, Vol. 17, pp. 475-479.
- Landorf, C., (2009) "Managing for sustainable tourism", *Journal of Sustainable Tourism*, Vol. 17, pp. 53-70.
- Martini, U. and Buffa, F., (2015) "Local networks, stakeholder dynamics and sustainability in tourism", *Sinergie*, Vol. 33, No. 96, pp. 113-130.
- Matarrita-Cascante, D., Anthony Brennan, M. and Luloff A.E., (2010) "Community agency and sustainable tourism development", *Journal of Sustainable Tourism*, Vol. 18, No. 6, pp. 735-756.
- Maser, C., and Kirk, C., (1996) "Sustainable development and local community development", in Maser C. (Ed.), *Resolving environmental conflict: Towards sustainable community development*, St. Lucie Press, DelRay Beach (FL).
- Murphy, P. E. and Murphy, A. E., (2004) *Strategic management of tourism communities*, Channel View Publications, Clevedon.
- Murphy, P. E., (1985) *Tourism: A community approach*, Methuen, London.
- Murphy, P. E., (1988) "Community driven tourism planning", *Tourism Management*, Vol. 9, No. 2, pp. 96-104.
- Ngilangwa, B., Meney, R. and Msafiri, C., (2018) "Exploration of a future scene for Community Based Tourism in the southern part of Serengeti ecosystem", *International Journal of Conservation Science*, Vol. 9, No. 4, pp. 733-748.
- Reed, M.S., (2008) "Stakeholder participation for environmental management", *Biological Conservation*, Vol. 141, pp. 2417-2431.
- Reid, D.G., Mair, H. and George, W., (2004) "Community tourism planning", *Annals of Tourism Research*, Vol. 31, pp. 623-639.
- Reggers, A., Grabowski, S., Wearing, S.L., Chatterton, P. and Schweinsberg, S., (2016) "Exploring outcomes of community-based tourism on the Kokoda Track, Papua New Guinea", *Journal of Sustainable Tourism*, Vol. 24, No. 8-9, pp. 1139-1155.
- Skanavis, C. and Giannoulis, C., (2009) "A training model for environmental educators and interpreters employed in Greek protected areas and ecotourism settings", *International Journal of Sustainable Development & World Ecology*, Vol. 16, No. 3, pp.164-176.

- Simmons, D.G., (1994) "Community participation in tourism planning", *Tourism Management*, Vol. 15, pp. 98-108.
- Simpson, M. C., (2008) "Community benefit tourism initiatives?" *Tourism Management*, Vol. 29, No.1, pp. 1-18.
- Thiyane, T.T., Sibanda, R. and Katrodia, A., (2018) "Impact of Public Private Partnerships on community- based tourism projects", *African Journal of Hospitality, Tourism and Leisure*, Vol. 7, No. 2.
- Timothy, D.J., (1999) "Participatory planning. A view of tourism in Indonesia", *Annals of Tourism Research*, Vol. 26, pp. 371-391.
- Timothy, D.J. and Tosun, C., (2003) *Appropriate planning for tourism in destination communities*. In Singh S., Timothy D.J. and Dowling R.K. (Eds.), *Tourism in destination communities*, CABI, Oxford, UK.
- Tosun, C., and Timothy, D., (2003) "Arguments for community participation in tourism development", *Journal of Tourism Studies*, Vol. 14, No. 2, pp. 2-11.

The Role of Collaborative Economy in Enabling Business Model Innovation Towards Circular Economy

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Abstract

Sharing and collaborative economy concepts, based on product use optimization, are always more considered by enterprises as a potential eco-innovative and competitive factor. Those principles also match with circular economy EU goals of waste prevention, reduction and resources valorization and efficiency.

Present work attempts to build a theoretical framework for collaborative and circular business models (CCBM's) by integrating both circular and sharing purpose. Those models aim at overcome waste and inefficiencies of actual linear economy, encouraging the transition from a "thrown away society" to a "regenerative society" in which instead products seller we have a service provider and where goods became much more a dematerialized value though for a need satisfaction. While today different CBM's and sharing models have been arranged, their integration through CCBM's lack of a clear harmonization and schematization order to support all stakeholders (organization, consumer and policy makers) in its understanding, and implementation, especially producers who are claimed to make a disruptive change in their way of think at their business.

Keywords – Business model, Circular economy, Collaborative approach, Industrial Symbiosis, Sharing economy

Paper type – Academic Research Paper

1 Introduction

The current production and consumption model is dependent on continuous growth and increasing resource consumption throughput (Gaudin, 2016). This model is so-called “take, make and dispose” or linear economy. A circular economy is a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops (EMF, 2012). Its main objective is to increase efficiency of resources by minimizing waste and resource extraction by closing the loops in terms of resources and materials (EC, 2014). Similarly, sharing economy principles, according which “an underutilized product is a lost product” (Gansky, 2010), can be considered strictly connected to circular economy issues. Actually, collaborative initiatives based on sharing strategies allow to overcome wastes and inefficiencies of linear economy and support the transition to circular economy (Bocken et al., 2016). According to the “European agenda for the collaborative economy” (EC, 2016), the term “collaborative economy”¹ refers to business models where activities, also facilitated by collaborative platforms, create an open marketplace for the temporary usage of goods or services often provided by private individuals. In particular, the European agenda states that collaborative economy involves three categories of actors:

- **service providers** who share assets, resources, time and/or skills — these can be private individuals offering services on an occasional basis (‘peers’) or service providers acting in their professional capacity (“professional services providers”);
- **users** of the services;
- **intermediaries** that connect providers with users and that facilitate transactions between them (‘*collaborative platforms*’ in case of online tools).

Although the sharing economy has its first appearance as a bottom up phenomenon and it was originally intended as an exchange among “privates” (Botsman and Rogers, 2010), it has grown and has been spread also in the private organizations and companies with interesting advantages in economic and environmental terms (Cohen, 2015). According to a study of Price Waterhouse Cooper (Lancefield et al. 2015), it is necessary to bring the collaborative practices within the organizations since many of them have underutilized potentials and capabilities. The application of the sharing and/or collaboration practices through B2B and B2C agreements, would allow a more efficient functioning of the enterprises (Bocken et al., 2016). The same goes to intangible assets such as intellectual property or company brands, which can be easily shared through the use of new technologies. This is the reason why flexible business models which change the workers expectations and stimulate process innovation, are emerging (Chesbrough, 2010). In particular, collaborative platforms can be used to help companies to develop new activities, by reducing costs and developing new income flows.

The shift from the linear economy to the circular economy has produced innovative

¹ In this paper the term “collaborative” and “sharing economy” will be used alternately

ways to do business and new business models have deeply changed the industrial sector (EMF, 2015). The literature defines a business model as a set of procedures that the organization puts in practice to create, deliver and capture values. (Osterwalder and Pigneur, 2010). The integration of the Circular Economy in the strategic management ground remains weak and insufficient and it is needed additional theoretical and empirical research on how this is adopted and implemented by the companies. On the other hand, evidence show that there is a lack of public awareness on the advantages of the Circular Economy approach, therefore the importance of additional research and scientific literature is also bigger (Su et al., 2013;). Sharing economy practices, which have grown rapidly in recent years thanks to new ways of contact such as platforms, often present elements that contribute to the transition to the circular economy (Demailly and Novel, 2014). Literature is lacking for this aspect, despite its strongly innovative footprint and the virtuous circle that it encompasses.

This paper wants to explore business models that use collaborative trends and tools and also comply with the circular economy approach.

2 From Linear to Circular and collaborative business model

The term *Business Model* refers to the conceptual logic of how the firm creates and appropriates economic value by charging the customer (user) a price for the solution to a problem (Teece, D. J. 2010). A **Circular Business Model** (CBM) as conceptual logic for value creation is based on the production of new offerings utilizing economic value retained in products after its use for (Carbon Trust. 2017). It therefore integrates principles of circular economy such as resource efficiency and waste preventions.

It is possible to detect the following **collaboration schemes** (Sposato et al. 2017) (fig. 1):

- **P2P (Peer-to-Peer)**, where the collaboration occurs among individuals intended as "private",
- **B2C (Business-to-Consumer)** among companies and single consumers,
- **C2B (Consumer-to-Business)** among single consumer to companies,
- **B2B (Business-to-Business)** among companies themselves.

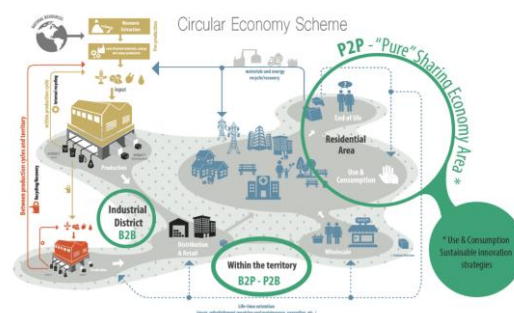


Fig.1. Shared and collaborative economy actors (P2P, B2P, B2B) within circular economy scheme. Source: ENEA

The intersection between circular business models and collaborative business models forms the Collaborative Circular Business Models (CCBM). The CCBMs focus on relationships and agreement among more stakeholder who are necessary to “recapture and recirculate” the value of the resources at different life cycle stages. CCBM’s aims at life-time extensions, use optimization of products and resources valorization. All actors involved in the product value chain cooperate and collaborate to maximize the value contained in products (both economic and material value) not only at production stage, but also during and after the use phase.

The Figure 2 outlines circular business models in relation to the life cycle stages of a product or service and detects which of them can also be classified as sharing and/or collaborative business models.

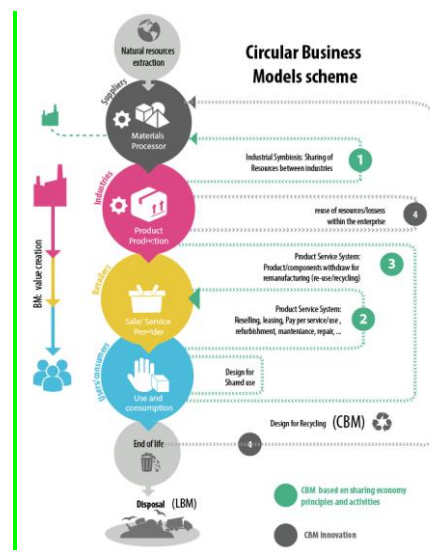


Fig.2. Circular and Collaborative Business Models. Source: ENEA

Collaborative practices imply a return flow to the producer from users/producers or between users, often including intermediaries between the two parties (Linder et al. 2013). In most cases intermediation and collaboration can be based on collaborative on-line platform..

3 Materials and Methods

The present work is a qualitative analysis of different collaborative circular business models (CCBM). The analysis is based on a holistic approach and tents to give a conceptual answer and hints on how to develop them further.

CCBM have been analysed by considering:

- the *type of relationships* between “collaborators” (who produces the value , who uses it , who delivers and recaptures it);
- the *drivers* for the circular and collaborative business model implementation by

considering the role of the main involved actors including the *different types of collaboration based on digital platform* or on more conventional agreement between the stakeholders involved.

4. Results

The CCBMs can be divided in two big groups: B2B and B2C.

4.1 Business-to-Business(B2B) CCBMs: the case of Industrial Symbiosis

Industrial symbiosis (IS) is an important collaborative circular economy business models (CCBM) which implements “closing the loop strategies” at the production stage through the collaboration between two or more companies in order to exchange, share or jointly manage resources, with both economic and environmental advantages for all parties and the possibility of creating new business opportunities. This integrated cross-industrial system is based on resource efficiency of underutilised resources (such as materials, energy, water, by-products) together with the shared use of assets, logistics and expertise capacity.

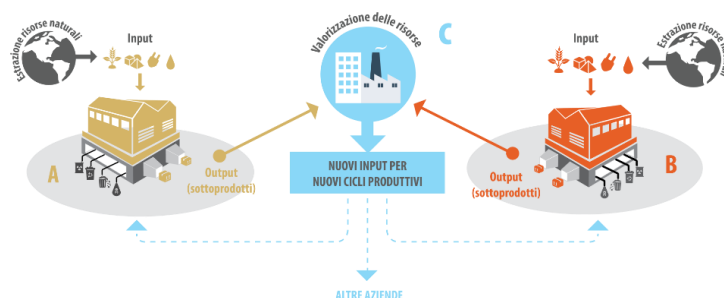


Fig.3. Industrial Symbiosis scheme. Source: ENEA

As shown in Figure 3, collaboration occurs between the “offering companies” that produce by-products and residues and “receiving companies” that receive those resources as a return flow and recapture its economic value, avoiding the utilization of other more cost expensive raw materials; depending of IS pathway, also intermediaries can act between the two parties (e.g. for potential residues treatment process). Therefore IS acts in networks of companies operating in different sectors of providing a mutual benefit or symbiosis for residues/by-products transactions. (Cutaia et al. 2014).

The enabling technology for IS implementation are the emerging on-line platforms for resources sharing (materials, energy products, water, services and expertise) among companies. An example is the Industrial Symbiosis platform developed by ENEA where companies can share their available and needed resources in in order to find potential collaboration with other companies interested in their exchange/valorization. The platform consist in a database of geo-referred input-output resources (uploaded by each company) and technologies (managed by ENEA) useful for the identification of potential

symbiosis pathways. In this case, the platform provides support to collaborate and work with companies for finding industrial symbiosis opportunities.

4.2 Business to Consumer (B2C) CCBMs: the case of Product Service System

The “product-service systems” (PSS) has been defined by Goedkoop et al. (1999) as “a marketable set of products and services capable of jointly fulfilling a user’s need. The product/service ratio in this set can vary, either in terms of function fulfilment or economic value”. Thus, more traditional material intensive ways of product utilization are replaced by the possibility to fulfil consumers’ needs through the provision of more dematerialized services, which are also often associated with changes in the ownership structure (Tukker, 2015). Business to Consumer (B2C) collaborative models offer a disruptive change in the producer/consumer relationship and behavior, switching from the concept of goods ownership to the concept of goods use (Mont, 2002). Customers are now individuals (users) who cooperate with companies for their needs satisfaction. It is based on the value of utilization, where products are no more consumable (material goods), but a performance where the consumer pays for its utilization to fulfill a need. In line with this, products are just a media to provide a function and the “costs of production is only a very small part of the costs involved in making a product available to the customer” (Giarini et al. 1998). This new, more service-oriented model of manufacturing growth has some key competitive factors such as the capability for continuous innovation, improved design and quality and customized goods, rather standardized products than the production of large volumes of goods (Reim et al., 2015; Valencia et al., 2015). Moreover, these new practices require a higher level of customer involvement and mindset change of the producers. The producers need to be capable of sensitizing the consumer on opportunities that environmental renovation bring. They encourage the update and are responsible of the “education” of the consumers on how to use the product.

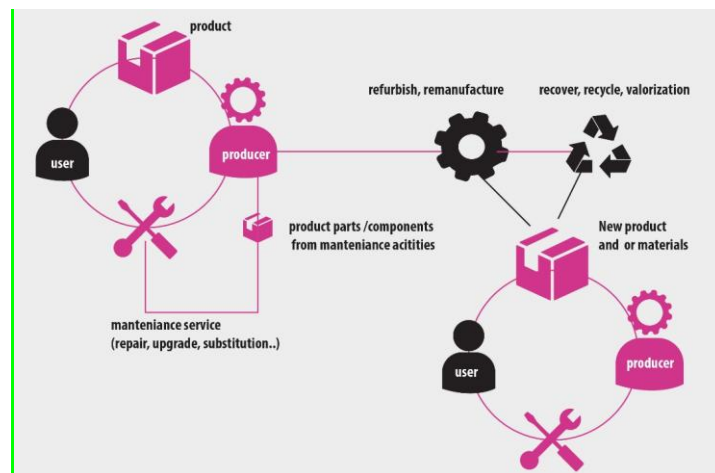


Fig.4. Pay-per-service scheme (PPS). Source: ENEA

As shown in the figure 4, the producer is the owner of the products and provides the users with the maintenance function through repairing, upgrading, substitution services etc. in this case the good is often delivered to the users for a long period. Collaboration between user and producer is iterative and continuous and determines constant product innovation in technological and environmental terms (i.e. domestic appliances that continuously update their energy efficiency class). This model brings radical changes not only in the use and post-use phase, but also in the product design. Also in this case the owner remains the producer (including the end of life management) but, to better maintain and capture the value of the return flow (which are more continuous than in a PPU model), the product needs to be conceived as a good that can be disassembled in smaller components in order to be able to repair it rather than throw it away. In a PPU, in fact, the main revenues for the company arise from the intensification of the product use (and the payment for its use), based on the principle that the sharing use imply the sharing cost among users of the product value. Otherwise, in a PPS, where the relationship not necessarily imply a shared use (or a high frequency), ecodesign strategies are not only more convenient, but indispensable for the business. In fact, each component should have materials and life-length that are coherent with its function and it should also be easily disassembled and repairable in order to favour the maintenance and material recovery (ecodesign strategies). Since the material value of the product is just a capital asset, producers are encouraged to take back their products, or some of its parts, remanufacture or refurbish them and offer them again when possible, or valorize its materials for new applications or products. In other terms, the closure of the loops becomes a cardinal point in the construction of the business model based on the PPS where the economic value of the materials is not entirely charged to the consumer.

5. Drivers for the CCBMs implementation

5.1 The role of the producers

The producers have a major role in the penetration of the circular and collaborative business models in the market. In fact, according to the discussion above, the extension of the producer responsibility in all life cycle phases of the product, covers the latter with a significant importance in changing the trends (Montalvo, 2016). This new responsibility is also a source of important opportunities and advantages. In fact, through the implementation of the CCBMs, the producers can increase the perception of the total value to the consumers or other producers thanks to an increased and continuous flow and exchange of information about their needs and preferences. This can consolidate the fidelity through time. They can specifically intervene in

- innovating the market (from both production and consumption point of view), particularly in sectors where industry is mature.
- anticipating the implications of future take-back legislation and materials /waste management
- being more flexible and prepared to changes in market demand and materials

price fluctuations.

5.2. The role of the platforms (intermediaries)

Concerning intermediaries role, they can support the whole innovation process (Kanda et al., 2015): from the innovation development phase to the innovation diffusion phase (Mignon, 2016). Intermediaries generally differ in recipient targets providing services to supply-side actors, i.e. innovation developers, or supports to demand-side actors, i.e. innovation adopters (Kanda and Mignon, 2017). In case of collaborative platform, its intermediary role provides support to both supply-side and demand-side actors, establishing continuity in the support. Collaborative platforms offer the potential for environmental benefits by providing the possibility to share resources more widely than in the past. The development of these platform can support circular business models and allow companies to get through the constraints of linear zero-sum thinking and to gain a circular advantage fostering new consumption models to be adopted by consumers.

From the preview experiences, it emerges that strategies for unlocking the Circular Economy potential include either bottom-up and top-down actions. Both these approaches need robust, clear and transparent information based on technical and scientific studies (evaluations, innovations and tools/models). The collaborative platforms can also be used to help companies develop new activities by reducing costs and developing new entrance flows.

5.3. The role of consumers

The European Strategy for the resource efficiency indicates that improving resource efficiency is not only a top-down objective, but it can also be a bottom – up approach. Local administrators have a consistent role in the citizens' participation but also their involvement and role is crucial for the adoption of measures that can improve resource efficiency. The PWC (Lancefield, D., et al. 2015) reveals that companies should pay attention to the consumers who can, in a near future, become direct competitors. The companies should assess if their consumers can found a P2P network and take over their market share by developing similar services. This is more often in contexts where certain services are widely requested by the population and are offered with high fixed prices and present an underutilization. For this reason, collaborative economy models are deeply changing the interactions between consumers and business world, passing from the user concept of sharing economy and evolving in the actual concept of “prosumers” (producer + consumer) of the collaborative models, by spreading and developing the concept of “co-creation” and “co-design” of products.

5.4. The role of policy and governance

A significant contribution to boosting the CCBMs is given by the public and institutional thrust which can spur their implementation by concrete actions such as favorable regulation and incentives. The intervention of the public sector can be justified for the aforementioned reasons and advantages that the CCBMs bring to the society.

Furthermore, it has also been argued that by offering market – based solutions, CCBMs are able to respond and contrast the market failure related to information asymmetry (Vitkovic 2016). Indeed, the “peer review” practice through platforms and feedbacks on the quality of a service or good, contributes on the reduction of the information asymmetry.

Nevertheless, due to its intrinsic difference in the way its business is developed, the sharing economy models are very difficult to frame under a traditional and standardized regulation. Busch et al point out how the existing regulatory framework is focused and designed after “bipolar” transactions between businesses and consumer and it does not provide solutions for the new situation that comprises not only business and consumers, but also platforms, (“triangular transactions”). In this regards, it is also argued that the sharing economy businesses are subject to less ex – ante regulation (Vitkovic, 2016) than the traditional ones, breaking this way the assumptions of the competition law.

These particular aspects have been an obstacle to the design of adequate policies that can favor the penetration of the CCBMs in the market and consequently help changing the market trends and the mindset towards a concrete transition to the circular and sharing economy practices. On the other hand, the EU has widely recognized the importance of the collaborative economy and has also actively worked in this direction. The EC (2016) has adopted the “European Agenda for the collaborative economy” which foresees orientation for the Member States on how to deal with the EU laws in application to the business models generated by the collaborative economy. The indications of the Commission concern focal points of the sharing economy, in particular: market access requirements; liability regimes; protection of users; self-employed and workers in the collaborative economy; taxation and monitoring. Through this Communication, the Member States are pushed to facilitate and spur the sharing economy practices by simplifying procedures for the peer to peer practices, recommendations on a favorable taxation without letting aside standards for service and product quality, consumer protection and workers’ rights.

The European Commission has also adopted an ambitious Circular Economy Package which consists of an EU Action Plan for the Circular Economy (EC, 2015) to help European businesses and consumers to make the transition to a stronger and more circular economy. This document underlines among others, the contribution of the sharing economy to the reaching of the circular economy objectives. Specifically “Innovative forms of consumption can also support the development of the circular economy, e.g. sharing products or infrastructure (collaborative economy), consuming services rather than products, or using IT or digital platforms” (EC, 2015) The foreseen actions are conceived following the life cycle approach: from the design to production (by minimizing the resourced used), to consumption (use, re-use and regeneration) and the management of the end of life (disposal, recover and recycle).

In March 2017, the European Commission and the European Economic and Social Committee (EESC) launched a joint European Circular Economy Stakeholder Platform (ECESP). The platform’s 24-member coordination group has now been chosen and the list of participants published. Selected through an open call for expressions of interest, the

coordination group will contribute in a crucial way to the ECESP's activities for the next 3 years. The group brings together circular economy stakeholders, with representatives principally from: civil society; business; trade unions; think tanks; public bodies. The ECESP also has a website to serve as a virtual meeting place where all members of the circular economy community can interact. In this way, stakeholders can work together to deliver results – sharing good practice and expertise, as well as strategies and pledges for the circular economy.

6 Conclusions

Applying the concept of collaborative approach to CBM, it is possible to point out how people organize in new assets and how the interaction between service provider and users is changing in an optic of global optimization of the resources. This approach contrasts the trends of the last decades where the economic value contained in a good has progressively diminished in relation to its function by opening the path to a system in which repairing an object has resulted to be more burdensome than buying it new. This has intuitively weighed on materials use and consumption, affecting severely environmental balances and boosting hardly the resource exploitation. On the other hand, material provision has a quite important cost in the total accountability of companies, therefore thinking of an economic valorization of the materials in a plurality of ways and methods may also become a competitive factor for the enterprises. Together with the rising concern of the society over environmental issues and the rising awareness on social issues, turning business practices in circular and collaborative ones, strongly confirms to be a wise strategy for being more innovative and consequently more competitive in the new markets.

The role of services in providing value is even more important. Not long ago, most of a product's added value came from the production processes that transformed raw materials into products. Now added value is created by technological improvements, intellectual property, product image and brand names, aesthetic design and styling; all of them nonmaterial aspects of products. These will help producers to differentiate and diversify their products to better respond to customers' demands.

References

- Bocken, N.M.P., De Pauw, I., Bakker, C., van der Grinten, B., (2016). *Product design and business model strategies for a circular economy*. Journal of Industrial and Production Engineering, 33, pp. 308–320.
- Botsman R., Rogers R., (2010), *What's mine is yours: the rise of collaborative consumption*, Harper Collins, New York NY, United States.
- Carbon Trust, (2017). *Defining the Concept of Circular Economy Business Model*. R2π. <http://www.r2piproject.eu/wp-content/uploads/2017/04/Defining-the-Concept-of-Circular-Economy-Business-Model.pdf> (accessed 15 January 2018)
- Chesbrough, H., (2010). *Business Model Innovation: Opportunities and Barriers*. Long Range Planning 43, 354-363.

- Cohen, M. J. (2015). *Sharing in the New Economy. The Future of Consumer Society. Prospects for Sustainability in the New Economy*, Oxford University Press.
- Cutaia, L., Morabito, R., Barberio, G., Mancuso, E., Brunori, C., Spezzano, P., Mione, A., Mungiguerra, C., Li Rosi, O., Cappello, F., (2014). *The project for the implementation of the industrial symbiosis platform in Sicily: the progress after the first year of operation* Pathways to environmental sustainability. Methodologies and experiences, Springer (ISBN 978-3-319-0825-4)
- Demailly, D., Novel, A.-S., (2014). *Économie du partage : enjeux et opportunités pour la transition écologique*, Studies N°03/14, IDDRI, Paris, France, 32 p.
- EC, European Commission, (2014). Communication from the Commission. “Towards a circular economy: A zero waste programme for Europe”. COM(2014)0398 final. Brussels, 2.7.2014.
- EC, European Commission, (2015). “Closing the loop - An EU action plan for the Circular Economy” COM(2015)0614 final. Brussels, 2.12.2015
- EC, European Commission, (2016). Communication from the Commission. “A European agenda for the collaborative economy”. COM(2016) 356 final. Brussels, 2.6.2016.
- EMF, Ellen MacArthur Foundation. (2012), “Towards the Circular Economy: Economic and business rationale for an accelerated transition”, <http://www.ellenmacarthurfoundation.org/business/reports/ce2012> (accessed 15 April 2019).
- EMF, Ellen MacArthur Foundation & McKinsey Center for Business and Environment, (2015), *Growth Within: a circular economy vision for a competitive Europe*. https://www.mckinsey.de/files/growth_within_report_circular_economy_in_europe.pdf (accessed 15 April 2019).
- Gansky, L. (2010). *The Mesh: Why the Future of Business Is Sharing*, Portfolio Hardcover.
- Giarini O, Liedtke P. (1998) *The Employment Dilemma and The Future of Work*. Alternative Title: Working in the New (Service) Economy. The final draft of the report to The Club of Rome. 1998: 140.
- Goedkoop MJ, van Halen CJG, te Riele HRM, Rommens, PJM, (1999). *Product Service Systems, Ecological and Economic Basis*. PricewaterhouseCoopers N.V. / Pi!MC, Storm C.S., Pre consultants.
- Goudin, P., (2016), “The Cost of Non-Europe in the Sharing Economy: Economic, Social and Legal Challenges and Opportunities“, European Parliament’s Directorate-General for Parliamentary Research Services.
- Kanda W. and Mignon I., (2017). *Intermediaries in sustainability transitions – differences and similarities of relevance for policy*. NTNU Sustainability Science Conference, 18–20 October 2017, Trondheim, Norway.
- Kanda, W., González, P. del R., Hjelm, O., Bienkowska, D., 2015. *A function of innovation systems approach for analysing the roles of intermediaries in eco-innovation*. Global Cleaner Production and Sustainable Consumption Conference, 1-4 November 2015, Sitges-Barcelona, Spain.
- Lancefield, D., Hawksorth, J., Vaughan R., (2015). *The Sharing Economy*. PwC Consumer Intelligence Series. <https://www.pwc.com/us/en/technology/publications/assets/pwc-consumer-intelligence-series-the-sharing-economy.pdf> (accessed 15 April 2019).
- Linder and Joustra, D. J., De Jong, E., Engelaar, F., (2013). *Guided Choices towards a Circular Business Model*, Eindhoven.
- Mignon, I., (2016). *Intermediary-user collaboration during the innovation implementation process*. Technology Analysis & Strategic Management: <http://dx.doi.org/10.1080/09537325.2016.1231299>
- Montalvo, C., Peck, D., Rietveld E., (2016). *A Longer Lifetime for Products: Benefits for Consumers and Companies*.

- Mont O. K. (2002). “*Clarifying the concept of product–service system*”. Journal of Cleaner Production, Volume 10, Issue 3, Pages 237-245
- Osterwalder, Pigneur (2010) “Business model generation. A handbook for visionaries” Editor: Yves Pigneur New Jersey, USA.
- Reim W., Parida V., Örtqvist D. (2015). “ *Product–Service Systems (PSS) business models and tactics – a systematic literature review*”. Journal of Cleaner Production, Volume 97, Pages 61-75
- Sposato P., Preka R., Cappellaro F., Cutaia L. (2017). “*Sharing economy and circular economy. how technology and collaborative consumption innovations boost closing the loop strategies*”. Environmental Engineering and Management Journal (EEJM), Vol.16 , No.8 .
- Su, B., Heshmati, A., Geng, Y., Yu, X., (2013). A review of the circular economy in China: moving from rethoric to implementation. J. Clean. Prod. 42,215e277
- Teece, D. J., (2010). *Business Models, Business Strategy and Innovation. In: Long Range Planning* 43, 172–194.
- Tukker A. (2015). “*Product–Service Systems (PSS) business models and tactics – a systematic literature review*”. Journal of Cleaner Production, Volume 97, Pages 76-91
- Valencia, A.; Mugge, R.; Schoormans, J.P.L.; Schifferstein, H.N.J., (2015). *The Design of Smart Product-Service Systems (PSSs): An Exploration of Design Characteristics*. International Journal of Design. Vol 9, No1.
- Vitković, D., (2016) “*The Sharing Economy: Regulation and the EU Competition Law*” Global Antitrust Review, Issue 9, 2016. Available at SSRN: <https://ssrn.com/abstract=2926852>

Towards a Performance Measurement System of Circular Supply Chains

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Abstract

A business ecosystem that plays an important role in the transition towards a circular economy is the supply chain. Performance measurement of supply chains is a key enabler for this transition.

Studies addressing performance measurement of circularity at a supply chain level appear to be scarce. Therefore, this paper aims to develop a performance measurement system for supply chains in a circular economy.

To develop this performance measurement system, a design science research methodology is applied. First, the requirements for an effective performance measurement system were identified. Subsequently, a performance measurement system that meets these requirements was developed. Finally, the performance measurement system was tested in a case study.

To the best of our knowledge, this paper provides the first and only tested performance measurement system of circular supply chains. The test showed that the performance measurement system meets most of the requirements. Additional tests will have to be performed to determine whether the performance measurement system meets all requirements.

Keywords – Supply Chain Management, Circular Supply Chain, Performance Measurement, Closed-loop supply chain, SCOR, Case study

Paper type – Research Paper

1 Introduction

A circular economy focuses on “... reducing, reusing, recycling and recovering materials in production/distribution and consumption processes” (Kirchherr et al, 2017). To date, performance measurement in the circular economy has primarily focused on measuring circularity at the level of products, companies or economies (Kirchherr et al, 2017; Saidani et al, 2018). However, studies addressing performance measurement of circularity at a supply chain level appears to be scarce (Elia et al, 2017; Saidani et al, 2018). Jain et al (2017) and Kazancoglu et al (2018) present frameworks for performance measurement. However, it is unclear if their frameworks meet the requirements of an effective performance measurement system (PMS).

The scarcity of performance measurement systems (PMS) for circular supply chains is remarkable, since supply chain management plays an important role in the transition towards a circular economy (van Buren et al, 2016). Performance measurement is a key enabler of supply chain management within this transition by reporting, controlling and improving the performance of supply chains (APICS, 2017; Bendoly et al, 2007; Bourne et al, 2005; Gunasekaran et al, 2004). Therefore, it is important to develop a PMS for supply chains in a circular economy, hereafter referred to as circular supply chains.

This paper contributes to existing literature by developing and testing a PMS for circular supply chains. To develop this PMS, a design science research methodology is applied (Peffers et al, 2007). The methodology is described in the next section, section 2, which is followed by the results from this research in the sections 3, 4 and 5. The PMS is evaluated via a case study, which is part of the iterative improvement approach of a design science research methodology. The evaluation is described in section 6. Finally, the paper ends with the conclusions in section 7.

2 Methodology

To develop a PMS of circular supply chains, the design science research methodology as described by Peffers, et al (2007) is used which includes the phases: (1) Problem identification and motivation (section 3) (2) Definition of requirements for the solution (section 4) (3) Design and development (section 5) (4) Demonstration and evaluation (section 6). The methodology applied in these phases is described in the following sections.

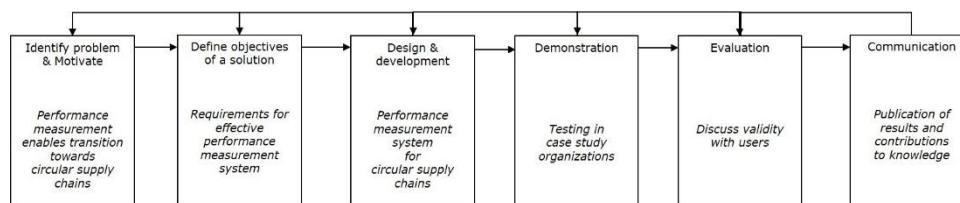


Figure 1: Design Science Research Methodology, adapted from Peffers et al (2007)

To identify the requirements for an effective PMS, a literature review was conducted. This literature review followed the approach as described by Webster and Watson (2002). Subsequently, the taxonomy of circularity indicators by Saidani et al (2018) was used to identify circularity indicators on micro -, meso – and macro level. These circularity indicators served as the base to identify three performance attributes of circularity: profitability, material efficiency and value retention. Finally, per performance attribute metrics were developed. A key requirement of PMS appeared to be the integration of multiple interlinked and interdependent metrics. Therefore, the metrics were developed so that they have mutual relationship and thus form an integrated PMS.

3 Problem identification and motivation

A PMS is used to compare current performance levels with targets, to facilitate an improved understanding of supply chain processes and encourage continuous improvements (Bendoly et al, 2007). Despite the growing importance of the circular economy, PMSs that enable the transition of supply chains towards a circular economy are still scarce.

4 Requirements for an effective PMS

In the 1910s, at the start of industrialization, performance measurement mainly focused on measuring the productivity per employee. In the 1950s, with the rise of quality control, more sophisticated productivity measurements were introduced. Subsequently, the focus moved to financial measurements to be able to better serve the interests of shareholders. Moreover, in the 1980s, measurements for customer satisfaction and efficient internal operations were introduced to recognize the importance of these stakeholders. With the introduction of multiple stakeholders, the importance of balanced decision making was also recognized. To enable this balanced decision making, different measurement were integrated in a PMS, such as the Balanced Scorecard (Kaplan and Norton, 1996). Finally, the focus moved to performance measurement of supply chains and performance measurement in context (use and change in the context of specific organizations), named performance management (Bititci et al, 2012).

PMSs should meet the following requirements to be effective:

- Multiple dimensions of performance. The PMS should capture the perspectives of multiple relevant stakeholders (Beamon, 1999; Caplice, 1995; Gunasekaran, 2004; Jensen, 2000; Neely, 1995) by providing a balanced portfolio of different dimensions of performance (Gunasekaran, 2004) and covering long-term and short-term objectives (Neely, 1995).
- Trade-offs. The PMS should recognize and allow for trade-offs between different dimensions of performance by providing insight in the interdependencies among metrics (Caplice *et al*, 1995).
- Drivers of performance. Rather than just financial metrics, the PMS should also include non-financial metrics that drive financial metrics (Bendoly, 2007; Caplice *et*

al, 1995; Gunasekaran, 2004; Maskell, 1989) and track activities that influence future, as well as current performance (Caplice, 1995).

- Horizontal integration. The PMS should contain metrics that are aligned along processes (Caplice *et al*, 1995; Gunasekaran, 2004; Neely, 1995).
- Vertical integration. The PMS should contain metrics comprised of levels of connected hierarchy (APICS, 2017). This enables to link strategy to decision making at each level in the organization (Beamon, 1999; Bourne, 2002; Caplice *et al*, 1995; Maskell, 1989; Neely, 1995). Moreover, it clarifies and translates vision and strategy into goals and actions (Jensen, 2000; Kaplan and Norton, 1996; Neely, 1997) and covers long-term, medium-term and short-term decision making and control (Bourne, 2002; Gunasekaran *et al*, 2004).
- Communication. Communicate to employees of all organizational levels the current organizational performance and how their individual efforts contribute to organizational success (Gunasekaran, 2004; Jensen, 2000).
- Limited range of metrics. The PMS should contain only critical performance metrics that represent key attributes (Bendoly, 2007; Bourne, 2002; Gunasekaran, 2004).
- Reward structure. The PMS should be consistent with the reward structure (Caplice, 1995; Neely, 1995).
- Network. The PMS should depict the organization's key components, partnerships and collaborations (Gunasekaran, 2004; Jensen, 2000).
- Benchmark. The PMS enables benchmarking across time, location and organizations (Beamon, 1999; Gunasekaran, 2004; Neely *et al*, 1996; Neely, 1997).
- Learning. The PMS stimulates learning, action and continuous improvement (Caplice, 1995; Gunasekaran, 2004; Kaplan and Norton, 1996; Maskell, 1989; Neely, 1996; Neely, 1997).

5 Design and development

In this section the design and development of the PMS will be described. This section follows the structure of the requirements for an effective PMS as described in section 4.1.2. First, the multiple dimensions of performance of the PMS are motivated. Subsequently, the trade-offs, drivers of performance, horizontal integration and vertical integration of the PMS is described.

5.1 Multiple dimensions of performance

The multiple dimensions of performance of a circular supply chain can be subdivided into economic, environmental and social performance, which is also referred to as 'triple P' (People, Planet and Profit) (Ahi and Searcy, 2015, Hassini *et al*, 2012). In the PMS, the economic performance and environmental performance will be included. The social performance will be excluded from the PMS. Social performance is still relatively underexposed in literature on circular economy (Ghisellini *et al*, 2016; Kirchherr *et al*,

2017; Saidani et al, 2018) and requires further research in order to be able to design a measurement of social performance.

5.1.1 Economic performance

The economic performance represents the profitable use of resources in the supply chain (Ahi and Searcy, 2015). Resources in the supply chain can be subdivided into costs and assets (APICS, 2017). Costs occur when the resources materials, water and energy are purchased and converted into an end product. Assets are resources that are used to support the conversion of materials, water and energy into an end product and for the distribution of this end product to the consumer. Assets are, for example, trucks, warehouses and machinery. Moreover, performance attributes for supply chains focus on cost reduction and an efficient use of assets (APICS, 2017). Therefore, a metric that measures the economic performance should include costs and assets. A metric that contains costs and assets is the well-known Return on Supply Chain Fixed Assets (APICS, 2017). Return on Supply Chain Fixed Assets represents the return an organization generates with its invested capital in Supply Chain Fixed Assets (land, warehouses, trucks and machinery)(APICS, 2017).

Return on Supply Chain Fixed Assets = (Supply chain Revenues – Total cost)/Supply Chain Fixed Assets

5.1.1 Environmental performance

This paper aims to develop metrics for circularity of supply chains. The relationship between circularity and environmental performance of supply chains is still unclear (Ahi and Searcy, 2015) and requires further research. By developing metrics for circularity of supply chains, this paper aims to contribute to a better understanding of the relationship between circularity and environmental performance. This paragraph will motivate the claim that circularity can be subdivided into two performance attributes: Material Efficiency and Value Retention.

The first performance attribute of circularity is Material Efficiency. Resource scarcity creates a clear need for material efficiency in supply chains (Alonso et al, 2007). Several authors stress the importance of material efficiency (Braun et al, 2018), reduction of waste (Yang et al, 2018) and collection of waste as a characteristic of circular supply chains (Batista et al, 2018; Braun et al, 2018). Circularity metrics on a product level (Saidani, 2018), such as the Life Cycle Assessment (Lieder and Rashid, 2016), Material inputs per unit of service, Material Flow Analysis and Substance Flow Analysis (Elia, 2017), The Circular Economy Indicator Prototype (Cayzer et al, 2017) and Ecological Rucksack (Spangenberg et al, 1999) all focus on material efficiency. Moreover, circularity metrics on an macro-economy level (EASAC, 2016; Mathews and Tan, 2011) focus on material efficiency. Material efficiency on a macro-economy level is determined by domestic material input, net additions to stock and total domestic output. This supports the relevance of material efficiency as part of the circularity metric on a supply chain level.

In line with the formula of material efficiency on a macro-economy level, the formula

of material efficiency on a supply chain level is determined by input of materials, inventory mutation of materials and output of products. The difference between input of materials and output of products is waste (Pearce and Turner, 1990). Waste can occur during production, consumption and recovery (Pearce and Turner, 1990).

For production, a certain weight or volume of materials is sourced (APICS, 2017). These materials are either placed in inventory or used to produce an end product. End products are either placed in inventory or sold to a consumer. Therefore, waste during production is (weight or volume of materials sourced (MS)) minus (weight or volume of inventory mutation (IM)) minus (weight or volume of total supply chain products sold (PS)).

During the process ‘consumption’, end products are used by a consumer and, after consumption, the products are returned or not. Therefore, waste during the process ‘consumption’ is (weight or volume of total supply chain products sold (PS)) minus (weight or volume of products returned (PR)).

During the process ‘recovery’, a certain weight or volume of the products returned is indeed recovered into recovered materials that can be used during production or during consumption. Therefore, waste during recovery is (weight or volume of products returned (PR)) minus (weight or volume of recovered materials (RM)). A metric of waste in the circular supply chain arises by adding the measures of waste for the three processes of the circular supply chain.

$$\text{Waste} = (\text{MS} - \text{IM} - \text{PS}) + (\text{PS} - \text{PR}) + (\text{PR} - \text{RM}) = \text{MS} - \text{IM} - \text{RM}$$

Finally, this metric is presented as Material Efficiency, a percentage of weight or volume of recovered materials in relation to the weight or volume of materials sourced.

$$\text{Material Efficiency} = (\text{MS} - (\text{MS} - \text{IM} - \text{RM})) / \text{MS} = ((\text{IM} + \text{RM}) / \text{MS}) * 100\%$$

The second performance attribute of circularity is Value Retention. Value is created during production and needs to be retained during consumption and recovery, so that during recovery a minimal amount of resources needs to be added in order to arrive at a new end product. Ellen Mac Arthur Foundation (2013a) refers to value retention as the power of circling longer. Yang et al (2018) describe value retention as slowing resource loops which aim to extend or intensify the utilization period, resulting in a slowdown of use of resources. Batista et al (2018) refer to prolonged life cycles as an fundamental aspect of a circular supply chain. Circularity metrics on a product level, on a company level and on an macro-economy level refer to value retention (Saidani et al, 2018). Usually this is expressed in principles such as, reuse is preferred over recycling, or is calculated as the percentage of reused over recycled as in the Material Circularity Indicator (Ellen Mac Arthur Foundation, 2018) and The Circular Economy Toolkit (Evans and Bocken, 2017). This supports the relevance of value retention as part of the circularity metric on a supply chain level.

In a similar way to the previous metric, the metric for value retention is also based on three processes of a circular economy: production, consumption and recovery (Ellen Mac Arthur Foundation, 2013a). The value retention is at its maximum under two conditions:

- the value created during production (SC cost of production) is retained during

- consumption with minimal cost to Maintain and Repair (SC cost of MR);
- it requires minimal cost to recover (SC cost of recovery) to create maximal revenues of recovery (SC revenues of recovery).

Value retention =

$$\left(\frac{((SC \text{ revenues of recovery} - SC \text{ cost of recovery} - SC \text{ cost of MR}))}{SC \text{ cost of production}} \right) * 100\% \text{)}^{NRF}$$

NRF = Number of recovery flows

A recovery flow is one sequence of production, consumption and recovery, in which the product is manufactured, consumed and recovered. Recovery flows can occur multiple times (Ellen Mac Arthur Foundation, 2013a). In case production and consumption occur and there is no recovery, the number of recovery flows equals 0. Following the formula described above, the value retention then equals 0.

5.2 Trade-offs

Environmental performance and economic performance can have a positive and a negative relationship (Wu and Pagel, 2011). The PMS developed in the current study aims to integrate environmental performance with economic performance to provide insight in possible trade-offs. See for a description of the integration paragraphs 5.4 and 5.5.

5.3 Drivers of performance

PMSs usually consist of performance attributes that focus on internal operations and customer satisfaction (APICS, 2017). The PMS in the current study focuses solely on performance of internal operations: an efficient use of assets and cost reduction. Performance on customer satisfaction, such as reliability, responsiveness and agility (APICS, 2017; Kaplan and Norton, 1996) are excluded from the PMS. Circular supply chains will continue to strive for reliability, responsiveness and agility of their processes to accomplish customer satisfaction. A circular supply chain does not differ on these performance attributes from any other supply chain. Therefore, performance on customer satisfaction will be excluded from the remainder of this research.

5.4 Horizontal integration

The requirement of horizontal integration indicates that a PMS should contain metrics that are aligned along processes (Caplice et al, 1995). The circular supply chain consists of three processes: production, consumption and recovery (Batista et al, 2018). Horizontal integration is accomplished by including metrics for profitability, material efficiency and value retention for all three processes.

5.5 Vertical integration

The requirement of vertical integration indicates that a PMS should have different connected levels within a hierarchy of metrics (APICS, 2017). These connected levels are

not present within the current PMS, which could be an interesting next step in the development of this PMS.

6 Demonstration and evaluation

The PMS is tested via a case study. The first paragraph will describe the company in which the PMS is tested. The second paragraph will describe the various performances of the company, as presented by the PMS. The third paragraph will describe the evaluation of the PMS by the company.

6.1 The company

The company produces plastic flooring in one central production facility in Western Europe from where it delivers the plastic flooring to distributors all over the world. These distributors sell the plastic flooring to the end consumers which are companies and private persons. The company's markets are: China, Asia, Africa, North-America, South-America, Oceania and Europe. The main market is Europe. The assortment consists of many products due to the wide choice of colours and designs of the floors. The assortment can be subdivided into 3 main product groups: clicked floors, glued floors and loose-laid floors. In clicked floors the floor consists of tiles that are clicked together. The glued floors are glued to a concrete subsurface. Loose-laid floors consists of tiles that are laid on the subsurface, without the use of glue. The main raw materials are various plastics, binders and pigments which are purchased from different suppliers all over the world.

6.2 Results

The PMS was applied for the supply chain of every product/market combinations. A product/market combination is a combination of a product group (clicked floors, glued floors or loose-laid floors) with a market (China, Asia, Africa, North-America, South-America, Oceania or Europe). The company assumed that the product/market combination of loose laid floors Europe provides the most interesting opportunities for circularity. For this supply chain the current and future performance with recovery will be presented in this paper.

Table 1: current performance supply chain loose laid floors Europe

Metric	Production	Consumption	Recovery
Return on Supply Chain Fixed Assets	-	-	-
Total Cost	100	-	-
Material efficiency	99%	0%	0%
Value retention	0%		

It appeared that Return on Supply Chain Fixed Assets was very time-consuming to determine. Therefore, only total cost was presented in the PMS. The total cost is presented as an index, due to confidentiality reasons. The company currently has no

returns of used products and therefore no recovery activities. This leads to a material efficiency of 0% in consumption and recovery and a value retention of 0%. The value of the product is lost after one flow.

Subsequently, the future performance of the supply chain with recovery was determined.

Table 2: future performance supply chain loose laid floors Europe with recovery

Metric	Production	Consumption	Recovery
Return on Supply Chain Fixed Assets	-	-	-
Total Cost	100	-	30
Material efficiency	99%	100%	99%
Value retention	70%		

It is assumed that all products sold are being returned after consumption, in other words: the material efficiency of ‘consumption’ is 100%. Recovery of returned materials leads to materials with the same quality as virgin materials. Therefore, the revenues of recovery are assumed to be equal to the Total Cost of production. This leads to a value retention of 70%. Furthermore, it is assumed that there is one recovery flow and the company does not have to pay the customer for their used product.

6.3 Evaluation of the PMS

The results were discussed with a focus group discussion with representatives of all departments. Furthermore, an expert interview was conducted with the supply chain manager. The results from the focus group discussion and the expert interview are categorized based on the requirements for effective PMSs, as described in section 4.

Multiple dimensions of performance

The company has experienced the PMS to be relevant to provide an overview of the company’s performance on circularity. Although social performance is excluded from the PMS, the company believes that a metric for social performance would be a valuable addition. Moreover, use of energy in production, in particular fossil fuels, seems to be lacking in the PMS.

Trade-off

For the company the possible relations between metrics is unclear. It is expected that improvement on one metric may lead to deterioration of performance on another metric. However, this relationship is not apparent based on the metrics.

The PMS measures the performance via multiple metrics. On the one hand it is helpful and relevant to have insight in these metrics. However, the question also rises which metrics should have priority.

Horizontal integration

Because the company currently has no returns, the results show material efficiency

and value retention of 0%. The company questions whether these numbers are relevant for supply chains with no returns. Due to the long lifetime of their products it is expected that these metrics will remain zero for many years to come. A PMS with future performance with recovery appears to provide more insights.

Communicate to employees of all organizational levels the current organizational performance

The PMS has helped to provide insight in the current state. The PMS has provided insight in the business case to return – after use – flooring, shred the flooring and use this as input for the production process. The business case has showed that returning loose-laid floors from customers in West Europe, transport costs and making it suitable to use in production, costs about 30% of the price of virgin raw materials. The market of Western Europe is in particular interesting because it is the main market and return transport costs will then remain relatively low. For other markets the quantities delivered are relatively low and therefore the quantities to be returned are also relatively low and the return transport costs will be higher which causes the business case to be less interesting. Recycling local-to-local and not returning the product to the production facility in Western Europe then seems a more interesting venue. Cooperation with competitors to recycle local-to-local also seems an interesting opportunity to increase the utilization of recycling facility.

The PMS has provided insight in the business to return – after use – glued flooring. Removing these floors from a building results in that not only the floor, but also the glue, equalizer and concrete are removed. Separating the flooring from the glue, equalizer and concrete leads to high costs and high use of energy and water. Therefore, for now recycling glued flooring is not a viable business. New developments to improve these removal processes are underway that may lead to a viable business case in the near future.

The PMS has provided the insight that the clicked floors currently have a low market share and therefore low quantities to return. Therefore, clicked floors are not a viable business case to return.

The PMS confirmed that amount of waste in the company is rather minimal. Throughout many years the company has developed a lot of knowledge in ways to minimize waste and to recycle waste to raw materials for its own production.

The term of circularity was still unclear to many employees in the company. A positive consequence of applying this PMS has been that it helped to discuss and promote circularity among employees and to create a better understanding of circularity and its opportunities for the company.

Enables benchmarking across time, location and organizations

Since there is not a benchmark available of previous time periods or from other organizations, the company found it difficult to evaluate the outcomes of the PMS. For some measures the outcome is 99%, which seems like a good score. For other measures the outcome is 30% which raises the question how much room for improvement there is and if this improvement is easy or difficult to accomplish. A benchmark tool together

with the PMS would be very helpful.

7 Conclusions

The current study presents a PMS in which economic and environmental performance is integrated. The test showed that the PMS provides insight in the business case of recovering products after consumption. Moreover, the PMS enables to discuss the topic of circularity and thereby provide a better understanding of circularity amongst employees.

In the use of PMSs there is a trade-off between usability and completeness. Return on Supply Chain Fixed Assets seemed to be a complete measure. However, the test showed that this metric is not very usable. Total cost appeared to be a better usable metric, although future case studies should test if this metric is complete.

Hierarchical integration of metrics on multiple levels still needs to be developed. Furthermore, opportunities to benchmark the results appear to be relevant. Information technology seems to be an essential tool to enable this benchmark, although data sharing between companies leads to various issues of confidentiality and trust.

Some requirements for effective PMSs could not be tested by this single case study. Therefore, more case studies are relevant.

References

- Ahi, P., & Searcy, C. (2015). An analysis of metrics used to measure performance in green and sustainable supply chains. *Journal of Cleaner Production*, 86, 360-377.
- Alonso, E., Gregory, J., Field, F., & Kirchain, R. (2007). Material availability and the supply chain: risks, effects, and responses.
- APICS (2017). *Supply Chain operations Reference (SCOR) model: Version 12.0*.
- Batista, L., Bourlakis, M., Smart, P., & Maull, R. (2018). In search of a circular supply chain archetype—a content-analysis-based literature review. *Production Planning & Control*, 29(6), 438-451.
- Bendoly, E., Rosenzweig, E. D., & Stratman, J. K. (2007). Performance metric portfolios: a framework and empirical analysis. *Production and Operations Management*, 16(2), 257-276.
- Bourne, M., Neely, A., Platts, K., & Mills, J. (2002). The success and failure of performance measurement initiatives: Perceptions of participating managers. *International journal of operations & production management*, 22(11), 1288-1310.
- Braun, A. T., Kleine-Moellhoff, P., Reichenberger, V., & Seiter, S. (2018). Case study analysing potentials to improve material efficiency in manufacturing supply chains, considering circular economy aspects. *Sustainability*, 10(3), 880.
- Cayzer, S., Griffiths, P., & Beghetto, V. (2017). Design of indicators for measuring product performance in the circular economy. *International Journal of Sustainable Engineering*, 10(4-5), 289-298.
- EASAC. (2016). Indicators for a circular economy. Retrieved on 22 March 2019 from https://www.easac.eu/fileadmin/PDF_s/reports_statements/Circular_Economy/EASAC_Indicators_web_complete.pdf
- Elia, V., Gnoni, M. G., & Tornese, F. (2017). Measuring circular economy strategies through index methods: A critical analysis. *Journal of cleaner production*, 142, 2741-2751.

- Ellen Mac Arthur Foundation, (2013a). Towards a Circular Economy—Economic and Business Rationale for an Accelerated Transition. *Ellen MacArthur Foundation: Cowes, UK*.
- Ellen Mac Arthur Foundation, (2018). Circularity Indicators. An Approach to Measuring Circularity. *Ellen MacArthur Foundation: Cowes, UK*. Retrieved on 22 March 2018 from <https://www.ellenmacarthurfoundation.org/programmes/insight/circularity-indicators>
- Evans, J.; Bocken, N. The Circular Economy Toolkit. Retrieved on 1 October 2018 from <http://circulareconomytoolkit.org/>.
- Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, 114, 11-32.
- Govindan, K., & Hasanagic, M. (2018). A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. *International Journal of Production Research*, 1-34.
- Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004). A framework for supply chain performance measurement. *International journal of production economics*, 87(3), 333-347.
- Jain, S., Jain, N. K., & Metri, B. (2018). Strategic framework towards measuring a circular supply chain management. *Benchmarking: An International Journal*, 25(8), 3238-3252.
- Kazancoglu, Y., Kazancoglu, I., & Sagnak, M. (2018). A new holistic conceptual framework for green supply chain management performance assessment based on circular economy. *Journal of Cleaner Production*, 195, 1282-1299.
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221-232.
- Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: a comprehensive review in context of manufacturing industry. *Journal of Cleaner Production*, 115, 36-51.
- Maskell, B. (1989). Performance measurement for world-class manufacturing, 1-4 series of articles on performance measurement. *Management Accounting*, (May-September).
- Mathews, J. A., & Tan, H. (2011). Progress toward a circular economy in China. *Journal of industrial ecology*, 15(3), 435-457.
- Neely, A., Gregory, M., & Platts, K. (1995). Performance measurement system design: a literature review and research agenda. *International journal of operations & production management*, 15(4), 80-116.
- Pearce, D. W., & Turner, R. K. (1990). *Economics of natural resources and the environment*. JHU Press.
- Peppers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of management information systems*, 24(3), 45-77.
- Saidani, M., Yannou, B., Leroy, Y., Cluzel, F., & Kendall, A. (2018). A taxonomy of circular economy indicators. *Journal of Cleaner Production*.
- Spangenberg, J. H., Femia, A., Hinterberger, F., Schütz, H., Bringezu, S., Liedtke, C., ... & Schmidt-Bleek, F. (1999). *Material flow-based indicators in environmental reporting* (No. 14). European Environment Agency.
- van Buren, N., Demmers, M., van der Heijden, R., & Witlox, F. (2016). Towards a circular economy: The role of Dutch logistics industries and governments. *Sustainability*, 8(7), 647.
- Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS quarterly*, xiii-xxiii.
- Wu, Z., & Pagell, M. (2011). Balancing priorities: Decision-making in sustainable supply chain management. *Journal of operations management*, 29(6), 577-59
- Yang, M., Smart, P., Kumar, M., Jolly, M., & Evans, S. (2018). Product-service systems business models for circular supply chains. *Production Planning & Control*, 29(6), 498-508.

Designing Energy-Based Exchanges in Eco-Industrial Parks: a Multi-Objective Optimization Approach

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Abstract

This paper proposes a linear programming model to design industrial symbiosis synergies in eco-industrial parks based on the exchange of waste energy among different companies. The model allows to fill two important limitations of previous studies: (1) it uses a multi-objective optimization perspective that considers economic and environmental issues simultaneously; (2) the integration of two decision-support tools, the former able to assess the amount of waste that can be effectively exchanged among companies, the latter able to suggest how to share the infrastructural costs arising from symbiotic synergies so that the economic benefits are fairly shared among the involved companies. A numerical case example is presented to show how the model works. The case highlights several applications of the model, which contribute to confirm its usefulness for companies, industrial symbiosis facilitators, and policymakers.

Keywords – Industrial Symbiosis, Eco-Industrial parks, Optimization problem, Decision-support tools

Paper type – Academic Research Paper

1 Introduction

1.1 Industrial Symbiosis

Industrial symbiosis (IS) is a subfield of industrial ecology that engages separate industries in a collective approach to competitive advantage, involving physical exchange of materials, energy, and services (Chertow, 2000). The IS practice refers to replacing production inputs required by a generic production process with wastes generated by other production processes, thus helping to close the loop of manufacturing processes. Companies adopting IS can reduce the amounts of both wastes disposed of in landfills and primary inputs used in production processes (e.g., Jacobsen, 2006). As a result, they can enhance production efficiency and decrease production costs (e.g., Yuan and Shi, 2009). Hence, the IS approach is able to create environmental benefits for the society and economic benefits for companies, simultaneously. For this reason, several countries are endorsing IS by promoting the development of IS networks (ISNs), i.e., networks of at least three firms involved in exchanging at least two wastes (e.g., Fichtner et al., 2005). The literature distinguishes two creation mechanisms for ISNs: these networks can emerge from the bottom, as the result of a spontaneous process undertaken by companies, or be designed by adopting a top-down approach. Examples of bottom-up ISNs are the so-called “self-organized ISNs” (e.g., Chertow and Ehrenfeld, 2012; Doménech and Davies, 2011) whereas eco-industrial parks (EIPs) are examples of top-down ISNs (e.g., Massard et al., 2018; Tudor et al., 2007). This paper focuses on EIPs.

1.2 Eco-industrial parks

In EIPs, companies can be involved in exchanging materials (i.e., wastes and by-products), water, energy, and services. A central authority – usually, one of the involved companies, a third company, an IS facilitator, or a research center – is in charge for designing and managing the IS exchanges among companies belonging to the park (Fraccascia et al., 2019). These exchanges are designed by adopting mathematical optimization models (for a detailed review of optimization models used to design eco-industrial parks, the readers are referred to Boix et al., 2015). While the design of material-based and water-based IS exchanges has been widely investigated by the literature, there are relatively few studies that deal with energy management in an EIP through mathematical optimization. When designing energy-based exchanges, several energy-specific issues must be considered: (1) energy is hard to store, hence it is critical ensuring the quantity match between demand and supply (Kikuchi et al., 2016), which is recognized as one of the most important conditions for developing IS (Fraccascia and Yazan, 2018); (2) energy exchanges require specific investments (e.g., the construction of pipelines) that increase the dependency on the symbiotic partner (Fichtner et al., 2005); and (3) companies need to be close enough because investments and heat losses increase with the length of pipelines (Korhonen, 2001).

1.3 Literature gaps

When considering optimization models for energy-based exchanges, two strong gaps in the literature can be identified. The first gap concerns the lack of multi-objective optimization studies that consider economic and environmental issues simultaneously. In fact, the existing optimization models for designing energy-based exchanges are devoted to maximize the economic performance or to minimize the environmental impact of the EIP. The second gap is related to the fact that the existing models focus on optimizing the EIP “globally”, without taking care of “local” aspects. For example, these models allow to minimize the overall investment costs in pipelines; however, they do not indicate how investments costs have to be shared among companies. In order to design and manage EIPs effectively, local issues must be taken into account. In fact, cost-sharing issues are critical for the establishment of IS relationships. In this regard, when independent companies should cooperate to pursue a common goal but the benefits of cooperation are unevenly shared, a misalignment incentive problem arises (Narayanan and Raman, 2004). In this case, companies gaining the scant part of economic benefits might be not willing enough to establish the cooperation, thus impacting on the overall EIP (Albino et al., 2016).

1.4 Outline of the paper

In this paper, we design a linear programming model to design energy-based exchanges in EIPs. The objective function takes into account both economic and environmental issues simultaneously. Technical and economic constraints are considered. The optimization model is integrated with the following tools, aimed at: (1) assessing the amount of energy that can be exchanged among each couple of companies, due to fluctuation in energy production and demand; (2) sharing investment costs among the involved companies. The first tool allows a better estimation of the environmental and economic benefits potentially created by IS cooperation, thus enhancing the reliability of the model. The second tool provides useful suggestions to the EIP managers on how to fairly share investment costs of infrastructures required to exchange energy, so that an incentive alignment toward cooperation occurs. A case example is used to test the model and to describe the usefulness in practice.

The rest of the paper is organized as follows. Section 2 presents the optimization model. Section 3 addresses the numerical case example. The paper ends with discussion and conclusions in Section 4.

2 The optimization model

This Section is divided into three subsections. Section 2.1 presents the hypothesis and the main features of the model. Section 2.2 addresses the design of infrastructures supporting energy exchanges. Finally, Section 2.3 concerns the tool for sharing the investment costs.

2.1 Hypothesis and main features

Let us consider that a given number of firms, I waste producers and J waste users, are located in the same EIP. Each waste producer is characterized by an annual production of the generic waste k , denoted as S_i^k , which can be discretized as the sum of the amount of waste produced in N temporal periods. Similarly, each waste user is characterized by an annual requirement for the input replaced by waste k , denoted as D_j^k , which can be discretized as the sum of the amount of waste produced in N temporal periods. Accordingly, it follows that:

$$S_i^k = \sum_{t=1}^N S_i^k(t) \quad (1)$$

$$D_j^k = \sum_{t=1}^N D_j^k(t) \quad (2)$$

The highest amount of waste k that can be exchanged during one year between waste producer i and waste user j , denoted as X_{ij}^k , can be computed as follows:

$$X_{ij}^k = \sum_{t=1}^N \min \left\{ S_i^k(t); \frac{D_j^k(t)}{\rho^k} \right\} \quad (3)$$

where ρ^k denotes how many units of input can be replaced by one unit of waste. Here, it is assumed that waste energy cannot be stored. Therefore, if at generic time t the amount of waste produced by firm i is higher than the amount of waste required by firm j and firm i does not have other symbiotic partners, the waste producer has to dispose of $S_i^k(t) - \frac{D_j^k(t)}{\rho^k}$ units of waste.

2.2 The mathematical formulation for designing the infrastructures

Let $i \in I$ be the set of waste producers, $j \in J$ the set of waste users, and $k \in K$ the set of wastes to be exchanged. Table 1 shows all the parameters used in the model.

Table 1 Parameters used in the model.

Technical parameters	
D_j^k	Annual amount of waste k demanded by firm j
S_i^k	Annual amount of waste k produced by firm i
L_{ij}	Distance between firms i and j [Km]
x_{ij}^k	Annual amount of waste k exchanged between firm i and firm j
T	Project lifetime [years]
ρ^k	Amount of input replaced by one unit of waste k
Unitary costs	
CC^k	Construction cost of pipeline to exchange waste k [€/Km×unit of waste]
CM^k	Annual maintenance cost of pipeline to exchange waste k [€/Km×unit of waste]
CT^k	Annual treatment cost for waste k [€/unit of waste]
DC^k	Disposal cost for waste k [€/unit of waste]
Cmp^k	Purchase cost for input replaced by waste k [€/unit of input]
Environmental costs	
τ^k	Environmental cost for disposing of waste k [€/unit of waste]
ϑ^k	Environmental cost for using the input replaced by waste k [€/unit of input]

The objective function to be maximized is as follows:

$$f = \text{ceasing costs} - (\text{infrastructural costs} + \text{additional operational costs}) \quad (4)$$

Ceasing costs can be modeled as follows:

$$\text{ceasing costs} = \sum_{k=1}^K \sum_{i=1}^I \left[(DC^k + \tau^k) \sum_{j=1}^J x_{ij}^k \right] + \sum_{k=1}^K \sum_{j=1}^J \left[(Cmp^k + \vartheta^k) \rho^k \sum_{i=1}^I x_{ij}^k \right] \quad (5)$$

where the first addend – i.e., $\sum_{k=1}^K \sum_{i=1}^I [(DC^k + \tau^k) \sum_{j=1}^J x_{ij}^k]$ – denotes the avoided costs related to waste disposal and carbon tax and the second addend – i.e., $\sum_{k=1}^K \sum_{j=1}^J [(Cmp^k + \vartheta^k) \rho^k \sum_{i=1}^I x_{ij}^k]$ – denotes the avoided costs related to the input purchasing. Note that environmental issues are included in the objective function by means of the parameters τ and ϑ .

Infrastructural costs are related to the building and maintenance of pipelines. They can be modeled as follows:

$$\text{infrastructural costs} = \sum_{k=1}^K \sum_{i=1}^I \sum_{j=1}^J \left(\frac{CC^k}{T} + CM^k \right) L_{ij} x_{ij}^k \quad (6)$$

Finally, additional operational costs are related to waste treatment. They can be modeled as follows:

$$\text{additional operational costs} = \sum_{k=1}^K \sum_{i=1}^I \sum_{j=1}^J CT^k x_{ij}^k \quad (7)$$

The objective function is subjected to the following two constraints:

- (a) $0 \leq x_{ij}^k \leq X_{ij}^k \quad \forall k, i, j$
- (b) $\{DC^k + \tau^k + (Cmp^k + \vartheta^k) \rho^k - \left[\left(\frac{CC^k}{T} + CM^k \right) L_{ij} + CT^k \right]\} x_{ij}^k > 0 \quad \forall k, i, j$

The former is a technical constraint, which imposes that the waste flows among companies must be not negative and not higher than the respective maximum amount of waste that is possible to exchange. The latter is an economic constraint, which imposes that each waste exchange must be economically feasible.

2.3 The mathematical formulation for sharing the investment costs

In this paper, we adapted the methodology proposed by Yazdanpanah and Yazan (2017), which is based on the concept of Shapley value (Shapley, 1953). Accordingly, in IS relationships costs are fairly shared when all the involved companies gain the same economic benefit from the symbiotic synergy. In this case, there is no incentive misalignment among the involved companies, since none of the involved companies can gain only a scant part of the total economic benefits created. In this regard, let α be the percentage of infrastructural costs and additional operational costs that the waste producer has to pay. Let us denote as α^* the value of the parameter α so that both of the involved

companies gain the same economic benefit from the IS relationship. It can be computed as follows¹:

$$\alpha^* = \frac{\sum_{k=1}^K [DC^k + \tau^k + (Cmp^k + \vartheta^k)\rho^k - \left(\frac{CC^k}{T} + CM^k\right)L_{ij} + CT^k]}{2 \sum_{k=1}^K \left[\left(\frac{CC^k}{T} + CM^k\right)L_{ij} + CT^k\right]} \quad (8)$$

The value of α is defined between two extremes α^{\min} and α^{\max} , which correspond to the scenarios where the economic benefits from the IS practice are equal to zero for the waste user and for the waste producer, respectively. The values of α^{\min} and α^{\max} can be computed according to the following equations:

$$\alpha^{\min} = \frac{\sum_{k=1}^K \left[\left(\frac{CC^k}{T} + CM^k\right)L_{ij} + CT^k - (Cmp^k + \vartheta^k)\rho^k\right]}{\sum_{k=1}^K \left[\left(\frac{CC^k}{T} + CM^k\right)L_{ij} + CT^k\right]} \quad (9)$$

$$\alpha^{\max} = \frac{\sum_{k=1}^K (DC^k + \tau^k)}{\sum_{k=1}^K \left[\left(\frac{CC^k}{T} + CM^k\right)L_{ij} + CT^k\right]} \quad (10)$$

According to the value of α^* , five cases can be highlighted: (1) $0 < \alpha^* < 1$, i.e., costs are shared between companies; (2) $\alpha^* = 0$, i.e., all the costs are paid by the waste user; (3) $\alpha^* = 1$, i.e., all the costs are paid by the waste producer; (4) $\alpha^* < 0$, i.e., all the costs are paid by the waste user, which also pays an additional compensation to the waste producer; and (5) $\alpha^* > 1$, i.e., all the costs are paid by the waste producer, which also pays an additional compensation to the waste user.

3 Case Example

Let us consider nine waste producers and nine waste users spread in a given geographic area as depicted in Fig 1. For the sake of simplicity, let us assume that only one waste is produced by firms (i.e., $K=1$) and that the waste can replace only one input. The annual amounts of waste produced and input required by each company are depicted in Table 2. For the sake of simplicity, let us assume that both the demand and potential supply of waste are constant in all periods, i.e., that $S_i^k(t) = S_i^k(t+1) \forall i = 1 \dots I, t = 1 \dots 11$ and $D_j^k(t) = D_j^k(t+1) \forall j = 1 \dots J, t = 1 \dots 11$. Technical and economic parameters are displayed in Table 3. Numerical results concerning the amount of waste to be exchanged between each couple of waste producers and waste users are depicted in

¹ This results from imposing the following equality:

$$\begin{aligned} \sum_{k=1}^K (DC^k + \tau^k)x_{ij}^k - \alpha \sum_{k=1}^K \left[\left(\frac{CC^k}{T} + CM^k\right)L_{ij} + CT^k\right]x_{ij}^k \\ = \sum_{k=1}^K (Cmp^k + \vartheta^k)\rho^k x_{ij}^k - (1 - \alpha) \sum_{k=1}^K \left[\left(\frac{CC^k}{T} + CM^k\right)L_{ij} + CT^k\right]x_{ij}^k \end{aligned}$$

Table 4. A graphical solution is highlighted in Fig 2 (squared distances are used).

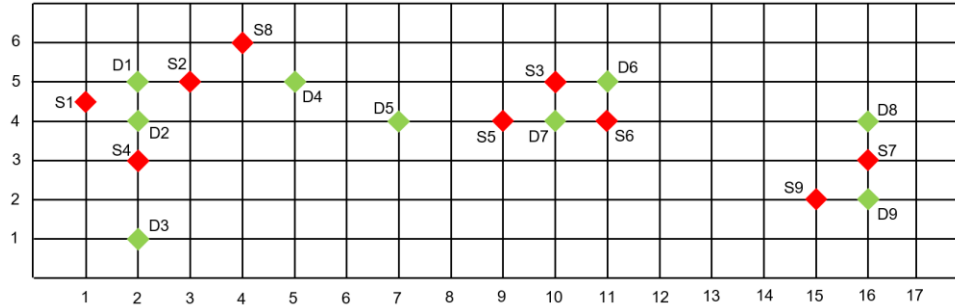


Fig 1 Geographic location of companies considered in the case example. Waste producers are depicted in red, waste users are depicted in green.

Table 2 Annual amounts of waste produced and input required by each company.

i, j	S_i^k	D_j^k
1	300000	370000
2	250000	250000
3	170000	330000
4	230000	230000
5	150000	220000
6	350000	240000
7	135000	290000
8	90000	165000
9	120000	145000

Table 3 Technical and economic parameters used for the case example.

Technical parameters	
T	10
ρ^k	1
Unitary costs	
CC^k	10 [€/Km×unit of waste]
CM^k	1.25 [€/Km×unit of waste×year]
CT^k	1.25 [€/unit of waste×year]
DC^k	0 [€/unit of waste]
Cmp^k	15 [€/unit of input]
Environmental costs	
τ^k	10 [€/unit of waste]
ϑ^k	5 [€/unit of input]

Table 4 Numerical results: annual amount of waste to be exchanged and values of parameters α .

	D1	D2	D3	D4	D5	D6	D7	D8	D9	% of waste not disposed of
S1	$x_{11}=260000$ $\alpha^*=0.22$ $\alpha_{\min}=-0.10$ $\alpha_{\max}=0.55$	$x_{12}=40000$ $\alpha^*=0.22$ $\alpha_{\min}=-0.10$ $\alpha_{\max}=0.55$	0	0	0	0	0	0	0	100%
S2	$x_{21}=110000$	0	0	$x_{24}=140000$	0	0	0	0	0	100%

	$\alpha^*=0.10$ $\alpha_{\min}=-0.60$ $\alpha_{\max}=0.80$			$\alpha^*=0.29$ $\alpha_{\min}=0.16$ $\alpha_{\max}=0.42$						
S3	0	0	0	0	0	0	$x_{37}=170000$ $\alpha^*=0.10$ $\alpha_{\min}=-0.60$ $\alpha_{\max}=0.80$	0	0	100%
S4	0	$x_{42}=210000$ $\alpha^*=0.10$ $\alpha_{\min}=-0.60$ $\alpha_{\max}=0.80$	$x_{43}=20000$ $\alpha^*=0.29$ $\alpha_{\min}=0.16$ $\alpha_{\max}=0.42$	0	0	0	0	0	0	100%
S5	0	0	0	0	$x_{55}=140000$ $\alpha^*=0.29$ $\alpha_{\min}=0.16$ $\alpha_{\max}=0.42$	0	$x_{57}=10000$ $\alpha^*=0.10$ $\alpha_{\min}=-0.60$ $\alpha_{\max}=0.80$	0	0	100%
S6	0	0	0	0	0	$x_{66}=240000$ $\alpha^*=0.10$ $\alpha_{\min}=-0.60$ $\alpha_{\max}=0.80$	$x_{67}=110000$ $\alpha^*=0.10$ $\alpha_{\min}=-0.60$ $\alpha_{\max}=0.80$	0	0	100%
S7	0	0	0	0	0	0	0	$x_{78}=135000$ $\alpha^*=0.10$ $\alpha_{\min}=-0.60$ $\alpha_{\max}=0.80$	0	100%
S8	0	0	0	$x_{84}=90000$ $\alpha^*=0.29$ $\alpha_{\min}=0.16$ $\alpha_{\max}=0.42$	0	0	0	0	0	100%
S9	0	0	0	0	0	0	0	0	$x_{99}=120000$ $\alpha^*=0.10$ $\alpha_{\min}=-0.60$ $\alpha_{\max}=0.80$	100%
% of input replaced	100%	100%	6,06%	100%	63,64%	100%	100%	81,82%	82,76%	

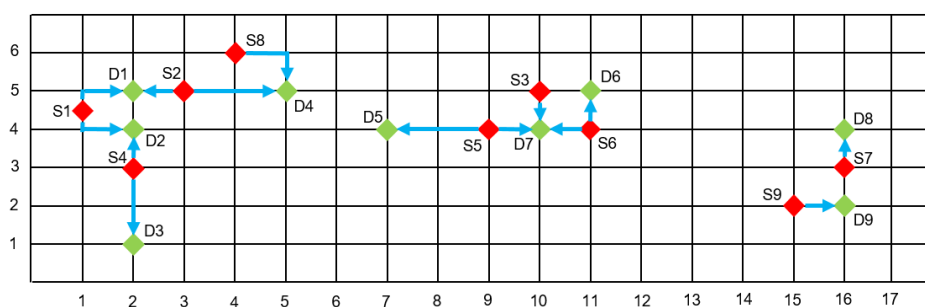


Fig 2 Graphical solution. Blue lines denote the pipelines to be built.

4 Discussion and Conclusions

This paper proposes a linear programming model to design energy-based exchanges in EIPs. This model provides some useful advances compared to the existing models. First, the objective function takes into account both economic and environmental issues simultaneously. In fact, environmental issues are modeled through the environmental

costs τ and ϑ . Second, the model is able to assess the amount of energy that can be effectively exchanged among companies because it considers fluctuations in waste energy production and demand, then not just considering the annual amount of waste produced and required. In fact, it might happen that, even in case of a perfect match between the annual amounts of waste produced and required, these amounts are produced and required in different periods and therefore the match cannot be ensured in the same period. In this regard, the example in Table 5 highlights that, despite the annual amount of produced and required waste is equal (i.e., 400 units), the actual amount that can be effectively exchanged is lower (i.e., 210 units) because of quantity mismatch occurring in each period. Finally, the optimization model is integrated with a decision-support tool able to propose the optimal policy for sharing costs arising from IS so that the economic benefits are fairly shared between each couple of involved companies. This is useful in order to avoid the problem of incentive misalignment, which is recognized as a strong barrier to the establishment of IS relationships.

Table 5 Example of a mismatch between demand and supply of waste.

Period	$S_i^k(t)$	$D_j^k(t)$	$X_{ij}^k(t)$
1	100	50	50
2	50	40	40
3	50	200	50
4	10	50	10
5	190	60	60
Total	400	400	210

A case example is presented, in order to show how the model works and to highlight its usefulness in practice. According to the numerical solution displayed in Table 4, a mismatch between demand and supply still remains. For example, the waste receiver 3 can replace only 6% of its input. Hence, in order to reduce such a mismatch, other waste producers should be added to the area. To this aim, the model can be used to identify where to locate the new plant(s), so that the economic benefits are maximized, via launching the optimization algorithm for different locations of the new plant(s).

From the numerical case, it can be highlighted that the value of α^* is higher than zero for all the IS relationships, ranging between 0.10 and 0.29. This means that in all cases the infrastructural costs should be shared between the involved companies, so that the economic benefits are fairly shared. This feature of the model can be particularly effective for managers in charge of designing the EIP, since avoids that companies put in practice opportunistic behaviors when negotiating the cost-sharing solution.

Finally, the model can be used to assess the impact of policy measures affecting environmental costs, waste disposal costs, and input purchase costs. For example, it can be useful to discover policy measures useful to make feasible IS opportunities that are currently not economically convenient.

There are some limitations that should be acknowledged. In fact, the model assumes that one waste can replace only one input. Furthermore, the model does not take into account the treatment processes that waste might require in order to be used as input. These issues are a driver for future research.

References

- Albino, V., Fraccascia, L., and Giannoccaro, I., (2016) "Exploring the role of contracts to support the emergence of self-organized industrial symbiosis networks: an agent-based simulation study", *Journal of Cleaner Production*, Vol. 112, pp. 4353–4366.
- Boix, M., Montastruc, L., Azzaro-Pantel, C., and Domenech, S., (2015) "Optimization methods applied to the design of eco-industrial parks: a literature review", *Journal of Cleaner Production*, Vol. 87, pp. 303–317.
- Chertow, M.R., (2000) "Industrial Symbiosis: Literature and Taxonomy", *Annual Review of Energy and the Environment*, Vol. 25, pp. 313–337.
- Chertow, M.R., and Ehrenfeld, J., (2012) "Organizing Self-Organizing Systems", *Journal of Industrial Ecology*, Vol. 16, pp. 13–27.
- Doménech, T., and Davies, M., (2011) "The role of Embeddedness in Industrial Symbiosis Networks: Phases in the Evolution of Industrial Symbiosis Networks", *Business Strategy and the Environment*, Vol. 20, pp. 281–296.
- Fichtner, W., Tietze-Stöckinger, I., Frank, M., and Rentz, O., (2005) "Barriers of interorganisational environmental management: two case studies on industrial symbiosis", *Progress in Industrial Ecology, an International Journal*, Vol. 2, pp. 73–88.
- Fraccascia, L., Giannoccaro, I., and Albino, V., (2019) "Business models for industrial symbiosis: A taxonomy focused on the form of governance", *Resources Conservation and Recycling*, Vol. 146, pp. 114–126.
- Fraccascia, L., and Yazan, D.M., (2018) "The Role of Online Information-Sharing Platforms on the Performance of Industrial Symbiosis Networks", *Resources, Conservation and Recycling*, Vol. 136, pp. 473–485.
- Jacobsen, N.B., (2006) "Industrial Symbiosis in Kalundborg, Denmark: A Quantitative Assessment of Economic and Environmental Aspects", *Journal of Industrial Ecology*, Vol. 10, pp. 239–255.
- Kikuchi, Y., Kanematsu, Y., Ugo, M., Hamada, Y., and Okubo, T., (2016) "Industrial Symbiosis Centered on a Regional Cogeneration Power Plant Utilizing Available Local Resources: A Case Study of Tanegashima", *Journal of Industrial Ecology*, Vol. 20, pp. 276–288.
- Korhonen, J., (2001) "Four ecosystem principles for an industrial ecosystem", *Journal of Cleaner Production*, Vol. 9, pp. 253–259.
- Massard, G., Leuenberger, H., and Dong, T.D., (2018) "Standards requirements and a roadmap for developing eco-industrial parks in Vietnam", *Journal of Cleaner Production*, Vol. 188, pp. 80–91.
- Narayanan, V. G., and Raman, A., (2004). "Aligning Incentives in Supply Chains", *Harvard Business Review*, Vol. 82, pp. 94–102.
- Shapley, L.S., (1953) "A value for n-person games", *Contributions to the Theory of Games*, Vol. 2, pp. 307–317.
- Tudor, T., Adam E., and Bates M., (2007) "Drivers and Limitations for the Successful Development and Functioning of EIPs (Eco-Industrial Parks): A Literature Review". *Ecological Economics*, Vol. 61, pp. 199–207.
- Yazdanpanah, V., and Yazan, D.M., (2017) Industrial Symbiotic Relations as Cooperative Games, in: 7th International Conference on Industrial Engineering and Systems Management (IESM-2017).
- Yuan, Z., and Shi, L., (2009) "Improving enterprise competitive advantage with industrial symbiosis: case study of a smeltery in China", *Journal of Cleaner Production*, Vol. 17, pp. 1295–1302.

Emergence and Evolution of Cooperative Behaviour in Industrial Symbiosis

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Abstract

In this paper, we provide practical decision support to managers in firms involved in Industrial Symbiotic Relations (ISRs) in terms of strategy development and test the hypothesis that in the long-term, playing a fair strategy for sharing obtainable ISR-related benefits is dominant. We employ multi-agent-based simulations and model industrial decision-makers as interacting agents that observe their history of cooperation decisions in ISRs. The agents are able to: learn from their past, deviate from relations in which their partner plays unfair, and change their strategy to reach higher long-term benefits. Results show that in a long-run industrial decision makers learn to play fair in ISRs. In addition to managerial support for developing long-lasting ISRs, our work introduces the concept of learning as a notion that links the micromotives in ISRs to their macrobehavior.

Keywords – Industrial Symbiotic Relations, Strategy Management, Learning in Industrial Relations, Industrial Symbiosis Evolution, Multiagent-Based Simulation

Paper type – Academic Research Paper

1 Introduction

Industrial symbiosis (IS) is a subfield of industrial ecology that engages separate industries in physical exchanges of waste materials, water, and energy (Chertow, 2000). Two companies implement an IS relationship (ISR) when at least one waste produced by the former is used to replace production inputs by the latter. By exchanging wastes for inputs, companies can reduce the amounts of wastes disposed of in landfills and the amounts of primary inputs purchased by traditional suppliers, thus generating environmental benefits for the collectivity and reducing their production costs at the same time (Jacobsen, 2006). Thanks to such a reduction, companies implementing IS can gain competitive advantage compared to their competitors not adopting IS (Esty and Porter, 1998). For these reasons, IS is recognized as a key practice to support the transition towards circular economy and policymakers are pushing companies to adopt such a practice (European Commission, 2015).

However, implementing an ISR requires that companies pay additional costs compared to their main businesses, i.e., costs to transport wastes from the producer to the user and costs to make wastes available to be used as inputs. In fact, some wastes may require a treatment process before being used as input, e.g., filtration, sorting, grounding processes, etc. Companies interested in an ISR have to negotiate how to share these additional costs among them which is a crucial phase for the creation of the ISR because determining how the total economic benefit created is shared among companies. In fact, a minimum economic benefit exists that motivate companies to symbiotically cooperate. Such a benefit depends on idiosyncratic features of companies, such as the desired return on investment (Mirata, 2004). In this regard, the literature provided several models proposing how the economic benefit overall created by ISR can be fairly shared between the involved companies, so that both of them are motivated enough to cooperate (Albino et al., 2016; Yazdanpanah and Yazan, 2017). However, real cases investigated by the authors showed that companies might adopt opportunistic behaviors during the cost-sharing negotiation phase, aimed at capturing the greatest part of the economic benefit overall created while leaving a scant part to the other company. In such a case, an incentive misalignment problem may arise (Narayanan and Raman, 2004), i.e., the company gaining the scant part of the benefit might be not motivated enough to cooperate with the symbiotic partner and it might prefer to reject the relationship. Furthermore, even if the relationship is not immediately rejected, such a misalignment may be responsible for reducing trust in the symbiotic partner, which can hamper the stability of the relationship in the long period (Lambert and Boons, 2002). In fact, high trust between the involved companies is recognized as a key facilitator for ISRs (Hewes and Lyons, 2008). Hence, the IS practice can be conceptualized as a form of ‘coopetition’, i.e., something in between pure cooperation and pure competition (Osarenkhoe, 2010). In fact, companies have to cooperate aimed at creating an economic benefit at the ISR level (which cannot be created unilaterally) but then they have to compete in appropriating such a benefit. So far, the literature focused on assessing the economic benefits overall created (i.e., on the

cooperation phase) but scant attention has been devoted to investigate how companies share such a benefit (i.e., to the competition phase).

This paper is aimed to fill this gap. First, we use non-cooperative game schemes (Nash, 1951) to model strategies that companies can adopt for benefit-sharing. Second, we employ agent-based simulation (Axelrod, 1997) to explore the iterated game and its evolution over time. Our aim would be to investigate how firms develop long-term and whether their potential to observe previous rounds of the industrial symbiosis game affects the evolution of their strategies.

The paper is organized as follows. Section 2 presents the game theory model developed. Section 3 presents the agent-based model and the simulation results. The paper ends with discussion and conclusions in Section 4 and Section 5, respectively.

2 Game-theoretical model

In this section, a non-cooperative game scheme (Nash, 1951) is used to model and predict the behavior of industrial firms in ISRs.

Let us consider two companies, the waste producer (P) and the waste user (U), which try to establish an ISR. The total economic benefit that can be created from such a relationship (π_{max}) can be computed by the following equation:

$$\pi_{max} = CW + CI - AC \quad (1)$$

where CW denotes the reduction in waste disposal cost gained by the waste producer, CI denotes the reduction in input purchase costs gained by the waste user, and AC denotes the additional costs stemming from the ISR, i.e., waste treatment and transportation costs (Fraccascia and Yazan, 2018). Companies have to negotiate how to share these additional costs and such a negotiation affects how the total economic benefits are shared between them. In this regard, let λ be the share of additional costs that is paid by the waste producer and let $1 - \lambda$ be the share of additional costs that is paid by the waste user. Hence, the economic benefits gained by waste producer (π_P) and the economic benefits gained by waste user (π_U) can be computed as follows:

$$\pi_P = CW - \lambda \cdot AC \quad (2)$$

$$\pi_U = CI - (1 - \lambda) \cdot AC \quad (3)$$

where $\pi_P + \pi_U = \pi_{max}$. According to the literature, a minimum net economic benefit exists for each company that makes the ISR convenient enough from the economic perspective. Let us denote the minimum benefit for the waste producer and user as ε_P and ε_U , respectively. When trying to establish an ISR, the waste producer (user) may play two strategies:

- A *fair* strategy, where he/she settles for gaining its minimum benefit ε_P (ε_U). So that the strategy can be considered fair, ε_P (ε_U) should be lower than $0.5 \times \pi_{max}$. In

such a case, the waste producer (user) will be willing to cooperate $\forall \lambda \leq \frac{1}{AC} [CW - \varepsilon_P]^1$ ($\forall \lambda \geq \frac{1}{AC} [\varepsilon_U + AC - CI]^2$);

- An *opportunistic* strategy, where he/she tries to capture the greatest part of the economic benefit created, leaving that the waste user (producer) gains its minimum benefit ε_U (ε_P). Hence, the waste producer (user) will be willing to cooperate for $\lambda = \frac{1}{AC} [\varepsilon_U + AC - CI]$ ($\lambda = \frac{1}{AC} [CW - \varepsilon_P]$), so that he/she will gain an economic benefit of $\pi_{max} - \varepsilon_U$ ($\pi_{max} - \varepsilon_P$)³.

The single-shot ISR game can be modeled as a non-zero-sum game⁴ simultaneously played by the two above-mentioned companies. Payoffs are evaluated as the net benefits for each player. The resulting payoff matrix is shown in

Table 4. Accordingly, the ISR will arise in three of the four scenarios:

- Both companies play the *fair* strategy. In such a case, they negotiate the value $\lambda^* \in \left[\frac{1}{AC} (\varepsilon_U + AC - CI); \frac{1}{AC} (CW - \varepsilon_P) \right]$, so that $\pi_P \geq \varepsilon_P$ and $\pi_U \geq \varepsilon_U$, simultaneously. Hence, the payoff of the waste producer is $CW - \lambda^* \cdot AC$ and the payoff of the waste user is $CI - (1 - \lambda^*) \cdot AC$;
- The waste producer plays the *fair* strategy and the waste user plays *opportunistic* strategy. In such a case, the waste producer gains the minimum benefit ε_P while the waste user gains $\pi_{max} - \varepsilon_P$;
- The waste producer plays the *opportunistic* strategy and the waste user plays *fair* strategy. In such a case, the waste producer gains $\pi_{max} - \varepsilon_U$ while the waste user its minimum benefit ε_U .

Finally, if both companies play the *opportunistic* strategy, the ISR does not arise and companies do not gain economic benefits.

Table 4 Payoff matrix for the proposed game theory model.

		Waste User	
		<i>Fair</i>	<i>Opportunistic</i>
Waste Producer	<i>Fair</i>	$CW - \lambda^* \cdot AC$ $CI - (1 - \lambda^*) \cdot AC$	ε_P $\pi_{max} - \varepsilon_P$
	<i>Opportunistic</i>	$\pi_{max} - \varepsilon_U$ ε_U	0 0

As can be noticed from Table 1, no dominant strategy exists for any of the actors. The game results in two Nash equilibria⁵, i.e., cells *fair-opportunistic* and *opportunistic-fair*. To verify this, we elaborate on the fact that in both these cases, none of the players can

¹ This comes from the following constraint: $CW - \lambda \times AC \geq \varepsilon_P$.

² This comes from the following constraint: $CI - (1 - \lambda) \times AC \geq \varepsilon_U$.

³ Under the assumption that $\varepsilon_P < 0.5 \times \pi_{max}$ ($\varepsilon_U < 0.5 \times \pi_{max}$), it results that $\pi_{max} - \varepsilon_U > 0.5 \times \pi_{max}$ ($\pi_{max} - \varepsilon_P > 0.5 \times \pi_{max}$).

⁴ While in zero-sum games the total benefit to all players in the game, for every combination of strategies, always adds to zero, in non-zero-sum games outcomes can have net results greater than zero, so that a gain by one player does not necessarily correspond to a loss by another.

⁵ A situation would be seen as a Nash equilibrium if neither of the involved players can benefit by deviating from it.

unilaterally increase its payoff by deviating. In this regard, let us consider that the waste producer (user) plays the *opportunistic* strategy and the waste user (producer) plays the *fair* strategy. In such a case, the waste producer (user) would have no interest in changing its strategy, since such a change would reduce its economic benefit, while the waste user (producer) cannot change its strategy because the relationship would be rejected by the waste producer (user). Therefore, the game stays in either of the two cells. This form of strategic play is also known in the non-cooperative games literature (Aumann and Shapley, 1994) as the max-min approach where a player P reasons about its strategies—to maximize its own utility—with the assumption that the opponent player O has the same goal (i.e., O aims to maximize its own utility and accordingly minimize P 's utility). Due to the non-cooperative setting of the game, from P 's point of view, it should select the strategy that maximizes its utility among all the O 's minimizing strategies.

All the above is about strategic choices is firms play once. In real-life situations, firms may get involved in multiple resource exchanges hence have to play the ISR game plenty of times. To understand the dynamics and evolution of ISRs (over time), we model ISRs behavior in the long run using an iterative ISR game among the involved firms. In this regard, the literature recognizes that path dependence plays a relevant role in long-term ISRs, i.e., that companies are influenced by the historical accumulations resulting from previous operations when taking decisions (Arthur, 1994; Boons and Howard-Grenville, 2009). Accordingly, possible behaviors that emerge in the long period can be highlighted. First, a company that is cooperating in the *fair-fair* scenario might start to adopt an opportunistic behavior by changing its strategy from *fair* to *opportunistic*, aimed at increasing the amount of economic benefits from the ISR, being confident that the symbiotic partner will continue to play *fair* strategy. However, opportunistic behavior is responsible for reducing trust between companies (Sako, 1992), which is considered as a key element for the stability of ISRs (Hewes and Lyons, 2008). In fact, the literature reports cases where ISRs were interrupted because of the lack of trust among the involved companies (Lambert and Boons, 2002). We model such a situation as the possibility for the company that is playing *fair* in the *fair-opportunistic* scenario to defect from the ISR. In the next section, long term game is explored by employing agent-based simulation.

3 Agent-Based Simulations for long-term IS relationships

In this section, we simulate multi-round games among multiple industrial firms, where each firm is modeled as an agent. The generic i -th agent is characterized by the following three idiosyncratic parameters:

- $\varphi(i)$ is the probability that the agent i plays the *fair* strategy when starting a new game;
- $\omega(i)$ is the probability that, if at time $t - 1$ the agent i was cooperating playing *fair* strategy with its partner, at time t the agent i changes its strategy and plays *opportunistic* strategy;
- $\delta(i)$ is the probability that agent i interrupts its current relationship because it is playing *fair* strategy and its partner is playing *opportunistic* strategy.

We consider two sets of resource-provider and resource-receiver agents. In the initial stage, for each agent the parameters φ , ω , and δ are randomly assigned between 0 and 1. For any arbitrary time-step t , the generic agent i can be: (1) currently cooperating with another agent j , where both of them played *fair* strategy at time $t-1$; (2) currently cooperating with another agent j , where i played *fair* and j played *opportunistic* strategy at time $t-1$; (3) currently cooperating with another agent j , where j played *fair* and i played *opportunistic* strategy at time $t-1$; (4) currently not cooperating with other agents.

We simulate 100 waste producers and 100 waste users interacting amongst each other for 1,000 runs. At the end of the simulation, we collect the values of parameters φ , ω , and δ of each company for each time step. In particular, the higher the value of φ , the more firms learned that adopting *fair* strategy is convenient for long-term ISRs. Alternatively, the higher the value of ω , the more firms learned that opportunistic behaviors resulting from changing strategy from *fair* to *opportunistic* strategy when the partner is playing *fair* strategy is detrimental for long-term ISRs. Finally, the higher the value of δ , the more firms learned to defect the relationship if its partner is playing *opportunistic* strategy. Simulations are replicated 10,000 times and values of φ , ω , and δ are averaged across the replications.

Simulation results are shown in Fig 1. Let us first consider the parameter δ . It grows from 0.5007 at $t=1$ to one at $t=449$ and keeps this value until $t=1,000$. Such a growth denotes that, in case a waste producer (user) plays *opportunistic* strategy, in the long term the waste users (producers) that are in relation with it learn that they can benefit more by defecting the relation. In fact, they can establish new ISRs with other firms playing *fair* strategy and gain higher economic benefits. Such a collapse of relation might be costly for the waste producer (user) because immediately reduces the economic benefits it gains from the ISR. As a result, firms learn that playing *fair* strategies is beneficial in the long term. In fact, the values of φ and ω support such an issue. In particular, as can be noticed from the parameter φ , in the long period the probability that companies play the fair strategy when starting a new game increases: φ grows from 0.4997 at $t=1$ to one at $t=414$ and keep such a value until $t=1,000$. The parameter ω shows two opposite trends over time: it grows from 0.5003 at $t=1$ to 0.5442 at $t = 153$ and then decreases to 0 at $t = 1,000$. This is representative for the fact that, initially, firms try to take advantage from adopting opportunistic behaviors, in particular by changing strategy from *fair* to *opportunistic* when both players are adopting *fair* strategy. In fact, the company changing strategy increases its own economic benefits from the ISR if its partner is available to keep the relationship despite its economic benefits are reduced. However, as the values of the parameter δ show, in the long period such a partner is more willing to interrupt the ISR with an opportunistic player because it learns that it can benefit more by defecting the relation. As a result, firms learn that opportunistic behaviors aimed at taking more advantage from existing ISRs are detrimental for their economic results.

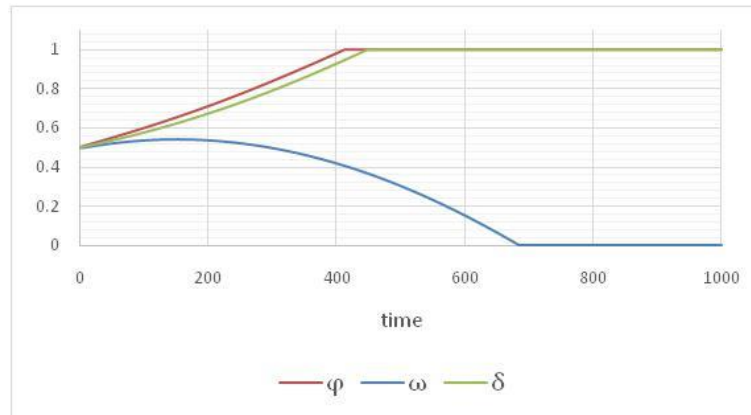


Fig 1. Simulation results.

4 Discussion

Our findings show that companies enter in a learning process on how to develop business strategies while assessing IS opportunities. Changing from *fair* to *opportunistic* strategy is not a long term and stable solution for companies as it only provides short term benefits and the challenge of finding a *fair-playing* partner increases over time. Changing from opportunistic to fair behavior enables companies to find a *fair-playing* partner quicker and thus, implementing IS business is easier. This also indicates a *fair-play* for companies when they first launch the negotiation phase. So, achieving collectivity while contributing to sustainability goals in a profitable manner is possible to learn by companies.

These results are in line with the literature highlighting the key role of collaboration for the success of the IS practice in the long period (Chertow, 2000; Lambert and Boons, 2002). Despite results show that the willingness to adopt opportunistic behavior is reduced in the long period, they also show that such a willingness increases in the short-medium period. In this regard, opportunistic behavior can be discouraged by developing trust between the companies involved in ISRs (Hewes and Lyons, 2008).

From the methodological perspective, agents learn because path dependence is recognized as a driving factor of current decisions of companies (Doménech and Davies, 2011). Considering the two presented ISR strategies in the former section, i.e., *fair* and *opportunistic* strategies, we test the hypothesis that in long-term, firms learn to implement the *fair* strategy. This is because in case a firm A applies opportunistic strategies, in long-term other firms that are in relation with A learn that they can benefit more by defecting the relation. Such a collapse of relation is costly for A as it has to establish new ISRs and pay corresponding costs, e.g., transaction costs. Such a framework is in line with the role of *path dependence* in the context of IS. In fact, firms are strongly influenced by their past ISRs in taking decisions about their current relationships (Boons and Howard-Grenville, 2009; Domenech and Davies, 2011). Considering Table 1, in any time-step, ISRs either take place in a *fair-fair* form or in a *fair-opportunistic* form (and never in an

opportunistic-opportunistic manner). As we discussed above, while in single-shot ISRs an opportunistic strategy results in higher benefit for industrial firms, in the long-term the opponent firms (on the other side of the relation) may defect the relation and establish new relations. Thus, the proposed ABM is considered to be an efficient tool to analyze network behavior. Such a tool can also be particularly useful for the managers of industrial clusters as well as regional policy-makers to push companies through sustainable behavior. A similar approach can be also adopted for different purposes of policy-making, e.g., to minimize energy consumption, carbon emissions or resource use as well as to produce socially sustainable solutions such as employment creation.

5 Conclusions

This paper has theoretical, managerial, and policy implications. In terms of theoretical implications, the integration of ABM with game theory for analyzing ISRs is an innovative approach, as to our knowledge no studies took place in the literature integrating two approaches in the field of IS. Organizational learning for (particularly self-emergent) IS networks is not in-depth analyzed in the literature of IS; so, this paper extends the applicability of game theory integrated ABM for organizational learning of companies to achieve sustainable behavior.

With regard to managerial implications, this paper highlights different dynamics that can take place in the construction of ISRs explaining them through a game model. This model is useful for managers to take more precise decisions with as much information as possible referring to cooperation between ISR companies.

The transaction between ISR firms results in undoubted environmental benefits, in the form of reduction of landfill saturation, as well as decrease in the environmental impacts related to the use of conventional raw materials. However, since the transaction is highly dependent upon actors' behavior (or simply IS additional costs do not allow better payoff), policymakers may encourage the establishment of the transaction, providing incentives to the involved actors (either to both of them or just to the one with the lower contractual power that could be more motivated to not enter or leave the transaction). In this way positive externalities could be internalized by actors contributing to the improvement of environmental benefits. Taking into account the *local* character of sustainable supply chains, such incentives may also be used within regional and inter-regional environmental policies frameworks. However, there is still need for efficient tools which can integrate the accounting of externality reduction in the computation process in decision-making. In this sense, this paper might be a leading one to indicate research need for such tools facilitating the application of environmental accounting and (economic-oriented) decision-making simultaneously.

This paper proposes also a novel business strategy development as *circular economy* calls for new business models that would facilitate the operation of the waste-based businesses to gain value-added while preserving primary resources.

Further research may include the optimization of the payoffs of the ISR firms taking into account the instable character of reusable end-of-life products (whose supply chains

structurally differ from ISR-based supply chains), in terms of quality level and continuity of supply. Moreover, in future agent-based simulations, we aim to take into account other operations-oriented dynamic parameters, e.g. physical quantity of resources, presence of environmental regulations, and alternative buyers/suppliers. Such factors may affect the contractual power and willingness to cooperate of companies. Our future research avenue is modeling actors' behavior through multi-player iterative games, when firms are involved in multi-dimensional Industrial Symbiotic Networks (ISNs).

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References

- Albino, V., Fraccascia, L., and Giannoccaro, I., (2016) "Exploring the role of contracts to support the emergence of self-organized industrial symbiosis networks: an agent-based simulation study", *Journal of Cleaner Production*, Vol. 112, pp. 4353–4366.
- Arthur, W.B., (1994) *Increasing Returns and Path Dependence in the Economy*, The University of Michigan Press.
- Aumann, R. J., and Shapley, L.S., (1994) *Long-Term Competition—A Game-Theoretic Analysis*, in *Essays in Game Theory*, Springer, New York.
- Axelrod, R. (1997) *The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration*, Princeton University Press, Princeton.
- Boons, F., and Howard-Grenville, J.A (2009) The Social Embeddedness of Industrial Ecology: Exploring the Dynamics of Industrial Ecosystems, in *The Social Embeddedness of Industrial Ecology*, ed. F. Boons and J.A. Howard-Grenville, Edward Elgar Publishing, Northampton.
- Chertow, M.R. (2000) "Industrial Symbiosis: Literature and Taxonomy", *Annual Review of Energy and the Environment*, Vol. 25, pp. 313–337.
- Doménech, T. and Davies M., (2011) "The Role of Embeddedness in Industrial Symbiosis Networks: Phases in the Evolution of Industrial Symbiosis Networks", *Business Strategy and the Environment*, Vol. 20, pp. 281–296.
- Esty, D.C. and Porter, M.E., (1998) "Industrial Ecology and Competitiveness", *Journal of Industrial Ecology*, Vol. 2, pp. 35–43.
- European Commission. 2015. *Closing the Loop - An EU Action Plan for the Circular Economy*. COM. Bruxelles. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0614>.
- Fraccascia, L. and Yazan, D.M., (2018) "The Role of Online Information-Sharing Platforms on the Performance of Industrial Symbiosis Networks", *Resources, Conservation and Recycling*, Vol. 136, pp. 473–485.
- Hewes, A.K. and Lyons D., (2008) "The Humanistic Side of Eco-Industrial Parks: Champions and the Role of Trust", *Regional Studies*, Vol. 42, pp. 1329–1342.

- Jacobsen, N.B., (2006) “Industrial Symbiosis in Kalundborg, Denmark: A Quantitative Assessment of Economic and Environmental Aspects”, *Journal of Industrial Ecology*, Vol. 10, pp. 239–255.
- Lambert, A.J.D. and Boons F., (2002) “Eco-Industrial Parks: Stimulating Sustainable Development in Mixed Industrial Parks”, *Technovation*, Vol. 22, pp. 471–484.
- Mirata, M., (2004) “Experiences from Early Stages of a National Industrial Symbiosis Programme in the UK: Determinants and Coordination Challenges”, *Journal of Cleaner Production*, Vol. 12, pp. 967–983.
- Narayanan, V. G., and Raman, A., (2004). “Aligning Incentives in Supply Chains”, *Harvard Business Review*, Vol. 82, pp. 94–102.
- Nash, J., (1951) “Non-Cooperative Games”, *Annals of Mathematics*, Vol. 54, pp. 286–295.
- Osarenkhoe, A., (2010) “A Study of Inter-Firm Dynamics between Competition and Cooperation – A Coopetition Strategy”, *Journal of Database Marketing & Customer Strategy Management*, Vol. 17, pp. 201–221.
- Sako, M., (1992) *Prices, Quality, and Trust : Inter-Firm Relations in Britain and Japan*. Cambridge University Press.
- Yazdanpanah, V., and Yazan, D.M., (2017) Industrial Symbiotic Relations as Cooperative Games, in: 7th International Conference on Industrial Engineering and Systems Management (IESM-2017).

Disentangling and Diagnosing Marketing-Related Knowledge Resources: Empirical Evidence from Spain

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Abstract

Traditional intellectual capital (IC) frameworks are often too broad to provide actionable recommendations for managers. To overcome this limitation, it has been suggested that more contextually informed frameworks could be developed. Accordingly, the aim of this paper is to identify and classify the knowledge resources that shape IC in the marketing function, as well as to test the content validity of the proposed framework, and to diagnose the strengths and weaknesses of Spanish firms in terms of marketing-related knowledge resources. To identify and classify knowledge assets in the field of marketing, we followed a literature-grounded approach. More precisely, we set out from the IC categories identified in the global IC literature (namely, human capital, organizational/structural capital and social/relational capital) and tried to identify the specific content of each of them in the marketing function, based on its characteristics and recent evolution. Afterwards, we tested the content of the new framework in a group of companies with different profiles (manufacturing/service, B2B/B2C, high-tech/low-tech, large/mid-sized) and carried out a survey in a representative sample of Spanish firms with at least 100 employees to diagnose their situation in terms of marketing-related IC. As a result, this paper presents a marketing-related IC architecture made up of three main categories, nine subcategories and eighty items. Moreover, the survey results demonstrate that marketing-specific human capital is the most developed knowledge resource in Spanish firms, followed by marketing-specific relational capital.

On the contrary, marketing-specific structural capital presents the lowest level of development.

Keywords – Intellectual capital, Knowledge resources, Marketing, Spain.

Paper type – Academic Research Paper.

1 Introduction

According to the knowledge-based view (Grant, 1996; Spender, 1996), knowledge is the most strategically important resource of the firm and the cornerstone of competitive advantage and value creation. Thus, managers must focus on producing, acquiring, retaining and utilising knowledge (Spender, 1996). The overall set of knowledge resources of an organization constitutes its intellectual capital (IC) (e.g., Edvinsson and Malone, 1997; Sveiby, 1997; Bontis, 1998).

The influence of IC on performance has been widely studied in previous research (e.g., Bontis *et al.*, 2000; Wang and Chang, 2005). However, most of the studies adopt a very aggregated approach, classifying knowledge resources at a very broad level (e.g., human capital, structural capital and relational capital of the whole company) and without reaching enough level of detail that could give rise to actionable recommendations. For example, human capital is grasped by means of indicators such as “our employees are highly skilled”, or “our employees are considered the best in our industry” (e.g., Bontis *et al.*, 2000; Subramaniam and Youndt, 2005) which do not clarify the specific skills and knowledge that employees should master. Similar general level aggregation takes place with structural capital and relational capital. As a result, IC-performance studies provide managers with very vague and general advice about what knowledge resources they need to promote to enhance performance (Chiucchi and Montemari, 2016; Kianto *et al.*, 2018).

In this regard, addressing the specific needs and configurations of IC in different functional areas of the firm represents a further step that may help overcome the above problem. In this study we have chosen to focus on the marketing function, which represents quite distinct, but still broadly relevant contextual domain for firms’ IC. This constitutes a relevant area to focus on, given its key role in attracting and retaining customers, and in shaping innovation and value creation efforts, which all are essential for company survival. Moreover, the numerous and rapid changes in the marketing field considerably affect the knowledge resources needed to successfully perform this function. New technologies cause the interaction between individuals and firms to occur through different channels, devices and touchpoints. As a result, new types of data and analytic approaches are emerging, as well as new marketing models, concepts and tools.

Considering this, the aim of this paper is (1) to identify and classify the knowledge resources that shape IC in the marketing function, (2) to test the content validity of the proposed framework, and (3) to apply it to diagnose the strengths and weaknesses of Spanish firms with at least 100 employees in terms of marketing-specific knowledge resources.

2 Disentangling marketing-related IC

2.1 Intellectual capital

As stated by Martín-de-Castro *et al.* (2011), providing an unified or unique definition of IC is almost impossible, considering the countless definitions that can be found in the literature. Nevertheless, Aramburu and Sáenz (2011) established that most of them can be classified into two groups: knowledge-based and holistic. While the knowledge perspective conceives IC as the sum of all knowledge resources that firms utilize for competitive advantage (Youndt *et al.*, 2004; Subramaniam and Youndt, 2005) the holistic perspective defines IC as the sum of the ‘hidden’ assets of the company not fully included on the balance sheet (Roos and Roos, 1997). This includes knowledge, but also employees’ attitudes, loyalty, motivation and flexibility (Marr, 2006), corporate culture (Brooking, 1997), relationships with customers and suppliers, brand names, trademarks and reputation (Sveiby, 1997), to name but a few. In this research, we adopt the first perspective, and thus we equate IC to “knowledge capital” (Reed *et al.*, 2006).

Whichever the perspective adopted, IC is split up into different components. The most widespread classification distinguishes between three main categories: human capital, organizational/structural capital and both internal and external social/relational capital (Reed *et al.*, 2006). From the knowledge perspective of IC:

- *Human capital* refers to employees’ knowledge, skills and abilities (Youndt *et al.*, 2004). The challenge of human capital is that firms have no complete control and management of employees and their knowledge (Roos, 1998).
- *Organizational/structural capital* consists of the institutionalized knowledge and codified experience stored in memory devices such as databases, manuals, routines, patents and the like (Youndt, *et al.*, 2004; Subramaniam and Youndt, 2005). Unlike human capital, structural capital is completely owned by the organization (Sveiby, 1997).
- *Social/relational capital* refers to the knowledge resources embedded within, available through, and derived from a network of relationships (Youndt *et al.*, 2004). These networks of relationships could be both internal to the firm (e.g., internal networks among employees, supervisors and between departments) and external (e.g., connections with customers, suppliers and other external partners; Edvinsson and Malone, 1997; Sveiby, 1997; Bontis, 1998).

Additionally, some studies have included other categories in an attempt to expand the traditional IC framework. Some of these ‘new components’ are: renewal capital, defined as the “actualized learning capability of the firm” (Kianto *et al.*, 2010) and entrepreneurial capital, conceptualized by Erikson (2002) as the individuals’ ability to pursue opportunities regardless of the resources they control. However, our study focuses on knowledge viewed as a stock rather than as a capability, and renewal capital and entrepreneurial capital are of the latter kind. Given this fact, this paper focuses only on the first three categories explained above, which are also the most widely utilized in the IC literature.

2.2 From IC at the company level to IC in the marketing function

Setting out from the knowledge perspective of IC, we define marketing-specific IC as *all the valuable marketing-specific knowledge resources that an organisation has access to and manages in order to develop its marketing capabilities and achieve its marketing-related goals*.

Notice that an organization does not need to own a resource to be able to utilize it (Helfat *et al.*, 2007). For instance, firms do not own their employees, but they benefit from their knowledge and expertise. Likewise, external alliances may enable them to have access to certain resources that they do not possess, such as market knowledge regarding a specific geographical context or knowledge regarding some type of technology.

It should be noted that in the above definition, marketing capabilities fall outside the scope of marketing-specific IC. Rather, marketing capabilities are seen to be grounded on the knowledge stocks that integrate marketing-specific IC (Kogut and Zander, 1992; Grant, 2010). These capabilities contribute to market performance and company growth by enabling the acquisition of new clients, the retention of existing ones and increased sales to already existing customers.

To build up the IC architecture of the marketing function, we need to identify the main knowledge objects that marketers need to deal with in order to perform their job, and see how they spread in individuals, the organization itself, and internal and external relationships (i.e., the main categories that make up IC in a company).

In the next paragraphs, we discuss the logic that gave rise to the identification of these knowledge objects (i.e., the different entities people in the marketing department should know about):

- *Customers* – The definition of marketing provided us with the first knowledge object. According to Kotler and Armstrong (2018), “marketing is the process of engaging customers and building profitable customer relationships by creating value for customers and capturing value in return” (p. 53). Therefore, *customers* constitute the first knowledge object of the marketing function. Marketing professionals must understand them in order to fulfil their mission.
- *Products and/or services* – Second, building and maintaining profitable customer relationships depends on delivering superior customer value and satisfaction, which in turn depends on product/service performance relative to customers’ expectations (Kotler and Armstrong, 2018). Thus, *products and/or services* (i.e., the company’s offering) constitute the second knowledge object of the marketing function. People in the marketing department must know the firm’s offering and ultimately contribute to improve it and/or to develop it.
- *Market(s)* – On the other hand, “marketing involves serving a market of final consumers in the face of competitors” (Kotler and Armstrong, 2018; p. 34). Accordingly, understanding the marketplace constitutes the first step of the marketing process, which gives rise to the third knowledge object of the marketing function: the *market* or markets in which the company operates. Marketing professionals must understand the market to adequately differentiate and position the company’s offering.

- *Internal context* – This view of the external context needs to be complemented with knowledge about the *internal context* of the firm (i.e., its mission and vision, overall constraints, interdependencies between different organizational units...) to guarantee that the decisions adopted, and the actions promoted are consistent with the overall setting.
- *Disciplinary knowledge* – So far, we have argued that marketers must know about customers, products and/or services, markets, and the internal context of the firm. However, to perform their job, marketing professionals also need a set of marketing-related concepts and theories (i.e., *disciplinary knowledge*; Rossiter, 2001) that help them to develop and implement a successful marketing strategy and address different work situations.
- *Know-how* – All the above knowledge involves “information-type” (Kogut and Zander, 1992) or “knowing about” knowledge (Grant, 2010). In other words, knowledge about traits and characteristics; facts and figures; ideas, concepts, theories and propositions. However, this type of knowledge constitutes only one side of the coin. The other side is *know-how* or knowledge about how to do something (in our case, a marketing task or activity). This kind of knowledge can only be partially captured by means of statements, diagrams and/or images that describe a method, process or practice, and is mainly tacit (Kogut and Zander, 1992). “It involves skills that are expressed through performance” (Grant, 2010; p. 163). Nevertheless, these personal skills are distinct from organizational capabilities. The latter “involve coordination between organizational members such that they integrate their skills with one another and with a variety of other resources” (Grant, 2010; p. 154).

Thus, once the knowledge objects of the marketing function have been presented, in the next sections we will show how they fit into the three types of “knowledge containers” that are considered in the IC literature (employees, the organization itself and relationships).

2.2.1 Marketing-specific human capital

Marketing-specific human capital (HC) refers to *all the knowledge residing among the marketing and sales people*. In other words, it consists of what employees of the marketing department know.

Unlike other IC categories (i.e., organizational/structural capital and social/relational capital), in which different subtypes of knowledge containers could be identified (see the next sections), in the case of HC, employees are the only “knowledge recipients”. Thus, within this IC category, specific subcategories will be mostly related to the knowledge objects previously described. Putting aside knowledge about the internal context of the firm (which we think is mostly embedded in internal relationships between the marketing department and other departments in the company), the IC subcategories considered in this domain are: customer knowledge; product/service knowledge; market knowledge; educational background (which constitutes the main source of disciplinary knowledge) and experience (which could reinforce disciplinary knowledge, but also others); and marketing-related skills (i.e., know-how-related knowledge).

Based on performance literature regarding marketing and sales staff, we have then identified the specific knowledge items to be considered within each subcategory:

- *Customer knowledge* – It refers to employees' knowledge about customers which allows satisfying their needs better than competitors (Saxe and Weitz, 1982; Rapp *et al.*, 2006). This subcategory is made up of 6 key aspects that people in the marketing function should know about their clients: needs, expectations, satisfaction levels, personality, behaviour and circumstances.
- *Product/service knowledge* – It refers to employees' knowledge about product specifications, applications and customer use situations (Cravens *et al.*, 1993; Rapp *et al.*, 2006). It encompasses 5 key issues that marketers should know about the company's offering: product/service specifications; product/service applications and functions; differences from competitors; potential causes of operating failure; and the firm's latest product and/or service developments.
- *Market knowledge* – It refers to employees' knowledge about the industry in which the company operates (Schillewaert and Ahearne, 2000; Rapp *et al.*, 2006). It is made up of 4 elements that show employees' knowledge about the industry: information on industry trends and relevant events, and information on competitors' activities and strategies.
- *Educational background and experience* – It refers to the formal educational background of employees in the marketing domain, to their updated knowledge in this area, and to their professional experience in the marketing and sales field, as well as in the industry in which the company operates. As already mentioned, the first two aspects included in the definition are tightly connected to disciplinary knowledge, while experience could also reinforce the other three types (i.e., customer-, product/service- and market-related-knowledge), as well as know-how. This subcategory is made up of 5 items gathering the different aspects included in the definition.
- *Marketing-related skills* – It refers to those skills that are deemed relevant for a professional in the marketing and sales field. Thus, it represents the know-how embedded in individuals. After a literature review, we have come up with 10 skills that are deemed relevant for a marketing professional (e.g., Schillewaert and Ahearne, 2000; Rapp *et al.*, 2006; Piercy *et al.*, 2009; Guesalaga, 2016): targeting skills, adaptive skills, problem solving skills, communication skills, planning and organizational skills, expenditure management skills, IT skills, social media management skills, teamwork skills, and creativity.

2.2.2 Marketing-specific structural capital

Marketing-specific structural capital (SC) refers to *all marketing-related knowledge residing in information systems, databases, documents, manuals, routines and procedures, as well as in any other physical and/or digital artefact*.

Given the plethora of marketing-oriented IT solutions that already exists (e.g., CRM, customer experience management software, customer journey tracking software, social media management software, marketing intelligence software and the like) and the

tremendous possibilities offered by data analytics, it seems reasonable to distinguish between organizational knowledge generated by means of different computer-based data processing tools, and more traditional forms of “organizational memory” (Walsh and Ungson, 1991), which do not involve data processing. Hence, according to the origin of the knowledge resource and its container, we distinguish between marketing-specific IT capital and marketing-specific organizational memory. Each subcategory will encompass several items regarding different knowledge objects:

- *Marketing-specific IT capital* – This subcategory focuses on marketing-related knowledge generated by different types of IT solutions. Based on an analysis of existing solutions in the market, a group of 12 knowledge resources has been identified, of which 7 refer to customer knowledge (knowledge regarding potential new customers, customers’ interests and concerns, customers’ sentiments and emotions, customer behaviour, customers’ journey stage, customers’ profitability, and existing customer groups and/or segments); 2 refer to product/service-related knowledge (product and/or service performance, and opportunities for product/service improvement and/or development); another 2 correspond to market knowledge (knowledge about top industry insiders and influencers; and about market trends); and 1 relates to know-how (performance of the marketing and sales staff).
- *Marketing-specific organizational memory* – It refers to different types of stored knowledge related to marketing that employees can access physically and/or digitally. Based mainly on the knowledge management literature (e.g., Argote, 2006; Dalkir, 2011; O’Dell and Hubert, 2011), 7 items have been proposed within this subcategory, of which 1 corresponds to customer knowledge (relevant and easily accessible information records about customers); another 2 to market knowledge (relevant and easily accessible records about competitors and market trends); another 1 to the internal context (“who knows what” directory) and 3 to know-how (availability of well-established routines and procedures, best practices and lessons learned, and information records on key projects, deals and/or campaigns).

2.2.3 Marketing-specific relational capital

Marketing-specific relational capital (RC) refers to *all marketing-related knowledge generated, transferred and preserved through interpersonal relationships*.

Depending on the actors involved and on their internal or external nature, these relationships could be grouped into four subcategories, each of them including knowledge items from different knowledge objects. The four subcategories are:

- *Internal relational capital (department level)* – It refers to the knowledge generated, transferred and preserved through interpersonal relationships within the marketing department. Given that, in the case of social/relational capital, the existing IC literature tends to focus on the relationships themselves, rather than on the knowledge generated through them, we have been unable to base on past research to propose the content of each subcategory. In the case of department-level relationships, we suggest that personal interactions between people from the marketing function could give rise to relevant insights about customers (1 item),

markets (3 items) and know-how (3 items). From a more general perspective, we also think that these personal interactions could give rise to new perspectives that challenge existing assumptions regarding any type of knowledge object (1 item).

- *Internal relational capital (inter-department level)* – It refers to the knowledge generated, transferred and preserved through interpersonal relationships between people from the marketing department and people from other departments or functions. In the case of this subcategory, we think that personal interactions between people from different departments contribute to a large extent to reinforcing knowledge regarding the internal context of the firm. Altogether, 4 knowledge items have been proposed for this knowledge object, which refer to a shared understanding of the overall firm setting (company vision, interdependencies between departments, problems and challenges, and system constraints). Customer knowledge (1 item) could also be strengthened through these relationships (for instance, people from other departments such as engineering can also interact with customers and gain relevant information for the marketing department), as well as some know-how related aspects (2 items regarding how to better integrate and/or coordinate work from different functions and departments, and problem diagnostic and solution). As in the previous subcategory, 1 more item has been included regarding the possibility of generating new perspectives that could challenge existing assumptions.
- *External relational capital (customers)* – It consists of the knowledge generated, transferred and preserved through interpersonal relationships between marketers and customers. Of course, personal interaction with customers will improve customer knowledge (2 items), but also product/service knowledge (2 items regarding the discovery of unsolved problems and of improvement opportunities), market knowledge (1 item regarding relevant insights about competitors) and know-how (1 item related to effective ways to diagnose and solve problems). As in the previous subcategories, 1 more item has been added about the generation of new perspectives that could challenge existing assumptions.
- *External relational capital (other external actors)* – It consists of the knowledge generated, transferred and preserved through interpersonal relationships between marketers and other external actors. This type of personal interactions could give rise to substantially increased knowledge about the market in which the company operates (5 items), but it could also provide the marketing department with some know-how related insights (2 items), as the discovery of new and relevant practices that could be adopted by the company, and effective ways to diagnose and solve problems. Like in the other subcategories, 1 more item has been included regarding the generation of new perspectives that challenge existing assumptions.

2.2.4 Content validation

Once the marketing-specific IC model with all its subcategories and items was developed, a pre-test was carried out to verify whether the proposed framework was comprehensible for the companies, and to identify whether either possible relevant elements were missing, or whether some of the knowledge stocks included could be left

over. Six companies participated in this validation test, which were carefully chosen to ensure diversity between different combinations of manufacture/service, B2B/B2C, high-tech/low-tech and medium-sized versus large-sized companies. The pre-test resulted in the confirmation of the proposed model about marketing-specific IC.

3 Diagnosing marketing-related IC in Spanish firms

After the pre-test validated the content of the marketing-specific IC framework, a representative survey was carried among Spanish firms in order to diagnose their strengths and weaknesses in this respect.

3.1 Methods

3.1.1 Sample and data collection

The population of the research was made up of Spanish companies with at least 100 employees. This threshold number was established to guarantee that companies had a well-established marketing and sales function. SABI database (Sistema de Análisis de Balances Ibéricos; System of Iberian Balance Sheet Analysis) was utilised to identify the companies that configured the population involved in the research. The total population was made up of 2,346 firms, which were classified into different groups according to different combinations of manufacture/service, B2B/B2C, high-tech/low-tech and medium-sized versus large-sized firms.

Once the sample size to carry out a representative study was calculated (342 firms), the target population was contacted by phone and a follow-up system was put in place to guarantee that proportions of the above-mentioned groups were preserved. The final sample was made up of 346 companies that answered the emailed or phone survey, for which total confidence was guaranteed. Given space limitations, details about the composition of the sample are omitted.

85.26% of the respondents held a managerial role in the marketing domain, and several of them highlighted the fact that the measurement instrument revealed to be a very complete self-assessment tool that allowed them to carry out an in depth-analysis of their strengths and weaknesses as a marketing department under a new and extremely relevant light. Thus, this also supported the content relevance of the proposed framework.

3.1.2 Measures

The items utilized to analyse the marketing-related IC categories were measured by means of 7-point Likert scales (1 = strongly disagree, 7 = strongly agree; or 1 = not at all, 7 = very satisfactorily), and were based on the above described framework.

3.1.3 Statistical analysis

Descriptive analysis of the data collected were performed using SPSS software version 25. The following section shows the results obtained.

3.2 Findings

For space reasons, only findings regarding the summary item of each of the marketing-related subcategories are presented. As can be seen in Table I, the most developed subcategories of marketing-specific IC in Spanish firms are those related to human capital, while those regarding structural capital constitute a clear weakness. On the contrary, relational capital occupies an intermediate position.

Table I. Descriptive analysis – Summary items

<i>Variable</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>
Marketing-specific HC customer knowledge	346	5.58	1.13
Marketing-specific HC product/service knowledge	345	6.05	1.01
Marketing-specific HC market knowledge	344	5.29	1.23
Marketing-specific HC educational background and experience	342	5.77	1.09
Marketing-specific HC marketing-related skills	344	5.75	0.96
Marketing-specific SC IT capital	345	4.66	1.45
Marketing-specific SC organizational memory	345	4.60	1.47
Marketing-specific internal RC department level	342	5.10	1.30
Marketing-specific internal RC inter-department level	343	5.04	1.34
Marketing-specific external RC customer-related	343	5.44	1.20
Marketing-specific external RC other external agents	339	5.12	1.27

4 Conclusions

This paper constitutes a relevant contribution to the IC literature, as is among the first ones that tries to deploy the general IC framework into a particular functional area of the firm (namely, the marketing function), which allows a more in-depth and meaningful assessment of a company's knowledge resources. Indeed, the model developed represents a complete self-assessment tool that allows marketing managers to carry out an in depth-analysis of the strengths and weaknesses of their department under a new and extremely relevant light. It also opens the way towards a more fine-grained set of IC-capability-performance studies that will allow to discover the very specific knowledge resources that managers should promote in order to enhance organizational capabilities and performance.

References

- Aramburu, N. and Sáenz, J. (2011) "Structural Capital, Innovation Capability, and Size Effect: An Empirical Study", *Journal of Management & Organization*, Vol. 17, No.3, pp. 307–325.
- Argote, L. (2006) "Organizational Memory", in Prusak, L. and Matson, E. (Eds.) *Knowledge Management and Organizational Learning*. Oxford University Press, Oxford, NY.

- Bontis, N. (1998) "Intellectual Capital: An Exploratory Study that Develops Measures and Models", *Management Decision*, Vol. 36, No. 2, pp. 63–76.
- Bontis, N., Keow, W. C. C. and Richardson, S. (2000) "Intellectual Capital and Business Performance in Malaysian Industries", *Journal of Intellectual Capital*, Vol. 1, No.1, pp. 85–100.
- Brooking, A. (1997) *Intellectual Capital*, International Thomson Business Press, London, UK.
- Chiucchi, M. S. and Montemari, M. (2016) "Investigating the "fate" of Intellectual Capital Indicators: A Case Study", *Journal of Intellectual Capital*, Vol. 17, No. 2, pp. 238–254.
- Cravens, D. W., Ingram, T. N., LaForge, R. W. and Young C. E. (1993) "Behavior-Based and Outcome- Based Salesforce Control Systems", *Journal of Marketing*, Vol. 57 (October), pp. 47–59.
- Dalkir, K. (2011) *Knowledge Management in Theory and Practice*, 2nd edition, The MIT Press, Cambridge, MA.
- Edvinsson, L. and Malone, M. S. (1997) *Intellectual Capital: Realising Your Company's True Value by Finding Its Hidden Brainpower*, Harper Collins, New York, NY.
- Erikson, T. (2002) "Entrepreneurial Capital: The Emerging Venture's Most Important Asset and Competitive Advantage", *Journal of Business Venturing*, Vol. 17, No. 17, pp. 275–290.
- Grant, R. M. (1996) "Toward a Knowledge-Based Theory of the Firm", *Strategic Management Journal*, Vol. 17, pp. 109–122.
- Grant, R. M. (2010) *Contemporary Strategy Analysis*, 7th edition, John Wiley & Sons, Chichester, West Sussex, UK.
- Guesalaga, R. (2016) "The Use of Social Media in Sales: Individual and Organizational Antecedents, and the Role of Customer Engagement in Social Media", *Industrial Marketing Management*, Vol. 54 (April), pp. 71–79.
- Helfat, C., Finkelstein, S., Mitchell, W., Peteraf, M. A., Singh, H., Teece, D. and Winter, S. G. (2007) *Dynamic Capabilities: Understanding Strategic Change in Organizations*, Blackwell, Malden, MA.
- Kianto, A., Ritala, P., Vanhala, M., and Hussinki, H. (2018) "Reflections on the Criteria for the Sound Measurement of Intellectual Capital: A knowledge-Based Perspective", *Critical Perspectives on Accounting* (in press).
- Kianto, A., Hurmelinna-Laukkanen, P. and Ritala, P. (2010) "Intellectual Capital in Service- and Product-Oriented Companies", *Journal of Intellectual Capital*, Vol. 11, No. 3, pp. 305–325.
- Kogut, B. and Zander, U. (1992) "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology", *Organization Science*, Vol. 3, No. 3, pp. 383–397.
- Kotler, P. T. and Armstrong, G. (2018) *Principles of Marketing*, 17th edition, Global edition, Pearson, Harlow, UK.
- Marr, B. (2006) *Strategic Performance Management*, Butterworth-Heinemann, Oxford, UK.
- Martín-de-Castro, G., Delgado-Verde, M., López-Sáez, P. and Navas-López, J. E. (2011) "Towards 'An Intellectual Capital-Based View of the Firm': Origins and Nature", *Journal of Business Ethics*, Vol. 98, No. 4, pp. 649–662.
- O'Dell, C. and Hubert, C. (2011) *The New Edge in Knowledge*, John Wiley & Sons, Chichester, West Sussex, UK.
- Piercy, N. F., Cravens, D. W. and Lane, N. (2009) "Sales Management Control Level and Competencies: Antecedents and Consequences", *Industrial Marketing Management*, Vol. 38, No. 4, pp. 459–467.
- Rapp, A. Ahearne, M., Mathieu, J. and Schillewaert, N. (2006) "The Impact of Knowledge and Empowerment on Working Smart and Working Hard: The Moderating Role of Experience", *International Journal of Research in Marketing*, Vol. 23, No. 3, pp. 279–293.

- Reed, K. K., Lubatkin, M. and Narasimhan, S. (2006) "Proposing and Testing an Intellectual Capital-Based View of the Firm", *Journal of Management Studies*, Vol. 43, No. 4, pp. 867–893.
- Roos, G. and Roos, J. (1997) "Measuring your Company's Intellectual Performance", *Long Range Planning*, Vol. 30, No. 3, pp. 413–426.
- Roos, J. (1998) "Exploring the Concept of Intellectual Capital (IC)", *Long Range Planning*, Vol. 31, No. 1, pp. 150–153.
- Rossiter, J. R. (2001) "What is Marketing Knowledge? Stage I: Forms of Marketing Knowledge", *Marketing Theory*, Vol. 1, No. 1, pp. 9–26.
- Saxe, R. and Weitz, B. A. (1982) "The SOCO Scale: A Measure of the Customer Orientation of Salespeople", *Journal of Marketing Research*, Vol. 19, No. 3, p. 343–351.
- Schillewaert, N. and Ahearne, M. (2000) *The Effect of Information Technology on Salesperson Performance*, ISBM Report 5-2001, Institute for the Study of Business Markets, Pennsylvania.
- Spender, J. (1996) "Organizational Knowledge, Learning and Memory: Three Concepts in Search of a Theory", *Journal of Organizational Change Management*, Vol. 9, No. 1, pp. 63–78.
- Subramaniam, M. and Youndt, M. A. (2005) "The Influence of Intellectual Capital on the Types of Innovative Capabilities", *The Academy of Management Journal*, Vol. 48, No. 3, pp. 450–463.
- Sveiby, K. E. (1997) *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*, Berrett-Koehler, San Francisco, CA.
- Walsh, J. P. and Ungson, G. R. (1991) "Organizational Memory", *Academy of Management Review*, Vol. 16, No. 1, pp. 57–91.
- Wang, W. Y. and Chang, C. (2005) "Intellectual Capital and Performance in Causal Models. Evidence from the Information Technology Industry in Taiwan", *Journal of Intellectual Capital*, Vol. 6, No. 2, pp. 222–236.
- Youndt, M. A., Subramaniam, M. and Snell, S. A. (2004) "Intellectual Capital Profiles: An Examination of Investments and Return", *Journal of Management Studies*, Vol. 41, No. 2, pp. 335–361.

Reflecting on the Intellectual Capital Literature: Is the Field at another Crossroads Point?

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Abstract

The paper reviews, reflects on and critically analyses the intellectual capital (IC) accounting literature to examine whether the way we conceptualize IC is a possible cause for the stalemate in the field. Future avenues of research are suggested by looking into the practices of integrated reporting and big data technologies for pragmatic solutions to IC problems.

The literature review takes a structured approach and uses Alvesson and Deetz (2000) critical framework for analysis in order to reveal the hidden structures behind the literature and to bring further insights into the different dimensions of IC.

Two types of literature review are brought together to deepen the analysis and provide an account of what is already known within IC accounting literature and map what is yet to be uncovered, while reflecting on the limitations of past efforts. The study identifies gaps of knowledge where more research would be useful by grouping the literature into specific themes of interest that problematizes the IC research: knowledge, classification and categorization, accounting measurement and performance.

The paper is relevant to researchers working within the IC field and connected areas, such as integrated reporting and sustainability accounting. Various avenues for resolving the issues which have placed IC at a cross-roads point are suggested to revive the field and to prevent others from facing the same problems.

1. Introduction

The demand to better understand and to account for intellectual capital (IC) has never been more acute. In order to gain competitive advantage in the digital era of knowledge and information, companies have to rely on IC resources as most forms of physical and financial assets are commodities which have been deemed unable to achieve further economies of scale (Alcaniz et. al., 2011; Jeny & Moldovan, 2018). The new “Industrial Revolution 4.0” (Schwab, 2017), characterised big volumes of data, fast developing digital technologies and large social media spread, all of which generate intangible value, has further increased the reliance on IC resources.

In an economy that emphasizes its reliance on IC to achieve high levels of performance, it is important to understand the mechanisms through which this resource adds value to a company, to uncover the unseen and untapped intangible value created by

companies of the digital era (Alcaniz et. al., 2011; Bonacchi et. al., 2011). However, the emerging picture of IC is somewhat confusing (). In reflecting on the theory and practice of IC, one of the founding fathers, Lief Edvinsson (2013), states that “*IC remains invisible fuzzy dimension*” and he asks whether “*in grappling for meaning of IC, we are suffering a kind of learned blindness*”. There are both academic and practice issues that contribute to the confusion around IC.

From an academic perspective, a multitude of definitions, models and frameworks for IC abound. The literature appears to have reached agreement on IC consisting of three elements: human, relational and structural capital (Secundo et.al., 2017). Nevertheless, what each one of these elements comprise of in their turn is less consistent between authors. Therefore, researchers have yet to agree on a holistic and comprehensive understanding of this concept (Abhayawansa, 2014). Additionally, the complexities of all IC dimensions highlighted by the multiple frameworks are not acknowledged and reflected into empirical research (Andriessen, 2004a; Dumay & Garanina, 2013).

Albeit being considered central to value creation, researchers still have difficulties explaining the exact mechanisms through which IC adds value. Is IC an input or an output in the process of value creation? Is the synergy created by the interaction of its components IC or added value? Some researchers argue that the measurement of IC could aid the understanding of the value creation process (Neely et. al., 2004).

Unsurprisingly, there are still no solutions to the measurement of IC. Mouritsen (2006) suggested that IC measurement problems cannot be addressed through ostensive research which concentrates on developing classification frameworks and, consequently, it focuses on stocks of IC and answer questions of “*what*”. Instead, he asserted that performative research, which offers an understanding of IC in action from a flow perspective is more appropriate because it answers questions of “*how*” (Dumay, 2009; Guthrie et.al.,2012). Despite the call for action research to better understand IC, Dumay (2013) observes that, “*many IC researchers are stuck in an evaluatory trap*”. They continue to develop further frameworks rather than providing a performative and critical research on IC. The focus on the practice of IC approaches and models rather than on its theoretical conceptualization (Secundo et.al.; 2015) created a gap between the theoretical and practical developments in the field, further confusing the meaning of IC (Edvinsson, 2013). Furthermore, through Mouritsen’s (2006) call IC has become a management issue rather than an accounting issue. This shuffled the debate from accounting for IC to business models, strategy and integrated thinking all of which still haven’t solved the problem of measurement and performance implications of IC. Additionally, it brought confusion on whether IC is a management system, at best a management accounting system, or an accounting tool to measure and create value.

From a practice perspective, companies initially found value in the IC frameworks to help them reflect their worth beyond financial outcomes. Multiple IC disclosure projects have been launched such as RICARDIS, EFFAS, WICI, Wissensbilanz, InCas, CADIC. Recently, companies and countries which have embraced the disclosure and management of IC are slowly starting to give up this practice with its pioneer Skandia leading the way (Dumay, 2016). In support, recent studies which investigate IC in action have found that

managers who are actively managing this resource are not making use of the IC terminology (Chiucchi, 2013). Instead they resonate much better with concepts such as the “*balanced scorecard*”, “*key performance indicators*” or “*human capital*”. In Denmark companies are quoting “*low perceived value of IC statements, both internally from a knowledge management perspective and externally in relation to the disclosure practice*” as the main reason behind their decision to abandon IC disclosure (Schaper, 2016 p.52). IC statements have been morphed into the new accounting initiatives of integrated reporting and sustainability accounting which struggle to gain momentum and be adopted by companies.

Adding to academic and practice issues, there have been limited recent theoretical developments and the scarce publications on the topic are not optimistic about the future of IC as a field of research (Dumay, 2016). On these accounts, after more than three decades of research, there would seem important differences between researchers’ and practitioners’ conceptualisation and understanding of IC still exist (Abhayawansa, 2014). Mary Barth (2018, p.7) explains it better: the issue of accounting for IC is not new but fixing it “*never seems to get traction*”. Similar to what Chatzkel was observing back in 2004, IC is in search of clarity and continues to fight for its legitimacy as a field of research. Hence, the field finds itself yet again at another cross-roads point. The need for a renewal of theoretical work within the IC field is apparent in order to resolve the impasse. Providing some clarity into our understanding of this concept, its characteristics and its evolution as a concept would be timely and provide a firmer foundation on which to build future research.

This paper advocates taking a step back into IC literature to examine whether the way we conceptualize this term is a possible cause for the current decline. It builds on previous important literature reviews on the subject, such as Petty and Guthrie (2000), Guthrie et. al. (2012), Dumay and Garanina (2013). However, compared to the previous studies, this one is theoretically oriented in that it does not only focus on the meta-analysis of the literature corpus according to well-established categories, but it delves into theoretical contribution up to date. Subsequently, it systematically reviews and reflects on what is already known within the IC literature, maps what is yet to be uncovered, while critically examines the limitations of past efforts. As a first attempt in the field, the study adds another layer of analysis by grouping the literature into themes overlapping the current issues surrounding IC as previously presented in the paper. As such, it identifies common threads, inconsistencies and gaps in the conceptualization of IC across the following themes:

1. **Knowledge theme** groups research which focuses on explain the knowledge and information characteristics of IC
2. **Classification & categorization theme** comprises of studies which have dealt with the IC division into separate elements and the creation of classification frameworks.
3. **Accounting measurement theme** concentrates on accounting measurement and reporting of IC
4. **Performance theme** consists of studies which aim to explain how IC is involved into the value creation process.

Finally, the paper suggests future avenues of research by investigating whether the practices integrated reporting and big data technologies can provide pragmatic solutions to IC problems and move the field past the cross-roads point or, by contrast, they suffer from the same fallacies. The rest of the paper is organized as follows. First, the method used to review the literature is presented next. Second, we describe the findings of the structured literature review and the critically analyse the research under each one of the themes of interest identified. Third, we investigate the lessons which can be learned from the current research into integrated reporting and big data. Finally, the paper presents futures avenue of IC research to move the field past its crossroads point.

2. Method

In order to identify the relevant IC literature to be included in the study we composed a list of journals which published papers in the field of IC by bringing together the lists of journals previously included in literature reviews on the topic. We identified twenty-five peer-reviewed journals known to be IC centric. We chose to go beyond accounting journals to include management one. While the focus of the review is on the accounting discipline, management has contributed greatly to our understanding of intellectual capital. As such, we consider it is essential to include these papers to have a better grasp of IC conceptualization and its implication for the accounting profession. The complete list of journals included in the review can be found in the appendix.

We performed a keywords based search via Web of Science using keywords such as intangible asset (Sveiby,1997), goodwill (Luthy,1998), immaterial asset (Edvisson&Malone,1997) or human assets (Andriessen & Tiessen,2000), strategic-firm resources (Barney,1986), invisible assets (Itami,1987), strategic firm-specific assets (Dierickx & Cool,1989), intangible assets (Hall,1992), core competencies (Prahalad & Hamel,1990; Kaplan & Norton,1992), firm capabilities (Nohria & Eccles,1991), knowledge assets (Teece,1998), knowledge-based resources (Wiklund & Shepherd,2003), dynamic capabilities (Teece et. al. ,1997) and intellectual capital.

The resulting number of articles have been grouped into the proposed themes by examining their titles and the abstracts. Within each theme we used Guthrie et. al. (2012) classification system for categorizing the articles. During this pilot stage two authors read the papers based on both abstracts and full text of the articles to discuss and make preliminary classifications. This resulted in a slightly modified coding scheme as outlined in Table 1. Then one author manually coded all the papers while the second and third author checked the coding for consistency. Occasionally, when there was coding ambiguity, the authors discussed the contents of the article until they agreed on the same codes. The advantage of manual coding is when words with similar meaning such as ‘human capital’ and ‘employees’ are encountered, they can be understood in their true sense and coded accordingly. Thus, manual coding allowed the researchers to use implicit knowledge of the situation so they could effectively interpret idiomatic and metaphorical text and complex subordinate phrases.

Finally, we utilised the classifications to establish a range of descriptive statistics for each theme, allowing us to understand the patterns emerging from the reviewed articles. This provides the basis for our meta-analysis and discussion of the IC field over the period in question. The following section outlines the meta-analysis and is followed by an open discussion of our findings.

2.1 Knowledge theme

Researchers have formulated identification criteria to indicate which organizational resources can be acknowledged as intellectual capital. Knowledge definitions link IC to knowledge as an identification criterion.

The first stage of IC research argued that only resources which have a knowledge component and produce value for the company can be classified as IC (Edvinsson & Malone; 1997). As such, Edvinsson and Malone (1997) define IC as *“knowledge that can be converted into value”* and Stewart (1997) states IC is *“packaged useful knowledge”*. At this point in time, knowledge is an attribute of the individual (Nonaka & Takeuchi, 1995). The IC definitions reflect this aspect. Hudson (1993) presents IC as *“a personal asset of individuals, a combination of genetic inheritance, education, experience, and attitude about life and business”*. Similarly, Edvinsson and Malone (1997) see it as *“combined knowledge, skill, innovativeness and the ability of the company’s individual employees”*. From this perspective, organizational resources are passive and centred around the human capital which enacts them. Subsequently, IC is about employee creativity, ideas and intuition, their ability to make sense of their work world and make appropriate decisions. In Nonaka and Takeuchi’s (1995) terms it is about the tacit knowledge which resides in the mind of the employees. As such, how to unpack an individual’s tacit knowledge and share it with others becomes the key organisational problem (Mouritsen & Larsen, 2005).

The second stage of IC research tries to solve this problem by putting forward the idea that IC represents only formalized knowledge which is visible in the organizational routines and procedures (Mouritsen et al., 2001). Luthy (1998) states that IC is *“something that is knowledge based, captured in an identifiable form, and useful in organizations”*. Ernst & Young (cited by Wall et al., 2004) view IC as *“intellectual material that has been formalised, captured and leveraged to produce a higher-valued asset”*. The process of formalizing knowledge decentres the individual and puts an emphasis on the *“knowledge and knowing capability of a social collective, such as an organization, intellectual community, or professional practice”* (Nahapiet and Ghoshal, 1998). Consequently, IC *“should not be person centred, but centred on collective processes and procedures”* (Mouritsen et al., 2001).

Decentring the role of human capital is a two-fold issue. On one hand, it suggests that in a collective human capital is one among several networked resources. Subsequently, other elements of IC, structural and organizational capital, can be equally important in the mix (Mouritsen and Larsen, 2005). On the other hand, the management of the networked knowledge resources and their effects become the new organisational problems to be questioned.

The latter issue evolved into the focus of the third stage of IC research which analysed how managers mobilize the bundles of knowledge resources to achieve high levels of performance in an organisational context. Specifically, it looked at where and how the management identifies, how much it invests, how it categorizes and how it makes decisions based on IC information (Mouritsen & Larsen, 2005). From this point of view, the management is the entity which is supposed to know the relation between individual and organizational knowledge and separate the two to make them manageable in the value creation process. As such, the third stage of IC research was concerned with the disentanglement of knowledge resources. However, the individual is part of the collective (organisation) and, by interacting with it, knowledge is continuously gathered, shared and transformed. Therefore, it is difficult to set boundaries to knowledge and it is widely diffused within the organisation and beyond it.

As a consequence of knowledge being so diffuse and without boundaries, IC is partially controlled or owned (Lev, 2001). Partial ownership and control imply that IC has only partial excludability, in other words, it is very difficult to legally prevent others from appropriating this resource or drawing economic benefit from it (Kim & Mauborgne, 1999). These characteristics are a two-edged sword with respect to the possible effects of IC on the organizational life.

On one hand, possessing a resource with these characteristics could be beneficial for a company because it makes IC a non-rival resource, meaning that it can be simultaneously used by many users without reducing its value (Lev, 2001; Andriessen, 2004b; Roos et. al., 2005). An obvious illustration of this characteristic is a database which can be used by different people at the same time without losing its value. Moreover, taking into consideration that information could be added to this database, its value could be enhanced. On the other hand, it could be detrimental to a company because it provides opportunities for free-rider effects. For example, the technology innovated in a research and development process can be used by other companies to develop other products, as patents are usually obtained for products and not for the technology itself (Flostrand, 2006). Therefore, partial ownership and excludability characteristics show that the concept of IC is not synonymous with value creation. There are as many opportunities to lose value through IC as there are opportunities to add value. Also, it explains why some researchers are susceptible to accepting the notion of competitive advantage as an equivalent to intellectual capital.

Knowledge definitions reduce the area of organizational resources which can represent IC by advocating “*knowledge*” as an essential identification criterion. Implicitly it had to provide philosophical explanations and take epistemological stances (Roos & Roos, 1997). Questions such as “*what is knowledge?*”, “*what do we mean by knowing?*” and “*how is knowledge developed?*” which, for a long time, have represented key concerns in philosophy, have been transferred to the understanding of intellectual capital. Answering these questions showed that IC is a bundle of networked knowledge resources which can equally create and destroy value. Also, it raised concerns about the volume, quality and even the existence of IC (Spender et.al., 2013).

2.2 Classification and categorization theme

The definitions discussed previously describe IC as the new factor of production capable of deriving competitive advantage due to its knowledge component, but only if it is leveraged and formalized. These definitions highlight that if IC is the key value driving resource at a company's disposal, managers need to be able to identify and measure it in order to achieve high levels of performance. One cannot manage what cannot be described (Andriessen, 2004b; Spender & Marr, 2006). Classification definitions have tried to address this concern. Projects such as the Danish IC Statement Guidelines (2003), PRISM (2001), MERITUM (2001) or DATI (2000) classified and categorized IC components and provided a series of instructions about what each IC element should comprise of and how they can be "*measured*" (Youndt et.al., 2004). However, for these projects, the purpose of measuring IC is not to accurately represent the value of intellectual capital, but to make it more accessible to managers and markets to make investment decisions. As such, they make use of non-financial indicators, narratives, visuals and diagrams to indicate the potential value of intellectual capital.

At first, researchers developed classification definitions which divided IC into individual elements and separately defined each one of them. At this stage, researchers were not concerned with explaining the performance implications of IC, they were merely acknowledging the existence of this resource within organizations. As such, the majority of classification models in the first stage take a static perspective on IC (Kianto et. al., 2014) and consider it a stock of knowledge accumulated at one moment in time (Bontis, 1998). The static- stock angle, allows for the IC elements to be stable and separable entities. Nonetheless, as mentioned in the knowledge definitions the focus was falling on the individual and the human capital component.

The second stage of IC research highlighted that IC elements are interrelated and sometimes integral to each other (Mouritsen et. al, 2001). Consequently, researchers started to explain through classification models how the various IC elements interact with one another into value creation chains. For example, Edvinsson (1997) describes this process in the following way: "*The financial focus is the roof. The customer focus and process focus are the walls. The human focus is the soul of the house. The renewal and development is the platform.*" (Edvinsson, 1997: p. 371). Bollen et. al. (2005) show theoretically that the more human capital companies possess the more structural and relational capital is created, while Nazari and Herremans (2007) argue that structural capital and relational capital cannot be created without human capital. Hence, human capital is the foundation of the value creation process, but similar to the knowledge definitions it is not IC's centre.

Despite studying the dynamics of IC elements interactions, the classification definitions in the second stage are still taking a static perspective on IC (Kianto et. al., 2014). By contrast, the third stage of research approached the IC from a dynamic perspective and was concerned with its value creation implications. It argued that IC is not only about what the organization possesses (stocks of resources), but also what the organization does (flows of resources) (Kianto, 2007). As such, IC comprises both the

value of its individual elements and the production output of their interaction which gets mobilized through knowledge management activities (Heisig, 2010; Veltri et.al. 2014).

For instance, Andreou et.al. (2007) empirically identify the following components of IC - market capital, human capital, decision effectiveness, organizational capital (technology and process capital) and innovation and customer capital. This categorization of IC components implies that, in practice, managers do not perceive IC only as a stock of resources which contribute to the value creation process, but also as a flow of knowledge described by management processes and mechanism, such as decision effectiveness.

In practice, it is difficult to separate stock and flow without establishing a time boundary. The value creation process is clearly complex, based on interactions between assets and elements and requires a continuous feedback between knowledge stocks and flows. Hence, similarly to third stage process definitions it suggests the performance implications of IC cannot be separated from its management.

Across the three stages of research many classification models have been developed which raises questions about how many components IC has and what each of these components in turn comprises (Youndt et. al., 2004). Also, the high number of classification models casts some doubt on the usefulness of defining IC component by component (Dumay, 2009).

Some pundits assert that the models are different only in appearance. As such, they reveal a similar structure for intellectual capital; however, they make use of different terminologies in order to highlight the perspective they are taking on IC (Bontis, 2001). Some of the models have been developed for auditing purposes, others for benchmarking purposes and commercial purposes etc. (Andriessen, 2004b). For example, Brooking's Technology Broker was developed for auditing purposes. The infrastructure assets component of IC in this model is very similar with structural capital element in Stewart's model developed for managerial purposes. In the same way, the renewal and development perspective in Edvinsson's model is similar to Kaplan and Norton's learning and growth perspective.

Nonetheless, there are differences between these models at a deeper level of analysis as the authors assign similar organizational resources to diverse IC components (Andriessen, 2004b). To illustrate, infrastructure assets in Brooking's framework contain only resources which are easily identifiable, while Sveiby (1997) includes in the internal structure not only this resource, but also elements which are not necessarily identifiable, such as organizational culture. Furthermore, the third stage of IC research has revealed that managers classify the components of IC into different categories than the theoretical frameworks. Subsequently, the categorization of IC into components is fragile and may not stand the test of practice.

From this standpoint, separating IC into components would not bring any additional information about its influence and contribution to organizational life (Andriessen, 2004b). In effect, it attempts to create superficial boundaries between elements which in practice are inseparable. "*It puts assets on hold*" while IC works in action through various complementarities between its components and other organisational resources (Mouritsen, 2009).

However, without separating IC into components it would be impossible to explain how IC derives value within an organization. Supporters of separating IC into components assert that the value of a classification resides in its *“ability to function as a heuristic device, as a help construction for interpretation”* (Grojer, 2001: p. 696). Therefore, IC classifications are useful as long as they allow a better understanding of the intellectual components’ behaviour. More specifically, the main interest surrounding IC is how each of its elements is able to create value by itself and together with others. The irony is that in order to understand synergies between IC elements, we need to separate them and in this was pause a process which is supposed to be dynamic. In effect, via measurement and classification resources are put on hold and required to stop interacting and thus required to stop working. In contrast, when resources work in the process they cannot be distinguished from each other and when resources are in action oversight is hampered.

Overall, categorizing IC might have the disadvantage of separating elements which operationally are inseparable, because it takes a stock perspective on intellectual capital. It has, on the other hand, the advantage that it allows a better identification of IC inside an organization and it divides it into elements which are sufficiently different between themselves to justify their separation. Hence, classifying IC into components allows a better conceptualization of this element and a better operationalization for research purposes (Roslender & Fincham, 2004). Some features of IC can be derived from the classification models: the potential value of IC is achieved in action and it is a dynamic resource with an idiosyncratic nature. As regards the first feature, the potential value of IC, IC components have to interact with each other and with tangible factors. Furthermore, the dynamic nature implies that IC is a concept in evolution, which undergoes changes across time and which must be constantly understood and interpreted (Kianto, 2007). The implication for researchers and practitioners is that an exhaustive list of IC components does not yet exist, due to these constant changes of classification (Grojer, 2001). The idiosyncratic nature of IC also implies that IC indicators are specific for each individual organisation, sector, industry, typology, size of organisation, etc.

2.3 *Accounting measurement theme*

The increased gap between the market and book value of a company and the “dot com” bubble are two important phenomenon which have been put down to the fact that the total value of IC is not shown in financial statements (Lev, 2004). In order to explain why the value of IC is not reflected in the financial statements, authors started to define IC by comparing it with a seemingly similar resource – intangible assets – already present in the balance sheets.

In accounting, intangible assets are defined as: *“an identifiable non-monetary asset without physical substance. An asset is a resource that is controlled by the entity as a result of past events (for example, purchase or self-creation) and from which future economic benefits (inflows of cash or other assets) are expected.”* (IAS 38 “Intangible assets”). The three stages of IC research have concentrated on different parts of this definition according to their main research objective.

In the first stage of IC research, accounting like definitions were limited to highlighting the intangible nature of IC and the various characteristics which follow from this. They presented IC as the *“invisible assets that include a wide range of activities”* (Itami, 1987) or as a resource which is *“valuable, yet invisible”* (Heisig et. al., 2001). By putting an emphasis on its *“invisibility”* researchers imply that IC has the same characteristics as the intangible assets in the sense that it is a non-monetary asset without physical substance.

As the research moved to the second stage focus on IC and performance, accounting like definitions followed suite and highlight the *“future economic benefits”* which can be derived from intellectual capital. Hence, IC at this stage of research is represented by *“not embodied financial goods. Their nature is not monetary, and they are an economic advantage for the company”* (Kreigbaum; 2001). Andriessen (2004b) believes that IC resources represent *“nonmonetary resources without physical substance that in combination are able to produce future benefits for the company”*.

In an economy that emphasizes its reliance on IC to achieve high levels of performance, it is important to understand the mechanisms through which this resource adds value to a company (Alcaniz et. al., 2011; Bonacchi et. al., 2011). For this reason, the third stage of IC research, highlighted the need to capture IC in order to aid the understanding of how it produces value-added inside an organization. Nazari and Herremans (2007) provide the following definition *“IC is intellectual material (which) if formalized and utilized effectively, it can create wealth by producing a higher value asset”*. They imply that in order to be able to classify a company’s intellectual capital, to identify how it supports a firm’s goals and to quantify the contribution this resource is making to the organizational performance, managers and shareholders need to measure it (Dumay, 2009; Spender et. al., 2013). In short, *“what you can measure you can manage, and what you want to manage, you need to measure”* (Roos et. al., 1997).

Therefore, the accounting like definitions expose the need to reduce the level of ambiguity in the conceptualization of IC and, by comparing it with the accounting terminology of intangible assets, they imply IC should be measured and captured in the same manner as traditional accounting assets. Hence, they require the same level of objectivity and certainty in the valuation of IC as in the valuation of traditional assets (Spender et.al., 2013).

However, this ambition is problematic for various reasons. As noted previously, most IC components cannot be recognized in the balance sheet as intangible due to restrictive accounting criteria (Lev et.al.; 2005). Specifically, IC can only be recognized in the financial statements if it can be clearly identified, is under the firm’s control, and its value and future financial benefits can be correctly determined (Jerman & Manzin, 2008).

However, the abstract nature of IC makes it very hard to capture and formalize and ultimately very difficult to identify. Furthermore, most IC components, as presented in the knowledge definitions section are not controlled by the company (Roslender & Fincham, 2004; Alcaniz et. al., 2011). Finally, when it comes to valuing assets two accounting methods are currently practiced: (a) identifying what they cost to create, or (b) determining their current market value. Nonetheless, IC is generally non-tradable which

makes it hard to estimate its cost. The current market value is usually determined by calculating the present value of the cash- flows generated by a specific asset. This is equally difficult to achieve as the components of IC are synergetic and interact with one another and with other assets making it difficult to identify them and the associated future cash flow streams.

Thus, accounting like definitions underline its immateriality and its potential for future economic benefits. The immateriality dimension makes IC an abstract resource, uncertain and hard to capture. For this reason, accounting definitions argue there is a necessity to measure IC if we are to comprehend the extent of the benefits for the organisation. Nonetheless, accounting faces considerable challenges in measuring IC due to restrictive accounting regulations.

2.4 Performance theme

Starting from the observation that traditional production factors are not able to generate abnormal returns anymore, researchers suggested that IC is the “new” untapped force for economic prosperity (Lev et.al., 2009; Spender, 2011). Process definitions have built on this observation and defined IC by its ability to represent the new strategic factor for creating value.

The first stage of IC research focused on raising awareness on the successful involvement of IC in the production process alongside other organisational resources. For example, Smith (1994) states that IC(IC) represents “*all the elements of a business enterprise that exist in addition to working capital and tangible assets...that make the business work*”. Brooking (1996) believes that IC represents “*the combined intangible assets, which enable the company to function*” highlighting the intangible nature of intellectual capital. At the same time, the first stage definitions emphasized the strategic importance of IC in a company and its significance as a source of organizational competitive advantage. Hall (1992; p. 136) states that IC is the “*value driver that transforms productive resources into value-added assets*”. In a similar vein, Viedma (2001) sees IC as the “*company’s core competencies, the key resources at its disposal*”. In line with this characteristic of intellectual capital, researchers believed that IC leads to greater levels of performance (Dumay,2012). This grand theory has been widely embraced and reiterated in the literature and in so doing forms the foundation of the second stage which sought to find causality between the different elements of IC– human, structural and relational capital - and organisational performance.

At an empirical level, the second stage of IC research concentrated on finding the direct and linear link between the three separate IC elements and performance. While at a theoretical level, it recognized that these IC elements interact and should be contextualised by other physical and financial resources in order to add value. As such, the theoretical arguments of the second stage hold the general belief that human capital is the building block for value creation, with structural and relational capital following. Simultaneously, it asserts that the competitive edge of IC rests on its ability to bond the organizational resources into a unique value-added chain. IC “*is merely providing a mechanism that allows various assets to be bonded together in the productive process of*

the firm” (Mouritsen, 2004). Daum (2002) claims that IC components “*often show network effects*” while Mouritsen and Larsen (2005) assert that IC should be “*understood as a bundle of knowledge resources that produce network effects*”. In other words, IC components are synergetic - when combined they produce more value than the sum of their individual parts (Bradley, 1997; Bontis et. al., 2000; Lev, 2001; Bontis & Fitz-enz, 2002).

The interactions between the elements of IC are a noteworthy theoretical progression. However, definitions in the second stage of IC research do not explain how IC leads to higher levels of performance, how IC is mobilised in this process, nor what trade-offs should be made. In an attempt to fill in this gap, the third stage of IC research focused on explaining these processes by studying IC in action.

It finds “*uncertainties*” in the roles and consequences of IC in firms. On one hand, it refutes the grand theory formulated in the first stage by showing IC can be a liability for the firm and it can destroy value as well as creating it. Murthy and Mouritsen (2011) assert that “*not all elements play a role because certain combinations of elements will favour either human or technology centered organisation*”. Simultaneously, IC is found to be more fluid than initially thought, the boundaries between its elements not well defined and the relationships between them very dynamic. To be specific, there are many possible variations for the interactions between the elements of IC depending on which one of elements the organizational strategies rely on.

On the other hand, the third stage of IC research shows that the causality between IC and performance is not linear as modelled in the second stage of IC research. The connection between IC and performance is more complicated acting both as inputs and outputs in the value creation process.

Process definitions start with placing IC at the centre of the value creation process considering it as key to a company’s competitive advantage. In the second stage of research, this type of definition brings further clarity into the competitive advantage capability of IC. They explain that the competitive advantage characteristic of IC manifests only through interactions between its elements and in conjunction with other resources. The third stage finds that, in the process of value creation, IC elements can contribute to a different extent and can both add and subtract value.

3. Integrated reporting and big data lessons – section under development

4. Conclusions and future avenues of research – section in progress

The arguments above show that IC is highly idiosyncratic and the way it is measured itself could reveal things about its attributes. It is hardly possible to develop measures that fill up IC since the boundaries between the elements of IC are loose and do only little to explain their various possible underlying logics. It is equally difficult to measure human creativity in a way that it has the same referent for companies which are

strategically different. This means that developing an exhaustive classification to fit all organisations is both not possible and not advisable. In consequence, IC becomes a very wide concept which can comprise of an infinite number of elements which could be measured in various ways.

Two possible approaches could be taken to “fix” IC as a concept in the next stages of research. On one hand, we could narrow down the concept of intellectual capital. Researchers could lead research on finding an IC definition which is widely accepted by the academic community and practitioners. This might seem an unachievable task, but one must not forget about the fact that we have achieved agreement before on abstract things such as the metric system or the gravitational force. We have agreed on these concepts because they have the same functionality for everyone. Hence, the question to be asked is what functionality does IC have? What does it serve us for? Nonetheless, if agreement at a general level is impossible, a list of most important IC elements and their fixed associated indicators could be developed at the industry level. This would partially solve measurement issues and would enhance a better understanding of the performance implications because we would know exactly what we measure and manage. Due to increased comparability we would be able to tell more about specific areas of IC that we are interested in.

On the other hand, we could embrace and celebrate the diversity surrounding IC. In line with the current conceptualization of this term, we could accept it is a wide boundless concept and treat it as an eco-system which. This means that we should concentrate less on measurement issues and more on performance implications. Specifically, measurement could be done using non-standardized, non-comparable indicators with the goal of making visible the “hidden” IC for managerial decision making. In this case, IC performance evaluation issues could be transferred to the managerial performance. Managers are the ones who are able to see the realities of an ever changing and dynamic value-creation process which links IC and performance. Thus, IC performance will be more about the appropriateness of the decision making, adaptability to the environment, response to opportunities and less about the direct links between IC and performance. This means that future research could test whether the managerial perceptions of the links between IC and performance hold during and after the decision-making process. This would tell us whether managers successfully mobilize IC towards organizational performance goals.

Note

The paper is at an incipient stage of development, but the author(s) believe(s) it has potential to become a good literature review paper. The paper needs to be considerably tightened up. Meta-analysis of the literature for each theme needs to be added in order to gear the paper towards the purpose described in the abstract. Also, a whole section on lessons to be learned from integrated reporting and big data research needs to be written up as well as the concluding section. Any recommendations and comments more than welcome.

References

- Alcaniz, L., Gomez-Bezares, F. and Roslender, R., (2011), Theoretical perspective on intellectual capital: A backward look and a proposal for going forward, *Accounting Forum*, 35 (2), pp.104-117.
- Andreou, A. N., Green, A., and Stankosky, M., (2007), A framework of intangible valuation areas and antecedents, *Journal of Intellectual Capital*, 8(1), pp.52-75.
- Andriessen, D., (2004a), IC valuation and measurement: classifying the state of the art, *Journal of intellectual capital*, 5(2), pp. 230-242.
- Andriessen, D., (2004b), *Making sense of intellectual capital*, Elsevier, Oxford, UK
- Abhayawansa, A.S.,(2014), A review of guidelines and frameworks on external reporting of intellectual capital, *Journal of Intellectual Capital*, 15(1), pp.100-141.
- Barney, J., (1986), Strategic factor markets: expectations, luck and business strategy, *Management science*, 32(10), pp.1231-1241.
- Barth, M.E. (2018), The future of financial reporting: insights from research, *Abacus*, Vol. 54 No. 1, pp. 1-13.
- Bollen, L., Vergauwen, P. and Schnieders, S., (2005), Linking intellectual capital and intellectual property to company performance, *Management Decision*, 43(9), pp. 1161- 1185.
- Bonacchi, M., Kolev, K., and Lev, B., (2011), *The Analysis and Valuation of Subscription-Based Enterprises*, Working paper, Yale University.
- Bontis, N. and Fitz-enz, J.,(2002), Intellectual capital ROI: a causal map of human capital antecedents and consequents, *Journal of Intellectual Capital*, 3(3), pp. 223-247.
- Bontis, N., (1998), Intellectual capital: an exploratory study that develops measures and models, *Management decision*, 36(2), pp. 63-76.
- Bontis, N., (2001), Assessing knowledge assets: a review of the models used to measure intellectual capital, *International Journal of Management Reviews*, 3(1), pp. 41- 60.
- Bontis, N., Keow, W. C. C. and Richardson, S., (2000), Intellectual capital and business performance in Malaysian industries, *Journal of Intellectual Capital*, 1(1), pp. 85-100.
- Bradley, K., (1997). Intellectual capital and the new wealth of nations, *Business Strategy Review*, 8(1), pp. 53-62.
- Brooking, A., (1996), *Intellectual Capital: Core Asset for the Third Millennium Enterprise*, Thomson Business Press, London
- Chiucchi, M. Serena, (2013), Measuring and reporting intellectual capital: lessons learnt from some interventionist research projects, *Journal of Intellectual Capital*, 14(3), pp. 395-413.
- Chatzkel, J.,(2004), Moving through the crossroads, *Journal of Intellectual Capital*, 5(2), pp.337-339.
- Choo, C. W., & Bontis, N., (2002), The strategic management of intellectual capital and organizational knowledge, *Knowledge, intellectual capital, and strategy*, pp. 185-204.
- Daum, J. H., (2002), *Intangible Assets and Value Creation*, Wiley, Chichester
- Dumay, J.,(2009), Intellectual capital measurement: a critical approach, *Journal of intellectual capital*, 10(2), pp. 190-210.
- Dumay, J., (2012), Grand theories as barriers to using IC concepts, *Journal of Intellectual Capital*, 13(1), pp.4-15.
- Dumay, J., (2013).The third stage of IC: towards a new IC future and beyond, *Journal of Intellectual Capital*, 14(1), pp.5-9.
- Dumay, J., (2016), A critical reflection on the future of intellectual capital: from reporting to disclosure, *Journal of Intellectual capital*, 17(1), pp.168-184.

- Dumay, J., and Garanina, T., (2013), Intellectual capital research: a critical examination of the third stage, *Journal of Intellectual Capital*, 14(1), pp.10-25.
- Edvinsson, L., (2013), IC 21: reflections from 21 years of IC practice and theory, *Journal of Intellectual Capital*, 14(1), pp. 163-172.
- Edvinsson, L. and Malone, M.S.,(1997), *Intellectual Capital: The Proven Way to Establish Your Company's Real Value by Measuring its Hidden Values*, Piatkus, London.
- Edvinsson, L., (1997), Developing intellectual capital at Skandia, *Long Range Planning*, 30(3), pp. 266-373.
- Flöstrand, P., (2006), The sell side – observations on intellectual capital indicators, *Journal of Intellectual Capital*, 7(4), pp.457 – 473.
- Grojer J. E., (2001), Intangibles and accounting classifications: in search of a classification strategy, *Accounting, Organizations and Society*, 26 (7/8), pp. 695-713.
- Guthrie, J., Ricceri, F., & Dumay, J., (2012), Reflections and projections: a decade of intellectual capital accounting research, *The British Accounting Review*, 44(2), pp. 68-82.
- Hall, R. ,(1992), The strategic analysis of intangible resources, *Strategic management journal*, 13(2), pp. 135-144.
- Heisig, P., (2010), Harmonisation of knowledge management – comparing 160 KM frameworks around the globe, *Journal of Knowledge Management*, 18(4), pp. 4-31.
- Heisig, P., Vorbeck, J. and Niebubr, J., (2001), Intellectual capital, in: Mertins, K., Heisig, P. and Vorbeck, J. (Eds), *Knowledge Management – Best Practices in Europe*, Springer, Berlin
- Itami, H., (1987), *Mobilizing Invisible Assets*, Harvard University Press, Cambridge
- Jeny, A. and Moldovan, R., (2018). Recognition and Disclosure of Intangible Assets-A Meta-Analysis Review. *Available at SSRN 3120397*.
- Jerman, M. and Manzin, M., (2008), Accounting treatment of goodwill in IFRS and US GAAP, *Organizacija* , 41(6), pp. 218–225.
- Kaplan, R. S. and Norton, D. P., (1992). The balanced scorecard measures that drive performance, *Harvard Business Review*, 70, pp.71-79.
- Kianto, A., (2007), What do we really mean by the dynamic dimension of intellectual capital?, *International Journal of Learning and Intellectual Capital*, 4(4), pp. 342-356.
- Kianto, A., Ritala, P., Spender, J. C., and Vanhala, M., (2014), The interaction of intellectual capital assets and knowledge management practices in organizational value creation, *Journal of Intellectual Capital*, 15(3), pp. 362-375.
- Kim, W. C. and Mauborgne, R., (1999), Strategy, value innovation and knowledge economy, *Sloan Management Review*, 40, pp.41-54.
- Lev, B., (2001), *Intangibles: Management, Measurement, and Reporting*, Washington
- Lev, B., (2004), Sharpening the Intangibles Edge, *Harvard Business Review*, 82 No.6, pp.108–116
- Lev, B., Canibano L. and Marr Bernard., (2005), An accounting perspective on intellectual capital, in Marr Bernard, 2005, *Perspectives on intellectual capital*, Elsevier, Oxford
- Lev, B., Radhakrishnan, S., and Zhang, W., (2009), Organization capital, *Abacus*, 45 (3), pp. 275-298.
- Luthy DH., (1998), Intellectual capital and its measurement, available at <http://www3.bus.osaka-cu.ac.jp/apira98/archives/pdfs/25.pdf> (Accessed October 2010)
- Mouritsen, J., (2004), Measuring and intervening: how do we theorise intellectual capital management?, *Journal of Intellectual Capital*, 5(2), pp.257-267.
- Mouritsen, J., (2006), Problematising intellectual capital research: ostensive versus performative IC, *Accounting, Auditing & Accountability Journal*, 19(6), pp.820-841.
- Mouritsen, J., (2009), Classification, measurement and the ontology of intellectual capital entities, *Journal of human resource costing & accounting*, 13(2), pp.154-162.

- Mouritsen, J., (2015), *Making things valuable*, Oxford University Press, USA.
- Mouritsen, J., & Larsen, H. T., (2005), The 2nd wave of knowledge management: the management control of knowledge resources through intellectual capital information, *Management accounting research*, 16(3), pp. 371-394.
- Mouritsen, J., Larsen H.T. and Bukh P.N.D., (2001), Intellectual capital and the 'capable firm': narrating, visualising and numbering for managing knowledge, *Accounting, Organizations and Society*, 26(7-8), pp. 735-762.
- Murthy, V. and Mouritsen, J., (2011), The performance of intellectual capital: mobilising relationships between intellectual and financial capital in a bank, *Accounting, Auditing and Accountability Journal*, 24(5), pp.622-646.
- Nahapiet, J. and Ghoshal, S., (1998), Social capital, intellectual capital and the organizational advantage, *Academy of Management Review*, 23(2), pp.242-266
- Nazari, J. A., and Herremans, I. M., (2007), Extended VAIC model: measuring intellectual capital components., *Journal of Intellectual Capital*, 8(4), pp.595-609.
- Neely, A., Kennerley M. and Martinez, V., (2004), Does the balanced scorecard work? An empirical investigation, *Proceedings of the EurOMA International Conference*, Fontainebleau, 27-29
- Nonaka I. and Takeuchi H.,(1995), *The knowledge-creating company*. New York: Oxford University Press
- Petty, R. and Guthrie, J., (2000), Intellectual capital: Australian annual reporting practices, *Journal of Intellectual Capital*, 1 (3), pp.241-251.
- Roos G., Pike S. and Fernstrom L., (2005), *Managing intellectual capital in practice*, Elsevier, Oxford
- Roos,G. and Roos, J., (1997), Measuring Your Company's Intellectual Performance, *Long Range Planning*, 30(3), pp.413-426.
- Roslender, R. and Fincham, R., (2004), Intellectual capital accounting in the UK: A field study perspective, *Accounting, Auditing and Accountability Journal*, 17(2), pp.178 – 209.
- Schaper, S. (2016), "Contemplating the usefulness of intellectual capital reporting", *Journal of Intellectual Capital*, Vol. 17 No. 1, pp. 52-82
- Schwab, K. (2017), "The fourth industrial revolution" Currency
- Secundo, G., Elena-Perez, S., Martinaitis, Ž. and Leitner, K.-H., (2015), An intellectual capital maturity model (ICMM) to improve strategic management in European universities, *Journal of Intellectual Capital*, 16(2), pp. 419-442.
- Secundo, G., Del Vecchio, P., Dumay, J. and Passiante, G. (2017), "Intellectual capital in the age of big data: establishing a research agenda", *Journal of Intellectual Capital*, Vol. 18 No. 2, pp. 242-261
- Smith, G.V., (1994), *The New Role of Intellectual Property in Commercial Transactions*, Wiley, New York, NY
- Spender, J. C., (2011), The problems and challenges of researching intellectual capital. *Managing Knowledge Assets and Business Value Creation in Organizations: Measures and dynamics*, pp.1-12.
- Spender, J.C. and Marr B., (2006), How a knowledge- based approach might illuminate the notion of human capital and its measurement, *Expert Systems with Application*, 30(2), pp.265-271.
- Spender, J.C., Bednarz-Łuczewska, P., Bordianu, A., and Rohaert, S., (2013), Intangibles: theory, categories, and the Kozminski matrix, *Knowledge Management Research and Practice*, 11(2), pp.101-111.
- Stewart, T.A.,(1997), *Intellectual capital - The New Wealth of Organizations*, London: Nicholas Brealey.

- Sveiby, K .E., (1997), *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*, Berrett-Koehler, San Francisco, CA.
- Veltri, S., Mastroleo G., and Schaffhauser-Linzatti M., (2014), Measuring intellectual capital in the university sector using a fuzzy logic expert system, *Knowledge Management Research & Practice*, 12(2), pp. 175-192.
- Wall, A., Kirk, R., and Martin, G., (2004), *Intellectual Capital: Measuring the Immeasurable?*, Elsevier.
- Youndt, M. A., Subramaniam M., and Snell S. A., (2004), Intellectual capital profiles: An examination of investments and returns, *Journal of Management Studies*, 41, pp. 335–362

Intellectual Capital and Organizational Performance in Chinese Firms: an Empirical Study

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Abstract

This study aims to examine the relationships among intellectual capital, customer value creation, employee job satisfaction, and market performance of firms in the Chinese context. A questionnaire survey was administrated with data collected from email, field visits, and an online platform. The hypotheses test and analysis were conducted with structural equation modelling. Human capital is significantly related to structural capital and structural capital positively influences both internal and external relational capital. There is a positive relationship between internal relational capital and employee job satisfaction. A positive relationship exists between external relational capital and customer value creation as well. Both customer value creation and employee job satisfaction positively affect the market performance of firms. This is one of few studies that explore the relationship between intellectual capital and market performance through internal factor: employee job satisfaction and external factor: customer value creation.

Keywords – Intellectual capital, market performance, customer value creation, employee job satisfaction, structural equation modelling

Paper type – Academic Research Paper

1 Introduction

Since the reform and the open door policy was initiated in 1978, the economy of China has developed dramatically and become the second largest economy in the world after the US (Claus and Oxley, 2014). It is predicted that China will probably replace the US in terms of economic aggregate around 2020 (Fouré et al., 2012). However, the unprecedented success of China in the past several decades has mainly depended on economies of scale in labor-intensive industries rather than knowledge-based approaches: invention and innovation (Fan, 2014). Therefore, it is urgent for China to transform its model of economic growth pattern from resource based to knowledge based. It is essential to seek further potential of Chinese firms to utilize their intangible assets to sustain the whole economic prosperousness in this knowledge-intensive era.

Intellectual capital (IC) is considered as a critical asset of knowledge-based business because the key attributes of products and services become invisible as wireless connections. The intangible asset, such as knowledge, is the most distinctive factor of manufacture and production under the current economic atmosphere (Leadbeater, 2000; Castilla Polo, 2007). The information networked environment and innovation as fundamental factors for competitiveness drive the importance of IC (Petty and Guthrie, 2000) in determining a nation's economic performance or business success (Castilla Polo, 2007; Zhu, 2009). Thus, it is interesting to explore the association of IC and firm performance, especially, in the developing countries (Kanchana and Mohan, 2017), such as China.

IC management is acknowledged as a powerful weapon to create value and innovation of firms (Roos et al., 1997; Al-Ali, 2003; Hussinki et al., 2017) when the basic resources are no longer capital, labor or natural resources but are knowledge workers (Drucker, 1993). In addition, Nonaka and Takeuchi (1995) investigated Japanese firms in the 1990s and found that their success depended on the ability to create knowledge and apply it to produce products and services. However, previous studies mainly focused on the IC and financial performance of the firms, for example, Bontis et al. (2000) and Liu et al. (2017), little attention has been paid to relationship of IC and internal factors, such as employee job satisfaction, external factors, such as customer valuation creation, even for a specific performance measurement of the firms, such as market performance. Thus, this paper tries to investigate the relationships among IC, customer value creation, employee job satisfaction, and market performance of the firms to address the above-mentioned issues.

2 Literature review and hypotheses development

According to Sullivan (2000), IC is defined as the hidden value of an organization that can be transformed into profit. In general, IC can be classified as human capital (HC), structural capital (SC) and relational capital (RC) (Kwee, 2008). HC related to the skills, competence, and knowledge of employees of an organization (Sveiby, 1997) cannot be owned by the organization (Edvinsson and Malone, 1997; Stewart, 1997). SC is about knowledge which can remain in the organization when employees leave (Sveiby, 1997).

RC relates to the relationships with all the stakeholders of an organization (Kwee, 2008). RC can be classified as internal relational capital (IRC) and external relational capital (ERC). IRC refers to all the relations within an organization, while ERC refers to all the RC concerned with all stakeholders outside the organizations, such as vendors, customers, and governments. However, the relationships among IC elements are varied and mixed. For instance, it reported that positive relationships existed among HC, SC, and RC (Bontis et al., 2000; Wang and Chang, 2005), but insignificant relationships among them can also be found (Zhang and Wan, 2006; Cheng et al., 2010). Therefore, it is essential to further assess the relationships among HC, SC, and RC. It is believed that people and their knowledge are the most important resources of firms (Liu and Lee, 2016). Staff members develop the SC of firms. Thus, hypothesis 1 is developed as follow.

H1: There is a positive relationship between HC and SC.

SC, such as business processes, collaboration tools, and databases, facilitates the communication of employees, suppliers, and customers. Then, hypothesis 2 and 3 can be formulated as:

H2: There is a positive relationship between SC and ERC.

H3: There is a positive relationship between SC and IRC.

Overall, an examination of the studies on IC and firm performance shows that the relationships among HC, SC, RC and firm performance in empirical studies are inconsistent, though some studies disclosed all of them were essential in determining firms' performance (Kamukama et al., 2010; Zhang and Wan, 2006). The indicators of firm performance were varied from research to research, which brings difficulties in comparisons. In particular, little attention has been paid to examine the association of RC with customer value creation and employee job satisfaction.

Customer value creation is one of the competitive advantages that can distinguish a firm from others, which is important for firms to focus on (Ulaga, 2001; Wang et al., 2004). ERC is an indicator of relationships with external stakeholders of firms. There might be a link between ERC and customer value creation. Thus, hypothesis 4 is proposed.

H4: There is a positive relationship between ERC and customer value creation.

Since Hawthorne studies in the late 1920s and 1930s, it has been believed that employee job satisfaction has a notable impact on individual performance (Petty et al., 1984), which finally results in status of firm performance (Robbins et al., 2013). Support and encouragement from internal colleagues could enable staff members to improve their job satisfaction and performance (Kianto et al., 2016). Therefore, hypothesis 5 and 7 are formulated as:

H5: There is a positive relationship between IRC and employee job satisfaction.

H7: There is a positive relationship between employee job satisfaction and market performance.

Most of the previous studies focused on the relationship between IC and financial performance of the firms. Fewer of them were conducted to investigate firms' market performance directly. Hussinki et al. (2017) argued that superior market performance of firms could result from the higher level of IC and knowledge management practices, but

clear quantitative relationships are missing. It suggests that knowledge and collaboration of customers significantly affect the marketing effectiveness of firms (Fidel et al., 2015). Therefore, hypothesis 6 is developed as:

H6: There is a positive relationship between customer value creation and market performance.

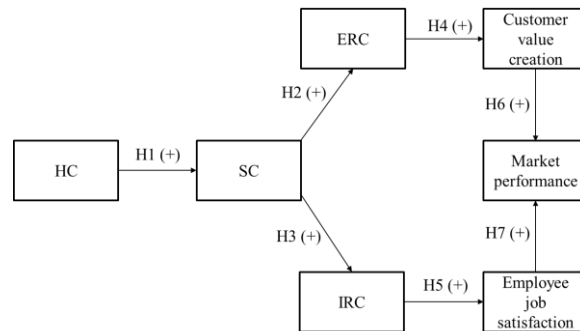


Figure 1: Research model

3 Research methodology

To address the research questions, a questionnaire from Professor Aino Kianto (Kianto et al., 2015) was applied to collect data from Chinese firms. The original English questionnaire was translated into Chinese and retranslated back into English to check if there was any misinterpretation in the translation process. The questionnaire was trial run in several firms before implementation and any possible misunderstanding was rectified. The primary sample was drawn from a list of companies in the database of Ningbo University who were either their alumni or collaborators. In addition, an Internet-based survey was conducted to supplement the data collection across China to collect more data.

In total, there are 139 valid responses which meet the requirement of sample size for data analysis. Around one third (34 percent) of them are managers and directors, the rest are from various professionals at various positions. Of the geographical locations, more than a half (66 percent) of the respondents are from Ningbo, 14 percent of them are from Shenzhen, six percent and two percent of them come from Shanghai and Beijing respectively. The rest of them are from other cities. As for the respondent's firm size, both large firms with more than 1000 employees and medium-size firms with 300 to 1000 employees represented around one-fifth (22 percent) each; small size firms with less than 300 employees accounted for another 14 percent; the size of the left firms remains unknown because of anonymous respondents

4. Empirical results

Based on the data collected from Chinese firms, SEM was adopted to test the hypotheses. Multivariate normal distribution of data underlies the ML methods in path analysis of SEM; thus, it is mandatory to test if the data is approximately normally distributed. Skewness and kurtosis are used to justify that the data conforms to normal distribution when the value of skewness should be within the scope of -1 to 1 (Coakes and Steed, 2009). Meanwhile, the value of kurtosis should fall within the range of -3 to 3 (Balanda and MacGillivray, 1988). Assessment of normality was conducted by AMOS (version 21) for the model in this study. The Mean, standard deviation (SD), skewness and kurtosis were presented in the following Table 2. The values of skewness and kurtosis of all the variables were within the recommended scope so that the data was approximately in the normal distribution, which could be used to apply ML estimation in SEM.

Table 2: Data descriptive statistics

Variable	Min	Max	Mean	SD	Skewness	Kurtosis
IRC01	1.000	5.000	3.23	1.002	0.091	-0.527
IRC02	1.000	5.000	3.52	0.951	-0.026	-0.482
IRC03	1.000	5.000	3.24	0.999	-0.022	-0.426
ERC01	1.000	5.000	3.38	0.928	-0.279	-0.093
ERC02	1.000	5.000	3.38	0.936	-0.345	-0.409
ERC03	1.000	5.000	3.36	0.868	-0.164	0.085
SC01	1.000	5.000	3.24	1.041	-0.076	-0.572
SC02	1.000	5.000	3.54	0.980	-0.551	0.037
SC03	1.000	5.000	3.35	1.068	-0.112	-0.704
HC01	1.000	5.000	3.60	0.961	-0.401	-0.197
HC02	1.000	5.000	3.27	0.984	-0.247	0.074
HC03	1.000	5.000	3.44	0.956	-0.224	-0.372
EJS01	1.000	5.000	3.06	0.915	0.114	-0.346
EJS02	1.000	5.000	3.02	0.921	-0.043	-0.346
CVC01	1.000	5.000	3.65	0.930	-0.565	0.14
CVC02	1.000	5.000	3.26	0.951	-0.231	-0.072
CVC03	1.000	5.000	3.73	0.873	-0.442	0.2
CVC04	1.000	5.000	3.54	0.935	-0.57	0.374
CVC05	1.000	5.000	3.59	0.946	-0.492	0.131
CVC06	1.000	5.000	3.49	0.920	-0.445	0.137
CVC07	1.000	5.000	3.38	0.888	-0.137	-0.003
MP01	1.000	5.000	3.38	0.974	-0.349	-0.03
MP02	1.000	5.000	3.31	0.962	-0.16	-0.386
MP03	1.000	5.000	3.36	0.956	-0.17	-0.258

It is impossible to gain scientific acceptance on empirical studies if data is neither reliable nor valid, in hence, data reliability and validity should be analyzed first before testing the hypotheses. In this study, all the values of alpha calculated by SPSS (Version 21) were varied from 0.809 to 0.913 as shown in the following Table 3 for all constructs indicating that reliability of measurement was convinced.

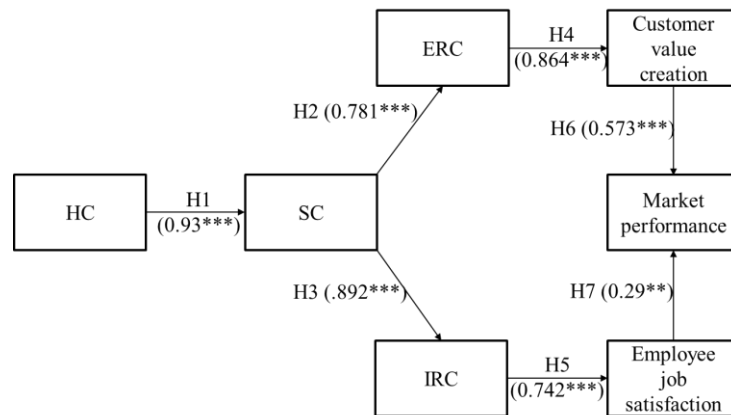
Table 3: Data reliability

Construct	Cronbach's Alpha (≥ 0.7)
Market performance	0.812
Customer value creation	0.913
Employee job satisfaction	0.838
IRC	0.809
ERC	0.858
SC	0.847
HC	0.823

Data validity can be measured by average value extracted (AVE) and composite reliability (CR). AVE measures the amount of variance that is captured by the construct in relation to the amount of variance due to measurement error, which should be more than 0.5 indicating that the constructs can explain most of the variance (Fornell and Larcker, 1981), whereas the value of CR should be no less than 0.6 (Bagozzi and Yi, 1988). All the values of AVE were more than 0.5. Meanwhile, the values of CR were above 0.8 as shown in Table 4 demonstrating the data validity is acceptable in this research.

Table 4: Data validity

Construct	Item	SE (≥ 0.5)	AVE (≥ 0.5)	CR. (≥ 0.7)
IRC	IRC01	0.749	0.591	0.8116
	IRC02	0.702		
	IRC03	0.848		
ERC	ERC01	0.864	0.7211	0.8857
	ERC02	0.807		
	ERC03	0.875		
SC	SC01	0.735	0.6077	0.8226
	SC02	0.776		
	SC03	0.825		
HC	HC01	0.743	0.6061	0.8217
	HC02	0.811		
	HC03	0.78		
Market performance	MP01	0.841	0.5992	0.8158
	MP02	0.649		
	MP03	0.818		
Customer value creation	CV01	0.802	0.5951	0.9112
	CV02	0.81		
	CV03	0.806		
	CV04	0.723		
	CV05	0.724		
	CV06	0.73		
	CV07	0.798		
Employee job satisfaction	EJS01	0.832	0.7246	0.8402
	EJS02	0.87		



*** p<0.001(two-tailed); ** p<0.01 (two-tailed); * p<0.05 (two-tailed); n.s.: not significant

Figure 2: Path coefficients and effects of research model

The fit statistics ($\chi^2=429.964$, $df=244$, $p=0.000$, $\chi^2/df=1.762$ RMSEA=0.074, SRMR=0.0688, NNFI=0.904, CFI=0.915) in Table 5 showed that the model was in an acceptable level in total. Hypothesis H1 (C.R.= 7.894, $p<0.001$) was supported and confirms that HC is the fundamental element to enhance SC. In addition, SC positively influences both IRC (C.R.= 9.835, $p<0.001$) and ERC (C.R.= 9.255, $p<0.001$), which accepted the assumptions of H2 and H3. ERC was positively related to customer value creation because of the significance of H4 (C.R.= 8.942, $p<0.001$) and IRC was beneficial to employee job satisfaction due to the significance of H5 (C.R.= 8.742, $p<0.001$). It also suggested that better market performance originated from customer value creation (supporting H6, C.R.= 5.174, $p<0.001$) and employee job satisfaction (supporting H7, C.R.= 2.871, $p<0.01$) in this model as shown in Table 6 and Figure 2.

Table 5: Goodness-of-fit statistics of research model

Fit index	$\chi^2(freedom)$	P	χ^2/df	RMSEA	SRMR	NNFI	CFI
Result	429.964(244)	0.000	1.762	0.074	0.0688	0.904	0.915
Recommended cut-off value	/	$p \geq 0.01$	≤ 3	≤ 0.08	≤ 0.1	≥ 0.9	≥ 0.9

Table 6: Results of hypotheses test for research model

	Estimate	S.E.	C.R.	p	Result
HC → SC	0.93	0.118	7.894	***	Support
SC → ERC	0.781	0.084	9.255	***	Support
SC → IRC	0.892	0.091	9.835	***	Support
ERC → CVC	0.864	0.097	8.942	***	Support
IRC → EJS	0.742	0.085	8.742	***	Support
CVC → MP	0.573	0.111	5.174	***	Support
EJS → MP	0.29	0.101	2.871	0.004**	Support

*** p<0.001(two-tailed) **p<0.01 (two-tailed) *p<0.05 (two-tailed)

Regarding the effect analysis, HC, SC, and customer value creation were more effective factors to influence market performance than IRC and ERC, which demonstrated that the market performance would grow to the magnitude of 0.538, 0.579, and 0.573 respectively if HC, SC, and customer value creation increased 1 magnitude. However, IRC ($0.742 > 0.662 > 0.616$) was the most influential factor to affect employee job satisfaction in terms of both direct and indirect effect. While ERC ($0.864 > 0.675 > 0.627$) was the strongest indicator to influence customer value creation among all the IC components. The details about direct, indirect, and total effect analysis are shown in Table 7.

Table 7: Direct, indirect and total effect analysis

Effect	Dependent Independent	SC	IRC	ERC	EJS	CVC	MP
Direct effect	HC	0.93	0	0	0	0	0
	SC	0	0.892	0.781	0	0	0
	IRC	0	0	0	0.742	0	0
	ERC	0	0	0	0	0.864	0
	Employee job satisfaction	0	0	0	0	0	0.29
	Customer value creation	0	0	0	0	0	0.573
Indirect effect	HC	0	0.829	0.726	0.616	0.627	0.538
	SC	0	0	0	0.662	0.675	0.579
	IRC	0	0	0	0	0	0.216
	ERC	0	0	0	0	0	0.495
	Employee job satisfaction	0	0	0	0	0	0
	CVC	0	0	0	0	0	0
Total effect	HC	0.93	0.829	0.726	0.616	0.627	0.538
	SC	0	0.892	0.781	0.662	0.675	0.579
	IRC	0	0	0	0.742	0	0.216
	ERC	0	0	0	0	0.864	0.495
	Employee job satisfaction	0	0	0	0	0	0.29
	Customer value creation	0	0	0	0	0	0.573

5. Discussions

According to the empirical results, one of the most significant findings in this study is that HC is the foundation of IC, which echoes studies in other regions conducted by Bontis et al. (2000); F-Jardón and Martos (2009); Mahmoodsalehi and Jahanyan (2009); Wang and Chang (2005). Meanwhile, it also reveals the relationships among HC and SC, IRC as well as ERC. But unlike the results of Bontis et al. (2000), SC plays a mediated role between HC and IRC as well as ERC in the tested research model, which indicates SC is beneficial for building stronger IRC and ERC. In fact, IT tools, business processes and the like belonging to SC facilitate the relationships for both internal and external stakeholders who are comprised of the RC of an organization as shown in the research model.

HC is fundamental for firm performance (Wang and Chang, 2005; F-Jardón and Martos, 2009; Bontis et al., 2000). In this study, it suggests that HC significantly affects the market performance of firms through the mediating factors, SC, IRC, ERC, customer value creation, and employee job satisfaction.

Based on Figure 2, it discovers that the correlations between customer value creation and market performance, employee job satisfaction and market performance are significantly positive. It reveals that firms with a higher value of customer creation would enhance their market performance, which is in accordance with the reality that customers and markets are inseparable. As more customers consume the firms' products or services, the probability of better market performance for the business increases. Employee job satisfaction should never be underestimated in its role on market performance, although total effects are less than customer value creation in terms of influencing market performance. In summary, those firms who create more HC, SC, IRC, and ERC for the higher level of customer value creation and employee job satisfaction could outperform their competitors about the market development.

All the studies have their own limitations, including our study: First, it is a common problem in organizational-level studies about individual report data that whether the response of each subject is representative of firm-level situations (Ferraresi et al., 2012). Second, the empirical findings depend on the data. Most of the samples come from East China where the economy is robust than West China. Though there are some overlaps of these two areas, such as Chinese culture, rules, and regulations, it is still preferable to limit generalizing the findings across China. Since China has significant variances between different regions, it would be interesting to observe the differences between Eastern and Western China in the future. Third, firms with different sizes, years of foundation, capital structures, and industries operate distinctly, especially towards IC management. It is necessary to consider the diversity of these firms in detail for future research.

Despite the aforementioned limitations, this research contributes to theory development in the following ways. This study revealed the associations of IC elements (HC, SC, IRC, ERC) from the background of the largest developing country, China. This is one of few studies investigating the relationship between IC and market performance directly. It implies that HC is the foundation of a firm from the empirical analysis and discloses the positive relationships of IC elements, namely, HC, SC, IRC, and ERC.

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References

- Al-Ali, N. (2003), *Comprehensive intellectual capital management: Step-by-step*, John Wiley & Sons, Danvers, Massachusetts.
- Bagozzi, R. P. and Yi, Y. (1988), "On the evaluation of structural equation models", *Journal of the academy of marketing science*, Vol 16 No. 1, pp. 74-94.
- Balanda, K. P. and MacGillivray, H. (1988), "Kurtosis: a critical review", *The American Statistician*, Vol 42 No. 2, pp. 111-119.
- Bontis, N., Chua Chong Keow, W. and Richardson, S. (2000), "Intellectual capital and business performance in Malaysian industries", *Journal of intellectual capital*, Vol 1 No. 1, pp. 85-100.
- Bontis, N. and Serenko, A. (2007), "The moderating role of human capital management practices on employee capabilities", *Journal of Knowledge Management*, Vol 11 No. 3, pp. 31-51.
- Castilla Polo, F. (2007), "The recent history of intellectual capital: the most significant topics and contexts in its development", *International Journal of Accounting, Auditing and Performance Evaluation*, Vol 4 No. 4, pp. 360-381.
- Cheng, M.-Y., Lin, J.-Y., Hsiao, T.-Y. and Lin, T. W. (2010), "Invested resource, competitive intellectual capital, and corporate performance", *Journal of intellectual capital*, Vol 11 No. 4, pp. 433-450.
- Claus, I. and Oxley, L. (2014), "The Chinese Economy, Past, Present and Future", *Journal of Economic Surveys*, Vol 28 No. 4, pp. 595-599.
- Coakes, S. J. and Steed, L. (2009), *SPSS: Analysis without anguish using SPSS version 14.0 for Windows*, John Wiley & Sons, Inc., New York.
- Drucker, P. F. (1993), *Post-capitalist Society*, Butterworth Heinemann, Oxford.
- Edvinsson, L. and Malone, M. S. (1997), *Intellectual capital: Realizing your company's true value by finding its hidden brainpower*, Harper Business, New York.
- F-Jardón, C. M. and Martos, M. S. (2009), "Intellectual capital and performance in wood industries of Argentina", *Journal of intellectual capital*, Vol 10 No. 4, pp. 600-616.
- Fan, P. (2014), "Innovation in China", *Journal of Economic Surveys*, Vol 28 No. 4, pp. 725-745.
- Ferraresi, A. A., Quandt, C. O., dos Santos, S. A. and Frega, J. R. (2012), "Knowledge management and strategic orientation: leveraging innovativeness and performance", *Journal of Knowledge Management*, Vol 16 No. 5, pp. 688-701.
- Fidel, P., Schlesinger, W. and Cervera, A. (2015), "Collaborating to innovate: Effects on customer knowledge management and performance", *Journal of Business Research*, Vol 68 No. 7, pp. 1426-1428.
- Fornell, C. and Larcker, D. F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of marketing research*, Vol 18 No 1. pp. 39-50.
- Fouré, J., Bénassy-Quéré, A. and Fontagné, L. (2012), "The Great Shift: Macroeconomic projections for the world economy at the 2050 horizon", *G-MonD Working Paper n23*
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E. and Tatham, R. L. (2006), *Multivariate data analysis*, Pearson Prentice Hall, Upper Saddle River, NJ.
- Huang, S. Y., (2014), "Intellectual Capital measures: Literature review" in (Eds.) *Management of Engineering & Technology (PICMET)*, 2014 Portland International Conference on in IEEE, pp. 1266-1273.
- Hussinki, H., Ritala, P., Vanhala, M. and Kianto, A. (2017), "Intellectual capital, knowledge management practices and firm performance", *Journal of intellectual capital*, Vol 18 No. 4, pp. 904-922.
- Kamukama, N., Ahiauzu, A. and Ntayi, J. M. (2010), "Intellectual capital and performance: Testing interaction effects", *Journal of intellectual capital*, Vol 11 No. 4, pp. 554-574.

- Kamukama, N., Ahiauzu, A. and Ntayi, J. M. (2011), "Competitive advantage: mediator of intellectual capital and performance", *Journal of intellectual capital*, Vol 12 No. 1, pp. 152-164.
- Kanchana, N. and Mohan, P. R. R. R. (2017), "A review of empirical studies in intellectual capital and firm performance", *Indian Journal of Commerce & Management Studies*, Vol VIII No. 1, pp. 52-58.
- Kianto, A., Liu, G. and Lee, R., (2015), "Knowledge management practices, intellectual capital and firm performance: empirical evidence from Chinese companies" in (Eds.) 16th European conference on knowledge management -ECKM 2015 in 2015, Academic Conferences International Limited, Kidmore End, pp.
- Kianto, A., Vanhala, M. and Heilmann, P. (2016), "The impact of knowledge management on job satisfaction", *Journal of Knowledge Management*, Vol 20 No. 4, pp. 621-636.
- Kwee, K. C. (2008), "Intellectual capital: Definitions, categorization and reporting models", *Journal of intellectual capital*, Vol 9 No. 4, pp. 609-638.
- Leadbeater, C. (2000), *New measures for the new economy*, Institute of Chartered Accountants, England & Wales.
- Ling, Y. H. (2012), "The influence of intellectual capital on global initiatives", *VINE*, Vol 42 No. 1, pp. 129-144.
- Liu, G. and Lee, R. (2016), "Knowledge management practices and firm market performance: A structure equation modeling approach", *Knowledge Management Forum*, Vol 1 No. 2, pp. 145-155.
- Liu, G., Tsui, E. and See-To, E., (2017), "Flourish or perish: An empirical study of the telecommunication equipment vendors from an IC perspective" in Tomé, E., Neumann, G. and Knežević, B. (Eds.) *Theory and Applications in the Knowledge Economy in Zagreb, Croatia 12-14 July 2017*, Faculty of Economics at the University of Zagreb and E4 Conferences, Lisbon, Portugal, pp. 529-544.
- Long Kweh, Q., Lu, W.-M. and Wang, W.-K. (2014), "Dynamic efficiency: Intellectual capital in the Chinese non-life insurance firms", *Journal of Knowledge Management*, Vol 18 No. 5, pp. 937-951.
- Mahmoodsalehi, M. and Jahanyan, S. (2009), "The effect of knowledge management on relationship between intellectual capital and business performance: A case study of Iran's industrial development and renewal organization (IDRO)", *Journal of Knowledge Management Practice*, Vol 10 No. 3, pp.
- Nonaka, I. and Takeuchi, H. (1995), *The knowledge-creating company : how Japanese companies create the dynamics of innovation*, Oxford University Press., New York.
- Olsson, U. H., Foss, T., Troye, S. V. and Howell, R. D. (2000), "The performance of ML, GLS, and WLS estimation in structural equation modeling under conditions of misspecification and nonnormality", *Structural equation modeling*, Vol 7 No. 4, pp. 557-595.
- Petty, M., McGee, G. W. and Cavender, J. W. (1984), "A meta-analysis of the relationships between individual job satisfaction and individual performance", *Academy of Management Review*, Vol 9 No. 4, pp. 712-721.
- Petty, R. and Guthrie, J. (2000), "Intellectual capital literature review: Measurement, reporting and management", *Journal of intellectual capital*, Vol 1 No. 2, pp. 155-176.
- Robbins, S. P., DeCenzo, D. A. and Coulter, M. K. (2013), *Fundamentals of management : essential concepts and applications*, Pearson, Upper Saddle River, N.J.
- Roos, J., Roos, G., Dragonetti, N. C. and Edvinsson, L. (1997), *Intellectual capital : navigating the new business landscape*, Macmillan Business, Basingstoke, England.
- St-Pierre, J. and Audet, J. (2011), "Intangible assets and performance: Analysis on manufacturing SMEs", *Journal of intellectual capital*, Vol 12 No. 2, pp. 202-223.

- Stewart, T. A. (1997), *Intellectual capital: The new wealth of organizations*, Doubleday / Currency, New York.
- Sullivan, P. H. (2000), *Value driven intellectual capital: how to convert intangible corporate assets into market value*, John Wiley & Sons, Inc., New York.
- Sveiby, K. E. (1997), *The new organizational wealth: Managing & measuring knowledge-based assets*, Berrett-Koehler Publishers, San Francisco.
- Taherparvar, N., Esmaeilpour, R. and Dostar, M. (2014), "Customer knowledge management, innovation capability and business performance: a case study of the banking industry", *Journal of Knowledge Management*, Vol 18 No. 3, pp. 591-610.
- Ulag, W. (2001), "Customer value in business markets: an agenda for inquiry", *Industrial Marketing Management*, Vol 30 No. 4, pp. 315-319.
- Wang, W.-Y. and Chang, C. (2005), "Intellectual capital and performance in causal models: Evidence from the information technology industry in Taiwan", *Journal of intellectual capital*, Vol 6 No. 2, pp. 222-236.
- Wang, Y., Po Lo, H., Chi, R. and Yang, Y. (2004), "An integrated framework for customer value and customer-relationship-management performance: a customer-based perspective from China", *Managing Service Quality: An International Journal*, Vol 14 No. 2/3, pp. 169-182.
- Zhang, B. and Wan, W. (2006), "An empirical research on the effects of intellectual capital investment and intellectual capital on business performance", *China Soft Science*, Vol 7 No. pp. 137-146.
- Zhu, N. (2009), "The intellectual capital theory and its practice in China", *International Journal of Learning and Intellectual Capital*, Vol 6 No. 4, pp. 349-361.

Asked for but not Wanted? On the Effect of Explicit Online Search for Sustainable Innovation Ideas

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Abstract

Sustainable development requires the creation of sustainable innovation ideas (SIIs), but also that these ideas are selected and implemented into new products and services that are more sustainable than the products and services they substitute. Although the increasing use of online idea management system (IMS) enables firms to have more opportunities to search and develop SIIs, the survival of these ideas appears to be highly uncertain due to the diverse contributors and complex contributions to ideas. Arguably, effective organizing of the search of SIIs is potentially critical but firms face significant challenges to advance the searched SIIs across various innovation processes in online IMS due to the far limited extant knowledge. This study aims to explore the role of different online search patterns for SIIs. It does so through an empirical study based on data from an online IMS in a large Swedish company. On this basis, several types of analyses are performed in order to identify different types of SIIs and explicit search patterns, as well as the role of different explicit search patterns in the management of different SIIs. The results show that the different explicit search patterns along one or more different dimensions of sustainability have influence different types of SIIs differently. The study contributes to both the literature on innovation and sustainability, shedding new light for management on knowledge search patterns, and thereby offering potential improvements to the approaches used to manage SIIs in online IMS.

Keywords – Innovation, Sustainability, Knowledge search, Ideas, Idea management system.

Paper type – Academic Research Paper

1 Introduction

As innovation is a driver for sustainable development (Silvestre and Țîrcă, 2019), there is a clear need for firms to foster innovation in order to reach the economic, environmental and social goals of the sustainable development agenda (Lupova-Henry et al., 2019; Boons et al., 2013; Dyck and Silvestre, 2018; Silvestre and Țîrcă, 2019). Previous literature notes that actions on an idea are of great potential for innovation as well as sustainability (Cluzel et al., 2013; Tyl et al., 2014). However, it has been found that SIIs with a high level of environmental and societal ambition (Tyl et al., 2016), to some extent have more difficulty to be selected than other types of ideas, and thus have to be more carefully supported (Tyl et al., 2016). This poses challenges to firms to advance SIIs through various stages of their innovation process due to their limited capabilities to handle the specific needs and requirements of sustainable innovation ideas. In particular with the widespread use online IMS, this challenge becomes even more substantial as most firms turn to be open to capture different types of ideas from an online community and sustainable innovation ideas may come from diverse sources who might also take on different roles, such as volunteers, peers or managers. Summarizing the above, the need to focus explicitly on the management of SIIs in online IMS stands out as an urgent and important issue to empirically investigate.

One key aspect tackled in the innovation management discourse concerns knowledge search (van den Ende 2015; Lopez-Vega et al., 2016). Given that different types of ideas are openly called for in IMS, it can be indicated that whether SIIs are explicitly sought after or not may potentially impact the creation and acceptance of these ideas. However, most literature on knowledge search has this far focused on where to search (internally or externally) (Lopez-Vega et al., 2016), whereas much less attention has been paid to how to search for ideas with a specific cognitive purpose. In order to fill this research gap, this study aims to *explore the role of explicit online search for SIIs*.

In order to fill this aim, we investigate the role of explicit online search based on data from IdeaBoxes, an online IMS in a Swedish multi-national telecom company. In the extracted data set, tags of ideas and IdeaBoxes such as cost saving and energy efficiency, were used to categorize different types of SIIs and sustainable IdeaBoxes with regards to the observed explicit search patterns. The results show that the explicit search on the different dimensions of sustainability has different influences on the different SIIs. For example, the explicit search on economic value ideas has a negative effect on the idea acceptance of environmental/or economical innovation ideas, while the explicit search on sustainability integrating environmental, social as well as economic concerns positively influences the acceptance of environmental innovation ideas. It is indicated that the SIIs asked for are sometimes not the needed ones, and then particularly when the economic value is taken into account. To our best knowledge, this is the first study that investigates how an online IMS is used to foster sustainable innovation and the effects of the knowledge search strategies used. The study contributes to both the literature on innovation and sustainability, shedding new light for management on knowledge search and providing a specific business approach to manage SIIs in a more fruitful way.

2 Theoretical background

2.1 Innovation for sustainability

With increasing awareness of the economic-social-ecological crisis the world is currently facing (Boons et al., 2013), sustainability concerns are increasingly incorporated into the research attention of scholars, the agendas of policy-makers and the strategies of companies (Geissdoefer et al., 2017; Silvestre and Țircă, 2019).

Innovation with an explicit focus on sustainability aspects is not a new phenomenon, but given the global challenges the world is facing, this type of innovation has attracted more attention than before. It can be noted that so-called "eco-innovations" or "green innovations" focusing on environmental and economic challenges have been widely discussed during the last decade as the outcome of special interests (Ardito et al., 2018). However, given the global sustainability challenges, decision-makers increasingly take ecological, economic and social sustainability aspects into account in their operations (Geissdoefer et al., 2017; Silvestre and Țircă, 2019). One crucial factor in succeeding in managing sustainability challenges is getting more and better sustainable innovations (Dyck and Silvestre, 2018), both of a technical nature, but also in the form of new products and services that enable reduced material and energy use by creating new patterns of action.

Therefore, there is a clear need for sustainable innovations that enable more sustainable ways of living (Lupova-Henry et al., 2019; Boons et al., 2013; Dyck and Silvestre, 2018; Silvestre and Țircă, 2019). Compared to the other types of innovations, the development and implementation of sustainable innovation are arguably equally complex, dynamic and uncertain. However, the purpose and direction of outcomes of sustainable innovations are often different in terms of their holistic trade-offs of environmental, social and economic performance. This has led previous research to emphasize that sustainable innovation is a process in which trade-offs regarding ecological, social and economic aspects need to be integrated into business activities, from idea creation to commercialization of new products and services (Charter and Clark, 2008).

2.2 Idea management for sustainable innovation

As the socio-ecological roles of products are largely determined by decisions during early product development phases, it is important to introduce a socio-ecological sustainability perspective early in the product innovation processes (Hallstedt et al. 2017), and particularly in the process of sustainable innovation idea management. Just like other types of innovations, also all sustainable innovations begin as ideas. Previous literature notes that actions on an idea are of great potential for innovation as well as sustainability (Cluzel et al, 2013; Tyl et al., 2014).

However, compared to other types of innovation ideas, SIIs, with a high level of environmental and societal ambition (Tyl et al., 2016), to some extent appear to be more difficult to be selected than other types of ideas, and thus need to be more carefully

supported (Tyl et al., 2016) in order to eventually be realized. This poses challenges to firms to advance SIIs through various stages of their innovation process due to their limited capabilities to handle the specific needs and requirements of SIIs. Although idea generation has recently been improved in many companies, e.g. through the introduction of tools supporting the construction of sustainable business models (O'Hare et al., 2014), the management of SIIs has received less attention. Therefore, in order to be able to create more and better sustainable innovations, increased knowledge is required about how these innovations should be handled, beginning with the generation, development and selection of SIIs.

2.3 Online search for SIIs

Idea management in companies is increasingly taking place in completely new ways, where the use of online IMS enables firms not only to search locally for good ideas, but seek ideas from both external experts and hobbyist volunteers through open calls, contests, or Internet-enabled communities (van den Ende et al., 2015). This creates a situation where many more can contribute to innovation with different skills and in different roles. At the same time, the management of ideas has become much more extensive and decentralized, which can lead to good ideas not being captured and realized for various reasons. In particular, with the holistic trade-offs of environmental, social as well as economic performance, SIIs that in some respects offer new and different combinations of values and thus run a particularly high risk of being treated prodigiously in these online IMS.

Thus, we contend that there is much room for new research contributions in how firms organize their online search for SIIs. An important practice to set direction of online search is related to idea selection. More specifically, SIIs can be captured through explicit search either for "known unknowns" (i.e. with explicitly stating a "tacit" need to solutions), or for "unknown unknowns" (i.e., through more ambiguous scanning for ideas in areas) (Lopez-Vega et al., 2016; van den Ende et al., 2015). Although it has been argued that "selection knowledge" and thus cognitive attention with explicit search are needed in order to enable firms to pick quality ideas (Kester et al., 2011; van den Ende et al., 2015), the role of explicit search in the management of SIIs is unclear due to the limited extant knowledge.

3 Research questions

Given that different types of ideas are openly called for in IMS, it can be indicated that whether SIIs are explicitly sought after or not may potentially impact the creation and acceptance of these ideas. However, the real role of explicit search patterns is not clear as the question how such search patterns influence the selection of different types of SIIs has not yet been thoroughly investigated. More specifically, as most of the previous literature in the field of innovation management and sustainability focuses quite myopically on only one goal at a time (Ardito et al., 2018), extant knowledge about the management of SIIs comprehensively integrating economic, environmental and social dimensions is limited.

For example, although scholars recently have started to focus on the development of innovation for sustainability, the literature is this far primarily aimed to concurrently meet environmental concerns through exploring the methodologies and tools of eco-ideation (e.g. Tyl et al., 2015), as indicated for instance by the concept of eco-innovation (Ardito et al., Kiefer et al., 2017). Furthermore, in terms of the literature related to organizing search pattern for ideas, most attention has been paid to where to search (internally or externally) (Lopez-Vega et al., 2016), whereas much less attention has been paid to how to search for ideas with a specific cognitive purpose.

In order to fill this research gap, this study aims to explore the role of explicit online search for SIIs. On this basis, and taking different dimensions of sustainability into account, two research questions are addressed:

RQ1: What different types of SIIs can be identified in online IMS?

RQ2: What is the influence of explicit search patterns on different types of SIIs?

4 Research methodology

4.1 Research setting

This empirical study was conducted based on data from an internal online idea management system called IdeaBoxes used in a Swedish multi-national telecom company. IdeaBoxes was set up in 2008 using crowdsourcing principles to capture and collectively develop innovation ideas globally from employees. This is performed through the use of non-competitive idea boxes for different specific problems, managed by one or more voluntary innovation managers. More specifically, in non-competitive idea boxes, more opportunities are provided not only for distributed and diverse employees to share their different sets of knowledge and experience, including sustainable development, but also for innovation managers to virtually search SIIs with the focus chosen for their idea boxes. As ideas are claimed by managers for interest, action or implementation, this signals that further resources will be assigned for actions related to the further idea implementation. This type of idea acceptance can be considered as a measurement of idea quality in this system.

4.2 Data collection and measurement

In this study, data about ideas generated during two years (from the 1st of December 2014 to the 1st of December 2016) were collected from open and collaborative non-competitive idea boxes in the IdeaBoxes system.. Although the collected ideas were addressing all types of innovation and not only SIIs, tags in the system labelled to ideas and idea boxes, e.g. cost saving, energy efficiency, power reduction, etc. could be used to define the types of ideas and idea boxes with respect to environmental, economic and social issues. On this basis, this empirical study was performed in three steps, where the results from the first step serves as an input to the analysis of the first and second research questions in the next two steps.

Step 1: Data collection and analysis at tag level

In this step, all tags used on ideas and idea boxes in this system were firstly collected from the database of IdeaBoxes. Thereafter, tags were classified into different dimensions of sustainability based on the sustainability criteria argued in previous literature (see e.g. Joung et al., 2013; Sikdar, 2003). During the coding at tag level, a systematic classification requires a coding framework for different dimensions of sustainability. The coding framework in this study was developed firstly based on the argued sustainability metrics, something which includes three groups corresponding to environment, economic as well as social aspects (Sikdar, 2003). The three groups summarized in Table 1 are one, two and three dimensional aspects of sustainability, respectively. Furthermore, sustainable development with its seven sub-dimensions was included as a coding framework regarding the normally used words in this concept. For example, for the environmental aspect in group 1, indicators such as pollution, emission, global warming (Joung et al., 2013; Sikdar, 2003) were collected.

Table 1 Coding framework for the types of tags

Types	Aspect	Indicators for coding	Example of coded tags
Group 1: One dimension	Environmental	Pollution, Emission, Environmental friendly, Global warming etc.	Emission reduction (Carbon, green gas, etc.) Reduce pollution (air, noise, etc.) Recycling, reuse paper, materials, phones, etc. Green energy, environment, electricity, etc.
	Economic	Cost, Value-added, Profit, Investment, Efficiency	Cost saving; More profit with less effort, increase profitability Optimized investment, investment strategy Save effort, time. Earn value, value added, etc.
	Social	Employee/Customer/Community benefits, Safety, Health, Satisfaction, etc.	Employee, customer and end user satisfaction; Healthy employee, insurance and environment, etc.
Group 2: Two dimensions	Environmental- Economic	The combination of environment and economic indicators, ecological footprint, eco-efficiency, resource saving/optimization, etc.	Save/Optimize fuel, power, electricity, energy, Save cost and reduce waste, save nature and save money, Recycle environment and cut costs, optimization of resource etc.
	Economic- Social	The combination of environment an social indicators, etc.	Socio-economic activity, safety and efficiency,
	Environmental- Social	The combination of environment an social indicators, etc.	Health and reduction of Co2
Group 3: Three dimensions	Environmental- Economical- Social	Sustainable, Sustainability	Sustainable development, sustainable world, sustainovation, etc.

Step 2: Data collection and analysis at idea level

This step is mainly to classify the ideas based on the coded tags in Table 1 with respect to the first research question. Firstly, ideas published in the non-competitive idea boxes were selected. Secondly, tags to the selected ideas were extracted. Thirdly, the number of different tags to ideas was calculated based on the results of Step 1. By doing so, ideas were classified into seven types with three dimensions as well. For example, if

tags to an idea are about environment and economy, this sustainable innovation idea is classified as the environmental-economic type. If tags to an idea are not about any dimensions of sustainability, ideas would be removed from the collected dataset.

Step 3: Data collection and measurement at idea box level

In terms of the second research question, as different types of sustainable idea boxes and other types of idea boxes were analyzed with regard to the observed explicit search patterns, the classification of idea box types was mainly undertaken in this step. Similar to Step 2, idea boxes where the selected SIIs were submitted were firstly collected. Thereafter, tags to the selected idea boxes were collected and the types of idea boxes were identified based on the number of different tags to idea boxes. On this basis, with respect to the seven types of tags, seven types of explicit search patterns for different SIIs can be identified. However, if there are no sustainable tags of idea boxes, the idea boxes are classified into the one without an explicit search for sustainability.

Furthermore, in order to test the influence of the explicit search patterns, a linear regression at idea box level was conducted. More specifically, the numbers of different accepted ideas in different types of idea boxes are measured as dependent variables and the numbers of different submitted ideas are added as control variables. The type of idea box with respect to the explicit search pattern is the observed categorized independent variable.

5 Result and Analysis

5.1 Data description

After data collection, measurement and analysis in the three steps above, focusing on the classified types of tags, ideas, and idea boxes, respectively, are summarized in Table 2.

Table 2 Types of tags, ideas and idea boxes

Tags types	Idea types	IdeaBoxes types
Environmental	Idea1: Environmental innovation idea	Ideabox1: Explicit search for Idea 1
Economical	Idea2: Economic innovation idea	Ideabox2: Explicit search for Idea 2
Social	Idea3: Social innovation idea	Ideabox3: Explicit search for Idea 3
Environmental – economic	Idea4: Environmental-economic innovation idea	Ideabox4: Explicit search for Idea 4
Economic-social	Idea5: Economic-social innovation idea	Ideabox5: Explicit search for Idea 5
Environment-social	Idea6: Environmental-social innovation idea	Ideabox6: Explicit search for Idea 6
Environment-economic-social	Idea7: Environmental-economic-social innovation idea	Ideabox7: Explicit search for Idea 7
Others		Ideabox8: Non explicit search for sustainability

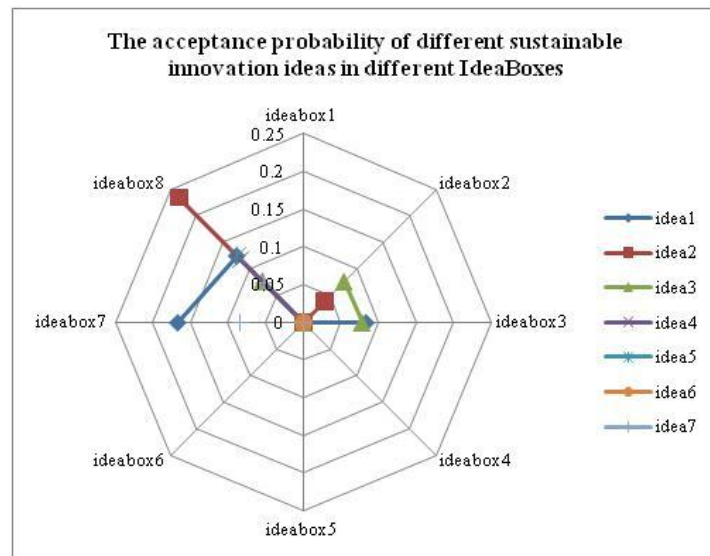
Based on the classification of ideas and idea boxes, the number of different ideas submitted and accepted in different types of idea boxes was calculated and shown in Table 3.

Table 3 The number of different ideas submitted and accepted in different types of idea boxes

Idea box types	Idea activity	The number of different ideas submitted and accepted						
		Idea1	Idea2	Idea3	Idea4	Idea5	Idea6	Idea7
Ideabox1	submitted	0	1	0	1	0	0	0
	accepted	0	0	0	0	0	0	0
Ideabox2	submitted	5	25	26	6	1	0	1
	accepted	0	1	2	0	0	0	0
Ideabox3	submitted	12	17	51	6	1	2	3
	accepted	1	0	4	0	0	0	0
Ideabox4	submitted	0	2	0	0	0	0	0
	accepted	0	0	0	0	0	0	0
Ideabox5	submitted	0	2	0	0	0	0	0
	accepted	0	0	0	0	0	0	0
Ideabox6	submitted	0	0	0	0	0	0	0
	accepted	0	0	0	0	0	0	0
Ideabox7	submitted	6	2	13	2	0	0	12
	accepted	1	0	0	0	0	0	1
Ideabox8	submitted	152	261	103	51	16	3	41
	accepted	19	61	8	6	2	0	3

From Table 3, it can be seen that most SIIs address one specific dimension of sustainability, and the largest number of ideas address economic aspects. Furthermore, it is interesting to notice that most of them have been submitted to idea boxes without an explicit search pattern for sustainability while the idea boxes with an explicit search for only environment has received only very few environmental innovation ideas.

For the influence of explicit search patterns, the percentage of accepted ideas in each type of idea box, with different explicit search patterns, was measured and the result is shown in the form of radar cart (see Figure 1).



In Figure 1, the acceptance probability of different SIIs in different IdeaBoxes was represented in the center. More specifically, Different sustainable innovation ideas are separated by different colours and shapes, while different IdeaBoxes are shown in different axes. Thus, different data points at different axes represent the acceptance probabilities of different SIIs in different IdeaBoxes.

The results show that there are quite different idea acceptance probabilities in different idea boxes in terms of different types of SIIs. More specifically, Idea2, namely ideas addressing economic aspects, have the highest idea acceptance probability in idea boxes without an explicit search pattern on sustainability, as compared to others. Similar to Idea2, Idea4 and Idea5 have higher idea acceptance probability in idea boxes without an explicit search pattern. Moreover, we see that there are no accepted environmental-social innovation ideas in any idea boxes. For the Idea1 and Idea7 types, the idea acceptance probability in idea boxes with an explicit search along three dimensions of sustainability is higher than the ones in idea boxes without an explicit search. By contrast, Idea3 has almost the same idea acceptance probability in idea boxes with an explicit search on economic or social aspects of sustainability and idea boxes without an explicit search on sustainability.

5.2 Regression results

With respect to the second research question, the influence of an explicit search on different SIIs was tested by the number of accepted different ideas. Model 1 is to test the influence of explicit search patterns on Idea1. In model 2, their influence on Idea2 was tested. In the same way, the influences of explicit search patterns on Idea3, Idea4, Idea5, Idea6 and Idea7 were tested in Models 3, 4, 5, 6, and 7, respectively. The regression results are shown in Table 5.

Table 5 Regression results - the influence of explicit search patterns

	Model1	Model2	Model3	Model4	Model5	Model6	Model 7
Dependent variable	Number of accepted ideas (Different ideas in different models)						
	Idea1	Idea2	Idea3	Idea4	Idea5	Idea6	Idea7
Control variable	Number of submitted ideas						
Idea1	-0.0062 0.0077	-0.0506 0.0162***	-0.0297 0.0074***	-0.0180 0.0024***	-6.219e-03 2.133e-03***	-	-0.0192 0.002***
Idea2	0.1339 0.0101***	0.4620 0.0212***	0.0582 0.0096***	0.0122 0.0032***	1.064e-02 2.795e-03***	-	0.0113 0.0029***
Idea3	-0.011 0.0084	-0.0385 0.0175**	0.1035 0.0080***	-0.0109 0.0027***	6.375e-03 2.316e-03***	-	-0.0095 0.0024***
Idea4	-0.1158 0.0322***	-0.4049 0.0678***	-0.0391 0.0307	0.1571 0.0103***	-2.120e-02 8.927e-03**	-	0.0639 0.0094***
Idea5	-0.1831 0.0652***	-0.5333 0.1370***	0.0069 0.0621	-0.1439 0.0207***	1.233e-01 1.804e-02***	-	-0.1282 0.0190***
Idea6	-0.4187 0.2080**	-0.8456 0.4373*	-1.5694 0.1981***	-0.1785 0.0661***	-2.421e-01 5.757e-02***	-	-0.0162 0.0607
Idea7	-0.0838 0.0341**	-0.2027 0.0718***	-0.0805 0.0325**	0.0317 0.0109***	-2.081e-02 9.456e-03**	-	0.0850 0.0099***
Independent variables	Type of idea box						
Ideabox1	0.0035 0.1966	0.0237 0.4134	-0.0025 0.1872	-0.0491 0.0626	3.130e-03 5.442e-02	-	-0.0243 0.0574
Ideabox2	-0.1844 0.0993*	-0.5420 0.2089***	-0.1556 0.0945*	-0.0574 0.0316*	-3.402e-02 2.749e-02	-	-0.0236 0.0290
Ideabox3	0.2086 0.1372	0.0756 0.2885	0.4104 0.1307***	-0.0006 0.0437	1.087e-02 3.798e-02	-	0.0075 0.0400
Ideabox4	0.0004 0.1707	0.2642 0.3590	-0.0057 0.1626	-0.0773 0.0543	4.890e-03 4.726e-02	-	-0.0369 0.0498
Ideabox5	-0.2583 0.3403	-0.8814 0.7157	-0.1127 0.3241	-0.0170 0.1083	-2.167e-02 9.421e-02	-	-0.0219 0.0993
Ideabox6	-	-	-	-	-	-	-
Ideabox7	0.4097 0.1605*	0.6646 0.3375*	0.0041 0.1528	-0.0868 0.0511*	4.755e-02 4.443e-02	-	-0.0303 0.0468
Ideabox8	-0.003 0.0161	0.0039 0.0339	-0.0019 0.0153	0.0037 0.0051	8.855e-05 4.464e-03	-	0.0015 0.0047
RE/N	0.0340/466	0.7147/466	0.3237/466	0.1082/466	0.094/466	-	0.0992/446
R^2	0.305	0.5401	0.4241	0.5427	0.1663	-	0.4212
Adjust R^2	0.285	0.5263	0.4068	0.529	0.1412	-	0.4038

The 7 Models in Table 5 show that the explicit search on the different dimensions of sustainability has different influence on different types of ideas. More specifically, Model 1 and Model 2 show that both environmental innovation ideas and economic innovation ideas were negatively influenced by the explicit search focusing on economic aspects, but positively influenced by the explicit search focusing on three dimensions of sustainability. In Model 3, it is seen that the explicit search pattern focusing on economic aspects has a negative influence on the acceptance of social innovation ideas whereas the social explicit search pattern has a positive influence. Model 2 shows that both the explicit search on economic aspects and the combination of all three dimensions of sustainability have a negative influence on the acceptance of environmental-economic innovation ideas. Other ideas and explicit search patterns do not show any statistically significant relationships. There is no result for the explicit search of social-environmental ideas because of the lack of ideas of the Idea6 type in the Ideabox6 type of idea boxes in the collected sample.

6 Discussion and conclusions

Since the use of online IMS enables firms to search ideas from more and diverse contributors with different skills and in different roles, ideas run the risk of being treated prodigiously, and this in particular applies to SIIs. Although the organizing of online search is arguably critical for idea management (van den Ende et al., 2015), questions regarding how explicit search patterns influence the management of different online SIIs have not yet been thoroughly investigated. This paper, with respect to this, aims to explore the role of explicit online search patterns in the management of SIIs. In order to fill this aim, two research questions have been addressed. They are: 1) What different types of SIIs can be identified in online IMS? 2) What is the influence of explicit search patterns on different types of SIIs?

With respect to the first research question, seven different types of SIIs in online IMS have been identified, including search foci addressing each one of the economic, ecological and social dimensions of sustainability, as well as their possible two- and three-dimensional combinations. Hence, we distinguish between environmentally-focused innovation ideas, economically-focused innovation ideas, social innovation ideas, environmental-economic innovation ideas, economic-social innovation ideas, environmental-social innovation ideas, and environmental-economic-social innovation ideas.

For the second research question, the results show that the different explicit search patterns have different influences on both the generation and the selection of SIIs. More specifically, in terms of the influence on idea generation, it shows that most SIIs have been submitted to idea boxes without an explicit search focus on sustainability while the idea boxes with an explicit search focus on environment have not received many environmental innovation ideas. This result on the one hand indicates that an explicit search focus on sustainability to some extent constrains the number of generated SIIs and there appears to be more creative space for creators to generate SIIs when not having an explicit search for sustainability. On the other hand, it also indicates that the creators concern the survival of their ideas and prefer to submit them to the more open system with less knowledge control. For the influence on the selection of SIIs, it is interesting to notice that there are no SIIs accepted in the idea box explicitly addressing environmental concerns. One possible explanation for this has been put forward by Bocken et al. (2011), namely that the early evaluation of ideas from an environmental perspective is likely to eliminate more radical ideas. Furthermore, it is found that the explicit search along the economic value dimension has a negative effect on the idea acceptance of environmental/social/economic/environmental-social ideas. By contrast, the explicit search for overall sustainability, integrating environmental, social as well as economic concerns, positively influences the acceptance of environmental/social/environmental-social ideas.

To our best knowledge, this is the first study that investigates how an online IMS is used to foster sustainable innovation in terms and the effects of related knowledge search strategies. The results theoretically contribute to the recent calls about better

understanding of sustainable innovation (Ardito et al., 2018), by showing the different types of SIIs, different explicit search patterns and the roles of different explicit searches in the generation as well as selection of different SIIs. Furthermore, this study deepens the knowledge about organizing online search in the field of digital innovation and sustainable development, extending the attention on the issues from “where” to “how” to search by providing a more comprehensive understanding of different explicit search patterns on different dimensions of sustainability.

In addition, this study also provides implications to manage SIIs in terms of knowledge search patterns in online IMS. With the investigated results about the submission as well as acceptance of SIIs in terms of different online search patterns, one of the important managerial aspects concerns the organizing search pattern for idea generation and selection. More specifically, the result that more ideas generated without the explicit search pattern than the ones with the explicit pattern on sustainability suggests that more open discussion environment without the settled knowledge search on sustainability is needed for the generation of SIIs. While in terms of the selection of SIIs, detailed explicit search patterns are suggested to be considered. In particular, for the SIIs emphasizing the environmental issues, it is suggested that environmental, economic as well as social performances are taken into account in the search pattern. However, the economic value is suggested to be carefully considered in the explicit pattern if it is a merely goal in the management of SIIs, as the early consideration economic value would result in the high risk of being treated prodigiously or rejected early.

To summarize, the results open for a discussion that the sustainable innovations ideas asked for might not be the ones actually wanted or needed. However, this study bears some limitations as well, for example, the limited generalizability of research findings to other firms due to the limited data from a single company, the ambiguity of idea success and the related possible variation in the definitions of idea success used in different idea boxes, etc. Despite the limitations, this research offers substantial insights for both scholars and practitioners into the micro-foundations of SIIs’ management, contributing to both the literature on innovation and sustainability, shedding new light for management on the role played by knowledge search patterns in idea creation and selection, and thereby offering potential improvements to the approaches used to manage SIIs in online IMS.

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References

- Ardito, L., Carrillo-Hermosilla, J., del Río, P., & Pontrandolfo, P. (2018). Corporate Social Responsibility and Environmental Management Invites Contributions for a Special Issue on 'Sustainable Innovation: Processes, Strategies, and Outcomes'. *Corporate Social Responsibility and Environmental Management*, 25(1), 106-109.
- Boons, F., Montalvo, C., Quist, J., & Wagner, M. (2013). Sustainable innovation, business models and economic performance: an overview. *Journal of Cleaner Production*, 45, 1-8.
- Bocken, N. M. P., Allwood, J. M., Willey, A. R., & King, J. M. H. (2011). Development of an eco-ideation tool to identify stepwise greenhouse gas emissions reduction options for consumer goods. *Journal of Cleaner Production*, 19(12), 1279-1287.
- Charter, M., Clark, T., 2007. Sustainable Innovation. The Centre for Sustainable Design. Farnham.
- Cluzel, F., Yannou, B., Millet, D., & Leroy, Y. (2016). Eco-ideation and eco-selection of R&D projects portfolio in complex systems industries. *Journal of Cleaner Production*, 112, 4329-4343.
- Dyck, B., & Silvestre, B. S. (2018). Enhancing socio-ecological value creation through sustainable innovation 2.0: Moving away from maximizing financial value capture. *Journal of Cleaner Production*, 171, 1593-1604.
- Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy—A new sustainability paradigm?. *Journal of cleaner production*, 143, 757-768.
- Hallstedt, S. I. (2017). Sustainability criteria and sustainability compliance index for decision support in product development. *Journal of Cleaner production*, 140, 251-266.
- Joung, C. B., Carrell, J., Sarkar, P., & Feng, S. C. (2013). Categorization of indicators for sustainable manufacturing. *Ecological indicators*, 24, 148-157.
- Kester, L., Griffin, A., Hultink, E. J., & Lauche, K. (2011). Exploring portfolio decision-making processes. *Journal of Product Innovation Management*, 28(5), 641-661.
- Kiefer, C. P., Carrillo-Hermosilla, J., Del Rio, P., & Barroso, F. J. C. (2017). Diversity of eco-innovations: A quantitative approach. *Journal of Cleaner Production*, 166, 1494-1506.
- Lopez-Vega, H., Tell, F., & Vanhaverbeke, W. (2016). Where and how to search? Search paths in open innovation. *Research Policy*, 45(1), 125-136.
- Lupova-Henry, E., & Dotti, N. F. (2019). Governance of sustainable innovation: Moving beyond the hierarchy-market-network trichotomy? A systematic literature review using the 'who-how-what' framework. *Journal of Cleaner Production*, 210, 738-748.
- O'Hare, J. A., McAloone, T. C., Pigosso, D. C. A., & Howard, T. J. (2014). *Eco-Innovation Manual: Working version for Pilot Application*.
- Sikdar, S. K. (2003). Sustainable development and sustainability metrics. *AIChE journal*, 49(8), 1928-1932.
- Silvestre, B. S., & Țircă, D. M. (2019). Innovations for sustainable development: Moving toward a sustainable future. *Journal of Cleaner Production*, 208, 325-332.
- Tyl, B., Legardeur, J., Millet, D., & Vallet, F. (2014). A comparative study of ideation mechanisms used in eco-innovation tools. *Journal of Engineering Design*, 25(10-12), 325-345.
- Tyl, B., Vallet, F., Pialot, O., Millet, D., Le Duigou, J., & Graves, G. (2016). The ESM approach: 8 mechanisms to efficiently support eco-ideation. In *Proceedings of the 14th International Design Conference—DESIGN 2016*.
- van den Ende, J., Frederiksen, L., & Prencipe, A. (2015). The front end of innovation: Organizing search for ideas. *Journal of Product Innovation Management*, 32(4), 482-487.

Circular Economy and Innovation Ecosystems: the Case of the Italian Circular Economy Stakeholder Platform - ICESP

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Abstract

The paper contributes at the debate on circular economy as emerging paradigm aimed to promote sustainable development patterns, by focusing on the issues of the innovation ecosystems and quintuple helix. Despite the topic of innovation results to be intrinsically linked to the paradigm of circular economy and the dimension of environmental sustainability is more and more recognized crucial into the debate on innovation ecosystems through the quintuple helix, the exploration of their meaning and dynamics in the perspective of circular economy is under-researched and calls for a deeper comprehension. Framed in the above premises, this paper presents the evidences of a single and extreme case study related to the Italian Circular Economy Stakeholder

Platform (ICESP), as good practice of a digital platform for stakeholders' engagement supporting the creation of an innovation ecosystem focused on the circular economy.

Keywords: Circular Economy, Innovation Ecosystem, Quintuple Helix, Digital Platforms, Stakeholders, ICESP

Nature of the proposed paper: Academic Research Paper

1. Introduction

Circular Economy is one of the most relevant trend topics in the public debate (Urbinati et al., 2017). As a branch of sustainability science aimed to reduce environmental impacts and promote sustainable patterns of development (Miliute-Plepiene & Plepys, 2015; Schneider, 2015; Haas et al., 2015), Circular Economy is recalling the interest of a large community of scholars and researchers interested into the exploration of its meaning and dynamics both at level of companies (Mylan et al., 2016) and governments (Grundel and Dahlström, 2016; Geng et al., 2009).

According to Ellen MacArthur Foundation (2015), Circular Economy aims to redefine patterns of growth, focusing on positive society-wide benefits, by gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system. It is strongly recognized as a way of sustainable growth in respect of environmental, and societal patterns with several implications also for regional and industrial development (Ghisellini, et al., 2016; Urbinati et al., 2017).

It is in this perspective that the conception and execution of actions and strategies of circular economy by private and public organizations recall the contribution of a plurality of stakeholders and this requires collaboration and shared values.

Despite the topic of innovation results to be intrinsically linked to the paradigm of Circular Economy, very few studies have explored its meaning and dynamic in the perspective of systems of innovation.

In the meantime, while the dimension of environmental sustainability results to be well recognized into the debate on innovation ecosystems (Etzkowitz, and Ranga, 2015), such as into the Quintuple Helix model through the helix of natural and environmental transitions (Grundel and Dahlström, 2016; Romano et al., 2014; Carayannis and Campbell, 2009), the research in this field has missed to understand how innovation ecosystems can support the development of processes of value creation in line with the principles of Circular Economy. As knowledge intensive and collaborative heterogeneous networks of actors supporting the creation of sustainable innovation (Etzkowitz and Ranga, 2015; Romano et al., 2014; Carayannis and Campbell, 2009), innovation ecosystems can play an important role in catalysing flows of knowledge in the domain of circular economy, also thanks to the embracement of virtual platforms. Web technologies and digital platforms have enhanced the opportunities of value creation into the innovation ecosystems by making more effective and rapid the processes of knowledge

creation, absorption and diffusion (Romano et al., 2014; Muntaner-Perich and de la Rosa, 2007).

In allowing the creation of a bridge between knowledge inside the organisations and knowledge outside the organisations, innovation ecosystems are favourable locus for value creation (Borin and Donato, 2015; Dumay, 2013). Also in this perspective, it is necessary to investigate which are the main characteristics and in which way a digital platform can support the creation of an innovation ecosystems for the achievement of goals related to the Circular Economy.

Framed in the above premises, this paper aims to offer an integrated reading and a contribution of systematization at the intersection of the research on Circular Economy and Innovation Ecosystems in the perspective of Quintuple Helix through the study of the Italian Circular Economy Stakeholder Platform (ICESP), as extreme case study of a platform based ecosystem of stakeholders specialized into the domain of circular economy.

The paper presents several elements of original contribution in terms of an integrated reading of well debated issues, such as Circular Economy and Innovation Ecosystems, as well as of the empirical evidences of ICESP, as relevant empirical context of analysis related to collaborative dynamics of innovation inspired at the model of Quintuple Helix and focused in the domain of Circular Economy.

The remaining of the paper is structured as follows: the literature background presents the theoretical pillars of study in terms of Circular Economy, Innovation Ecosystems and Quintuple Helix. In the section 3, the methodological approach is presented; the section 4 presents the evidences related to the case study at ICESP and in the paragraph 5. the conclusions and implications for theory and practice are presented.

2. Literature background

2.1 Circular Economy and stakeholders' involvement

Circular Economy is one of the most actual issue of the current public debate (Urbinati, et al., 2017). It has been identified as a promising source of solutions at the challenges associated to the sustainable development goals identified by the United Nations (Geissdoerfer et al., 2018), since it is based on the assumption that products and resources continue to circulate in closed loops by minimizing waste, emission, and costs (Ellen MacArthur Foundation, 2013; Ranta, et al., 2018). Indeed, circular economy suggests the shift from linear model of production and consumption to circular ones able to preserve environmental and economic value within the system (Nußholz, 2018).

Different schools of thought have inspired the current theorization of the Circular Economy (Geissdoerfer et al., 2018), such as the regenerative design (Lyle, 1994), Industrial Ecology (Graedel and Allenby, 1995), Ecosystem metaphor (Su et al., 2013), Looped and performance economy (Stahel, 2010), Industrial symbiosis (Chertow, 2000). The debate on Circular Economy continues to be fluorescent and populated by different perspectives of studies aimed to deepen meaning, dynamics and implications of circular economy at level of single companies, industries, public organizations, urban areas and

territories (Innella et al., 2017; Cappellaro et al., 2019). In such a context, the study of the business model for the circular economy is one of the most actual, mainly for what concerns the value creation and its determinants (Urbinati et al., 2017; Ranta, et al., 2018). A circular business model incorporates all the “elements that slow, narrow, and close resource loops” (Geissdoerfer et al., 2018, pp. 191). As result of the application of Circular Economy principles into the functioning of a business model, it requires to reserve a particular attention at some sustainable issues such as the sustainable nature of value, a long term perspective and the growing role of stakeholders (Urbinati, et al., 2017; Geissdoerfer et al., 2018). The involvement of stakeholders within the organizational ecosystem has been identified by other authors (Lewandowski, 2016; Antikainen and Valkokari, 2016; Nußholz, 2018) as crucial for the successful implementation of a circular business model. Despite this the full comprehension of the role of stakeholders for the successful implementation of a circular economy strategy is still under-research and calls for more research. Specifically, it is necessary to understand which are the mechanism more suitable for their active involvement as well as to explore the role and contribution that digital platforms can have in enabling the creation of an innovation ecosystem focused on the challenges of circular economy.

2.2. Innovation Ecosystems and Digital Platforms: a Quintuple Helix perspective

The issue of innovation ecosystems has been a topic largely debated with different contributions shaping from the regional development to the open innovation. The premises at the basis of the systemic view on innovation ecosystem is that innovation is not more a linear but a systemic process that grows within a network of inter-organizational relationships (Zajac and Olsen, 1993; Powell et al., 1996) able to promote the interrelation and integration of different knowledge sources and providers (Romano, et al., 2014). Designing and managing of these complex network of actors, also defined as innovation ecosystems, become mandatory to assure the achievement of innovation goals by assuring participation and user-centrality for the sustainable, inclusive and intelligent growth of individuals, companies and territories (Passiante and Romano, 2016). Innovation ecosystems are institutional infrastructures supporting networking and collaboration among a plurality of stakeholders by activating virtuous and knowledge-intensive flows of knowledge (Asheim and Gertler, 2005; Romano et al., 2014). The debate on innovation ecosystems identifies the attribute of sustainability within its main characteristics (Passiante and Romano, 2016). The inbound and outbound flows of knowledge activated by the interaction of the stakeholders within the ecosystems, make these environments as sustainable contexts to booster the process of value creation, in its larger definition. A useful framework for mapping and managing the dynamics undertaken in such contexts is identifiable into the Quintuple Helix model (Carayannis and Campbell, 2011). Inspired at the logic at the most well-known framework of the Triple Helix model (Garner and Ternouth, 2011; Etzkowitz, and Zhou, 2006), representative of the fruitful and knowledge relevant interactions between governments, academia, industries and institutions, the Quintuple Helix model embeds the Quadruple Helix (Carayannis and Campbell, 2009), that included the media based and culture based

public, with the context of the natural environment, by demonstrating a more visible attention at the sustainability dimension. In such a process, universities and research centers, large and small companies, institutions and governments are called to collaborate and cooperate each other, by sharing knowledge and exchanging experiences, with a more direct and active involvement of users in all the stages of the innovation process.

Despite the topic of innovation results to be intrinsically linked to the paradigm of Circular Economy, very few studies have explored its meaning and dynamic in the perspective of systems of innovation.

In the meantime, while the dimension of environmental sustainability results to be well recognized into the debate on innovation ecosystems (Etzkowitz, and Ranga, 2015), such as into the Quintuple Helix model through the helix of natural and environmental transitions (Grundel and Dahlström, 2016; Romano et al., 2014; Carayannis and Campbell, 2009), the research in this field has missed to understand how innovation ecosystems can support the development of processes of value creation in line with the principles of Circular Economy. The process of value creation into the innovation ecosystems arises from the interactions and flows of knowledge activated by a plurality of actors that can be physically and virtually connected. In allowing the creation of a bridge between knowledge inside the organisations and knowledge outside the organisations, innovation ecosystems are favourable locus for value creation (Borin and Donato, 2015; Dumay, 2013). Web technologies and digital platforms have enhanced the opportunities of value creation into the innovation ecosystems by making more effective and rapid the processes of knowledge creation, absorption and diffusion (Romano et al., 2014; Muntaner-Perich and de la Rosa, 2007). Also in this perspective, it is necessary to investigate which are the main characteristics and in which way a digital platform can support the creation of an innovation ecosystems for the achievement of goals related to the Circular Economy.

3. Methodology

This paper employs an exploratory qualitative approach based on the methodology of case study (Yin, 1994, 2003) and research in action (Argyris, and Schön, 1989). As suitable investigative tool for the analysis of a contemporary phenomenon in its natural setting, case study is preferred when the boundaries between phenomenon and context are not clearly evident (Yin, 1994, 2003). As for the research in action, the active involvement of researchers into the development of the study has allowed to access at a privileged and rigorous sources of information.

The case analyses the Italian Circular Economy Stakeholder Platform - ICESP, as extreme case study of a platform based ecosystem of stakeholders specialized into the domain of circular economy.

Conceived as a virtual environment supporting the processes of networking, knowledge sharing and collaborative partnership, ICESP is the Italian Circular Economy Stakeholder Platform, a mirror Platform of ECESP, the European Circular Economy Stakeholder Platform. ECESP is a joint initiative by the European Commission and the

European Economic and Social Committee and was born to foster the transition towards a circular economy bringing together stakeholders active in the broad field of the circular economy as action included in the 2015 EU Action Plan for the Circular Economy actions, concept enforced in the last Communication COM (2019) 190 final (Bruxelles, 4.3.2019).

ICESP has been launched in May 2018 by ENEA, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development.

For its characteristics and features, ICESP is clearly identified as an extreme case study.

The case of ICESP is here addressed toward the comprehension of the dynamics and processes of an innovation ecosystem built around a digital platform and populated by a community of actors, that in coherence with the framework of Quintuple Helix, will promote processes of fertilization and promotion in the field of the circular economy.

More in detail, the case study analysis has been organized around three main areas, related to the its strategic, functional-organizational, and technical model.

4. Findings

Focusing on the pillars of the theoretical background (circular economy, innovation ecosystem through digital platforms, and quintuple helix,), the analysis of ICESP has to be address toward the comprehension of its strategic, functional-organizational, and technical model.

About the strategic model, the study has allowed to understand as ICESP exists because the European Commission, in order to support the Circular Economy Action Plan strategies and future related funding, has launched the *European Circular Economy Stakeholder Platform* – ECESP. ENEA has been selected in ECESP Coordination Group as representative of the Research sector, and in consideration of this three-year assignment, it has been enrolled by the Commission to act as a national hub for the circular economy. Therefore, ENEA promoted the realization of an ECESP national Italian interface, by the constitution of the “*Italian Circular Economy Stakeholder Platform* - ICESP”. Both are initiatives for deepening and stakeholders’ engagement, to overcome sectorial activities and highlight inter-sectorial opportunities and challenges through a meeting point where stakeholders can share their solutions and work together to address specific challenges, linking existing initiatives and supporting the circular economy at national, regional and local level, to support its implementation.

ICESP main goal of short-medium-long term is to create a point of national convergence on initiatives, experiences, critical issues, perspectives and expectations on the circular economy that the Italian system wants and can represent in Europe with a single voice, promoting the *Italian way for circular economy*, to overcome the fragmentation of Italian initiatives on Circular Economy and to establish a permanent instrument promoting the dialogue, knowledge and Italian best practices diffusion.

As for the linkage with the ECESP, ENEA will transfer the information derived from the participation in the ECESP Coordination Group towards ICESP members and at the

same time it will disseminate in Europe the Italian good practices in the field of circular economy gathered through ICESP.

Furthermore, ECESP inputs will be fed in ICESP to ensure continue and fruitful connection (Figure 1.)



About the functional-organizational model, ICESP's stakeholders are currently represented by institutions, industries and business associations, research, civil societies. In particular, the ICESP platform follows two different and complementary ways to contribute. It is possible to sign the ICESP Charter to become effective member and/or contribute to working groups. The effective members are distributed as follows:

ORGANIZATION TYPE	NUMBER
Institutions	8
Industries and business associations	28
Research Centres and Universities	11
Civil society	2

ICESP subscribers agree on the relevance and the common interest regarding:

- eco-innovation, research, development and technology transfer;
- regulatory, financial and market instruments;
- enterprises and supply chains organizational models;
- measurement tools and indicators;
- guidance and support to businesses;
- promotion of new cultural approaches and lifestyles;
- role of territories and cities in guiding the transition from global to local and vice-versa

However, many other organizations are involved in working groups even if they have not signed the Charter, reaching an approximate number of 100.

ICESP 's work is organized in the following six working group (see also table XX):

- WG1: Research and eco-innovation, knowledge diffusion and education
- WG2: Policy and Governance tools

- WG3: Instruments for measuring circular economy
- WG4: Systems and models for sustainable and circular design, production, distribution and consumption
- WG5: Cities and territory
- WG6: Best Practices and Integrated Approaches

Within the WG5 “Cities and territory” stakeholders are classifiable according to the quintuple helix, because citizens, social entrepreneurs and activists are engaged in the platform too.

Furthermore, some good practices linked to WG5’s activities are classifiable within the frame of the quintuple helix, in which citizens and city makers are the main actors, together the other representatives of the quintuple helix, and a few best practices in which citizens are become co-governors of city commons have been collected, too.

All them are involved in periodic consultations in relation to the ECESP Coordination Group meeting. Additionally, the operational and consultation activities realized by the Working Groups are aimed to produce position papers, recommendations and guidelines to be presented in ECESP and will be useful for the promotion of the Italian way for circular economy and with various topics of interest including:

- Research and eco-innovation
- Dialogue and good practices collection
- Dissemination of knowledge and training
- Regulation
- Financial instruments
- Circular economy measurement
- Improvement of public awareness on sustainable consumption models

Finally, the WGs are also involved into the organization of events dedicated to communication and dissemination of results.

As for mechanisms adopted for activating cooperation, each Working group has 2 or 3 coordinators (see table 2), engaging to set up periodical meeting to activate cooperation and deliver the expected results.

Table

<i>Working Group</i>	<i>Coordination</i>
WG. 1 - Research and eco-innovation, knowledge diffusion and education	CNA, Puglia Region-ARTI, University of Bologna
WG. 2 - Policy and Governance tools	Minister of Environment DG-RIN, Minister of Economic Development, Unicircular
WG. 3 - Instruments for measuring circular economy	ENEA, Minister of Environment –DG SVI
WG. 4 - Systems and models for sustainable and circular design, production, distribution and consumption	ENEA, ENEL, Intesa Sanpaolo Innovation Center
WG. 5 - Cities and territory	Agency for Territorial Cohesion , ENEA
WG. 6 - Best practices and Integrated approaches	ENEA, Puglia Region-ARTI, Unioncamere

The platform includes a strong work from the coordination team for ensuring the achievement of results in line with the platform aim. Moreover, the General assembly sets the annual plan for the Working Groups (WGs) work. The activities are carrying out both in offline mode as well as online by using the interface available on the website www.icesp.it.

The outcomes are published in the website and are available for free download. Another offline/online work has been developed for the contribution on Good Practices (GPs). Indeed, the GPs can be directly uploaded in the website (function foreseen by June 2019) but also they can be uploaded by coordination team (the manager of website) that collects them in the WGs activities through stakeholders' involvement, using a specific format. All those GPs are the basis for implementing the ICESP GPs database that is then implemented on the ICESP website and has a specific interface for the users. The GPs format takes into account all mandatory fields required by the European Platform ECESP in order to make possible for the contributors to make easier the submission also in ECESP website, increasing the visibility and the GP dissemination.

Different stakeholders are expected to contribute in different way and these expectations are reflected in working group. For example, research (RTO and Academy) is more engaged in Research and Ecoinnovation working group, while industries in Design, Production and Consumption system working group. However, all the sectors are involved in all working group to ensure the "ICESP closing the loop".

As for the technical model, ICESP has a website aiming to become an interactive way for stakeholders' communication. Other National platforms exist, with similar approach even if with different internal mechanism. However, every platform is configured as voluntary work supporting ECESP work through Coordination Group. Standard does still not exist

5. Conclusions

Aimed to provide a contribution of systematization at the intersection of the research on Circular Economy and Innovation Ecosystems in the perspective of Quintuple Helix, the study has analysed the case of ICESP, as institutional initiative aimed to support the development of circular economy. As extreme case study of a platform supporting the creation of an innovation ecosystem, the analysis of ICESP has been addressed toward the comprehension of its strategic, organizational and technological model.

In allowing to demonstrate how the availability of a digital platform, conceived in the frame of larger and institutional strategy, can positively impact on the creation of an innovation ecosystem, the case of ICESP has offered interesting insights on the different categories of stakeholders involved in and their characterization according to the model of quintuple helix.

Implications for theory arise in terms of replication of the study, also through the embracement of investigative tools aimed to monitor the role and centrality of stakeholders, the foresight and the dynamic analysis of their behaviours, the comparison of similar initiatives in different national and regional contexts. Additionally, the study

offers several implications for the agenda of policy makers, in terms of sustainable and collaborative innovation processes for supporting the development of circular economy.

References

- Antikainen, M., & Valkokari, K. (2016). A framework for sustainable circular business model innovation. *Technology Innovation Management Review*, 6(7).
- Argyris, C., & Schön, D. A. (1989). Participatory action research and action science compared: A commentary. *American behavioral scientist*, 32(5), 612-623.
- Asheim, B. T., & Gertler, M. S. (2005). The geography of innovation: regional innovation systems. In *The Oxford handbook of innovation*.
- Borin, E., & Donato, F. (2015). Unlocking the potential of IC in Italian cultural ecosystems. *Journal of Intellectual Capital*, 16(2), 285-304.
- Cappellaro, F., Cutaia, L., Innella, C., Meloni, C., Pentassuglia, R., Porretto, V., (2019), Co-design of a circular economy through urban living labs: Transformative planning practices in Rome (Italy). *Urban Transformations* (Forthcoming)
- Carayannis, E. G., and Campbell, D. F. (2009), “Mode 3 and Quadruple Helix: toward a 21st century fractal innovation ecosystem”, *International journal of technology management*, Vol.46, No. 3-4, pp. 201-234.
- Carayannis, E. G., & Campbell, D. F. (2012). Mode 3 knowledge production in quadruple helix innovation systems. In *Mode 3 knowledge production in quadruple helix innovation systems* (pp. 1-63). Springer, New York, NY.
- Chertow, M. R. (2000). Industrial symbiosis: literature and taxonomy. *Annual review of energy and the environment*, 25(1), 313-337.
- Dumay, J. (2013). The third stage of IC: towards a new IC future and beyond. *Journal of Intellectual Capital*, 14(1), 5-9.
- Etzkowitz, H., & Zhou, C. (2006). Triple Helix twins: innovation and sustainability. *Science and public policy*, 33(1), 77-83.
- Etzkowitz, H., and Ranga, M. (2015), “Triple Helix systems: an analytical framework for innovation policy and practice in the Knowledge Society”, In *Entrepreneurship and Knowledge Exchange* (pp. 117-158). Routledge.
- Garner, C., & Ternouth, P. (2011). Absorptive capacity and innovation in the triple helix model. *International Journal of Knowledge-Based Development*, 2(4), 357-371.
- Geissdoerfer, M., Morioka, S. N., de Carvalho, M. M., & Evans, S. (2018). Business models and supply chains for the circular economy. *Journal of Cleaner Production*, 190, 712-721.
- Geng, Y., Fu, J., Sarkis, J., & Xue, B. (2012). Towards a national circular economy indicator system in China: an evaluation and critical analysis. *Journal of Cleaner Production*, 23(1), 216-224.
- Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner production*, 114, 11-32.
- Graedel, T. E., & Allenby, B. R. (1995). *Industrial Ecology* Prentice Hall. Englewood Cliffs, NJ.
- Grundel, I., and Dahlström, M. (2016), “A Quadruple and Quintuple Helix approach to regional innovation systems in the transformation to a forestry-based bioeconomy”, *Journal of the Knowledge Economy*, Vol. 7, No.4, pp. 963-983.
- Haas, W., Krausmann, F., Wiedenhofer, D., & Heinz, M. (2015). How circular is the global economy? An assessment of material flows, waste production, and recycling in the European Union and the world in 2005. *Journal of Industrial Ecology*, 19(5), 765-777.

- Innella, C., Barberio, G., Brunori, C., Musmeci, F., Petta, L., (2017). Economia circolare in ambito urbano. *Energia-Ambiente-Innovazione* 1, 58-63.- DOI 10.12910/EAI2017-009
- Lewandowski, M. (2016). Designing the business models for circular economy—Towards the conceptual framework. *Sustainability*, 8(1), 43.
- Lyle, J. (1994), *Regenerative Design for Sustainable Development*, Wiley, New York, NY.
- Miliute-Plepiene, J., & Plepys, A. (2015). Does food sorting prevents and improves sorting of household waste? A case in Sweden. *Journal of Cleaner production*, 101, 182-192.
- Muntaner-Perich, E., and de la Rosa Esteve, J. L. (2007), “Using dynamic electronic institutions to enable digital business ecosystems”, In *Coordination, Organizations, Institutions, and Norms in Agent Systems II* (pp. 259-273). Springer Berlin Heidelberg.
- Mylan, J., Holmes, H., & Paddock, J. (2016). Re-introducing consumption to the ‘circular economy’: a sociotechnical analysis of domestic food provisioning. *Sustainability*, 8(8), 794.
- Nußholz, L.K. (2018), A circular business model mapping tool for creating value from prolonged product lifetime and closed material loops, *Journal of Cleaner Production*, 197 (2018), pp. 185-194.
- Passiante, G., & Romano, A. (Eds.). (2016). *Creating Technology-Driven Entrepreneurship: Foundations, Processes and Environments*. Springer.
- Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative science quarterly*, 116-145.
- Ranta, V., Aarikka-Stenroos, L., Ritala, P., & Mäkinen, S. J. (2018). Exploring institutional drivers and barriers of the circular economy: a cross-regional comparison of China, the US, and Europe. *Resources, Conservation and Recycling*, 135, 70-82.
- Romano, A., Passiante, G., Del Vecchio, P., and Secundo, G. (2014) “The innovation ecosystem as booster for the innovative entrepreneurship in the smart specialization strategy” *International Journal of Knowledge-Based Development*, Vol. 5, No.3 , pp. 271–288.
- Schneider, A., (2015) Reflexivity in sustainability accounting and management: transcending the economic focus of corporate sustainability, *J. Bus. Ethics*, 127 (2015), pp. 525-536.
- Stahel, W. (2010). *The performance economy*. Springer.
- Urbinati, A., Chiaroni, D., & Chiesa, V. (2017). Towards a new taxonomy of circular economy business models. *Journal of Cleaner Production*, 168, 487-498.
- Yin, R. (1994). *Case study research: Design and methods* (2nd ed.). Beverly Hills, CA: Sage Publishing.
- Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage.
- Zajac, E. J., & Olsen, C. P. (1993). From transaction cost to transactional value analysis: Implications for the study of interorganizational strategies. *Journal of management studies*, 30(1), 131-145.

Environmental Sustainability of Syngas Production from RDF in Apulia Region

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Abstract

The issue of urban waste has become a priority from a social and environmental point of view and in literature there are various papers studying technological and economic solutions to overcome these problems. For this reason, important strategic choices are needed, with the goal to increase the recovering of waste separate collection (to reduce waste landfilled) and to increase energy recovery from waste value chain. The aim of the paper has been to assess the environmental impacts of a pilot plant from RDF (refused derived fuels) to syngas, through the LCA methodology to create innovative network of sustainable business closing the loop in terms of circular economy. Syngas is a gas obtained from a pyro gasification process, which converts carbonaceous material into simpler molecules of CO, CO₂, hydrogen and methane (syngas) to be reused to feed small engines or to produce other chemical intermediates. The case study presented, offers the possibility to evaluate an alternative option to reduce waste landfilled, creating in the same time new business and a new model of “share” in knowledge ecosystem perspective. Considering the circular economy aspect, the use of RDF to produce syngas, can represent a goal to be pursued. The environmental analysis shows that a small plant to produce syngas, if well managed, can represents an important choice for the environmental performance. On the basis of data and considering that a percentage of 20-30% has lost in the Biological and Mechanical Treatment, in Puglia there is potential RDF-end of waste in the range of 374 – 428 millions of kilograms per year. Hence, according to the provincial areas of Apulia, almost six plants would be implemented, creating replicable models with the final aim to “quickly” re-use waste and re-invent industry.

Keywords – Circular economy, Syngas production, eco-innovation, sustainability,

Paper type – Practical paper

1. Introduction

Recently the European Union promoted the new economic system that has been also based on the valorisation of secondary raw materials, to reduce waste generation and create new materials and commodities from waste within a continuous economic cycle. This aim can certainly be pursued by reducing urban waste amount to be sent to landfills, increasing both the recovery of materials and energy. The issue of urban waste has become a priority from a social and environmental point of view and in literature there are various papers studying technological and economic solutions to overcome these problems. From a circular economy perspective, a possible option could be “waste to energy” that is to create a value supply chain using Refused Derived Fuels (refused derived fuels) obtained from urban waste to produce synthetic gas (syngas) avoiding fossil fuels use. According to the Italian law, the RDF labelled as “end of waste” are only produced in authorized plants certified UNI En15358 or registered Emas (Environmental Management Audit Scheme). A declaration of conformity by the manufacturer sanctions the status of end of waste, and it must be compiled according to specific scheme attached to the regulation.

The RDF gasification is sustainable from a social and environmental point of view: from social point of view, it integrates waste separate collection into the supply chain, enhancing a more careful verification of undifferentiated waste and, in the same time, allowing to trace the matter flows from the various production processes. This last aspect guarantees an effective control of management in each of the management phases, certifying it as non-hazardous waste. From an environmental point of view, because it allows to recover energy that could be reused to power production plants that are fuelled by fossil fuels.

In Puglia the problem of waste is becoming an urgent issue to be solved and the priority is to find efficient technical and managerial options. For this reason, important strategic choices are needed to increase the waste separate collection, which rate (47%) is not high enough, and the energy recovery from waste value chain. In this direction, innovative small power plants could be used to produce syngas, a synthesis gas obtained from a pyro gasification process, which converts carbonaceous material into simpler molecules of CO, CO₂, hydrogen and methane (syngas) to be reused to feed small engines or to produce other chemical intermediates.

For this reason, important strategic choices are needed, with the goal to increase the recovering of waste separate collection (to reduce waste landfilled) and to increase energy recovery from waste value chain. For example, small power plants could be used to produce syngas, a synthesis gas obtained from a pyro gasification process, which converts carbonaceous material into simpler molecules of CO, CO₂, hydrogen and methane (syngas) to be reused to feed small engines or to produce other chemical intermediates.

The aim of the paper has been to assess the environmental impacts of a pilot plant from RDF (refused derived fuels) to syngas through the LCA methodology to create innovative network of sustainable business closing the loop in terms of circular economy. The case study presented, offers the possibility to evaluate an alternative option to reduce

waste landfilled, creating in the same time new business and a new model of “share” in knowledge ecosystem perspective. Moreover, based on the results, a potential implementation at territorial level of this approach has been considered.

2. Materials and methods

The LCA analysis has been performed to verify from environmental point of view whether the production of syngas can be considered a strategic initiative to be used in long- and medium-term choices at territorial level. After calculating the environmental impacts, the successive step has been to validate the hypothesis to implement in Apulia region different small plants of syngas production for developing a circular economy model. From these analyses a useful location for the plants could be the provincial area. The territorial level has been chosen, because the local approach allows for avoiding and/or reducing the economic and environmental cost of the waste transport. In the hypothesized model, percentage of mixed waste treated to become input for the syngas production has been analyzed. In 2018 over $1,750 \cdot 10^6$ kg of solid urban wastes have been produced in the region Apulia (Regione Puglia, 2018). About 47% of the total urban waste have been collected separately, while the remaining part, about $922 \cdot 10^6$ kg were mixed waste, that is not sorted at source and that needs to be managed. It usually treated in Biological and Mechanical Treatment plant to separate and manage waste according to chemical and physical characteristics. From these plants, which are eleven in Apulia, about 58% was disposed of in landfills (ISPRA, 2018). In the hypothesized model, percentage of mixed waste treated to become input for the syngas production has been analyzed. Furthermore, the LCA analysis has assessed the environmental impacts to understand the validity of the approach from the environmental point of view.

2.1 Syngas production

Before illustrating the hypothesis, a briefly information related to the syngas is given. Syngas is a mixture of gases comprising carbon monoxide (CO) and hydrogen (H₂), methane (CH₄) and carbon dioxide (CO₂). Biomass such as agricultural wastes, forest products, grasses, residual waste and other cellulosic material may be converted to syngas. Syngas, furthermore, is an intermediate in the chemical and bio- refining industries and has a vast number of uses because can be converted into alkanes, olefins, oxygenates, and alcohols, such as ethanol and it is also used as an intermediate in producing synthetic petroleum as a fuel or lubricant via the Fischer–Tropsch synthesis or can be used to produce organic molecules, such as synthetic natural gas (SNG-methane). In the last years, syngas has been studied to produce from waste materials that would otherwise need to be discarded. Instead of placing waste products in landfills, these waste products can be used to generate a useful, energy rich product. This makes the syngas conversion process both an efficient means of producing energy and an environmentally friendly option for the recycling of waste products, in the light of circular economy. Syngas is obtained by a thermo-chemical reaction process named gasification. Gasification transforms the carbonaceous material (biomass, waste, coal,

etc) into a mixture of combustible gases, containing 20-40% hydrogen (H₂), 35-40% carbon monoxide (CO), 0-15% methane (CH₄) and 25-35% carbon dioxide (CO₂).

During the process, the material is heated at a high temperature of approximately 850°C with a controlled amount of oxygen, air and/or steam (gasifying agent) and limited combustion to supply thermal energy and sustain the reaction. The gasification process takes place inside a reactor and can be divided into two stages: the first stage – pyrolysis, where the volatile components of the fuel are released by means of a series of complex reactions at temperatures below 600°C (Cherubini and Stromman 2011).

2.2 The studied process analysis

The LCA analysis has been carried out to a pilot plant that has been operative for a period of six months, as experimental phase, to produce Syngas from RDF. The production of the RDF is developed in the following phases:

- waste collecting;
- bio- stabilization
- mechanical separation of the inert and metallic fraction

The incoming waste undergoes a process of shredding that reduces the volume to less than 250 mm to be subsequently loaded in specific boxes for the stabilization of organic residues. The bio stabilization phase goes on for about a week and is carried out by injecting air allowing the mass to be uniformly oxygenated, favouring a temperature of around 40°C. During this phase, the weight is reduced by about 30%. Starting from a ton of urban waste, about roughly 700 kg of RDF are obtained, and this has been the result of plant, as well. The average waste transport for this study was calculated at 150 km and it was hypothesized to produce biochar that varies from a minimum of 3% (with the production of syngas equal to 97%) to a maximum of 33% (with the production of syngas equal to 67%). Biochar is formed from ashes (inert material) and a carbon residue. Biochar has a good calorific value, and this means that can be reused in the plant (Arena 2012; Arena et al, 2014; Field et al., 2013).

Table 1 shows the product percentage of the waste that results from the production process (as underlined above, 1.95 kg for 1 kg of syngas produced has been calculated. A preliminary screening of the relevant parameters of the waste for RDF has been necessary.

Table1: Waste average composition

Wood	12%	0.23
Paper	41	0.80
Organic matter	2.5	0.05
Metals non-ferrous	2.5	0.05
Glass	1.5	0.03
Plastic	29	0.57
Textiles	11.5	0.22
<u>RDF</u>	<u>100</u>	<u>1.95</u>

Considering the indications of the UNI EN 15359: 2011 standard, considering the intrinsic characteristics of the RDF, such as the calorific value, the content of chlorine and mercury, the RDF was suitable for the plant experiment. During the operation of the plant, a massive loss has been recorded, probably due to cellulose and plastics decomposition. The process is technically feasible with different material used during the experimental phase as plastics residual of industrial treatment and paper waste (Materazzi, 2016)

Table 2 illustrates a summary of the main characteristics of the plant.

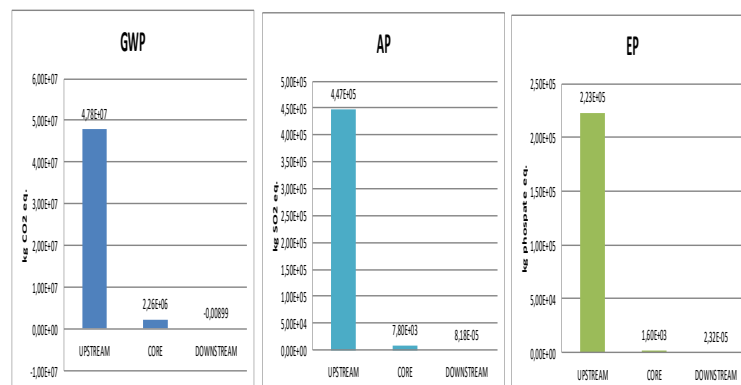
Table 2 Characteristics of powerplant of Syngas production

Main technical features	
Operation plant	1000 kg/h
Average temperature	800 °C
Gassifier agent	Nitro
Biochair production	Between 3% up to 33%
Energy input	2,5 kW/h
Syngas density	1,1 kg/Nm ³

To have a correct operative functioning of the plant it is important to take under control different parameters as gasifier agents, temperature, fluidizing speed.

3. Results and Discussion

The first hypothesis has been to assess the environmental factors to verify the opportunity to proceed with this plant technology. According to the LCA methodology, the study has been split into upstream, core (mainstream), and downstream. with the Ga.Bi software (Ecoinvent v. 3.3 of Ga.Bi software v. 6.6). Data have been collected from literature and primary data collected from the power plant. The functional unit is normalized to 1 kg of syngas produced (Schreiber et., 2012; Sebastian et al., 2011). Figure 1 highlights the preliminary analysis of the study (showing only the results of global warming, the eutrophication and the acidification).



The upstream phase is the more critical between environmental emission. This is important because correct management of the collection phase and the management of the arrival of the input for thermo-chemical conversion represent the most important aspects to consider for environmental emission. During the core phase, the emissions are very low, as compared to the upstream phase, and this is a confirmation that a strategy based upon the syngas can play an important role in the circular economy approach. However, it is necessary to create the preconditions to make the RDF suitable, considering that it is the most problematic aspect of the supply chain. Emissions are strictly imputable to the movement of waste within the site, because of the bio-stabilization and selection process to create RDF. The intermittent steps between the different phases of the pre-treatment phase need to be improved, such as the handling of waste before the loading phase, which occurs by means of mechanical shovels. Inside the gasifier, the main problems are related to the erosion and corrosion phenomena which can make the gasifier stop. In many cases, the problems of corrosion are due to alkaline compounds, such as potassium, which can be found both in the biomasses and in the organic waste fraction, which can react with the silicon forming silicates creating encrustations on the walls of the gasifier. This problem certainly is more enhanced because the gasifier is a small plant, but in any case, it has caused different problems.

4. Conclusion

Sharing innovation, technologies and resources within this case study moves towards the closing of the loop and circular economy. It can reduce the amount of waste landfilled and exported recovering material and energy otherwise lost creating, in the same time, new sustainable business and better environmental performance.

Considering the circular economy aspect, as underlined above, the use of RDF can represent a goal to be pursued. The environmental analysis shows that a small plant, if well managed can represents an important choice for the environmental performance. On the basis of data shown in the previous section and considering that a percentage of 20-30% has lost in the Biological and Mechanical Treatment, in Puglia there is potential RDF-end of waste in the range of 374 – 428 millions of kilograms per year.

Hence, according to the provincial areas of Apulia, almost six plants would be implemented, the greatest one in Bari, for the total production of syngas in the range of $190 - 218 \cdot 10^6$ kg per year.

It must be underlined that Region Apulia provided for a waste management perspective up to 2020-2025, in which the separate collection would be increased to 65%, the landfill disposal reduced. In this waste management outlook, the role of production of RDF end of waste should be improved. In this direction the RDF use could be one of the possible options to decrease the still high (355,000 t in 2017) amount of mixed waste exported by our country.

Other consideration is represented by the technological aspect. Has underlined, the syngas conversion from RDF input has good environmental performance indicators. Consequently, co-gasification processes can also be designed to broaden the possible

technology usage scenarios. The syngas produced can be used in different applications, depending by the level of purity obtainable by input selection after the preliminary treatments. The main alternatives are the use as an energy carrier or as a building block for the synthesis of different chemicals (from hydrogen with methanol, ammonia, liquid fuels, etc.). The latter is very important as, unlike from incineration process (waste-to-energy), a technological approach based on the production of syngas can have a multiplicative effect as it can feed new value production chains and not only be used for energy production. These considerations can help a significant reduction of wastes to landfill, avoiding environmental problems and enhancing a policy based on the shifting to circular economy approach.

This kind of more sustainable approach to manage the waste could be successfully implemented in the different Italian regions creating replicable models made available by local network (all actors involved) with the final aim to “quickly” re-use waste and reinvent industry. Indeed, the case study has been analyzed also with a knowledge ecosystem perspective the opportunity to create a cohesive and dynamic system within all the actors involved.

References

- Arena, U., (2012), Process and technological aspects of municipal solid waste gasification. A review *Waste Management*, 32, pp. 625-639;
- Arena, U. F. Di Gregorio, (2014) Gasification of a solid recovered fuel in a pilot scale fluidized bed reactor *Fuel*, 117A, pp. 528-536;
- Cherubini F, Stromman AH (2011) Life cycle assessment of bioenergy systems: State of the art and future challenges *Bioresource Technology* (102), 437-451;
- Field JL, Keske CMH, Birch GL, Defoort MW, Cotrufo MF (2013) Distributed biochar and bioenergy coproduction: A regionally specific case study of environmental benefits and economic impacts. *Glob Change Biological Bioenergy*, 5:177-191;
- ISPRA (Institute for Environmental Protection and Research) (2018). Rapporto rifiuti urbani. Edizione 2018. ISPRA, Rome. ISBN 978-88-448-0928-7
- Regione Puglia, 2018. Dati R.S.U. in Puglia-2018.
http://www.sit.puglia.it/portal/portale_orp/Osservatorio+Rifiuti/Osservatorio+Rifiuti+Cittadino/RSU+in+Puglia/ accessed 01 March 2019
- Materazzi M., (2016), Performance analysis of RDF gasification in a two stage fluidized bed-plasma process, *Waste Management Volume 47, Part B*, January 2016;
- Schreiber A, Zapp P, Marx J (2012), Meta-analysis of life cycle assessment studies on electricity generation with carbon capture and storage. *Journal Industrial Ecology* 16(S1): S155-S168;
- Sebastian F, Royo J, Gomez M (2011) Cofiring versus biomass-fired power plants: GHG (greenhouse gases) emissions savings comparison by means of LCA (life cycle assessment) methodology. *Energy* 36: 2029-2037.

Improving the Performance of Knowledge Worker through Feedback of Cognitive Time Distortion

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Abstract

The improvement of knowledge worker performance with reference to the workload is a great challenge to most economies and their firms. In many knowledge-intensive organizations, the key cost component is the worker's worktime. Recent research has demonstrated that a worker's dual temporal experience gives rise to an unconditional Cognitive Time Distortion (CTD), understood as the relation between perceived time and physical time, for a given event. By reducing and controlling for CTD significant knowledge worker performance improvement can be achieved. We have, however, little knowledge about how to decrease the knowledge worker's level of CTD while doing knowledge work. In this study, we test different feedback techniques in a laboratory experiment aiming at influencing and controlling the CTD of individuals. The context of the experiment is worker performance feedback, with regard to worker's self-assessment of worktime for a given work conducted. One group (n=32) receives performance feedback contenting monetary reward information only, whereas a second group (n=31) receives performance feedback containing only information on the level of worker's CTD. The results show that the provision of feedback of CTD produces different self-assessments of worktime, as compared to the group that only received monetary-related feedback. The group with feedback information about the level of CTD manifests a significantly lower variance of CTD in their time assessment than did the group that received monetary reward information only. These results suggest profound implications for the performance feedback practices for knowledge workers performance.

Keywords – Cognitive time distortion, Feedback of error of time assessment, Knowledge worker, Temporal workload, Worker performance management.

Paper type – Academic Research Paper

1 Introduction

The activity and success of today's economic organizations such as software and data processing companies, recruiting firms, financial, businesses, consulting and accounting services firms to a large extent depend on the performance of knowledge workers and the volume of this workers is increasing in developed countries (Salas-Vallina et al., 2018; Sawant and Jain, 2017; Sørensen and Holman, 2014; Turriago-Hoyos et al., 2016). In current work environments, these workers often experience high workload and time pressure (Froehle and White, 2014; Škerlavaj et al., 2018). Hence, the improvement of knowledge worker performance and productivity with reference to the workload is a great challenge for most organizations.

For many knowledge-intensive organizations, the key cost component is the worker's worktime. Previous cognitive science literature demonstrates a significant difference between a worker's cognitive time and physical clock time. The Temporal Workload Equation suggests that a worker's dual temporal experience gives rise to an unconditional CTD, understood as the relation between perceived time and physical time that significantly affects key economic indicators such as profit, productivity, workload and risk (von Schéele, 2001; von Schéele and Haftor, 2013; 2015; 2018; von Schéele et al., 2018). It is also established that the reduction of a knowledge worker's CTD contributes to a higher efficiency of the workload (von Schéele and Haftor, 2018). Previous experimental studies on time prediction and assessment demonstrate the importance of experience and training (Block et al., 2010; Halkjelsvik and Jørgensen, 2012; Roy et al., 2008; Roy and Christenfeld, 2007; Thomas et al., 2003; 2007; Tobin and Grondin, 2012; 2015), yet without showing how CTD can be controlled so that its detrimental influence on economic indicators is suppressed. Particularly, it is unclear what feedback mechanism is recommended for controlling CTD.

Over the last decades, different management techniques were advanced with the aim to provide higher efficiency of workers' workload (Sawant and Jain, 2017, Sørensen and Holman, 2014). Yet, the idea of "nudge" interventions and behavioral science techniques for changing individual behaviour and performance has achieved particular attention (Benartzi et al., 2017; Thaler et al., 2014). The nudge theory proposes to affect individual performance by the choice architecture that alerts people and directs behaviour in a predictable way (Thaler and Sunstein, 2008). One of the tools of the choice architecture is feedback provided to an individual (Thaler et al., 2014). Many organizations provide monetary-based feedback to affect performance of their employees, yet without achieving desired outcomes (Lourenço, 2015; Kosfeld et al., 2017). This evidence calls for additional research on feedback techniques in relation to knowledge worker performance.

This study presents a comparison of “nudging” the knowledge worker behavior so as to reduce CTD in a laboratory experiment with the aim to understand how CTD can be controlled. The here presented laboratory experiment evaluates two different performance feedback information for individual knowledge workers aiming at influencing and thereby controlling the CTD of individuals. The context of the experiment is worker performance feedback, with regard to worker’s self-assessment of worktime for a given work conducted. One group received performance feedback contenting monetary reward information only, whereas a second group received performance feedback containing only information with the level of worker’s CTD.

The results of the laboratory experiment demonstrate that unlike monetary-related feedback, time-related feedback of CTD significantly reduces error in time assessment (von Schéele, 2001) and soften the lever effect of the distorted time assessments. The provision of feedback of CTD produces different self-assessments of worktime, as compared to the group that only received monetary rewards. The group with feedback information about the level of CTD manifests a significantly lower variance of CTD in their time assessment than did the group that received monetary reward information only. These results suggest profound implications regarding the performance feedback as a tool for nudging where we demonstrate the importance of information on the worker’s level of CDT. The successful outcome of the time-related feedback is here suggested to be considered and further studied from the perspective of the nudge theory.

The paper is structured accordingly: Section 1 presents a summary of research on current nudge interventions together with a mathematic definition of CTD in section 2. Section 3 informs the reader about the details of a laboratory experiment, in which different modes of controlling the CTD is tested. In section 4 the results from the laboratory experiment are presented. The paper concludes with a discussion of the obtained results together with remarks about further research.

2 Theoretical background

Below, we review studies that explore the role of nudging via feedback on individual behavior, describe CTD definition and summarize current empirical evidence on individual time perception and time assessment.

2.1 Nudging through feedback

Although the concept of feedback is a fundamental factor for both manual and knowledge workers (Frey and Osterloh, 2002), current motivation systems including feedback are shown to just partly affect knowledge worker behaviour and improve performance (Hopp et al., 2009; Markova and Ford, 2011; Pink, 2009; Salas-Vallina et al., 2018). Over the last decades, the idea of “nudge” interventions for changing individual behaviour and performance has achieved particular attention (Benartzi et al., 2017; Thaler et al., 2014). The nudge theory proposes to influence individual performance by the choice architecture that directs behaviour in a predictable way significantly

changing incentives (Thaler and Sunstein, 2008). One of the tools of the choice architecture is feedback given to an individual (Thaler et al., 2014).

Feedback is defined as an action taken by external party to provide information regarding aspects of the conducted task performance (Kluger and DeNisi, 1996). Feedback is often mentioned as one of the most powerful influences on individual behaviour and performance improvement (Molloy and Boud, 2014). Feedback provision and its relevance is supported by different theoretical traditions. In psychological literature, feedback is demonstrated to have positive effects on motivation, attention and learning (Kluger and DeNisi, 1996). In behavioral economics, feedback is considered as a means to nudge individual behaviour in a desired direction (Thaler and Sunstein, 2008). Although a number of studies demonstrate how feedback can improve individual performance (Garbers and Konradt, 2014; Song et al., 2017), they also show the complexity of feedback techniques that do not always have positive results. For example, monetary-based feedback does not always positively affect knowledge worker behaviour and performance (Lourenço, 2015; Kosfeld et al., 2017). Therefore, in this paper we seek for a special type of feedback that will nudge knowledge workers towards efficient workload and performance.

For knowledge-intensive organizations worktime is a key cost component. Recently, it was demonstrated that CTD (the relation between perceived time and physical time for a given event) significantly affects key economic indicators such as profit, productivity, workload and risk (von Schéele, 2001; von Schéele and Haftor, 2013; 2015; 2018; von Schéele et al., 2018) and a reduction of a knowledge worker's CTD contributes to a higher efficiency of the workload (von Schéele and Haftor, 2018). However, we still have a lack of knowledge on how to control CTD and what feedback technique is recommended to manage CTD. Below, we explain in more detail the definition of CTD and review studies that provide empirical evidence on factors that can significantly affect individual time prediction and time assessment.

2.2 Cognitive time distortion, temporal prediction and assessment

Psychological literature that addresses human cognition provides clear evidence that there is a difference between physical clock time and worker's cognitive time (Block and Eisler, 1999; Levin and Zakay, 1989; Nembhard and Uzumeri, 2000). Moreover, humans experience temporal duration differently (von Schéele and Haftor, 2014, von Schéele and Haftor, 2018). CTD denoted as τ_i is understood here as the ratio between *cognitive time* (t_c) and *physical time* (t_p) which can be formalized accordingly:

$$\text{Time Distortion: } \tau_i = (t_c / t_p)_i \quad (1)$$

The operationalization of CTD focuses on measuring a deviation of the cognitive time with reference to a certain reference point, or event. In equation 1, “ i ” may be a process, project, or a service contract. Both t_c and t_p must in the definition refer to the same event,

in order to give sense and meaning to CTD. CTD in the assessment of 1 cognitive hour may vary between 1.08 and 2.14 physical hours (von Schéele et al., 2018).

Previous literature on temporal assessment investigated time assessment from two perspectives. On the one hand, studies focused on the predicted time assessment before the task was performed (Roy and Christenfeld, 2008; Tobin and Grondin, 2012). On the other hand, time assessment was also studied after the task was completed (Tobin et al., 2010; Bisson et al., 2012). For example, it was established that prior experience with a task has a positive effect on predicted time of task performance (Block et al., 2010; Halkjelsvik and Jørgensen, 2012; Roy et al., 2008; Roy and Christenfeld, 2007; Thomas et al., 2003; 2007; Tobin and Grondin, 2012; 2015). It was found that simple short task practice of 2 minutes significantly increased the accuracy of temporal prediction of individuals in task performance (Thomas et al., 2003). Moreover, it was shown that the number of trials positively affects the accuracy of temporal prediction (Roy and Christenfeld, 2007). Tobin and Grondin (2012) also demonstrated that prior task duration knowledge can improve the accuracy of temporal prediction significantly.

Some studies investigated the question of time assessment when time assessment is done after the task is performed and demonstrate mixed results (Tobin and Grondin, 2015). Boltz et al. (1998) found it difficult to find time assessment differences between experts and novices. Other studies demonstrate a significant difference in time assessment between these groups of participants, demonstrating that experts are better in time assessment than novices (Roy et al., 2008; Tobin and Grondin, 2015) and thus highlight the importance of prior experience and training with a task on the perceived duration of the task.

Although prior experience and training is shown to positively affect temporal prediction and time assessment after the task was performed (Roy et al., 2008; Tobin and Grondin, 2015) and there is also empirical evidence that temporal feedback about the duration of the task may positively affect temporal prediction of the task (Roy et al., 2008; Ryan and Fritz, 2007), the question of how CTD can be managed and what feedback mechanism can improve time assessment precision has not been addressed. To address this gap, a detailed laboratory experiment was conducted to understand how time precision assessment can be managed with time-related feedback of CTD in comparison to monetary-related feedback.

3 Method

A laboratory experiment was designed and conducted to fulfill the following criteria: (a) participants chosen are appropriate for the experiment, (b) participants performed a knowledge-intensive task to mirror real work settings, and (c) sample size is sufficiently large to provide statistical power.

3.1 Participants

The laboratory experiments comprised of 63 participating students (n=63) at the Royal Institute of Technology, Stockholm. They were divided into two groups, where

each group received different modes of feedback. One feedback mode was based on bonus (*Monetary-related feedback*), while the other feedback mode was based on information about the CTD (*CTD-related feedback*). Each group had to assess time durations five times consecutively, and the result of the mean values and the variance of the time assessments were compared. Before feedback to each group, there were no significant differences in mean values of CTD, and no significant difference in variance of CTD. Table 1 demonstrates distribution between feedback mode and gender.

Table 1 Crosstabulation between feedback mode and gender

			Gender		Total
			Male	Female	
Feedback mode	Monetary-related	Count	20	12	32
		Percentage of total	31.7	19.1	50.8
	CTD-related	Count	8	23	31
		Percentage of total	12.7	36.5	49.2
Total		Count	28	35	63
		Percentage of total	44.4	55.6	100.0

The participants in the experiment were 44.4% male and 55.6% female. Among participants with male gender, 20 (31.7%) received monetary-related feedback and 8 (12.7%) received CTD-related feedback. Among participants with female gender 12 (19.1%) received monetary-related feedback and 23 (36.5%) received CTD-related feedback respectively.

3.2 Procedure and material

Each participant performed an independent work task (putting a jigsaw puzzle together as soon as possible) in a room without any clock and assessed the duration of five-time intervals. The puzzle consisted of 60 pieces and was enough complicated to guarantee that an adult person would need at least 15 minutes to finish the puzzle. During the experiment all five intervals had the same time duration of 2 minutes and 26 seconds. The participants were not informed about the length of time intervals and received only information when an interval started (participants received a message: “*time interval starts now*”) and ended (participants received a message: “*time interval ends now*”). Directly after finishing time interval, the participants were asked to assess its duration as accurate as possible. After that the participants received feedback and continued work by indicating that the next time interval starts now. The procedure was repeated five times and the experiment was finished by informing the participants about the aim of the research.

The monetary-related feedback was designed in a way to imitate certain management strategies that favour “bonus system” and monetary reward. The participants were orally informed that they will receive a reward of 500 SEK if they make the most accurate time assessment. After each assessment the participants received the following feedback

message: “Good work! Well done! If you continue to make even better assessment next time, you may earn money bonus”.

The CTD-related feedback was designed to investigate how individuals react on being informed about their cognitive time distortion. The participants were orally informed that they will receive feedback indicating how their time assessment complied with the objective duration in percent. After each assessment the participants received the feedback message: “Good work! Well done! However, your time assessment was xx % too high or too low.”, depending on the true value in percent of how much his/her time assessment deviated from the objective time. For each time interval, the physical time, subjective time assessment and CTD were registered.

4 Results

The experiment was designed to investigate how the mode of feedback: monetary-related versus time-related feedback on CTD affects time assessment after tasks were completed. The results of the experiment demonstrate that the mode of feedback produces different time assessment of worktime (see Figure 1).

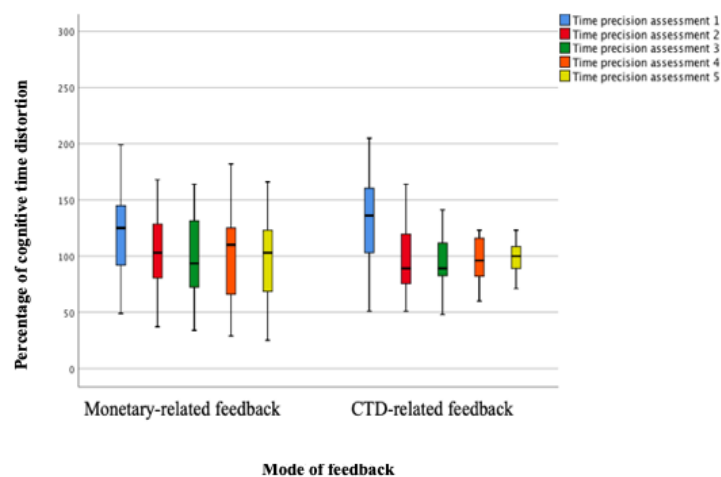


Figure 1. Box plot of different modes of feedback mode's influence on time precision assessment.

As depicted in Figure 1, the five-time assessments divided into groups of feedback modes. The group that received feedback about their CTD, exhibit significantly lower standard deviation as compared to the group that has feedback about monetary-related feedback. These results are supported by Levene's test of homogeneity of variance (Table 2).

Table 2. Levene's test of homogeneity of variance

		Levene Statistic	df1	df2	Sig.
Time precision assessment 1	Based on Mean	.240	1	61	.626
	Based on Median	.222	1	61	.639
	Based on Median and with adjusted df	.222	1	60.160	.639
	Based on trimmed mean	.242	1	61	.624
Time precision assessment 2	Based on Mean	.885	1	61	.350
	Based on Median	1.021	1	61	.316
	Based on Median and with adjusted df	1.021	1	56.105	.317
	Based on trimmed mean	.916	1	61	.342
Time precision assessment 3	Based on Mean	8.765	1	61	.004
	Based on Median	7.163	1	61	.010
	Based on Median and with adjusted df	7.163	1	43.496	.010
	Based on trimmed mean	8.265	1	61	.006
Time precision assessment 4	Based on Mean	15.016	1	61	.000
	Based on Median	12.473	1	61	.001
	Based on Median and with adjusted df	12.473	1	41.615	.001
	Based on trimmed mean	15.037	1	61	.000
Time precision assessment 5	Based on Mean	21.232	1	61	.000
	Based on Median	18.920	1	61	.000
	Based on Median and with adjusted df	18.920	1	39.294	.000
	Based on trimmed mean	21.089	1	61	.000

The results in Table 2 demonstrate that from time assessment no 3, there is a significant difference between the variance of the two groups with different feedback modes. The group with time-related feedback manifests a significantly lower variance of CTD in their time assessment that did the group with monetary-related feedback. Time-related feedback reduces the variance of time assessments to less than half of the variance in comparison to monetary-related feedback.

The Hawthorne effect of the experiment was minimized by anonymous and voluntary participation (Campbell and Stanley, 2015). The threat of the construct validity such as hypotheses guessing (Cook et al., 2002) was minimized by informing participants about the aim of research at the end of the experiment. The internal validity was ensured by a

short duration of the experiment. Students who participated in the experiment performed knowledge-intensive tasks and are representative of the target population.

5 Discussion and Conclusion

In many industries, knowledge workers' worktime represents the key cost component of a firm's cost structure. Recent studies demonstrate that CTD can cause time leakage and thus affect knowledge worker performance. Yet, we know little how to decrease the level of CTD while doing knowledge work to ensure improved performance. The present study presents a comparison of "nudging" the knowledge worker behavior so as to reduce CTD by providing time-related feedback.

The results of this study show that unlike monetary-related feedback time-related feedback on CTD is more effective at managing individual time assessment and its precision. Key theoretical implication of this study is the empirical evidence that CTD can be controlled if managed correctly. Moreover, we demonstrate that a nudge technique (Thaler et al., 2014), in our case time-related feedback is very relevant as a management technique in individual time assessment. This technique is shown to significantly reduce CTD and contributes to a higher efficiency of the workload (von Schéele and Haftor, 2018) and thus improve knowledge worker performance.

Although a significant body of studies shows the role of previous experience and training in temporal prediction and time assessment (Block et al., 2010; Tobin and Grondin, 2012; 2015), there is also some evidence that temporal feedback about the duration of the task may positively affect temporal prediction of the task (Roy et al., 2008; Ryan and Fritz, 2007). However, no studies have demonstrated how time-related feedback affect time assessment after the task was performed. In this study, we addressed this gap and demonstrate in experimental settings that time-related feedback on CTD can significantly improve time assessment.

The results of the study also demonstrate that monetary-related feedback does not significantly affect time assessment and thus can be incorrectly used by managers in adjusting individual workload. In contrasts, the results of this experiment enable managers with a technique on time-related feedback of CTD that can be used to improve the efficiency of the workload. Applying this technique may improve the precision of time assessment, optimize the workload and thus, improve knowledge worker performance.

The results of this study also provide recommendations for future research. First, during the experiment all five intervals had the same time duration. Future research can change time duration of intervals to avoid the learning curve effect. Second, in our experiment time duration of 2 minutes and 26 seconds was used. Longer durations of more than only some minutes would provide more detailed evidence on how time-related feedback affects time assessment. Third, between experimental intervals were no brakes and thus future research could investigate time assessment with longer pauses. Finally, actual knowledge-intensive practices could reflect real-world practices by providing a more detailed consideration of CTD and time assessment.

References

- Benartzi, S., Beshears, J., Milkman, K. L., Sunstein, C. R., Thaler, R. H., Shankar, M., Tucker-Ray, W., Congdon, W. J. and Galing, S., (2017) "Should Governments Invest More in Nudging?", *Psychological Science*, Vol. 28, No. 8, pp. 1041-1055.
- Bisson, N., Tobin, S. and Grondin, S., (2012) "Prospective and Retrospective Time Estimates of Children: A Comparison Based on Ecological Tasks", *PLoS One*, Vol. 7, No. 3, e33049.
- Block, R. A. and Eisler, H., (1999) The complete bibliography on the psychology of time, 1839-1999. [Machine-readable data file], Bozeman: Montana State University, Department of Psychology [Producer and Distributor].
- Block, R. A., Hancock, P. A. and Zakay, D., (2010) "How Cognitive Load Affects Duration Judgments: A Meta-Analytic Review", *Acta Psychologica*, Vol. 134, pp. 330-343.
- Boltz, M. G., Kupperman, C. and Dunne, J., (1998) "The Role of Learning in Remembered Duration", *Memory and Cognition*, Vol. 26, No. 5, pp. 903-921.
- Campbell, D. T. and Stanley, J. C., (2015) *Experimental and quasi-experimental designs for research*, Ravenio Books.
- Cook, T. D., Campbell, D. T. and Shadish, W., (2002) *Experimental and quasi-experimental designs for generalized causal inference*, Boston: Houghton Mifflin.
- Frey, B. S. and Osterloh, M., (2002) *Successful management by motivation: Balancing intrinsic and extrinsic incentives*, Berlin, Heidelberg, New York: Springer.
- Froehle, C. M. and White, D. L., (2014) "Interruption and Forgetting in Knowledge-Intensive Service Environments", *Production and Operations Management*, Vol. 23, No. 4, pp. 704-722.
- Garbers, Y. and Konradt, U., (2014) "The Effect of Financial Incentives on Performance: A Quantitative Review of Individual and Team-Based Financial Incentives", *Journal of Occupational and Organizational Psychology*, Vol. 87, No. 1, pp. 102-137.
- Halkjelsvik, T. and Jørgensen, M., (2012) "From Origami to Software Development: A Review of Studies on Judgment-Based Predictions of Performance Time", *Psychological Bulletin*, Vol. 138, No. 2, p. 238.
- Hopp, W. J., Iravani, S. M. and Liu, F., (2009) "Managing White-Collar Work: An Operations-Oriented Survey", *Production and Operations Management*, Vol. 18, No. 1, pp. 1-32.
- Kluger, A. N. and DeNisi, A., (1996) "The Effects of Feedback Interventions on Performance: A Historical Review, a Meta-Analysis, and a Preliminary Feedback Intervention Theory", *Psychological Bulletin*, Vol. 119, No. 2, p. 254.
- Kosfeld, M., Neckermann, S. and Yang, X., (2017) "The Effects of Financial and Recognition Incentives Across Work Contexts: The Role of Meaning", *Economic Inquiry*, Vol. 55, No. 1, pp. 237-247.
- Levin, I. and Zakay, D., (Eds.). (1989) *Time and human cognition: A life-span perspective*, (Vol. 59), Elsevier.
- Lourenço, S. M., (2015) "Monetary Incentives, Feedback, and Recognition – Complements or Substitutes? Evidence from a Field Experiment in a Retail Services Company", *The Accounting Review*, Vol. 91, No. 1, pp. 279-297.
- Markova, G. and Ford, C., (2011) "Is Money the Panacea? Rewards for Knowledge Workers", *International Journal of Productivity and Performance Management*, Vol. 60, No. 8, pp. 813-823.
- Molloy, E. K. and Boud, D., (2014) *Feedback Models for Learning, Teaching and Performance*, in *Handbook of Research on Educational Communications and Technology* (pp. 413-424), Springer, New York, NY.

- Nembhard, D. A. and Uzumeri, M. V., (2000) "Experiential Learning and Forgetting for Manual and Cognitive Tasks", *International Journal of Industrial Ergonomics*, Vol. 25, No. 4, pp. 315-326.
- Pink, D. H., (2009) *Drive. The surprising truth about what motivates us*, New York: Riverhead.
- Roy, M. M. and Christenfeld, N. J., (2007) "Bias in Memory Predicts Bias in Estimation of Future Task Duration", *Memory and Cognition*, Vol. 35, No. 3, pp. 557-564.
- Roy, M. M. and Christenfeld, N. J., (2008) "Effect of Task Length on Remembered and Predicted Duration", *Psychonomic Bulletin and Review*, Vol. 15, No. 1, pp. 202-207.
- Roy, M. M., Mitten, S. T. and Christenfeld, N. J., (2008) "Correcting Memory Improves Accuracy of Predicted Task Duration", *Journal of Experimental Psychology: Applied*, Vol. 14, No. 3, p. 266.
- Ryan, L. J. and Fritz, M. S., (2007) "Erroneous Knowledge of Results Affects Decision and Memory Processes on Timing Tasks", *Journal of Experimental Psychology: Human Perception and Performance*, Vol. 33, No. 6, p. 1468.
- Salas-Vallina, A., Alegre, J. and Guerrero, R. F., (2018) "Happiness at Work in Knowledge-Intensive Contexts: Opening the Research Agenda", *European Research on Management and Business Economics*, Vol. 24, No. 3, pp. 149-159.
- Sawant, H. and Jain, K. K., (2017) "Issues Related to Knowledge in Knowledge Intensive Organisations – A Literature Review", *International Journal of Knowledge Management Studies*, Vol. 8, No. 3-4, pp. 299-315.
- Škerlavaj, M., Connelly, C. E., Cerne, M. and Dysvik, A., (2018) "Tell Me if You Can: Time Pressure, Prosocial Motivation, Perspective Taking, and Knowledge Hiding", *Journal of Knowledge Management*, Vol. 22, No. 7, pp. 1489-1509.
- Song, H., Tucker, A. L., Murrell, K. L. and Vinson, D. R., (2017) "Closing the Productivity Gap: Improving Worker Productivity Through Public Relative Performance Feedback and Validation of Best Practices", *Management Science*, Vol. 64, No. 6, pp. 2628-2649.
- Sørensen, O. H. and Holman, D., (2014) "A Participative Intervention to Improve Employee Well-Being in Knowledge Work Jobs: A Mixed-Methods Evaluation Study", *Work and Stress*, Vol. 28, No. 1, pp. 67-86.
- Thaler, R. and Sunstein, C., (2008) *Nudge: The gentle power of choice architecture*, New Haven, Conn.: Yale.
- Thaler, R. H., Sunstein, C. R. and Balz, J. P., (2014) *Choice architecture, in behavioural foundations of public policy*, ed. E. Shafir, Princeton, NJ: Princeton University Press, pp. 428-439.
- Thomas, K. E., Handley, S. J. and Newstead, S. E., (2007) "The Role of Prior Task Experience in Temporal Misestimation", *The Quarterly Journal of Experimental Psychology*, Vol. 60, No. 2, pp. 230-240.
- Thomas, K. E., Newstead, S. E. and Handley, S. J., (2003) "Exploring the Time Prediction Process: The Effects of Task Experience and Complexity on Prediction Accuracy", *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, Vol. 17, No. 6, pp. 655-673.
- Tobin, S. and Grondin, S., (2012) "Time Perception Is Enhanced by Task Duration Knowledge: Evidence from Experienced Swimmers", *Memory and Cognition*, Vol. 40, No. 8, pp. 1339-1351.
- Tobin, S. and Grondin, S., (2015) "Prior Task Experience Affects Temporal Prediction and Estimation", *Frontiers in Psychology*, Vol. 6, p. 916.
- Tobin, S., Bisson, N. and Grondin, S., (2010) "An Ecological Approach to Prospective and Retrospective Timing of Long Durations: A Study Involving Gamers", *PloS one*, Vol. 5, No. 2, e9271.

- Turriago-Hoyos, A., Thoene, U. and Arjoon, S., (2016) "Knowledge Workers and Virtues in Peter Drucker's Management Theory", *SAGE Open*, Vol. 6, No. 1, pp. 1-9.
- von Schéele, F. and Haftor, D., (2015) "The Map or The Reality? How Leverage Effects of Time Leakages Distort Key Ratios in Information Economy", in *Proceedings of the 2nd Dubrovnik International Economic Meeting DIEM 2015*, p. 231.
- von Schéele, F. and Haftor, D. M., (2014) "Cognitive Time Distortion on the Performance of Economic Organizations", *Systems Research and Behavioral Science*, Vol. 31, No. 1, pp. 77-93.
- von Schéele, F. and Haftor, D., (2013) "Consequences of Cognitive Time Distortion on the Performance of Economic Organizations", *Systems Research and Behavioral Science*, Vol. 31, No. 1, pp. 77-93.
- von Schéele, F. and Haftor, D., (2018) "Temporal Workload in Economic Organizations: A Hidden Condition of Economic Efficiency", *Journal of Business Research*, Vol. 88, pp. 415-420.
- von Schéele, F., (2001) *Controlling time and communication in service economy*, Doctoral Thesis. Royal Institute of Technology, Stockholm.
- von Schéele, F., Haftor, D. M. and Pashkevich, N., (2018 in Press) "Cognitive Time Distortion as a Hidden Condition of Worker Productivity", *Journal of Business Research*. Available online: <https://www-sciencedirect-com.ezp.sub.su.se/science/article/pii/S014829631830554X>

The Ecosystem Dynamics of the fourth Industrial Revolution: the Knowledge Work Design of the Future

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Abstract

We have in this paper looked into what forms the knowledge worker in the future both on a corporate level and a societal level. We have interviewed researchers working with these issues in the Swedish telecommunication company Telia and the Norwegian telecommunication company Telenor. These are both companies making their living of understanding the future both on a corporate level and a societal level.

We have concluded that robotics and AI will be more advanced, but neither the way we are working nor the way we are organizing work will change much in the years to come. The processing of information will be an even more critical work task either in itself or integrated into every work task. Every knowledge worker will have to try to see and think through what will be happening today and tomorrow. The past, present, and future will merge into a working reality. There will be dynamic scenarios together with the corporate, team and individual networks. Those grasping and understanding the situations working in professional and organizational networks will be the winners. They will be the bottom-up needed for corporate success still working in a top-down hierarchy delivering products and services through a global logistics.

We have found that the one key for any organization in the future will be an analytical eye-toward-the-future where anything happening is analyzed and reported to the top management and coordinated into future deliveries. The key employees will be those implementing AI-based products and services on demand to advances customers. They will have a bottom-up understanding that is not needed in the eye-towards-the-future system and the top management system. The problematic issue for future work is the need for bottom-up understanding, sideways understanding and senior management based strategy and organizational coordination where project teams are coordinated working in collaboration.

The main finding is the slow change in Telia and Telenor towards a real knowledge worker using more of his working time to significant business issues. We will get a framework where a professional knowledge worker is using his qualifications or what he is educated for and where his professional experiences and attitudes are used in a positive way for delivering excellent results. The framework for the future will be

ordinary people achieving extraordinary results in teams owing to their education, experiences, and attitudes.

According to Telia and Telenor, we will take the environmental issues much more seriously, and large corporation together with the dominating economic powers will make the necessary starting steps to save the world. The saving of the earth represents a concentration of both corporate and national power. Neither Telenor nor Telia plan to reduce the number of employees, but will deliver higher profits and much higher sales per employee. Neither Telia nor Telenor look upon the AI technology as a threat only as many possibilities.

This study concludes that there will be many small positive corporate and societal steps for each year towards 2030 improving the way we are living and working together with environmental improvements. The reconstruction of the middle class is also emerging — neither a perfect nor imperfect world.

Keywords: Future knowledge work, Innovation, Fourth industrial revolution, Robots, Automation, Artificial intelligence

1. Introduction

In today's increasingly, knowledge-intensive and turbulent economy organizations are facing new levels of uncertainty and ambiguity. To survive many businesses must become more flexible and adaptive of the future. However, they face an oxymoronic situation where efficiency calls for standardization and routinization, while effectiveness calls for flexibility and tailor-made solutions. In the literature, these considerations often are treated as separate streams of knowledge. For example, the KM literature has a bias in considering knowledge as a "thing" that should be distributed through digitalized processes, gaining efficiency through standardization (Beck 2016).

On the contrary, the literature about professional service firms (PSFs) pays attention to expertise and knowledge as social constructions. The workplace of the future is not a concrete "thing" but a creation based upon subjective speculations about the consequences of globalization and technology for how we are organizing work in the future. The first industrial revolution started in England (Taylor 1911); the second one began in the US with the birth of standardization and the mass market, globalization, technology, and logistics drove the third one while the fourth one will incorporate the second and the third revolution by adding workable artificial intelligence solutions, as well as life science inventions (Bravermann 1974).

This literature is about how robots and artificial intelligence will transform working life. Our purpose is to understand what the workplace of the future will be. The researchers investigating these issues are writing about substantial changes where robotics and AI will take over the work and where we will get a well-educated elite of 20-30% succeeding and where the job of the masses are threatened and where a sizeable portion of the workforce will be without possibilities for work. The erosion of the middle class is described as the future.

Once the dust has settled from the fourth industrial revolution, workplaces and professions might be unrecognizable. A new class is seeing the light of day: the precariat (Dignan 2019). We will live side-by-side with the "working poor" – people who have several jobs, but still can't make ends meet (Ehrenreich, 2001). There will be a small salaried elite consisting of innovation and knowledge workers. Workplaces will be unrecognizable. Robots will have destroyed bureaucratic hierarchies, and torn apart the middle classes. What will remain will be contract workers with insecure jobs. Concurrently, we are seeing the emergence of a new level of knowledge pajama-workers – people who can do their jobs in bed or at a café table. Slightly further into the future, we can see a significant transformation in professional environments. Doctors will be medical engineers; nurses will be nursing assistants accompanied by robots. Robots and holograms might be replacing teachers. Moreover, taking this scenario further, we see the downfall of the great dinosaurs. Robots might diagnose and prescribe.(Susskind 2016).

While the industrial society caused the middle classes to grow and live in greater comfort, there is much to suggest that the Fourth Industrial Revolution will decimate the middle class. The decimation of the middle class might lead to that power and authority takes over the arena of knowledge management.(von Hippel 2003)

We know that most jobs will change rapidly. Until now, educated people have been able to find employment. In the future, many educated people will not find jobs. It seems likely that most jobs will be those either at the bottom or the top of the wage scale. We will see the development of the precariat and the working poor, but also well-paid innovation workers and knowledge workers.

Robots and informants are causing changes in employment structures. Old jobs disappear, and people are laid off. The public and corporate sector are creating fewer fulltime jobs, but more part-time jobs. The experience will be a disrupted and transformed work life. These trends are a direct outcome of the transition to the fourth industrial revolution.

The increasing informational and knowledge-related content of jobs is an expression of the emergence of a new organizational logic, with its specific characteristics; Lego-flexibility. Lego flexibility means that the production chain is outsourced to several countries by a cost-, quality-, innovation-and-competence logistic. Experience design is an innovative management and organizational model, where the focus is on user experience in the processes and the coupling between the customers and the workers who do what the organization is designed to do, i.e., the people in the front-line. Also backoffice may be attended to from a design perspective on organizational work(Von Krogh 2000).

Any social system that fails to balance between stability and change and at the same time being innovative will not be able to steer the ship at a time of increasing complexity. We see the transition from information and intensive knowledge jobs, to an increasing demand for innovation intensive jobs (West 2018)..

Robots, nano-computers, and information will interact with each other permeating all areas of employment. We figuratively, imagine this as neurons communicating in the human brain. Familiarity with contexts and a direct "hands-on" contact required by

traditional industrial production will be less critical. The implications for educational institutions and their educational programs and methods are already apparent.(Zsiska 2018).

The robots, nano-computers in networks and informants, will be characterized by a tripartite organization. Firstly, the market is developed for robot operators who will not need background knowledge other than experience in the work they perform, i.e., they are skilled production workers and will receive the appropriate training. The traditional knowledge professions will secondly be developed by reinforcing and translate their knowledge base about the design and development of the informants. Thirdly, new disciplines and trades will be generated that model, build and maintain robotic machines, informants and nano-computers. Robots, artificial intelligence, and informants are giving rise to such momentous changes that it is difficult to envisage how working life will develop in the future(Turner 2000),

We have in this paper looked into what forms the knowledge worker in the future both on a corporate level and a societal level. The future might be 2025, 2030 or 2035. We have interviewed researchers working with these issues in the Swedish telecommunication company Telia and the Norwegian telecommunication company Telenor. These are both companies making their living of understanding the future both on a corporate level and a societal level. The researchers investigating these issues are writing about substantial changes where robotics and AI will take over the work and where we will get a well-educated elite of 20-30% succeeding and where the job of the masses are threatened and where a sizeable portion of the workforce will be without possibilities for work. The erosion of the middle class is described as the future.(Tuschmann 2011).

We have concluded that robotics and AI will be more advanced, but neither the way we are working nor the way we are organizing work will change much in the years to come. The processing of information and its meaning will be an even more critical work task either in itself or integrated into every work task. Every knowledge worker will have to try to see and think through what will be happening today and tomorrow. The past, present, and future will merge into a working reality. There will be dynamic scenarios together with the corporate, team and individual networks. Those grasping and understanding the situations working in professional and organizational networks will be the winners. They will be the bottom-up needed for corporate success still working in a top-down hierarchy delivering products and services through a global logistics. (Zuboff 1986, 2018).

We have seen the car industry produce three times as many cars with one-third of the workers in the last generation. There is a dismissing return in how much we can reduce the numbers of workers for AI, robotics, and logistics. Delivering education and health care will anyhow be a work demanding human employees. Providing services might be more automated, but will still be work demanding. There is no reason to believe that we neither have come to an end of the middle class nor the number of people working. There might be more flexibility in the work life, but in 2030 there will be more people working

than at any time and more people than anytime will be educated at all level(Tsoukas 1996)-).

Our proposition is the opposite of the literature:

- (1) The corporate changes owing to AI, robotics and new information and communication technology(ICT) will be much smaller than anticipated and done by a step by step change with more knowledge workers than ever implementing the changes over time
- (2) The environmental issues will be handled much more seriously both by larges corporations and large nations and global cooperating agencies starting the reducing of the global temperature and CO2 gases.

2. Originality and value of the study

The originality of the work is to set the agenda for a discussion of societal and corporate driving forces. The consequences for the future work will be described, analyzed and explored. The future knowledge scenario gives a platform for what might be the future for work and the implications of the development already in action. The idea of this paper is rooted in doubt about an essential part of the literature describe as happening towards 2030. We wanted to look into if these opinions about the future compared to how the frontrunners look into the future. We have identified the telecommunication companies as frontrunners of the future.

The research question of this paper is:

What forms the knowledge work towards 2030 on a societal and corporate level?

3. Design/methodology

The study is an explorative study using a survey study together with the literature along with own imagination and intuition. We have interviewed five professionals in the future research division of Norwegian Telenor (The world 7th largest telecommunication company) about their views of the workplace of the future. We have also conducted two interviews at the Swedish telecommunication company Telia. Future work-life department (The world 12th largest telecommunication company). The interviews were conducted in March 2019. We are comparing the empirical data with the results from the literature.

4. Corporate findings

We can summarize the findings from Telenor and Telia in three sections. Both companies state the need for knowledge about different future scenarios, a dynamic understanding of the market, and the importance of corporate and professional networks.

4.1 The dynamic sharing economy of the future

1. Scenarios of the future. The future scenarios are including a plot of continuing as before, the worst scenarios and the best situations and the consequences of these scenarios. The scenarios are the eye towards the future every company needs.
2. A dynamic understanding of the market and the development of the market. There will be different aspects of the market, and there will be a reused market supporting the sharing economy. There will be a high-end delivery on demand of the most advanced solutions where the key employees form the future together with key customers. The communication here will be a bottom-up connection both to the eye-of-the-future department and the top management group.
 - (a) A product-network-service delivery as today.
 - (b) Second-Hand product delivery is reusing products. The reused and sharing part will be made to meet the demand for reusing smartphones and tablets.
 - (c) An on-demand market delivering advanced tailored products and services, The key employees will be working with them on the demand market, and their understanding of the offerings and customers will be essential for Telenor.
3. Networking platforms where there will be many individuals, team, corporate and professional networks relating to each other. The systems will both be including and excluding members.

Grounded in these three premises – of scenarios, dynamic markets and networking platforms, we elaborate why and how they may unfold in the future work organizations.

4.2 The future corporate systems

1. The eye towards the future or data analyzing as information and knowledge will be extreme essential to survive.
2. Bottom-up key employees are working for the on-demand market.
3. Kaizen team system is linking system 1 and 2 to mode 4.
4. Top-down managers are making the right decisions, choices, and strategies. The engaging story is needed to make the strategy into reality.
5. Coordination of all activities
6. Specialization for on.demand deliveries of high-tech products and standardization for traditional products and services working hand-in-hand.
7. A second-hand market of products and services reusing products
8. Networking platforms are linking Telenor and their professional employees together with a global political, economic, social and technical trends.

4.3 The future workplace

The employees in the foreseeable future will be working smarter and greener accepting new technology like robotics, and digitalization AI solutions. The findings on individual level may be summarized in 22 issues.

The future in this kind of portrayal is brighter for knowledge workers than anything seen or documented anytime. Zooming into what is already in the making, according to informants in Telenor and Telia, we may capture brighter and darker sides, which both are worth unveiling.

1. Most employees in Scandinavia will be educated Bachelor, Master and Doctoral degrees. The whole workforce will be well educated, and there will be a collaboration with the best global educational institutions for employing and training the best students.
2. The employees will be working in teams either on-site or virtually. The collaboration will be a critical success factor.
3. There will be an administrative and a professional pipeline not as today to secure only the best management, but to secure that the professionals have their pipeline.
4. The working language will be English, but employees with foreign languages and different cultural backgrounds will be in demand.
5. The employees will be working greener including traveling less and thinking greener and smarter for all services and products. The critical professional story will be working smarter and greener.
6. Loyalty, trust, engagement, and discipline will be even more critical than today. To both keep and recruit professionals with these attitudes will be important.
7. The employees may need more leadership (follow up and directions along which to work) and less management (control), but it may unfold in virtual and distributed ways. The leaders must both be charismatic and visionary and have authority. To be able to tell the corporate story of the future, pictures and animation will be an essential leadership attitude.
8. The working hours will be more flexible with the possibility to work at different sites and hours.
9. Solution and results will be a reward in itself where the team will be more rewarded than today. The conclusion is that more knowledge-based employees perform on itself, but are more satisfied with a team performance reward.
10. The employees will have to be able to govern their availability to avoid out burn and stress.
11. There will be no (or less) single offices, but common workspaces for sharing and collaboration.
12. There will be more single women and single men working for Telenor while there will at the same time be more possibility for parents concerning daycare and flexible hours.
13. There will be no (or less) parking spaces, but everything will be based upon walking, biking and traveling through public transportation.
14. Continuous internal and external executive education will be demanded. There will be certificates for finished executive education.
15. The workplace will be more aesthetics and artistic decorated for inspiration. Art management will include well-decorated workplaces.

16. There will be entrepreneurial and innovative corporations in the company circulating employees through creative work sites.
17. The managers will be recruited through internal success and less through external success.
18. Social and emotional competence will be in higher demand.
19. Solution oriented team project working people will be necessary.
20. Telenor and Telia will be open for more and more nationalities and diverse backgrounds.
21. There will be more women as middle managers and top managers. Women are dominating all professional educations in Scandinavia, and by 2030 they will have passed the 30% level both as middle managers and senior managers.
22. Change and transformation leadership will be more important than transaction leadership.
23. The project organization form will dominate with less permanent organizational forms and more short-term organizational forms.
24. The top management team will be a temporary task force trying to use the task force form to be more innovative.

Concluding the 22 changes, adaption and adjustments there is nothing revolutionary in any direction. Work life will slowly adjust to a changing reality. We will see knowledge workers concentrating on their knowledge, experiences, and attitudes. We will see ordinary knowledge workers deliver extraordinary results.

The future of knowledge work design and content is brighter than at any time.

4.4 The future world perspective

Schein (1993) is pointing to the foundational but difficult to grasp world view in any organizational culture. Telenor and Telia have divided their world views into four possibilities for 2030. The four chances are brief scenarios with powerful consequences for Telenor and the world:

1. The red digitalized world dominated by small entrepreneurs and innovators stretching the AI possibilities beyond anything seen so far. Telenor will need to identify these smart corporations for understanding, cooperation, and buy-ups.
2. The blue corporate world dominated by large corporations like Apple, Microsoft, Amazon, and Telenor. These corporations will both define the future, take all benefits and through global governance dominate regions and nations. The smaller corporations will be mergers and buy-ups.
Telenor is the 7th largest telecommunication corporation in the world today and will have to work to become one of the five dominating corporations in telecommunication.
3. The yellow human world where ethics, sustainability and sharing with local, regional, national and over national agreements for a more rational and democratic society. The humanistic perspective.
4. The green world with over governmental units (EU, UN, OECD, IMF, WTO, etc.) and large nations supporting environmental and climate issues. Green

decisions will bind both corporations and countries. The decisions will be needed to bring the climate issues under control.

5. Discussion

Telenor and Telia like most of the literature reported have no clear cut opinion of the future defined as 2030. There is insecurity with a lot of options or possibilities. Perhaps we will be continuing doing more of what we are doing today. Most of the technology development and AI literature are saying the opposite.

We might be seeing the industrialization of knowledge work with stronger control systems at all levels. There will be many people without work through the phase of robotics, and according to traditional Marxististic analyses, they will press down the wages. The globalization will make the competition for job stronger.

On the other hand, the more technology and AI-based the economy become the more knowledgeable employees we need. We will need people with knowledge (i.e., excellent education), experiences and the right attitudes. The robotics and AI might give a working market where there will be a higher demand for perhaps one-third of the workforce.

One-third of the workforce will provide us with manual production and services. One third might be without work and as the best solution paid a form of low public salary.

Telenor's solution will be a blue corporate world producing and delivering more than anytime with a green world taking care of the climate and public services. A yellow world with humanity and dignity together with a green world might be a utopia. A red world with smaller entrepreneurs and corporations delivering frontend technology changing the power of the large corporations might be a solution. We have concluded that the work of the future might not be as different from today as many predict.

Loyalty, discipline, trust, and engagement will still be in high demand. Project organizing and agility have been working well for a generation, and we have seen the less and less permanent organizational structure, as already suggested by Mintzberg (1979).

We have on one side literature describing the coming changes as a revolution for the way we are working and organizing (Dignan, 2019) while the more empirical research work from researchers living the differences tell us about a future very much like the situation today. There are not any changes in the development of larger global corporations with more power and more employees, although Chinese data-bases are reaching a critical mass of data, expertise, talent, and capital. The concentration called blue development by Telenor will continue.

The dominating economic blocks and countries will probably still be China, USA, EU, Japan, South Korea, and the UK. There will however be a more significant focus upon environmental issues including global decisions relating to the global temperature and the carbon use. The larger corporations will support these issues to a greater degree and contribute to a greener world for all of us if alerted and also enabling practices to find new ways.

Concluding highlights

The future looks bright from a perspective of the two leading Scandinavian telecommunications corporations. We will gradually adjust step by step towards 2030. The consequences of AI, robotics and information technology will be manageable. Scandinavia already works as a testing ground for new technology and knowledge intensive products/services due to its high penetration of education, distributed wealth, technological adoption and expected trust towards others. The individual qualifications are increasing for knowledge (formal education). Experiences and most of all the right professional work attitudes. Social and emotional skills for teamwork will be even more critical. We will at the Scandinavian arena have more than 50% women as middle managers and top managers-

The eye-towards-the-future analyzing the future will be crucial for all corporations.

Bottom-up communication from those handling the most advanced customer needs will also be crucial.

The future analytical studies must be linked to the bottom-up and top-down management to be able to coordinate all the activities of the corporation. More and more of this coordination will be organized in temporary teams and projects. Less and less of the organization will be permanently organized, and even the leader teams might be temporary task forces.

The large corporations like Telenor and Telia will be much more concerned about environmental issues. Working greener and smarter will be important issues. The cooperation with regions, nations and over national units will be much stronger trying to improve the environmental matters for customers and their organization.

6. Future framework

We have found that one key for any organization in the future will be an analytical eye-toward-the-future where anything happening is analyzed and reported to the top management and coordinated into future deliveries. The key employees will be those implementing AI-based products and services on demand to advances customers. They will have a bottom-up understanding that is not yet common in the eye-towards-the-future system and the top management system. The problematic issue for future work is thus the need for bottom-up understanding, sideways understanding and senior management based strategy and organizational coordination where project teams are coordinated working in collaboration.

The main finding is the slow change in Telia and Telenor towards a real knowledge worker using more of his/her working time to significant issues. We will get a framework where a professional knowledge worker is using his/her qualifications or what s/he is educated for and where his/her professional experiences and attitudes are used in a positive way for delivering excellent results. The framework for the future will be ordinary people achieving extraordinary results owing to their combinations of education, experiences, and attitudes, as well as becoming part of a right project. It will however also be creative specialists ("talents") and entrepreneurial groups meeting in workshops,

cafes, coworking spaces and elsewhere, in and across organizational boundaries. The future of knowledge work is giving people the opportunities to deliver excellent results and to be rewarded for these results as a part of their team. To make ordinary people as well as talents actually produce extraordinary results in groups is the future and knowledge work.

7. The way ahead

The research needs to be expanded to different sectors within production and services. Tele- and communication corporations are representing a knowledge-intensive service that might be compared to future views within finance, shipping, property, consulting and ICT service corporations. The results might be different or similar. There are many opinions about the future and all changes that will be made by AI and robotics

References

- Beck, U. (2016) *The Metamorphosis of the World: How Climate Change is Transforming Our Concept of the World*. 1st Edition. Cambridge: Polity Press.
- Braverman, H. (1974) *Labor and monopoly capital : the degradation of work in the twentieth century*. New York: Monthly Review Press
- Dignan, A. (2019) *Brave New Work: Are You Ready to Reinvent Your Organization?* Penguin.
- Ehrenreich, B. (2001) *Nickel and Dimed: On (Not) getting by in America*. New York: Henry Holt & Co.
- Mintzberg, H. (1979) *The structuring of organizations*. Englewood Cliffs, N.J: Prentice Hall.
- Schein, E. (1993) On Dialogue, Culture, and Organizational Learning. *Organizational Dynamics* 22(2): 40-51.
- Susskind, R. and Susskind, D. (2016) *The Future of the Professions: How Technology Will Transform the Work of Human Experts*. Oxford: Oxford University Press.
- Taylor, F. W. (1911) *Scientific management*. Westport, Conn.: Greenwood Press.
- Turner, V. (1974) *Dramas, Fields, and Metaphors: Symbolic Action in Human Society*. Ithaca, Cornell: University Press.
- Tushman, M., et al. (2010) Organizational designs and innovation streams. *Industrial and Corporate Change* 19(5): 1331-1366.
- Tsoukas, H. (1996) "The Firm as a Distributed Knowledge System: A Constructionist Approach." *Strategic Management Journal* 17: 11-25.
- von Hippel, E. and von Krogh, G. (2003) Open Source Software and the 'Private-Collective' Innovation Model: Issues for Organization Science. *Organization Science* 14(2): 209-223.
- Von Krogh, G., et al. (2000) *Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation*. Oxford: Oxford University Press.
- West, D. M. (2018) *The Future of Work: Robots, AI, and Automation*. Washington D.C.: The Brookings Institution. World Economic Forum (2018).
- World Economic Forum (2018). *The Future of Jobs Report*. <https://www.weforum.org/reports/the-future-of-jobs-report-2018> (accessed 04.04.2019).
- Ziska, F., Ed. (2018) *Handbook of Research on Information and Cyber Security in the Fourth Industrial Revolution*. Hershey, PA, USA: IGI Global.

Zuboff, S. (1988) In the age of the smart machine: the future of work and power. New York, Basic Books.

Zuboff, S. (2018) The technology revolutions revisited, MIT Press, Boston.

A Model for Profiling Information and Knowledge Management in the Public Sector

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Abstract

In the modern society organization's ability to manage its information and knowledge resources is critical. The purpose of this study is to design and test a profiling model for information and knowledge management, which can be used both for frequent monitoring for trend analysis and in-depth analysis of factors supporting contemporary knowledge and information management practices of the organization. The proposed model combines the aspects of knowledge-based management and information management and it is developed by following design theory principles. The model is designed for public sector, especially for those organizations, which purchase and are responsible for the provision of public services. These organizations are in a critical role in developing and aligning information and knowledge management practices of regional ecosystems. They also serve as employer for great number of knowledge workers regionally. It can be argued that this kind of maturity model can also support the performance of knowledge workers operating in the public sector as it offers a route towards the development of more functional information and knowledge management practices within and across the public organisations.

Keywords – Knowledge management, Maturity model, Performance, Information management, Public sector

Paper type – Academic Research Paper

1 Introduction

In the recent decades, maturity models have been presented in many different managerial fields such as information management, strategy management, and performance management (e.g. Aho, 2012; Becker et al., 2009; Jääskeläinen and Roitto, 2015; Kruger and Johnson, 2010; Van Aken et al., 2005; Wettstein and Kueng, 2002). These models have been designed both for managerial and academic purposes. At best, maturity models can increase the understanding on the status of current management practices and supports in identifying strengths and most critical development areas (Jääskeläinen and Roitto, 2015). They are also powerful tools supporting benchmarking between organizations or networks with comparable criteria. There is indication in the literature that maturity models can improve the performance of organizations (Bititci et al., 2015) by presenting desirable characteristics for operating, leading usually also to better work satisfaction and work performance. Maturity models may also evaluate the ability of organizations to manage knowledge in networks and ecosystems.

There are a few existing maturity models for knowledge and information management (e.g. Hsieh et al., 2009; Pee and Kankanhalli, 2009; Poepplbush et al., 2011, Teah et al., 2006). This study contributes by combining the existing models and linking them to the established information process management model by Choo (2002). Consequently, the paper adds to the literature by balancing the technical aspects of information management and performance measurement (cf. Van Aken et al., 2005; Wettstein and Kueng, 2002) with factors supporting organizations and ecosystems to adopt new knowledge-related technologies as well as factors supporting the actual usage of those technologies.

The purpose of this study is to design and test a maturity model for information and knowledge management. The evaluation part of the model is based on a survey, which can be implemented through both interviews and a questionnaire. The model is designed for public sector, especially for the organizations, which purchase and are responsible for the provision of public services. These organizations are in a critical role in developing and aligning information and knowledge management practices of regional ecosystems. They also serve as employer for great number of knowledge workers regionally. It can be argued that this kind of maturity model can also support the performance of knowledge workers operating in the public sector as it offers a route towards the development of more functional information and knowledge management practices within and across the public organisations.

2 Methodology

This study utilizes design science approach in which the intention is to both develop scientific knowledge and solve practical problems (Andriessen, 2004; Van Aken, 2007). In design science, the effectiveness and validity of proposed solutions are evaluated both by researchers and users in the field of model application. The study follows process model for designing maturity models based on design science approach (de Bruin et al., 2005) presented in the figure 1. This research follows the first four steps of the figure.

In the first phase, decisions regarding purpose and focus of the model are made. The model is developed to support the information and knowledge management of public sector organizations organizing service provision in social and healthcare sector. Thus, the focus of the model is domain specific, focusing on information and knowledge management process in public sector. The main purpose of this model is to provide description about the state of information and knowledge management in organizations operating in this sector, i.e. the model is viewed as a diagnostic tool in order to identify development needs. Thus, the model is not just descriptive, but entails also prescriptive elements.



Figure 1 Main phases in constructing a maturity model (adapted from de Bruin et al., 2005)

The design phase includes the decisions regarding audience and respondents, and methods of application. In this research, managers and experts responsible for information and knowledge management in organizations purchasing public services were chosen as a target informants of the research. Because the major purpose of the model is to provide understanding about the state of information and knowledge management of an organization in order to support internal development (by identifying development targets), self-evaluation including 5 point Likert scale was chosen as method of application.

In the third phase it is necessary to identify what needs to be measured in the maturity assessment (content) and how this can be measured. In this phase, the construction of the model proceeds with the definition of evaluation main perspectives and variables of the model and implementation plan. The evaluation variables identified were classified into two main perspectives: information and knowledge management and user satisfaction regarding the main components of information and knowledge management. The design and content of the model synthesizes earlier literature. The basic framework extends the information process management model by Choo (2002). The framework established focal themes of information and knowledge management. This section is described in more detail in sections 3.2. and 4.1.

This paper will also report the testing phase of the model, which is conducted by the potential users. First, a web-based survey based on the profiling model was carried out in nine organizations in three different Finnish counties in order to evaluate the state of the information and knowledge management. Second, the results of the analysis and feedback related to the model and its usability was collected in focus group interview in one large participating organization. This phase is described in section 4.2.

3 Theoretical premises of the profiling model

3.1. Maturity models

The maturity model idea has been widely spread to different management areas, such as process management and performance management (Bititci et al., 2012). Maturity model can be seen as an umbrella concept, which is divided into three different parts (Jääskeläinen and Roitto, 2014). The maturity model framework defines the evaluation variables to be measured. Maturity model instrument defines how these variables are measured. The maturity profile is the overall status of an organization, which combines the information gathered through the maturity model instrument.

Maturity concept is often considered ambiguous. When formal systems such as information systems are examined, similar terms include the level of sophistication (e.g. Evans, 2004), the level of completeness and scope (e.g. Evans, 2004; de Waal et al., 2009) and the evolution-phase of the examined systems (e.g. Speckbacher et al., 2003). Another viewpoint to maturity is the relevance of examined processes or systems for managers (Hatry, 2006) which is the eventual test for the usefulness of information and knowledge management systems, practices and models. This also relates to the context in which the examined process or system is used. Therefore, it has also been proposed that employee satisfaction towards the examined system or process should be included in the maturity analysis (Jääskeläinen and Roitto, 2014).

Since the model design considers maturity as a multidimensional concept, we decided to use the term profiling model instead of maturity model in order to emphasize the importance of combining the dimensions of maturity level and employee satisfaction. This approach is also in alignment with the performance measurement profiling model by Jääskeläinen and Roitto (2014).

This research considers the maturity of information and knowledge management as a three-way phenomenon consisting from the level of scope, sophistication, and satisfaction towards the system. These aspects combined give an extensive overview of information and knowledge management in the organization. However, these three aspects cannot be ranked in order of importance. In this study, the scope is defined according to the original framework (Choo, 2002). Sophistication is related both to the information system sophistication (Salleh et al., 2010) and the possibility to provide and utilize information in a more detailed way (Schläfke et al., 2013).

3.2. Information and knowledge management framework

The profiling model takes into account the whole spectrum of information and knowledge management. Thus, it includes the more technical side of information handling and the softer side of humans related to knowledge, but it also takes into account both the viewpoints of the employees and the organization. In other words, we define information and knowledge management as systematic process that support both the employee's work and the competitiveness of the organization by integrating technology and human aspects together. As Lake and Erwee (2005) have stated, information and

knowledge management is about of finding, selecting, organizing, distilling, and presenting information in a way that improves an employee's understanding within the work context. Furthermore, it also enhances organizations to gain insight and understanding from its own experience and data sources, and support utilization of knowledge in problem solving, decision making and strategic planning. (Lake and Erwee, 2005)

In order to follow this rather comprehensive definition of information and knowledge management, main framework as the bases for the model was defined. Firstly, the general information process management model (Choo, 2002) was selected as the backbone of the framework in order to capture the information processing phases of employees. This model is generally applied in information management field as it includes general phases that are needed in information handling, such as gathering, organizing, storing and utilization. Secondly, this information management process viewpoint was supplemented by the general guidelines of master data management (MDM) in order to include more organization level goals for insights and understanding to support decision making and strategic planning (Lake and Erwee, 2005). The main framework for the profiling model construction is presented in figure 2.

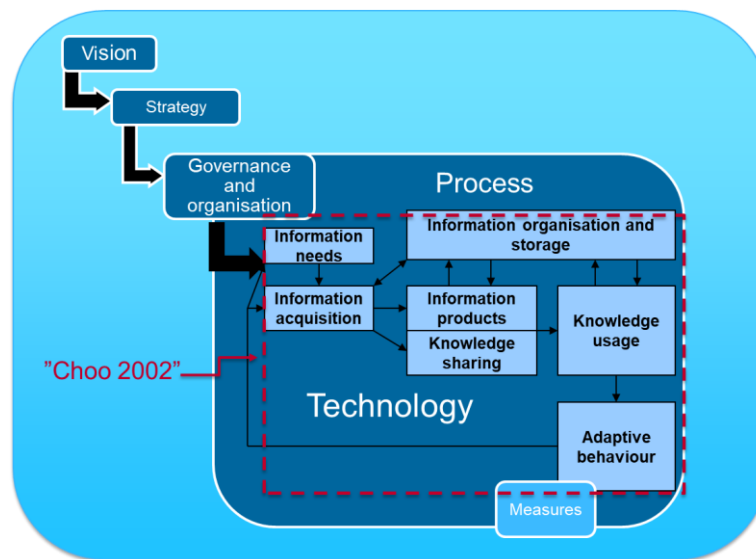


Figure 2. Main framework of information and knowledge management used as the bases for the profiling model construction. (Based on Choo, 2002)

3.3. Overview of existing maturity models in information and knowledge management

The reviewed models vary in their background, research fields, and implementation areas. This section overviews the models by presenting their varying characteristics.

The scope of the model was intentionally large since this paper aims at presenting an overarching maturity model of information and knowledge management. However, even within a more specific sub-field such as performance management the scope of models

varied from the content of measurement systems (Cocca and Alberti, 2010; Van Aken et al., 2005; Wettstein and Kueng, 2002) to the use of measurement information in management (Aho, 2011). Most of the models appear to be segmented to any organization – with a few exceptions such as the model by Cocca and Alberti (2010) intended for SMEs and the model by Brooks et al. (2015) designed for health care.

The execution of the models is designed either for interactive assessment in a small set of firms (e.g. Khatibian et al. 2010; Teah et al. 2006) or large surveys for the self-assessment of employees (e.g. Tung et al., 2011; Jääskeläinen and Roitto, 2014). The evaluation instruments varied between the reviewed models. 9 studies utilized a traditional survey with likert scales, 6 studies presented a maturity grid for the evaluation of maturity levels in selected areas (typically 10 or less) and 2 relied on the hybrid of the two former evaluation approaches. Some of the studies did not clearly present how the presented aspects should be evaluated.

Half of the presented models were not tested in practice. Notably, none of the reviewed information management/system models was tested in practice. The way of testing varied from single case studies to large scale surveys. Studies implementing and testing the presented models included the following:

- Aho, 2011, Jääskeläinen & Roitto, 2015, Marx et al. 2012; Wettstein & Kueng, 2002; Tung et al. 2011 (performance management models),
- Hsieh et al. 2009; Khatibian et al. 2010; Kruger and Johnson 2010; Pee and Kankaanhalli 2009, Teah et al. 2006 (knowledge management models),
- Lahrman et al. 2011, Popovitch et al. 2012 (business intelligence models).

This study intentionally concentrated on the models presented in the academic literature since the aim was to design an overarching model which could be utilized as a survey. This excluded several models with consultative background, such as Capability Maturity Model (CMM and CMMI) in information management. The consultative models typically present a concise list of assessment factors (up to ten) which are then evaluated by using grades with written descriptions fitting into one A4 page.

4 Defining the design and content of the model

4.1 Selecting critical variables from the existing literature

The design work started by reviewing the literature. Google scholar search was used to identify existing maturity models in the area of information and knowledge management. Search terms maturity, maturity model, effective, effectiveness were used in different fields. These fields included information management, information systems, knowledge management, knowledge-based management, performance management and business intelligence. 24 suitable publications were found in the following fields:

- information management (1 article)
- information systems (1 article)
- knowledge management (7 articles)
- knowledge-based management (no hits)

- performance management (9 articles)
- business intelligence (6 articles)

The analysis of articles was conducted by three researchers. Both the characteristics of the articles and their content were analyzed. The descriptive analysis included the type of the article (literature review, empirical analysis, model presentation) and evaluation type of the model (e.g. maturity grid, likert-scale). Content wise the main task was to identify critical variables included in the existing models which could fit into the main research framework. In the first phase the fit between the framework and the reviewed models were analyzed. It was found that the framework can be successfully used to select and focus the variables from the existing literature, although the concepts and terms were sometimes different. Adjustment of the terminology to the original framework was carried out jointly by the three researchers. It is notable that not all of the identified studies were eventually used since they did not always present a framework for maturity analysis, the model did not fit properly in our framework, or the article did not present the actual content of the model. It was found that of 16 studies presented a new model, 3 used an evaluation tool for empirical analysis related to information and knowledge management, 4 were purely literature reviews (eventually not presenting any model) and 1 examined the benefits of maturity models in management. It was a bit surprising how few studies openly presented the content of the discussed models.

The variables were selected based on their recurrence in the reviewed studies, empirical testing, and the diversity and extent in the light of the perspectives of the framework. It was deemed important that a balanced number of evaluated aspects can be identified for different perspectives of the model. The three researchers first carried out independent work followed by the synthetization of results. Overlapping variables were combined and the correct perspectives for each variable was determined. At this stage 54 different variables were identified. Although, the list of variables was deemed as mostly appropriate, it was seen as too extensive to be implemented in the practice. Next phase was to prioritize the list of variables. After the commentary of larger researcher group (total of 8), the number of critical variables narrowed down to 25. The end result is presented in table 1.

Table 1 Main perspectives and variables of the model

Main perspective of the framework	Critical variable	Source
Vision and strategy	Existence of knowledge management strategy and targets	Aho, 2011; Brooks et al. 2015
	Strategic alignment of knowledge management	Aho, 2011; Lahrman ym., 2011
	Extent and significance of knowledge management	Lahrman ym., 2011; Teah et al., 2006
	Systematic approach to the development of knowledge management	Aho, 2011; Lahrman ym., 2011; Van Aken et al., 2005; Teah et al., 2006; Wettstein ja Kueng, 2002
Administrative structure and organization	Top management support	Brooks et al. 2015; Jääskeläinen & Roitto, 2015; Lahrman ym., 2011; Pee and Kankaanhalli 2009; Teah et al. 2006, Tung et

		al., 2011
	Commitment of employees	Jääskeläinen & Roitto, 2015; Tung et al., 2011
	Expertise and knowledge of employees	Aho, 2011; Becker and Knacksted, 2009; Lahrman ym., 2011; Popovic ym., 2012
	Resources	Van Aken et al., 2005
Information needs	Identification of information needs (e.g. link between technology and management needs, needs of different stakeholders)	Aho, 2011
	Understanding of information needs	Aho, 2011
Information acquisition	Information gathering and availability	Teah et al. 2006; Van Aken et al., 2005
	Availability of information	Aho, 2011; Jääskeläinen & Roitto, 2015; Popovic ym., 2012
	Overall satisfaction towards the main perspective	
Information organization and storage	Enterprise architecture	Aho, 2011; Lahrman ym., 2011
	Data storage in information systems	Aho, 2011; Jääskeläinen ja Roitto, 2015; Wettstein & Kueng, 2002
	Data integration	Becker and Knacksted, 2009; Brooks et al. 2015; Marx et al., 2012; Lahrman ym., 2011, Popovic ym., 2012
Information products and services	Information systems supporting reporting and analytics	Aho, 2011; Jääskeläinen & Roitto, 2015; Marx et al., 2012; Popovic et al., 2012
	Overall satisfaction towards the main perspective	
Information distribution	Communication of information	Aho, 2011; Wettstein & Kueng, 2002; Teah et al., 2006; Van Aken et al., 2005
	Real time delivery of information	Aho, 2011; Popovic et al., 2012; Van Aken et al., 2005
Information use and adaptive behavior	Performance management process	Aho, 2011; Marx et al., 2012; Popovic et al., 2012; Wettstein and Kueng, 2002
	Information use in decision-making	Aho, 2011
	Information use in resource allocation	Jääskeläinen & Roitto, 2015
Performance measures	Link between measures and strategy	Aho, 2011; Jääskeläinen ja Roitto, 2015; Van Aken et al., 2005
	Scope of measures	Aho, 2001; Jääskeläinen ja Roitto, 2015; Marx et al., 2012; Tung et al. 2011; Van Aken et al., 2005; Wettstein ja Kueng, 2002, Pee and Kankaanhalli, 2009
	Quality and reliability of measurement information	Aho, 2001; Jääskeläinen ja Roitto, 2015; Popovic et al., 2012
Outcomes	Performance outcomes of knowledge management	Lahrman et al. 2011

It can be seen that not all of the perspectives include the same number of variables. It was especially difficult to identify variables for the information needs perspective.

Satisfaction towards each perspective was added to the model due to the definition of maturity for the designed model. It was not included in the variables of the reviewed models, although the model by Jääskeläinen and Roitto (2014) included the same idea of evaluating the satisfaction for the two main perspectives of their maturity model.

4.2 Testing the model

First, the model was tested with a self-evaluation survey. A web-based survey based on the profiling model was sent to 109 upper managers (excl. political management), middle managers responsible for information and knowledge management and ICT-expert respondents in 9 Finnish public sector organizations, mainly in social and healthcare sector. Altogether 37 persons responded to the survey, resulting in the response rate of 34%.

In the survey, respondents were asked to evaluate statements related to critical variables of the profile model by 5-point Likert scale. Survey included 95 statements. In the survey, respondents were not forced to choose option in Likert scale, but they had possibility to select 'not able to answer' or '?' if the evaluated aspect appeared ambiguous. In addition, in each section, respondent were asked to give feedback about each section of the survey (open-ended sections).

Around 9-30% of respondents gave feedback about the survey, either concerning main perspectives or the survey as a whole. The authors analyzed the open-ended feedback, and made some modifications to the survey. Based on the feedback, sections 'Information use' and 'Adaptive behavior' were combined into one section 'Information use and adaptive behavior'. This modification needs to be acknowledged when analyzing results, since originally each main perspective is based on the framework of the model. In addition, focal concepts of the survey (data, measure, measurement, measure information, knowledge management) were defined more specifically and the phrasings of couple of questions were modified. Two questions were also removed from the survey.

Respondents had opportunity to assess the overall usability, validity, relevance, clarity and practicality of the model. Most of respondents (65%) regarded the survey as comprehensive and valid tool for evaluating the state of KM. However, usability, relevance and clarity scored lower (41 – 46%). Based on comments, this was due to the length of the survey, and lack of shared definitions of central concepts as mentioned earlier. However, the average response time was 15 min as planned, and it can be regarded as rather normal for a survey-based tool.

In the second phase, testing was carried out in a focus group interview in one large participating organization. Altogether 6 persons in managerial positions (either top management or middle management) in the field of information and knowledge management, ICT and general management participated the focus group interview, where the results of the analysis and feedback related to the model and its usability was collected.

According to participants, the survey forms a solid picture of information and knowledge management in an organization and specifies various competence areas needed for knowledge and information management, i.e. ICT, measurement and

management. Results described the KM state of organization quite well reflecting validity of the tool; for example, low scores in section ‘Information organization and storage’ was not surprise, but rather a well-known issue in the organization. Survey was considered as a good tool to describe the current, (as-is) state of information and knowledge management, serving as a basis for discussions and identification of development needs. Hence, its relevance was seen as high.

Participants were interested to see overall results of the survey (comparative data form all participating organizations) for benchmarking. When comparing results, some limitations of the method (self-assessment) were identified. For example, the organization’s scores were relatively low compared to others, even though they are known for their efforts in KM development. This may be due to high standards of respondents in the organization making them more critical than other organizations evaluated. Hence, one potential approach for using the survey could be an auditing approach where trained auditors evaluate different organizations with well-specified instructions and specifications supporting the model. In this way, benchmarking of results would be based on more consistent evaluation results.

5 Results

This study describes the design of a profiling model for information and knowledge management, which provides description about the state of information and knowledge management in organizations in order to identify development needs. Thus, the important aspect in the use of the presented model is the comparison between evaluated maturity level and employee satisfaction in the each main dimension of the model. In this purpose, for example the averages of survey responses can be used as shown in the Figure 3. The results presented in the figure are based on the data gathering during the testing of the model. This comparison enables the evaluation of the purposefulness of different development areas and prioritizing development objects. The following figure along with the table illustrates the idea.

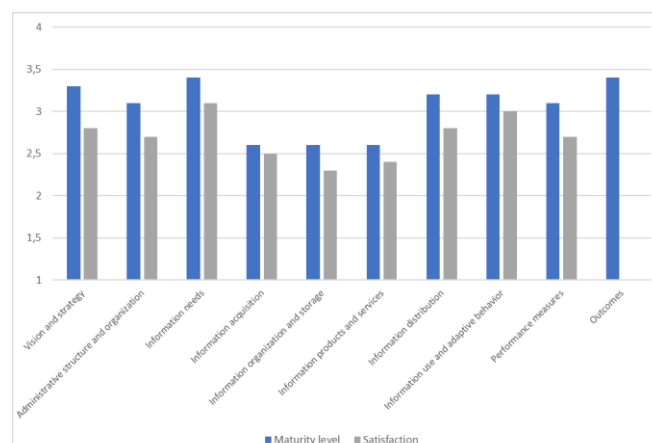


Figure 3 Illustration of results in different perspectives of the model

Table 2 presents an example of interpreting the results including four different maturity profiles based on different combinations of maturity level and employee satisfaction. The profiling can be based on the averages of Likert-scale (1-5) results in different areas of the model. For example, results above 3 can be interpreted as high satisfaction or advanced practices and vice versa. This threshold can also be decided based on the gathered data in order to reach a meaningful amount of responses in different profiles. If the model is used in benchmarking, also the difference in the results can be used in determining the thresholds for different profiles.

For example, if organization's information and knowledge management practices and satisfaction are both scored low, as in 'Information acquisition', 'Information organization and storage' and 'Information products and services' in the Figure 3, organization can be regarded as 'Novice' related to these perspectives, and these areas should be high priority development targets.

Table 2 Example of interpreting the results of the model

High employee satisfaction and basic information and knowledge management practices "Facilitator" <p>The organization is able to take the most of the current information and knowledge management practices. The basics of information and knowledge management are covered. This area should not be prioritized in development work.</p>	High employee satisfaction and advanced information and knowledge management practices, "Advanced exploiter" <p>This is the desired situation in most cases. The information and knowledge management practices are advanced and the organization is able to exploit them fully.</p>
Low employee satisfaction and basic information and knowledge management practices, "Novice" <p>The examined area is as a whole at the rather primitive level. This area should be prioritized in the development work.</p>	Low employee satisfaction and advanced information and knowledge management practices, "Experimenter" <p>Information and knowledge management in this area is characterized by the development and experimenting of novel models and systems. However, the organization has not invested in taking the new ideas and system into use. It may also be that the developed systems are not serving the needs of employees.</p>

In this study, the profiling model was considered as a comprehensive and valid tool to determine the state of organization's information and knowledge management and identifying development needs. The primary purpose of the model is to function as a diagnostic tool implemented by self-evaluation survey. However, potential users of the model underlined the need for comparative information. If the model is used for benchmarking purposes, the use of trained auditors to conduct the evaluation in a consistent manner would increase the reliability of results.

6 Conclusions

Overall it can be concluded that there are no established academic models for maturity analysis of information and knowledge management. Although different models have been presented in the literature, surprisingly few have been tested and implemented in practice. In addition, the models do not present an overarching view to knowledge and

information management process and the choice of evaluation perspectives is not always clearly justified. There was therefore room for the new model presented in this study. More specifically, the presented model aims to fill the following gaps in the literature.

Most of the existing maturity models have the assumption that more is better, i.e. it is always desirable to obtain more sophisticated technologies and practices (Marx et al., 2012; Wettstein and Kueng, 2002). The model developed in this study creates maturity profiles which combine satisfaction of employees and the maturity of practices. By capturing satisfaction, the designed new model highlights purposeful objectives of developing information and knowledge management. It acknowledges that also lower maturity levels can suffice if employees are satisfied. In this way the model takes different contextual criteria for information and knowledge management practices into account.

This study contributes by testing the designed model. Many models have been applied as interactive audits in single cases (Bititci et al., 2012) while more extensive empirical data and testing is often lacking (Marx et al., 2012; Tung et al., 2011). Most of the existing models are generic and not segmented to specific types of industries. Implicitly they support the purposes of private companies. This study contributes by segmenting the model for the public sector. Models originating from the consultancy may be straightforward to use but such models lack theoretical foundation and are derived from an arbitrary design method (cf. Marx et al., 2012). This study aims to find the right balance between academic rigor and practical relevance.

This study identified a need for various versions and uses for the profiling model. Different versions of the model will serve two different purposes management: shorter version for frequent monitoring for trend analysis of factors supporting contemporary information and knowledge management. Longer version provides more in-depth information explaining the potential causes of changes in the results. Self-evaluation survey works as a diagnostic tool, whereas evaluations conducted by external auditors serve benchmarking purposes.

This study also provides a new kind of model for the management of knowledge workers. Earlier studies on the information and knowledge management maturity have not captured the satisfaction of knowledge workers, which eventually determines whether the information and knowledge management systems and practices are beneficial for the organization. The presented model enables that the perspective of individual knowledge workers can be taken into account in determining the objects of improvements.

References

- Aho, M. (2012), "What is your PMI? A model for assessing the maturity of performance management in organizations", PMA 2012 Conference, Cambridge, UK, July 11-13.
- Andriessen, D. (2004), "Reconciling the rigor-relevance dilemma in intellectual capital research", *The Learning Organization*, Vol. 11 Nos 4/5, pp. 393-401.
- Becker, J., Knackstedt, R. and Pöppelbuß, J., (2009) "Developing maturity models for IT management – a procedure model and its application", *Business & Information Systems Engineering*, pp. 213-222.

- Bititci, U.M., Garengo, P., Ates, A. and Sai S. Nudurupati, S.S., (2015) "Value of maturity models in performance measurement", *International Journal of Production Research*, Vol. 53, No. 10, pp. 3062–3085.
- Bititci, U., Garengo, P. and Ates, A. (2012), "Towards a maturity model for performance and management", *PMA 2012 Conference*, Cambridge, UK, July 11-13.
- Brooks, P., El-Gayar, O. and Samikar, S. (2015), "A framework for developing a domain specific business intelligence maturity model: Application to healthcare", *International Journal of Information Management*, Vol. 35, pp. 337–345
- Bruin, T., Rosemann, M., Freeze, R. and Kulkarni, U. (2005), "Understanding the main phases of developing a maturity assessment model", *Proceedings of 16th Australasian Conference on Information Systems (ACIS)*, Sydney, November 30-December 2.
- Choo C.W, (2002) "Information management for the intelligent organization, art of scanning the environment", USA, Information Today.
- Cocca, P., Alberti, M. (2010), A framework to assess performance measurement systems in SMEs, *International Journal of Productivity and Performance Management*, Vol. 59 No. 2, pp. 186-200.
- de Waal, A., Kourtiti, K. and Nijkamp, P. (2009), "The relationship between the level of completeness of a strategic performance management system and perceived advantages and disadvantages", *International Journal of Operations & Production Management*, Vol. 29 No. 12, pp. 1242-1265.
- Evans, J.R. (2004), "An exploratory study of performance measurement systems and relationships with performance results", *Journal of Operations Management*, Vol. 22 No. 3, pp. 219-232.
- Hatry, H.P. (2006), "Performance measurement: getting results", 2nd ed., Urban Institute Press, Washington, DC.
- Hsieh, P.J Lin, B and Lin, C. (2009), "The construction and application of knowledge navigator model (KNM™): An evaluation of knowledge management maturity", *Expert Systems with Applications*, Vol. 36, pp. 4087–4100.
- Jääskeläinen, A. and Roitto, J-M., (2015), "Designing a model for profiling organizational performance management", *International Journal of Productivity and Performance Management* Vol. 64 No. 1, pp. 5-27.
- Khatibian, N., Hasan, T. and Jafari, H. A. (2010), "Measurement of knowledge management maturity level within organizations", *Business Strategy Series*, Vol. 11, No. 1, pp. 54-70.
- Kruger, J.C. and Johnson, R.D., (2010) "Information management as an enabler of knowledge management maturity: A South African perspective", *International Journal of Information Management*, Vol. 30, pp. 57–67.
- Lahrmann, G., Marx, F., Winter, R., & Wortmann, F. (2011, January). Business intelligence maturity: Development and evaluation of a theoretical model. In *2011 44th Hawaii International Conference on System Sciences* (pp. 1-10). IEEE.
- Lake, P. and Erwee, R. (2005). "Knowledge exchange in a regional network." *International Journal of Organisational Behaviour*, 9(6), 642-658.
- Marx, F., Wortmann, F. and Mayer, J.H. (2012), "A maturity model for management control systems", *Business & Information Systems Engineering*, Vol. 4 No. 4, pp. 193-207.
- Pee, L.G. and Kankanhalli, A. (2009), "A model of organizational knowledge management maturity based on people, process, and technology", *Journal of Information & Knowledge Management*, Vol. 8, No. 2, pp. 79-99.
- Poeppelbush, J., Niehaves, B., Simons, A. and Becker, J., (2011) "Maturity models in information systems research: literature search and analysis", *Communications of the Association for Information Systems*, Vol. 29, pp. 505-532.

- Popovič, A., Hackney, R., Coelho, P. S., & Jaklič, J. (2012). Towards business intelligence systems success: Effects of maturity and culture on analytical decision making. *Decision Support Systems*, 54(1), 729-739.
- Salleh, N.A.M., Jusoh, R. and Isa, C.R. (2010), "Relationship between information systems sophistication and performance measurement", *Industrial Management & Data Systems*, Vol. 110 No. 7, pp. 993-1017.
- Schläfke, M., Silvi, R. and Möller, K. (2013), "A framework for business analytics in performance management", *International Journal of Productivity and Performance Management*, Vol. 62, No. 1, pp. 110-122.
- Teah, H.Y, Pee, L.G., and Kankanhalli, A., (2006), "Development and application of a general knowledge management maturity model", *The Tenth Pacific Asia Conference on Information Systems, PACIS 2006 Proceedings*, pp. 400-416.
- Tung, A., Baird, K. and Schoch, H.P. (2011), "Factors influencing the effectiveness of performance measurement systems", *International Journal of Operations & Production Management*, Vol. 31 No. 12, pp. 1287-1310.
- Van Aken, E.M., Letens, G., Coleman, G.D., Farris, J. and Van Goubergen, D. (2005), "Assessing maturity and effectiveness of enterprise performance measurement systems", *International Journal of Productivity and Performance Management*, Vol. 54Nos 5/6, pp. 400-418.
- Van Aken, J.E. (2007), "Design science and organization development interventions aligning business and humanistic values", *The Journal Of Applied Behavioral Science*, Vol. 43 No. 1, pp. 67-88.
- Wettstein, T. and Kueng, P.A. (2002), "A maturity model for performance measure systems", in: Brebbia, C. and Pascola, P. (Eds), *Management Information Systems: GIS and Remote Sensing*, WIT Press, Southampton, pp. 113-122.

Barriers of Knowledge Sharing Effecting Work Performance and Value Creation in an Industrial Organization

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Abstract

Customer value is a key element for any organization, especially to give direction to different facets of an industrial organizations. By developing Knowledge Management and knowledge-sharing practices, the value creation potential could be improved in organizations. However, in practice there are several barriers that hinder effective knowledge sharing. In this paper focus is set on the knowledge-sharing barriers typology synthesized by Riege (2001), which are then applied in an exploratory case study of an industrial organization in Finland. Based on Riege's typology, the major knowledge-sharing barriers are identified in the case organization, and their role in hindering work performance and value creation is further analysed. Finally, development actions are proposed based on the empirical findings. Our findings in this study argue that effective knowledge-sharing practices among employees is a key enabler for successful value creation in an industrial organization.

Keywords – knowledge sharing, knowledge management, work performance, value creation, industrial organization

Paper type – Academic Research Paper

1 Introduction

Studies from extant literature suggests that knowledge management (KM) is seen as a strategic and important approach but often not easy to implement in organizations (Omotayo 2015, Dalkir 2011, Bhojaraju 2005). As part of KM, a knowledge-sharing culture (Intezari et al. 2017) can only be found reasonable and beneficial if senior management demonstrates the value of a culture that supports and rewards its employees (Lee et al. 2016). Knowledge-sharing activities depend very much on motivation and on the voluntary participation of employees (Llopis and Foss 2016). In this regard, management should be skilled and sensitive to employee-sharing activities that are actively arranged/carried out within organizations (Riege 2005). In other words, KM should be the evolution of effective managerial practices that fosters an open knowledge-sharing culture that can impact better work performance in organizations. (Lee et al. 2016, Chang and Tung-Ching 2015, Moteleb and Woodman 2007, Birkinshaw 2001).

By developing KM and knowledge-sharing practices, the value creation potential could be improved in organizations (North and Kumta, 2018, Cepeda-Carrion 2017). Customer value is a key element for any organization, especially to give direction to different facets of an industrial organizations. Customer value further aids in the streamlining of strategies and goals within organizations (Blocker et al. 2011, Johnson and Weinstein 2004, Duchessi 2002). However, the understanding of value creation practices is often unclear due to the fuzzy nature of value as a concept. Whereas, knowledge sharing often cannot be implemented as a project-driven approach; instead it requires structural change starting at the policy level of the organization. When supporting knowledge sharing activities, management need to be aware of the ability to alter the culture to implement change in organizations (Corfield and Paton 2016). In fact, studies have identified several barriers can be found for employees not embracing a more sharing culture and thereby less value creation and work performance in organizations. For a deeper understanding, the research question of this study focuses on - *What are the barriers that hinder knowledge sharing to create value and work performance in an organization?*

In the next section, a review of the literature on value creation, KM practices and knowledge-sharing barriers are presented. Focus is set on the knowledge-sharing barriers typology synthesized by Riege (2005), which are then applied in an exploratory case study of an industrial organization in Finland. Based on Riege's typology, the major knowledge-sharing barriers are identified in the case organization, and their role in hindering work performance and value creation is further analysed. Finally, development actions are proposed based on the empirical findings. Our findings in this study argue that effective knowledge-sharing practices among employees is a key enabler for successful value creation in an industrial organization.

2 Brief background on value creation

Value as a term is used in many different contexts. For value definition, the customer perspective seems still to be valid (North and Kumta, 2018, Cepeda-Carrion 2017). Delivering and creating superior customer value for customers can be seen as increasing the value of the organization. There is a monetary worth to the organization in both high-value customers and individual customers which can be quantified, whereas the organization's value is quantified as the worth to its stakeholders. Nevertheless, customer value takes the perspective of the organization's customers (Sørensen and Jensen 2015). When defining customer value, customer value can be defined so that it represents the trade-off between sacrifices and benefits from the provider's relationship and product resources which the customers think and believe to be facilitating their goals (Helander and Vuori 2017). At the same time, it is quite often customer value changes because customers alter their own expectations. This aspect is a critical challenge for providers because failing to meet customer expectations may lead to dissatisfaction and terminate the customer relationship (Blocker et al. 2011).

To attain and maintain customer value, it means continuously creating experiences that exceed customer expectations (Sørensen and Jensen 2015). Considering value is often defined by the customers, Johnson and Weinstein (2004) argue that if the organization's value is outstanding then it turns buyers into lifetime customers. Companies have to create value for their customers and face the possible problems related to success and also failure such as (e.g. declining market share and customer loyalty, decreasing profits etc.) and thereby long term challenges. In any case, customer value is a key element for organizations to give direction and unite different business functions by means of strategies and common goals; recognize the importance of the focus on customer expectations and needs; and implement and develop information, personnel, business and quality systems to ensure and deliver the required customer value. For example, the study by Duchessi (2002), the approach built from the customer value perspective can be described as a pyramid with strategies and goals at the top and quality, personnel, information and business systems at the bottom.

3 Overview of knowledge management and knowledge sharing barriers

3.1 Knowledge management in organizations

According to Bhojaraju (2005), knowledge management is seen as an organizational approach that is not often easy in implementation. A number of studies (c.f. King (2009), Birkinshaw (2011), Bhojaraju (2005), Moteleb and Woodman (2007)) have defined knowledge management and its importance for organizations. The definition of knowledge has often been stated as a "justified personal belief." There are many classifications which specify various different kinds of knowledge (Hislop et al. 2018). The most relevant and important distinction is between "tacit" and "explicit" knowledge. Knowledge is often tacit in nature and has developed over a long period of time. Some of

it has merged into business activities, processes and relationships that have been created over time when a series of continuous improvements have been implemented. Whereas explicit knowledge is available in the form of sentences, words and documents, and different types of organized data like computer programs (King 2009).

Creating organizational knowledge is rather dependent on tapping the tacit and quite often highly subjective insights, hunches and intuitions of individual employees and making these insights available for use and testing by the organization. (Hislop et al. 2018) Personal commitment plays a key role in terms of the employees' sense of identity with the organization and its mission. Embodying tacit knowledge in actual technologies and products to achieve actual personal commitment will require supervisors and managers who are as comfortable with symbols and images as they are with numbers measuring work productivity and market share. Typically, knowledge management also ends up focusing on recycling existing knowledge rather than on generating new knowledge and more important is the ability to bring new knowledge into the organization. (Nonaka and Toyama 2015, Birkinshaw 2001)

The notion of knowledge management should be richer so as to create insight into 1) why to manage knowledge 2) what knowledge to manage and 3) how to manage knowledge. There is a need for multiple interpretations of knowledge and flexibility to blend and change or extend these interpretations in different organizational contexts (Moteleb et al. 2007). Knowledge management should be the evolution of good management practices (Hislop et al. 2018). KM presents a change in focus regarding the use and development of knowledge which increase the effectiveness of any organization. In this regard, extensive research has been done from different perspectives related to organization and knowledge management. However, there remains a need to combine the different perspectives on knowledge management and find a possibility to combine theory and practice that is more comprehending for organizations to use in their development towards better performance. This is why knowledge management cannot be just one project among others. It requires structural change in the policy of the organization (Llopis and Foss 2016).

Studies such as Chang and Tung-Ching (2015), Davenport and Prusak (2014), King (2009), von Krogh (1998) and Dalkir (2011) have raised different aspects of knowledge management within the organization from a process perspective. Knowledge management improves certain processes such as collaborative decision making, innovation, collective and individual learning in organizations. The outcome is often created by these organizational processes are better products, services, relationships and decisions as well as organizational behavior, which in turn lead to improved organizational performance (King 2009). Furthermore, an organization's performance depends quite a lot on how managers are able to activate individuals and teams to turn knowledge into value-creating activities. Activities can take place through five different phases: 1) initial sharing of experience, knowledge and practices among team members, 2) effective creation of concepts for new products and services based on shared knowledge, 3) justification of these concepts is rooted in the organization's strategy, focus interviews and market studies, and 4) building a prototype service offering and 5) the leveraging of concepts,

prototypes and offering throughout the organization (von Krogh 1998). Coming to the management of knowledge processes, knowledge can be refined, stored, shared, transferred, created, acquired and re-used within organizations. In a way efficient planning of KM processes can improve the processes of innovation, individual and collaborative learning and thereby decision-making within the organization (King 2009).

One of the KM processes needed to improve organizations' performance is knowledge sharing (Paulin and Suneson, 2012) and often sharing activities depend very much on motivation and on the voluntary participation of employees. Management need to be skilled and sensitive to the sharing activities that are ongoing/underway and proceeding within the organization. A knowledge-sharing culture can only be found reasonable and beneficial if management shows the benefits, supports it and rewards those who embrace it. It seems that private sector organizations use KM for internal knowledge sharing, targeting specific areas of the organization. Their KM initiatives are often concerned with managing business and administrative knowledge, whereas public sector organizations use knowledge management for both external and internal knowledge sharing through the organization and their KM initiatives are most often concerned with managing product-related knowledge (Dalkir 2011).

3.2 *Riege's barriers in knowledge sharing*

Existing literature identifies many examples of where knowledge-sharing practices have not reached their goals such as to manage the organization's skills and assets. This occurs mainly because of potential barriers to knowledge sharing. It has been agreed and acknowledged that the biggest challenges in the organization's sharing practices is maximizing and protecting the value which is derived from tacit knowledge. This tacit knowledge is held by the organization's stakeholders, in particular its customers and employees (Riege 2005). The recognition and identification of knowledge-sharing barriers has a very important role in KM strategy, whether it is part of the organizational culture or not. Failures in knowledge sharing often occur because organizations try to adjust their organizational culture to fit the goals of knowledge sharing, instead of implementing them so that the knowledge-sharing strategy would fit the organizational culture (Riege 2005). Riege's (2005) study highlights barriers at three different levels, namely organizational, individual and technological levels of knowledge sharing.

3.2.1 *Background on Riege's three levels of knowledge sharing barriers*

At the organizational level perspective, barriers quite often tend to be linked to a lack of infrastructure and resources, economic viability, accessibility of informal and formal meeting spaces, and the physical environment (Riege 2005). For successful sharing of knowledge within the organization, the right organizational conditions and environment have to exist. There are many ways to share organizational, social or individual knowledge effectively. Barriers at the organizational level can include a number of examples. This can be size of business units not small enough to enhance contact and facilitate ease in sharing knowledge, hierarchical structure in the organization that can

inhibits most of the sharing practices, deficiency of organization resources that can provide adequate sharing opportunities, lack of appropriate infrastructure which supports sharing practices, lack of transparent recognition and rewards that would motivate people to share knowledge, shortage of informal and formal spaces to generate, reflect on and share new knowledge. Finally, there can be barriers in terms of lack of managerial direction and leadership on how to communicate clearly the benefits and values of knowledge-sharing practices, sharing initiatives and its integration with KM strategy into the organization's strategic goals are unclear or missing (Riege 2005).

At the technology level, barriers occur with difficulties in integrating, building and modifying technology-based systems. Barriers also correlate with factors like unrealistic expectations of ERP/IT systems and an unwillingness to use applications because of a mismatch with requirements (Riege 2005). Knowledge sharing is also a technology issue and challenge. There is a little doubt that technology can be a facilitator to support and encourage knowledge sharing and its processes by making sharing more effective and easier. Ultimately, the key issue is to implement and choose the technology which is most suitable and provides a close fit between organizations and people. Potential barriers to sharing can happen due to lack of communication and demonstration of all the possible advantages of new systems compared to the existing one, reluctance to use IT systems due to lack of experience and familiarity with them, mismatch between integrated IT systems and processes restricts sharing practices and individual's requirements, unrealistic expectations of employees about what technology can and cannot do, lack of integration of IT processes and systems impedes the way people do things and also the absence of technical assistance and support as well as maintenance of integrated IT system's communication flows disrupt/hinder work routines (Riege 2005).

Finally, at the individual (employee) level, barriers to sharing knowledge are often factors such as the lack of trust and time, differences in national culture, lack of social networks and communication skills as well as overemphasis of position status. For more illustration, individual barriers (Riege 2005) can occur due to lack of trust in people because there may be occurring misuse of knowledge or taking unjust credit for it, taking ownership of intellectual property due to fear of not receiving accreditation and recognition from colleagues and managers, difference in levels of education, differences in gender, age differences, insufficient evaluation, feedback, capture, communication and tolerance of past mistakes that would enhance organizational and individual learning, dominance in sharing explicit over tacit knowledge such as experience and know-how that requires observation, hands-on learning, dialogue and interactive problem solving.

Motivation can be a reason for barriers at the individual level as sharing knowledge can be seen as additional work. This is due to the extra time required for communication and documentation etc. Employees may not expect reciprocal benefits from transferring their knowledge because they do not experience it or they not believe in these benefits. Even if people do expect some kind of reward for their contributions, the answer to the question "What's in it for me?" is not always clear to employees suffering from lack of motivation. The need for self-motivated creativity exists in order to foster knowledge sharing. Quite often the benefits of the contribution to a knowledge database are received

by a different stakeholder at a later point of time, and the benefits are quite often earned by colleagues of the provider, not the provider him/herself. Knowledge sharing can be beneficial only if everybody provides their knowledge unselfishly within the organization (Disterer 2001).

When going further and deeper into the individual perspective, individual-level barriers to sharing can be described as uncertainty, loss of power and revelation. Uncertainty can be seen especially as a feeling among less experienced and younger people, because they are not able to judge if their working results represent valuable knowledge. Their knowledge cannot be estimated if it is too well known or general or if the knowledge is too specific for a special situation and therefore useless for colleagues in other cases. The positioning on the scale of specific to general is by no means trivial and thus creates uncertainty (Disterer 2001). Loss of power is quite a common feature at the individual level as knowledge can be used to enforce spheres of influence and to take action; passing knowledge on to colleagues may grant some of this potential. Likewise, those who do not own this knowledge are deprived of this influence. This applies to knowledge about procedures, competitors, suppliers' methods, formulas as well as customers from the business perspective. In this sense, someone who passes on knowledge to a colleague will lose the exclusiveness of her or his influence and this might suggest some respect and job security. "Knowledge is power," where experts with rare knowledge have the monopoly of knowledge and reputation, causes knowledge hoarding rather than knowledge sharing (Disterer 2001).

4 Empirical study

The empirical research was carried out as an exploratory case study, applying qualitative research methods. The empirical data set was gathered by means of thematic interviews at a single factory unit of the industrial case organization. The interview framework was the same in all the interviews, although the interviews were very open and conversational in nature. The interview themes were as follows: background and work history, typical working week, customer value creation, information flow and data flows, knowledge management practices, challenges related to information and knowledge, change management and lastly, an open discussion on the things that work well in general and which things should be developed currently. Altogether six persons operating in various roles (sales representative, sales manager, project assistant, production manager, unit manager and key account manager) was interviewed.

Analysis of the empirical data revealed that within the case organization several changes were occurring at the organizational and personal level, all of which had an effect on the knowledge-sharing culture as well as work performance and even customer value creation potential. Despite this, at a general level the work community in the factory unit was happy and the atmosphere was good, which was further identified as one of the key factors supporting an open knowledge-sharing culture.

"The premises are mainly good, the facilities in our factory are good. The working environment is fine, very comfortable."

"High professionalism"

"Our advantage is that it is a compact factory and that they come nicely along together."

"Good spirit in a small group"

At the same time, however, due to the constant changes, the roles and job descriptions were unclear and there were difficulties in work performance and task completion.

"Unclear job descriptions, difficulties to tell colleagues what each should do"

"There is a gap between production and the office in the factory community."

It was also partly felt that all the recent changes had been made by/had come from the main office of the case organization without listening to the factory unit. Therefore, there was more dissatisfaction with the current situation than there had been earlier.

"The former factory manager was tough and clear, able to rely on things being handled. Now I have to look after him, even though it is not my job. "

Moreover, problems had been identified in the knowledge sharing both within the factory unit - due to unclear job descriptions and changed, distant managerial relationships, as well as in information system problems - and especially in the direction of the main office of the case organization.

"There is an IT system that functions at some level, but people have to check things manually too many things".

"Clearer tools should be used to manage the order-delivery process. There are gaps there between the functions."

Some shortages of resources and lack of some special skills were also identified, and it was also stated that exceptional situations caused a lot of extra adjustment due to the tough/inflexible information systems and, in some cases, the lack of proactive attitude among the workers.

"Managing Raw Material Stocks. This is especially true for information systems, such as inventory management. If you promise a customer a specific schedule, you should know how to stock up the raw material. Partly information system, sort of human resource thing. Long-term automation and inventory IT improvements could do well."

These identified challenges represented all three categories of Riege's typology: organizational, individual and technological knowledge-sharing barriers, see Table 1 for summary of the empirical results. Within the table, barriers that are present in Riege's original typology are written in *italics*.

Table 1. Empirical results based on Riege's knowledge-sharing barriers three-level typology.

INDIVIDUAL LEVEL BARRIERS	ORGANIZATIONAL LEVEL BARRIERS	TECHNOLOGICAL LEVEL BARRIERS
Poorer understanding of customer requirements in production than earlier, as contact level is missing	Communications break-down between sales, operative and development functions	Data and information is incoherent and splattered into different information systems
<i>Difference in levels of education, causing e.g. shortages in language skills</i>	Knowledge sharing problems between the unit and the corporation level	Information systems are not used comprehensively
<i>Insufficient learning loop and tolerance of past mistakes</i>	Unclear roles and job descriptions	<i>Unrealistic expectations of employees about what technology can do or can't do</i>
<i>Lack of trust (towards other units)</i>	<i>High competitiveness between other subsidiaries</i>	<i>Lack of integration of IT processes and systems</i>
<i>General lack of time</i>	<i>Deficiency of resources</i>	<i>Lack of technical support</i>

5. Discussions and Conclusion

Extensive research on different perspectives related to knowledge sharing is evident in the literature, but there remains an empirical gap with regard to understanding of knowledge sharing barriers for better work performance and value creation in industrial organizations. While many studies on knowledge-sharing barriers have been presented in the literature, description/discussion of their practical implementation is less common. This paper adds to the literature by identifying certain barriers of knowledge sharing and suggest some considerations in the context of an industrial organization. The study attempts to address the research question of what are the barriers that hinder knowledge sharing to create value and work performance in an organization. In Table 2 the identified barriers and proposed solutions to overcome the barriers are presented.

Based on the analysis of case evidence, there were knowledge sharing barriers at the individual and technological levels in the organization. There was limited understanding of customer requirements in production department. A solution such as customer visits can help to increase interaction between key customers and production people. Furthermore there were differences in levels of education due to language deficiency skills and this could be solved by providing time and support for personnel development. Lack of trust between different units in the organization is also identified as an impediment to knowledge sharing. To an extent this sharing barrier can be attributed to high competitiveness between subsidiaries. This barrier could be solved through nurture of open environment by introducing more informal meetings between the unit managers and create a development of trust in the organization

At the technical level a knowledge sharing barrier was identified which is regarding unrealistic employees' expectation of what technology can create value or not. To manage the unrealistic expectations, for example, relevant IT courses and related training programs could be offered to employees and thereby provide the understanding of how IT can support worker performance/value creation. Another knowledge sharing barrier at the organization level is the roles and job descriptions seems to be less clear and not defined

well. In a way, this unclear role definition contributed to insufficient learning loop and less tolerance of past mistakes in the organization. This could be addressed by designing clear roles and job descriptions across the organization and also create open discussions environment in the organization. Moreover established or well defined job descriptions and routing practices can create more time efficiencies in work, prioritization of tasks, learning from mistakes and overall value creation and work performance in the organization.

Table 2. Propositions to overcome the identified barriers.

INDIVIDUAL LEVEL		ORGANIZATIONAL LEVEL		TECHNOLOGICAL LEVEL	
Key identified knowledge-sharing barriers	Proposed solution to support worker performance and value creation	Key identified knowledge-sharing barriers	Proposed solution to support worker performance and value creation	Key identified knowledge-sharing barriers	Proposed solution to support worker performance and value creation
Poorer understanding of customer requirements in production than earlier, as contact level is missing	Increased interaction between key customers and production people, e.g. customer visits	Communications break-down between sales, operative and development functions	Clearer work roles, rules and practices for communication	Data and information is incoherent and splattered into different information systems	New information system acquisition and implementation
<i>Difference in levels of education, causing e.g. shortages in language skills</i>	Time and opportunities for personnel development	Knowledge sharing problems between the unit and the corporation level	More regular meetings between the unit and corporation level key people	Information systems are not used comprehensively	IT courses for the personnel
<i>Insufficient learning loop and tolerance of past mistakes</i>	Open discussion on the previous occasions. Open and justified decisions.	Unclear roles and job descriptions	Roles of the people in the unit are discussed and decided together	<i>Unrealistic expectations of employees about what technology can do or can't do</i>	IT courses for the personnel
<i>Lack of trust (towards other units)</i>	More informal meetings between the unit managers	<i>High competitiveness between other subsidiaries</i>	More informal meetings between the unit managers.	<i>Lack of integration of IT processes and systems</i>	IT courses for the personnel IT oriented person employment
<i>General lack of time</i>	Clearer job descriptions, routine practices	<i>Deficiency of resources</i>	Clearer processes, priorozation, learning from mistakes, IS development	<i>Lack of technical support</i>	IT oriented person employment

In conclusion, organizations are forced to be in the mode of continuous change and organizational agility requires efforts from management perspectives of human resources, business, knowledge and quality. This organizational mindset is the new 'normal' as organizations' operating environment is dynamic in nature. This can be seen as changing environmental dynamics in customer demands, political context and emerging/new megatrends that influence the flows of knowledge at the individual and organization levels. As for an industrial organizations being the study focus, the main objective is to create added value for its stakeholders such as customers, partners, owners and in particular employees. In practice, this means organizational decisions and processes that

can minimize barriers and reduce lead time to foster better knowledge sharing, which can create added value for the important stakeholders of the organization.

References

- Birkinshaw J. (2001) Why is Knowledge Management So Difficult? *Business Strategy Review*, 12: 1, 11-18
- Bhojaraju G. (2005). Knowledge Management: Why we need it for corporate. *Malaysian Journal of Library & Information Science*. 10:2, 37-50
- Blocker, C., Flint, D., Myers, M. & Slate, S. (2011) "The Role of Proactive Customer Orientation in Global Markets." *Journal of the Academy of Marketing Science*, Vol. 39, No. 2, pp. 216-233.
- Cepeda-Carrion, I., Martelo-Landroguez, S., Leal-Rodríguez, A. L., & Leal-Millán, A. (2017). Critical processes of knowledge management: An approach toward the creation of customer value. *European Research on Management and Business Economics*, 23(1), 1-7.
- Chang, Christina Ling-hsing, and Tung-Ching Lin. (2015) The role of organizational culture in the knowledge management process. *Journal of Knowledge management* 19.3: 433-455.
- Corfield, A., & Paton, R. (2016). Investigating knowledge management: can KM really change organisational culture?. *Journal of Knowledge Management*, 20(1), 88-103.
- Dalkir, K. (2011) *Knowledge Management in Theory and Practice* (2nd Edition). Cambridge, MA, USA: MIT Press
- Davenport T. H and Prusak, L. (2014). *Working Knowledge: How Organizations Manage What They Know*. ACMIT Magazine.
- Disterer, G. (2001). Individual and social barriers to knowledge transfer. *Journal of business administration*, 34(1), 1-7.
- Duchessi, P. (2002). *Crafting Customer Value: The Art and Science*. Purdue University Press.
- Hislop, D., Bosua, R., & Helms, R. (2018). *Knowledge management in organizations: A critical introduction*. Oxford University Press.
- Helander, N., & Vuori, V. (2017). Value Co-creation Analysis in Customer-Supplier Network Relationships. In *Practices for Network Management* (pp. 251-262). Palgrave Macmillan, Cham.
- Intezari, A., Taskin, N., & Pauleen, D. J. (2017). Looking beyond knowledge sharing: an integrative approach to knowledge management culture. *Journal of Knowledge Management*, 21(2), 492-515.
- Johnson, W.C & A. Weinstein. (2004) *Superior Customer Value in the New Economy: Concepts and Cases*. CRC Press. Boca Raton. London.
- King, W.R. (2009) *Knowledge management and organizational learning*. Knowledge management and organizational learning. Springer, Boston, MA, 2009. 3-13.
- Lee, J. C., Shiue, Y. C., & Chen, C. Y. (2016). Examining the impacts of organizational culture and top management support of knowledge sharing on the success of software process improvement. *Computers in Human Behavior*, 54, 462-474.
- Llopis, O., & Foss, N. J. (2016). Understanding the climate-knowledge sharing relation: The moderating roles of intrinsic motivation and job autonomy. *European Management Journal*, 34(2), 135-144.
- Von Krogh, G. (1998). Care in knowledge creation. *California management review*, 1998.
- Moteleb A.A and Woodman M.(2007). Notions of Knowledge Management Systems: a Gap Analysis. *The Electronic Journal of Knowledge Management* 5:2, 55 – 62.

- Nonaka, I., & Toyama, R. (2015). The knowledge-creating theory revisited: knowledge creation as a synthesizing process. In *The essentials of knowledge management* (pp. 95-110). Palgrave Macmillan, London.
- North, K., & Kumta, G. (2018). *Knowledge management: Value creation through organizational learning*. Springer.
- Omotayo, F. O. (2015). Knowledge Management as an important tool in Organisational Management: A Review of Literature. *Library Philosophy and Practice*, 1(2015), 1-23.
- Paulin, D. and Suneson, K., (2012) "Knowledge transfer, knowledge sharing and knowledge barriers – Three Blurry terms in KM", *The Electronic Journal of Knowledge Management*, Vol. 10, No. 1, pp. 81-91.
- Riege, A. (2005). Three-dozen knowledge-sharing barriers managers must consider. *Journal of Knowledge Management*. 9:2 18-35.
- Sørensen, F., & Jensen, J. F. (2015). Value creation and knowledge development in tourism experience encounters. *Tourism Management*, 46, 336-346.

Designing Knowledge Ecosystems for Business Education Based on Knowledge Dynamics

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Abstract

The purpose of this paper is to explore the complexity of designing knowledge ecosystems for business education based on the theory of knowledge fields and knowledge dynamics. That means to change the paradigm of university education based on the traditional rigid curriculum into a new paradigm based on adequate knowledge ecosystems. The new paradigm reflects the needs of developing a personal learning environment in a volatile, uncertain, complex, and ambiguous (VUCA) environment. Business education should adapt its design to the complexity of the real business environment dynamics and to the need of strategic thinking. The present paper integrates results from a qualitative and a quantitative research performed in the period January-March 2019. Qualitative research is based on the critical analysis of literature dedicated to business education and on the theory of knowledge fields and knowledge dynamics. The theory assumes that knowledge can be understood as a spectrum composed of rational, emotional and spiritual knowledge fields which interact continuously. Each form of knowledge can be transformed in any other form of knowledge, as energy forms in thermodynamics. Thus, business education can integrate all of these forms of knowledge and develop a deeper understanding of the complexity of the real world. Quantitative research is based on a survey done with students enrolled in business administration program. We got 269 valid questionnaires and then we processed them by using the specialized software package SPSS. The knowledge ecosystem is conceived as a learning environment where students can benefit both of the university knowledge transfer and mind developing processes, and of internship programs in some companies which provide direct business experience for them. The design of the knowledge ecosystem considers also some other types of business activities like business clubs, entrepreneurship incubators, workshops and leadership

summer schools. Strategic thinking integrates all these forms of knowledge and creates a support for long term decision-making.

Keywords – Business education, Knowledge Dynamics, Knowledge Fields, Knowledge Ecosystem

Paper type – Academic Research Paper

1 Introduction

Knowledge ecosystem is a metaphor built on the analogy with ecological systems and their processes. Being a metaphor, its definition is rather fuzzy (Miller, 2015; Valkokari, 2015), but the core meaning is clear. It refers to a system of systems which interact in concordance with some principles and set of values (Bray, 2007; Maracine and Scarlat, 2009). The governing principles come from the knowledge management systems and they refer to knowledge creation, acquisition, sharing, transfer, transformation and use. The ecological metaphor induces the idea that the component systems can have a positive or negative contribution to the whole dynamics of the knowledge ecosystem determined by their field of interests. The present research focuses on knowledge ecosystems designed for business education, where the component systems can be: universities or faculties having business programs, research centers or institute, companies, business incubators, financing agencies for business start-ups, students' business clubs, international students' exchange programs. Thus, the driving force of the whole knowledge ecosystem considered in the present research is business education, and the gravitational field which determine the interactions between the systems is the university system. The research question for the present research can be formulated as follows: How should the knowledge ecosystem for business education be designed such that it would satisfy much better the needs of future businessmen than the classical approach of the rational knowledge curriculum and a campus centered education based on knowledge transfer.

2 Literature review

Business education is a complex topic since the concept of *business* is defined in multiple ways. Economists define business in terms of money and profits, but business means to create value for society. As Drucker (1993, p. 79) posits, "A business is not defined by the company's name, statutes, or article of incorporation. It is defined by the want the customer satisfies when he buys a product or a service. To satisfy the customer is the mission and purpose of every business". Although business is based on economic and managerial principles it cannot be reduced to them. It integrates knowledge from multiple disciplines which can explain how to identify the needs of people and how to satisfy them by creating products and services. Business education should reflect this complexity and students should learn how to design business and how to create value for customers. They should constantly seek a "fruitful balance between reliability and

validity, between art and science, between intuition and analytics, and between exploration and exploitation” (Martin, 2009, p. 62).

Business education as performed today in business schools is based on a certain curriculum, which represents a linear composition of disciplines within a generic framework approved by some accreditations agencies. Teaching and learning are still dominated by the well-known transfer of knowledge from professors to students within the chosen disciplines (Gherardi et al., 1998). That kind of education becomes insufficient for the present students thinking that they will work in a turbulent economic environment and in a business future with many uncertainties (Bejinaru, 2018; Martin, 2009; Mintzberg, 2004; Spender, 2014). Some researchers propose to move from a static and rigid curriculum toward a dynamic and flexible one with a shortened life cycle (Albert and Beatty, 2014).

Tsang and Tsui (2017) introduce the concept of Personal Learning and Network Environment (PLE&N), by using the support of information technology. The new concept focuses on the students’ willingness to enlarge their knowledge horizon by using information platforms and developing knowledge networks. Tsui and Dragicevic (2018) consider that curriculum can be improved by engaging students, graduates and professionals in its design and integrating their vision on a fast changing business environment. Thus, they developed new approaches for curriculum design by “co-creation with the support of scenario development techniques facilitated in the personal learning and network environment (Tsui and Dragicevic, 2018, p. 850). This approach of involving students in co-creation of their curriculum stimulates their efforts in learning by creating new driving forces for knowledge exploitation and exploration (Pechham, 1995). Also, this creative approach “should cultivate student curiosity, creativeness, critical attitude, enthusiasm, and responsibility for contributing to society” (Jurše and Mulej, 2011, p. 1450). Networking implies a skill for *connectivism*, a process by which a person enters in connection with many others via internet and establishes new links (Dunaway, 2011; Vătămănescu et al., 2015, Vătămănescu et al., 2018).

Prominent business schools aim to prepare not only business workers but business leaders who can change the world. To achieve this goal, business schools should put a “greater emphasis on ethics and corporate governance” (Bajada and Trayler, 2016, p. 458). Corporate governance and corporate social responsibility require a new mindset structured around a new set of values which depart from the profit maximization principle applied without any consideration for the social and natural environment (Anninos and Chytiris, 2012; Bratianu and Bejinaru, 2017; Choudhury, 2015; Wallis and Valentinov, 2016). That idea is emphasized very well by Mitroff and Denton (1999, p. 91): “We have gone too far in separating the key elements. We need to integrate spirituality into management. No organization can survive for long without spirituality and soul”.

Business education needs a new understanding of consumers’ behaviour and their decision-making process. As Hill (2008, p. 2) posits, “Breakthrough in brain science have revealed that people are primarily emotional decision makers”. The classical split between cognition and emotion should change into a bridge, and in the new knowledge

ecosystem students should be exposed to experiential learning (Kolb and Kolb, 2005) and emotional knowledge (Bratianu and Orzea, 2013).

3 The theory of knowledge fields and knowledge dynamics

A knowledge ecosystem should approach the complexity of business environment and integrate all forms of knowledge. According to the theory of knowledge fields (Bratianu, 2015), there are three basic fields of knowledge: rational, emotional, and spiritual. Rational knowledge is the explicit knowledge which we learn by using a natural or symbolic language. It is about the mental reflection of the world in which we are living. Emotional knowledge is a wordless knowledge which results from the work done by the sensory systems and the cognitive unconscious (Damasio, 2012; LeDoux, 1998). Emotional knowledge is processed by emotional intelligence (Goleman, 1998), and System 1 of thinking (Gladwell, 2005; Kahneman, 2011). Spiritual knowledge is about cultural values and beliefs. It is about our existence and about working motivation or spirituality (Barret, 2010; Nonaka and Takeuchi, 1995). Spiritual knowledge is processed by spiritual intelligence and transformed into spiritual capital (Zohar and Marshall, 2000). Spiritual knowledge is the raw material in functioning spiritual leadership.

Knowledge dynamics can be interpreted both as a *flow* (Nissen, 2006, Nonaka et al., 2008; Schiuma, 2009), and as a *transformation* (Bratianu, 2015). For understanding the knowledge ecosystem dynamics both interpretations are useful. Knowledge flows within a company but also across its boundaries, when considering the company just a node in a network. Knowledge sharing and knowledge loss contribute directly to the flow of knowledge within the knowledge ecosystem (Bratianu et al., 2011). Knowledge flow is a metaphor coming from the Newtonian mechanics and is very much used due to its simplicity and intuitiveness. Knowledge transformation is a metaphor coming from thermodynamics and refers to the transformation of a knowledge field into another, as proved by neuroscience research. Rational knowledge can be transformed into emotional or spiritual knowledge; emotional knowledge can be transformed into rational and spiritual knowledge; and spiritual knowledge can be transformed into rational or emotional knowledge (Bratianu, 2015). This knowledge dynamics is essential in experiential learning (Kolb and Kolb, 2005), and in developing generic skills in business education (Bratianu and Vatamanescu, 2017). For instance, students in their internship program are expected to learn by doing, when emotional knowledge obtained through sensory systems is transformed into rational knowledge and integrated into the theoretical structure they got from professors' lectures. Designing a knowledge ecosystem for business education should consider this enlarged framework.

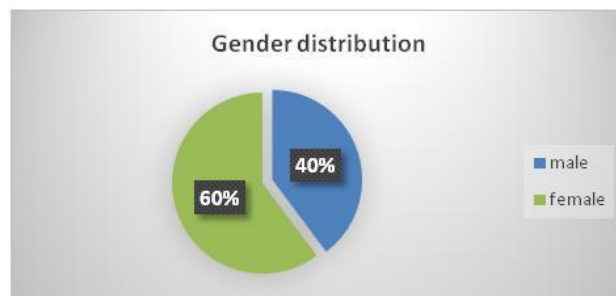
4 Methodology

The main research tool we relied on was the questionnaire to better design knowledge ecosystems for business education. In order to create this questionnaire we had to undergo several stages: the first one consisted in a thorough literature review analysis (qualitative

methodology) for establishing the theoretical framework of the research in question and it also helped in establishing potential hypotheses. Through it, we managed to better understand how knowledge dynamics acts as flow, that there are several fields of knowledge rational, emotion and spiritual and they can shift shape under specific conditions. In the second stage we drafted the questionnaire to measure the variables previously identified in the literature review. For a third stage, we tested the draft questionnaire with a smaller sample consisting in a group of experts on business education, knowledge fields and knowledge ecosystem to establish whether there are any redundancies, biases, misleading questions or the framework effect. Following, we established the final improved form of the questionnaire which consisted in 33 items. For the present article, we will only analyze the first 24 questions. Except for the demographic questions, all of them were closed questions meant to deliver answers on 5-point Likert scale: 1 (strongly disagree), 2 (disagree), 3 (neither agree nor disagree), 4 (agree), and 5 (strongly agree). The questions were randomized as to avoid the framework or priming effect and they were distributed to a non-probabilistic sample. The population we targeted was mainly made of students coming from business administration faculty at the Bucharest University of Economic Studies. We physically distributed 436 questionnaires to students, after the distribution we managed to collect 269 valid questionnaires, obtaining a response rate of 61.69%. The refined data was put to analysis by using the dedicated software SPSS 20. Furthermore we used Principal Component Analysis (also known as factorial analysis, which is a dimension reduction method). This kind of analysis results in grouping different sets random variables. Additionally, in this case the factor reveals latent correlations among variables (Tabachnick and Fidell, 2007, Vizitiu et al., 2018; Hadad, 2018), translated into an equation system.

5 Results and discussions

The structure of the statistical population under scrutiny can be characterized as follows: 126 students belonged to the second year of bachelor accounting for 46.85% of the sample, while 143 belonged to the third year of bachelor accounting for 53.15% with ages belonging to the interval 18-35-years old, the average being 20.80. The gender structure of the respondents can be depicted in the figure below:



Source: Authors' own processing

Figure 1. Respondents' gender distribution

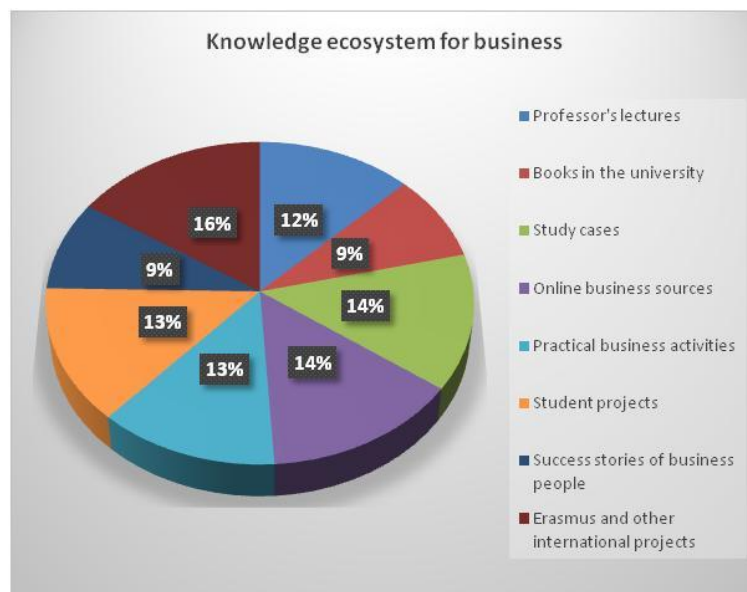
Analysis

Table 1. Descriptive statistics

Variable	Statistical mean	Standard deviation
Q1	4.15	0.86
Q2	3.80	0.89
Q3	3.96	0.82
Q4	4.26	0.84
Q5	3.91	0.86
Q6	4.53	0.69
Q7	4.35	0.79
Q8	3.94	1.10
Q9	4.45	0.81
Q10	4.34	0.87
Q11	3.60	1.17
Q12	4.64	0.82
Q13	3.66	1.05
Q14	4.68	0.92
Q15	3.23	1.23
Q16	4.54	1.09
Q17	3.21	1.32
Q18	2.21	1.44
Q19	3.48	1.40
Q20	3.60	1.45
Q21	3.25	1.75
Q22	3.47	1.55
Q23	2.29	1.72
Q24	4.01	1.64
Q25	2.52	1.84
Q26	3.19	1.90
Q27	3.17	1.89
Q28	3.64	1.93
Q29	2.75	2.18
Q30	20.73	1.43
Q31	0.72	1.97
Q32	2.64	1.92
Q33	4.36	1.99

Source: Authors' own processing

The statistic means of the first 12 variables hint towards somewhat contradictory results indicating that they have relative awareness about the type of knowledge fields confirmed by the statistical means which were mostly above average, despite the fact that the factors did not cluster as predicted in the subsequent factorial analysis. In terms of their ability of knowing the ways knowledge transfer happens the results are encouraging again revealing a mature thinking and understanding of how knowledge can shift its forms according to certain conditions and exposure to different ecosystems. The preferred learning ecosystem by the sample is composed of: on the last place they prefer learning from books (2.21), the success stories of professionals seems not to exert enough influence on their learning eco-system accounting for a mean of 2.29. They seem to be mostly motivated by Erasmus experience and other international projects which would ensure a comprehensive individual development. A still preferred instrument for the education of business students resides in the case studies with a mean of 3.48. An important element of the ecosystem that is starting to take hold of it is represented by the internet sources (3.60).



Source: Authors' own processing

Figure 2. Knowledge ecosystem for business education

In the first part of the statistical analysis we decided to check for the consistency of the knowledge fields and awareness of the students in this respect we employed the factorial analysis reducing the 12 questions to three factors that grouped as follows. The present paper strictly analyzed the first 24 questions and the last three.

Table 2. Grouping of items into factors

<p><i>Factor 1: Learning awareness</i></p> <p>Q2. I consider that business is a dominant rational activity</p> <p>Q6. Efficient learning is based on a good motivation</p> <p>Q7. Entrepreneurship is based on learning by doing</p> <p>Q9. Learning is more efficient when there is a clear purpose in life</p> <p>Q10. I learn mostly from case studies, student projects and seminars</p>
<p><i>Factor 2: Rational field</i></p> <p>Q1. I appreciate the rationality of professors' lectures</p> <p>Q3. I always integrate new knowledge in my logical thinking system</p> <p>Q4. Appreciation of professors' critical thinking.</p> <p>Q5. I consider that business has an important emotional dimension</p>
<p><i>Factor 3: Spiritual field</i></p> <p>Q8. Working in project teams helps me in developing my emotional intelligence</p> <p>Q11. Working and learning in project teams implies sharing similar values</p> <p>Q12. Sharing knowledge is crucial for the survival of an eco-system</p>

Source: Authors' own processing

The reliability of the grouping of the factors is confirmed by the Kaiser-Meyer-Olkin test which is almost 0.8, therefore the method of factorial analysis is an efficient one to be applied on the collected sample (Table 3). The KMO test for both female and male can be consulted in the appendixes.

Table 3. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.778
Bartlett's Test of Sphericity	Approx. Chi-Square	344.3
	df	42
	Sig.	.000

Source: Authors' own processing

The emotional component is very important, yet dispersed throughout all the three factors: Q6-7 in factor 1; Q5 in factor 2, and Q8 in factor 3.

The first Factor is entirely devoted to *learning awareness* and builds on the rationality of the business process. Good motivation, a clear purpose in life, learning by doing and learning by means of case studies are all subsequent to learning awareness.

The second Factor, *rational field* of knowledge accounts for increased independence of the subjects which is given by their maturity of assessing the intellectual quality of the lectures, the capacity to integrate new knowledge by developing consonant and dissonant relationships with their existing structures. Moreover under this factor, subjects also have an important appetite for the critical thinking of their information conveyer, whom in our case is the professor. As surprising as it may seem, the emotional dimension of the business is highly positively correlated within this factor because most people consider that engaging in a business endeavor equally requires reason and emotion. In spite of the oversimplification of game theory pioneers, that economy is a game which can be strictly

defined by profit maximization and rationality, the current philosophy (e.g., behavioral economics) does not exclude emotional factors from the process of decision making.

The third Factor, *spiritual field*, builds on personal development via engaging in team-work and stimulating communication, with the main emphasis being placed on sharing values and knowledge.

The total variance explained per the entire model is 42.971%. At the same time we decided to conduct the factorial analysis segregated by male and female. The variance explained for male is 46.472% whereas the one for women is 42.797%. This value stems from the theoretical framing of restraining the number of factors to 3.

In each of the two particular cases (male/female), the reliability of the factorization procedure is confirmed by the Kaiser-Meyer-Olkin test with values 0.742 and 0.699 (see appendixes).

Table 5. Factor structure
OVERALL

	Factor		
	1	2	3
1		0.614	
2	0.456		
3		0.494	
4		0.69	
5		0.53	
6	0.71		
7	0.608		
8			0.657
9	0.568		
10	0.596		
11			0.585
12			0.57

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 4 iterations.

Table 6. Factor structure
MALE

	Factor		
	1	2	3
1		0.627	
2			0.8
3		0.593	
4		0.628	
5	0.553		
6			0.555
7			0.584
8		0.524	
9	0.555		
10			0.459
11	0.761		
12	0.511		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

Table7. Factor structure
FEMALE

	Factor		
	1	2	3
1			0.544
2			
3		0.498	
4		0.617	
5		0.641	
6	0.755		
7	0.606		
8			0.703
9	0.463	0.529	
10	0.662		
11			0.661
12			

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

The colors represent the variance of each clusters with respect to the range of items (initial questions 1-12). For example, Factor 2 in Table 5 is more centered on items regarding the rational knowledge (questions 1-4), compared, e.g., to factor 3 in Table 7 which is the most scattered over the whole range of items.

One can notice that Factor 3 from Male and Factor 1 from Female are almost similar: they both include Q6, Q7 and Q10, and differ only with respect to the membership of

Q2/Q9. On the other hand, it is noteworthy that Q2 and Q12 do not correlate significantly within the female factorization. This result calls for future investigation.

7 Conclusions

According to our analysis of the business ecosystems, the universities should turn their attention more to gaining access to online databases and sources for the students to be informed as it seems this is their most preferred means of acquiring knowledge and it also reveals a striking tendency of the Millennials and Z generations to orient their attention to more digitalised content.

Moreover, they exert an inclination to being pragmatic and strategic thinkers, not going for the accumulation of a large volume of information but an actual ability to learn which in turn can convert into enormous volumes of information stored. Another poignant finding is that the fields of knowledge are not clearly delineated in the minds of the interviewees, however they intertwine which could request for better teaching aligned to the necessities of the students as to further align their abilities and skills to the requirements on the labour market.

International projects play a crucial role in shaping a future employee and ensuring both self-esteem and the development of the individual and an advanced agility ability for the labour market.

With respect to knowledge dynamics, students are eager to learn by doing, to learn from their professors, projects and business meaning that these dynamics are boundaryless, confirming that the learning pattern of student has shifted.

The main limitations of the paper come from the fact that we strictly addressed the students of one faculty within the university which has actually 12 faculties, from the fact that we were not able to also conduct focus groups with different stakeholders including deans, vice-deans, rectors or curriculum developers. Further analyses can be conducted by not restricting the number of factors.

Acknowledgements

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References

- Albert, M. and Beatty, B.J. (2014). “Flipping the classroom applications to curriculum redesign for an introduction to management courses: impact on grades”. *Journal of Education for Business*, 89(8), 419-424.
- Anninos, L.A. and Chytiris, L.S. (2012). “The sustainable management vision for excellence: implications for business education”. *International Journal of Quality and Service Sciences*, 4(1), 61-75.
- Bajada, C. and Trayler, R. (2016). “Introduction to threshold concepts in business education”. *Education + Training*, 58(5), 458-462.

- Barret, R. (2010). "Culture and consciousness: measuring spirituality in the workplace by mapping values". In Giacalone, R.A. and Jurkiewicz, C.L. (Eds.). *Handbook of workplace spirituality and organizational performance* (2nd Edition, pp. 255-275). M.E. Sharpe, New York.
- Bejinaru, R. (2018). "Assessing students' entrepreneurial skills needed in the knowledge economy". *Management & Marketing. Challenges for the Knowledge Society*, 13(3), 1119-1132.
- Bratianu, C. (2015). *Organizational knowledge dynamics: managing knowledge creation, acquisition, sharing, and transformation*. IGI Global, Hershey.
- Bratianu, C., Agapie, A., and Orzea, I. (2011). "Knowledge dynamics modelling using Analytic Hierarchy Process (AHP)". In Turner, G. and Minnone, C. (Eds.). *Proceedings of the 3rd European Conference on Intellectual Capital*, 18-19 April 2011, University of Nicosia, Cyprus. Academic Conferences and Publishing International, Reading.
- Bratianu, C. and Bejinaru, R. (2017). "Knowledge strategies for increasing IC of universities". In Lopez, I.T. and Serrasqueiro, R. (Eds.). *Proceedings of the 9th European Conference on Intellectual Capital* (pp. 34-42), Instituto Universitario de Lisboa (ISCTE), Portugal, 6-7 April 2017, Academic Conferences and Publishing International, Reading.
- Bratianu, C. and Orzea, I. (2013). "Emotional knowledge: the hidden part of the knowledge iceberg". In Janiunaite, B., Pundziene, A. and Petraite, M. (Eds.). *Proceedings of the 14th European Conference on Knowledge Management* (Vol.1, pp. 82-90). Academic Conferences and Publishing International, Reading.
- Bratianu, C. and Vatamanescu, E.M. (2017). "Students' perception on developing conceptual generic skills for business: a knowledge-based approach". *VINE Journal of Information and Knowledge Management Systems*, 47(4), 490-505.
- Bray, D. (2007). "Knowledge ecosystems: a theoretical lens for organizations confronting hyperturbulent environments". In McMaster, T., Wastell, D., Ferneley, E. and DeGross, J. (Eds.). *Organizational dynamics of technology-based innovation: diversifying the research agenda*, Springer, Boston.
- Choudhury, M. (2015). "Integrity: a systematic philosophico-economic abstraction". *Kybernetes*, 44(3), 368-383.
- Damasio, A. (2012). *Self comes to mind: constructing the conscious brain*. Vintage Books, New York.
- Drucker, P.F. (1993). *Management: tasks, responsibilities, practices*. HarperBusiness, New York.
- Dunaway, M.K. (2011). "Connectivism: learning theory and pedagogical practice for networked information landscape". *Reference Service Review*, 39(4), 675-685.
- Gherardi, S., Nicolini, D. and Odella, F. (1998). "Toward a social understanding of how people learn in organizations: the notion of situated curriculum". *Management Learning*, 29(3), 273-297.
- Gladwell, M. (2005). *Blink: the power of thinking without thinking*. Back Bay Books, New York.
- Goleman, D. (1998). *Working with emotional intelligence*. Bloomsbury, London.
- Hadad, S. (2018). "The geographic distribution of Knowledge Economy (KE) within the European Union (EU)". *Management & Marketing*, 13(3), 1089-1107.
- Hill, D. (2008). *Emotioomics. Leveraging emotions for business success*. Revised Edition. Kogan Page, London.
- Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus & Giroux, New York.
- Jurše, M. and Mulej, M. (2011). "The complexities of business school alignment with the emerging globalization of business education". *Kybernetes*, 40 (9/10), 1440-1458.
- Kolb, A.Y. and Kolb, A.D. (2005). "Learning styles and learning spaces: enhancing experiential learning in higher education". *Academy of Management Learning & Education*, 4(2), 193-212.
- LeDoux, J. (1998). *The emotional brain: the mysterious underpinnings of emotional life*. Phoenix, New York.

- Maracine, V. and Scarlat, E. (2009). "Dynamic knowledge and healthcare knowledge ecosystem". *The Electronic Journal of Knowledge Management*, 7(1), 99-110.
- Martin, R. (2009). *The design of business. Why design thinking is the next competitive advantage*. Harvard Business Press, Boston.
- Miller, F.Q. (2015). "Experiencing information use for early career academics' learning: a knowledge ecosystem model". *Journal of Documentation*, 71(6), 1228-1249.
- Mintzberg, H. (2004). *Managers not MBAs. A hard look at the soft practice of managing and management development*. Financial Times/Prentice Hall, New York.
- Mitroff, I. and Denton, E.A. (1999). "A study of spirituality in the workplace". *Sloan Management Review*, 40(4), 83-92.
- Nissen, M.E. (2006). *Harnessing knowledge dynamics: principled organizational knowing & learning*. IRM Press, Hershey.
- Nonaka, I. and Takeuchi, H. (1995). *Knowledge-creating company: how Japanese companies create the dynamics of innovation*. Oxford University Press, Oxford.
- Nonaka, I., Toyama, R. and Hirata, T. (2008). *Managing flow: a process theory of the knowledge-based firm*. Palgrave Macmillan, London.
- Schiuma, G. (2009). "The managerial foundations of knowledge assets dynamics". *Knowledge Management Research & Practice*, 7(4), 290-299.
- Spender, J.C. (2014). *Business strategy. Managing uncertainty, opportunity, & enterprise*. Oxford University Press, Oxford.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*. Allyn & Bacon/Pearson Education.
- Tsang, H.W.C. and Tsui, E. (2017). "Conceptual design and empirical study of a personal learning environment and network (PLE&N) to support peer-based social and lifelong learning". *VINEJournal of Information and Knowledge Management Systems*, 47(2), 228-249.
- Tsui, E. and Dragicevic, N. (2018). "Using the scenario development and personal learning environment and network to support curriculum design". *Management & Marketing. Challenges for the Knowledge Society*, 13(2), 848-858.
- Valkokari, K. (2015). "Business, innovation, and knowledge ecosystems: how they differ and how to survive and thrive within them". *Technology Innovation Management Review*, 5(8), 17-24.
- Vătămănescu, E.M., Andrei, A.G., Leovaridis, C. and Dumitriu, L.D. (2015). "Exploring network-based intellectual capital as a competitive advantage. An insight into European university from developing economies". In Cegarra-Navarro, J.G. (Ed.). *Proceedings of the 7th European Conference on Intellectual Capital* (pp. 350-358). Technical University of Cartagena, Spain, 9-10 April 2015, Academic Conferences and Publishing International, Reading.
- Vătămănescu, E.M., Andrei, A.G. and Pinzaru, F. (2018). "Investigating the online social network development through the Five Cs Model of Similarity: the Facebook case". *Information Technology & People*, 31(1), 84-110.
- Vizitiu, C., Agapie, A., Paiusan, R., Hadad, S., & Nastase, M. (2018). "Adapting a corporate entrepreneurship assessment instrument for Romania. *South African Journal of Business Management*", 49(1), 1-7.
- Wallis, S.E. and Valentinov, V. (2016). "The imperviance of conceptual systems: cognitive and moral aspects". *Kybernetes*, 45(9), 1437-1451.
- Zohar, D. and Marshall, I. (2000). *Spiritual intelligence: the ultimate intelligence*. Bloomsbury, London.

Engaging Actors for Market-Oriented Competence Creation in Logistics Knowledge Triangle ecosystems. Perspectives from an EU project

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Abstract

Nowadays, Logistics has become one of the most strategic areas for organizational performance, becoming progressively more and more challenging with the birth of new regulations, innovative technologies, and new customer demands, particularly related to the spreading of Industry 4.0 and the rise of new sustainability issues. The numerous changes that have been occurring in the sector are making it a priority for educational institutions to provide students and workers with high-quality competences and skills that businesses require in order to keep pace with the market.

This paper presents some findings and perspectives from a European research project called "FRAMELOG, European Framework for 'Knowledge Triangle' in the Logistics Sector", which is focused on the knowledge dynamics of the so-called Knowledge Triangle (hereafter, KT). The KT is considered a suitable framework for defining a macro knowledge ecosystem which links educational organizations, research institutions, and for-profit entities with the common scope of creating high-quality competences. In this macro perspective, we first performed a multiple case study analysis at European level to identify some effective methods and tools used to implement dynamic knowledge-creating connections among cross-sectorial key organizations in the logistics area. Subsequently, following a literary review and focus group activities, we identified a panel of indicators that can be used to assess and guide the building of collaboration between organizations, according to the Deming Cycle.

In addition, some "Methods", "Tools and Actions" and "Guidelines" were created to help organizations working in the KT ecosystem to effectively set up those steps needed to increase collaboration within it.

From the early findings of the FRAMELOG Project, it appears that conjoint knowledge-creating dynamics, such as the sharing of good practices, the use of different guidelines and the application of stakeholder engagement techniques, can contribute to stimulating proactive relationships between organizations, in the common objective of creating high-level skills on logistic topics and for the overall logistics sector.

Reducing the distance between organizations working in the fields of education, research, and business can enable the implementation of virtuous spirals of knowledge creation in all three areas, leading to the formation of an effective knowledge ecosystem for the logistics area; by extension, this can also foster an increase in the productivity of the whole industry and greater well-being at regional, national, and European levels.

Keywords – knowledge dynamics, stakeholder engagement, knowledge triangle, logistics, supply chain management

Paper type – Practical Paper

1. Introduction

Logistics¹ and Supply Chain Management² topics have been growing in importance in both scientific literature and business practices for the increasingly strategic impact of related activities, both at a micro (single organisation) and a macro level (country). The various changes that have occurred and are occurring under multiple aspects, such as new regulations, globalization (Arvis *et al.*, 2018), new customer demands, sustainability issues (Carter & Easton, 2011), and innovative technologies, particularly the ones related to Industry 4.0 (Barreto *et al.*, 2017; Wang, Gang, *et al.*, 2016); Lamba & Singh, 2017; Macaulay *et al.*, 2015; Pfohl *et al.*, 2017), raise the need for new professionalism and both transversal and specialized competences to guide organizations through this constant transformation (Trautrimis *et al.*, 2016). A recent study (McKinnon *et al.*, 2017) highlights a significant European shortfall of competences and adequate staff profiles for logistics and underlines the need for both in-depth research and practical business-oriented solutions. In this context, public and private educational systems should react by adjusting their offer to keep it aligned with the new methods, contents, and competences required by the market and they should actively contribute to the development of this growing sector.

A theoretical approach that can be used to frame the connections and analyse the relationships among very different actors, meaning educational organizations and business entities, is the so-called Knowledge Triangle (Markkula, 2013; Unger & Polt, 2017). Within the KT, we applied the basic, well-known Nonaka theories, from the original one on dynamic knowledge creation (Nonaka, 1994) to the one on “Ba” (Nonaka & Konno, 1998; Nonaka, Konno, & Toyama, 2000).

In this framework, bilateral relationships are drawn among education, business and research organizations that are vital for “improving the impact of investments and inter-

¹ “Logistics is the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the organization and its marketing channels in such a way that current and future profitability are maximized through the cost effective fulfillment of orders” (Christopher, 2005, p. 4).

² “Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses and stores, so that merchandise is produced and distributed in the right quantities, to the right locations, and at the right time, in order to minimize system-wide costs while satisfying service level requirements” (Simchi-Levi, Kaminsky, & Simchi-Levi, 1999, p. 1).

organizational knowledge circulation in the three activities involved” (Scipioni, Niccolini, 2018). Goal-oriented relationships among actors may enable a higher circulation of knowledge regarding competence formation – by sharing and discussing practices, instruments, ideas and future orientations – oriented to higher quality and effectiveness of the overall educational system in responding to market needs.

In this context, the European project “FRAMELOG” was funded by the European Commission from September 2016 to August 2019, to create a “European Framework for ‘Knowledge Triangle’ in the Logistics sector”, meaning a set of theoretical background and instruments designed for organizations to enhance their level of collaboration, and consequently the quality of education in the logistics area. The participating Partners, with the University of Pisa acting as Coordinator, already represent a Knowledge Triangle, with a scope that includes educational and research institutions (University of Transylvania in Brasov, University of World Economy), three specialized businesses representing associations (one at the European Level (The European Logistics Association) and two operating at the national level (Bulgarian Logistics Association and Associazione Italiana Logistica e Supply Chain Management)), as well as EU project specialists (Effebe – Finance & Banking, *Associazione per lo Sviluppo Organizzativo e delle Risorse Umane*), covering four different countries (Italy, Bulgaria, Romania, and Belgium).

Following the presentation of the different research methods and data used in the study, some preliminary findings and related discussions will be offered to share the experience of an articulated application of a theoretical framework in a real logistics context in Europe.

2. Methods

To address the presented topics, mixed qualitative and quantitative methods were used over a period of three years. To begin, a multiple case study analysis (Yin, 2009) was performed on European examples of an already applied Knowledge Triangle in the logistics area, with higher education institutions, research centres and companies actively working together in the field. Together with a literature review of European general educational systems and methods, this methodology was considered well-suited for an exploratory study of the state-of-art of the educational offer in logistics. While considering the limitations of case study research, in terms of empirical generalizability (Hammersley et al., 2000) and of transferability of specific instruments and practices investigated in different contexts, it nevertheless offered a starting point in the study of the underlying collaboration concepts and the subsequent design of an adaptable framework of criteria, indicators, and tools for the widest possible audience.

Firstly, a snowball sampling procedure was adopted. To select the sample of case studies, the FRAMELOG Project Partners provided known examples of collaborations among the three actors of the Triangle, in the logistics sector. Starting from those examples, and cross-referencing official rankings of top universities across Europe, a sample of case studies – of universities – were selected to be deeply analysed. In order to

conduct interviews with reference people of the selected cases, a template was prepared and shared with the interviewers.

Secondly, several focus group sessions were held with experts from educational, research, and business organizations, in order to theorize a framework out of the case study analysis and the available literature on the topic. It was considered essential to have a leading pattern to follow in the development of the framework and to guide the brainstorming activity; at that point, the Deming cycle (1993) was identified as the most representative one. This cycle illustrates the activity development of an improvement-oriented organization, identifying the four ideal stages of Planning, Performing, Checking, and Innovating for strategic and operative activities. In each focus group session, a document was shared among the participants to work on and, depending on the progressive results, an updated version of the same document became the basis of the following meetings. After several sessions, and a final validation among the participating partners, a conclusive version of “the FRAMELOG framework” was shared in March 2018.

Finally, to test the real effectiveness of the proposed framework among key stakeholders, both quantitative and qualitative analyses were conducted, starting from January 2019. For the quantitative analysis, a structured questionnaire with a five-point Likert scale evaluation was prepared and administered at both national and European levels; this survey was meant to assess the relevance of the presented framework and the effectiveness of the built-in tools in achieving high-quality and effective collaboration among KT actors. As regards the qualitative analysis, a European focus group session was held in Brussels on 13th March 2019, which delved into specific and highly relevant aspects of the framework in detail.

In the section that follows the main preliminary findings will be presented and discussed, although the final evaluation of the proposed framework is not yet available and the presented tools may still need to be fine-tuned accordingly.

3. Findings and discussion

In the next paragraphs, the findings presented are arranged by research method applied.

3.1 Multiple case study analysis

From the multiple case study analysis, a set of 13 examples of effective collaboration were identified across Europe¹, as summarized in the following table.

¹ From EU project FRAMELOG, *Compendium of Good Practices*, 2016-1-IT02-KA203-024565

Table 5_Selected case studies on KT application in Europe (extrapolated by the authors)

University	Country
1. Zaragoza Logistics Center (ZLC)	Spain
2. Rotterdam School of Management, Erasmus University	The Netherlands
3. The University of Huddersfield	The United Kingdom
4. Kühne Logistics University (KLU)	Germany
5. University of National and World Economy	Bulgaria
6. Montanuniversität Leoben	Austria
7. Hull University Business School	The United Kingdom
8. Jönköping University	Sweden
9. Politecnico di Milano School of Management	Italy
10. Budapest Metropolitan University	Hungary
11. University of Padova	Italy
12. University of Pisa (Polo Universitario Sistemi Logistici Livorno)	Italy
13. University of Gothenburg and Chalmers University of Technology	Sweden

The analysis of the case studies showed heterogeneity in terms of type, ownership, country of origin, and level of influence (local, national, international, or combined) of the single organizations, meaning there were different levels of influence on the integration of the Knowledge Triangle. For example, those universities with a mostly national influence present a high socio-economic impact on their respective country (e.g. ZLC: a high level of local employment), while the more international-oriented ones (e.g. KLU) activate, on average, a greater number of cross-border activities, such as participation in international projects. The principal common features of the case studies analysed can be summarized in the following points:

- a strong professional orientation toward facilitating employability, with a practical orientation of both study material and educational method;
- the development of a competency-based approach to curriculum design, and the combination of education and work experiences;
- the presence of only one strategic connection inside the Triangle, mostly between the education and business fields.

The complete description of each case study feature, along with a detailed comparative analysis, has been included in the “Compendium of Good practices”, which provides concrete examples of applicable patterns for collaboration among KT actors; it is a document that is available to and designed for organizations in the logistics area.

3.2 Focus group analysis

Following the case studies analysis, “the FRAMELOG” was set up through the focus group activity. It consists of a framework of criteria, methods, and tools identified and/or developed for educational, research, and business organizations to improve collaboration among the other actors of the KT, with the common objective of enhancing the quality of competence formation in the logistics area.

“The FRAMELOG” presents 19 indicators (for a detailed list of indicators, see Annex I); for each of them, a “Method”, a set of “Tools and possible Actions” and a “Guideline” were identified to help organizations align themselves with the identified indicators for specific collaboration-oriented activities. The above-mentioned features are organized in three sections, according to the first three Deming cycle phases: Plan, Do, and Check. The phase in which an organization works to reinvent its activity on the basis of both the “Check” stage and, in this context, the discussions within its collaboration environment, corresponding to Deming’s fourth phase (Act), is translated into a set of “Guidelines for implementing the FRAMELOG” associated with selected high-impact indicators. In fact, once the actor (an organization) considers following the Guidelines to set up its own activities, it starts moving on a positive and proactive path towards a more integrated environment in which it works with the other actors, “acting” as a collaborative player inside the Knowledge Triangle.

Table 6_Main features of "The FRAMELOG" (extrapolation by the authors)

Indicators	Phases of activity flow (PDCA)	Methods	Tools and possible actions to be used/implemented	Guidelines
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In the study, one of the features considered most strategic for effective collaboration among educational, research, and for-profit organizations is the presence of conjoint activities between them, with a tangible result in terms of, for example, student employment, intellectual products (e.g. scientific papers, research projects), long-term partnerships, and/or dissemination events. In this logic, the “Guidelines for implementing the FRAMELOG” are intended as a guide to setting up the related collaboration activities, with the necessary adaptation to the specific context. These indications should help organizations to set up their own activities considering a combination of lessons learnt, general indications coming from other organizations’ good practices, and insights from scientific literature.

Among the tools highlighted as strategic for setting up a collaboration pattern among the KT actors, the “FRAMELOG Stakeholder Engagement Plan” merits special note. In this document, a stakeholder analysis and a summary of possible communication actions, objects, and strategies are presented as a tool to be used by organizations in attracting and managing its “key stakeholders” for collaboration. For example, the Stakeholder Engagement Plan can support the development of some activities suggested for the “Planning” phase of the collaboration, such as arranging for students to visit business facilities in order to make them aware of the real functioning of logistics procedures inside a company; this is designed to go hand-in-hand with traditional in-school learning.

Finally, after analyzing the preliminary results of the testing activity, some initial insights can be highlighted from the stakeholders’ perception of the proposed methods, actions, and tools. In particular, from the results of the Italian assessment, an overall average of 4.1 points out of 5 was reached for the tested elements. In more detail, stakeholders from both the educational and business areas seem to support the

construction of the FRAMELOG and the suggested tools; they consider those tools that are reactive and quickly applicable, i.e., with few procedural barriers for their concrete organization and development, to be most useful and effective.

In the next few months, the results from the Belgian, Bulgarian, and Romanian quantitative assessments and from the European focus group session (Brussels, March 2019) will be available and will provide a European overview of the stakeholders' perception of the framework. With the systematic evaluation of all the feedback from the FRAMELOG key stakeholders, some important indications will be highlighted and used in the final adjustment of the FRAMELOG and the developed tools to support organizations in creating high-quality logistics competences in the context of a more collaboration-oriented environment.

4. Conclusions

The orientation toward a more collaborative environment, which would enable an organization to not only reach its own stated goals, but redesign them to constantly enhance its performance thanks to its openness to new ideas, procedures, and methods to remain competitive in the market, is something that can be found in every economic sector. For logistics, it has become essential as the sector is increasingly becoming more competitive in terms of rapid technological innovations, new profiles of players coming into different areas, and fast-changing consumer needs. In this context, the formation of high-quality competences plays a strategic role in creating those essential intangible assets that support organizations in their innovation process. A possible pattern that educational, research, and business organizations can refer to when improving their collaboration for the formation of logistics-oriented competences is the Knowledge Triangle concept applied to logistics and the related "FRAMELOG" framework of methods, actions, and tools.

The embedding of the identified indicators for "FRAMELOG" implementation within the Nonaka knowledge-creation spiral concept, aligned to the Deming PDCA framework of activity, could contribute to developing a more collaborative and dynamic managerial approach for the actors inside the Knowledge Triangle. In fact, redesigning or activating collaboration-oriented strategic and operational activities as well as applying good practices and insights from scientific literature along with stimulating suggestions from experts, should help organizations to enhance knowledge creation and circulation among the KT players, as shown in the following figure.

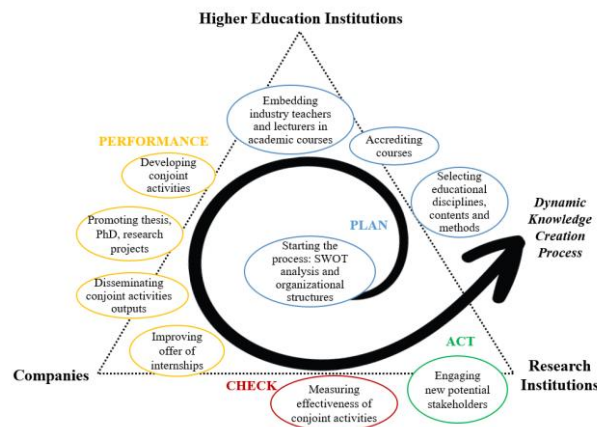


Figure 1_FRAMELOG high-impact indicators embedded in Nonaka's knowledge-creation spiral (extrapolation by the authors) within the Knowledge Triangle

Although the planning phase appears to be the most strategic one to focus on, collaboration should certainly be activated in each stage of the Deming cycle. Looking at collaboration as a constantly evolving knowledge-creation spiral, each collaboration-oriented activity builds the basis of a virtuous cycle which will progress towards high-quality relationships among educational, business, and research institutions. Only after the collaboration is enacted, can the practical design, application, and control of specific tools and conjoint processes possibly take place and lead, as specifically analysed in this study, to a higher quality of competence formation in the logistics area. Widening the application of the “FRAMELOG” outside specific contexts and single organizations, an overall and systematic enhancement of collaboration in logistics competence formation should help to shorten the distance between the three angles of the Knowledge Triangle and create an inter-organizational, hybrid Nonakian “Ba”, thus enabling the development of knowledge-sharing relationships and consequent strategic and operative processes, jointly oriented toward the enhancement of competence formation.

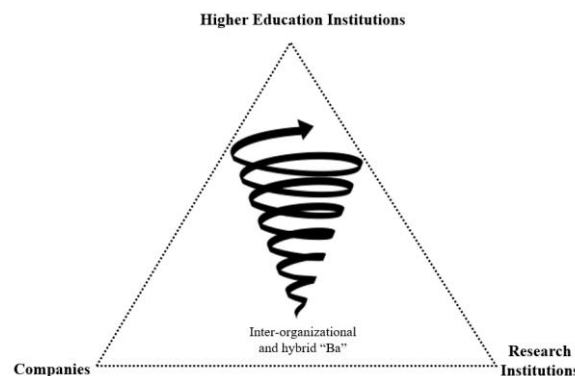


Figure 2_Knowledge Triangle enabling the development of Nonaka's inter-organizational and hybrid "Ba" for knowledge-creation (Authors' adaptation from Nonaka, Toyama, Konno, 2000: 14)

Like any process, this collaboration scheme would need initial proactive players to activate the process and increase the chances of success, as experienced also in other contexts and with different stakeholders (Ferraro & Beunza, 2018). So far, universities seem to be the primary activators of the knowledge-sharing process that favours KT application in Logistics. From the ongoing testing activities, the interaction among key stakeholders, the sharing of a common approach to conjoint activities, the use of quickly applicable instruments to boost collaboration, and the involvement of governance representatives are considered essential features that enable the process to be effective from a long-term perspective. Once the evaluation phase is concluded, more refined results will be available, but, for the moment, some aspects can be positively highlighted. In fact, although the applicative methods could vary from one context to another, a general attention and potential commitment of organizations within the KT to the formation of high-quality competences in Logistics has been confirmed. This is evident, in particular, in the creation of macro knowledge ecosystems in which the exchange of ideas, practices, and tools is enacted, leading its members to higher levels of performance, with wider recognition and openness to those innovations and growing opportunities deemed necessary for remaining competitive in the market.

References

- Arvis, J. F., Ojala, L., Wiederer, C., Shepherd, B., Raj, A., Dairabayeva, K., & Kiiski, T. (2018). *Connecting to Compete 2018: Trade Logistics in the Global Economy*. World Bank
- Barreto, L., Amaral, A., & Pereira, T. (2017). Industry 4.0 implications in logistics: an overview. *Procedia Manufacturing*, 13, 1245-1252
- Carter, C. R., & Liane Easton, P. (2011). Sustainable supply chain management: evolution and future directions. *International journal of physical distribution & logistics management*, 41(1), 46-62.
- Christopher M. (2005), *Logistics and Supply Chain Management*, Prentice-Hall, 3rd edition
- Deming, W. E. (1993). *The New Economics for Industry. Government, Education*.
- EU project 2016-1-IT02-KA203-024565 “‘FRAMELOG’ European framework for ‘Knowledge Triangle’ in the logistics sector”, KA2 - Cooperation for Innovation and the Exchange of Good Practices, Strategic Partnerships. Official website: www.framelog.eu
- Ferraro, F., & Beunza, D. (2018). Creating Common Ground: A Communicative Action Model of Dialogue in Shareholder Engagement. *Organization Science*, 29(6), 1187–1207.
- Hammersley, M.; Foster, P. and Gomm, R. (2000). Case study and generalisation. In: Gomm, R.; Hammersley, M. and Foster, P. eds. *Case Study Method: Key Issues, Key Texts*. London: Sage, pp. 98–115.
- Lamba, K., & Singh, S. P. (2017). Big data in operations and supply chain management: current trends and future perspectives. *Production Planning & Control*, 28(11-12), 877-890
- Macaulay, J., Buckalew, L., & Chung, G. (2015). Internet of things in logistics: A collaborative report by DHL and Cisco on implications and use cases for the logistics industry. *DHL Trend Research and Cisco Consulting Services*
- Markkula, M. (2013). The knowledge triangle renewing the university culture. P. Lappalainen & and M. Markkula (Eds.), *The Knowledge Triangle: Re-Inventing the Future*, 11-31.
- McKinnon, A., Flöthmann, C., Hoberg, K., & Busch, C. (2017). *Logistics Competencies, Skills, and Training: A Global Overview*. World Bank Publications, 17.

- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization science*, 5(1), 14-37.
- Nonaka, I., & Konno, N. (1998). The concept of “ba”: Building a foundation for knowledge creation. *California management review*, 40(3), 40-54.
- Nonaka, I., Toyama, R. and Konno, N. (2000), “SECI, *Ba* and leadership: a unified model of dynamic knowledge creation”, *Long Range Planning*, Vol. 33 No. 1, pp. 5-34
- Pfohl, H. C., Yahsi, B., & Kurnaz, T. (2017). Concept and diffusion-factors of industry 4.0 in the supply chain. In *Dynamics in Logistics* (pp. 381-390). Springer, Cham.
- Simchi-Levi D., Kaminsky P., Simchi-Levi E., Bishop W. (2007). *Designing & Managing The Supply Chain: Concepts, Strategies and Case Studies*, 3rd edition McGraw-Hill Book Company
- Scipioni S., Niccolini F. (2018) Breaking down knowledge barriers between higher education, research, and business in Logistics. Evidence from the “FRAMELOG” Erasmus+ Project. 1st International Management, Quality and Marketing Conference Proceedings, RANEP, Moscow (Russia).
- Trautrim, A., Defee, C., & Farris, T. (2016). Preparing business students for workplace reality—using global virtual teams in logistics and SCM education. *The International Journal of Logistics Management*, 27(3), 886-907.
- Unger, M., & Polt, W. (2017). The knowledge triangle between research, education and innovation—a conceptual discussion. *Допчаїм*, 11(2 (eng))
- FRAMELOG Consortium, (2018) "Compendium of good practices" EU project 2016-1-IT02-KA203-024565 FRAMELOG European framework for 'Knowledge Triangle' in the logistics sector, KA2 - *Cooperation for Innovation and the Exchange of Good Practices*
- Wang, Gang, et al. (2016). "Big data analytics in logistics and supply chain management: Certain investigations for research and applications." *International Journal of Production Economics* 176: 98-110
- Yin, R. K. (2009). *Case study research and applications: Design and methods*. Sage publications, London.

Web references

http://ec.europa.eu/education/policy/higher-education/knowledge-innovation-triangle_it
[http:// www.framelog.eu/](http://www.framelog.eu/)

Annex I

#	PDCA cycle phase	FRAMELOG indicators: Presence of
1	PLAN	Courses or exams in Logistics
2		Dedicated staff for collaboration on didactic activities related to logistics topics
3		Centres for Research on Logistics
4		External contacts for selecting educational contents
5		External contacts for defining educational programmes
6		External contacts for choosing lecturers
7		External contacts for selecting educational methods
8		External contacts for governance on Logistics
9		Research activities/ topics in Logistics
10	DO	Conjoint research projects, consultancies on Logistics
11		Logistics-related events
12		Coordination, offer of internships in Logistics
13		Coordination, offer of thesis topics related to Logistics

#	PDCA cycle phase	FRAMELOG indicators: Presence of
14		Visits organized to facilities related to Logistics topics
15		Temporary and/or permanent partnerships on Logistics
16		PhDs, grants, fellowships, professorial chairs on Logistics topics
17	CHECK	Alignment of course requirements and external partners in Logistics
18		Employment consequent to internships/ projects in Logistics
19		Production of intellectual output: papers, patents, software etc. on Logistics

Chit-Chat Matters: Work-Related Knowledge Flows through Informal Inter-Organizational Ties

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Abstract

Industrial clusters are characterized by an intense actors interacting with the effect of sharing existing knowledge and creating new one. In this environment knowledge unevenly flows across organizational boundaries and a significant part is exchanged via informal channels.

Despite some scholars argued that only general and low-value information can be shared through this kind of channels (Breschi & Lissoni, 2001), empirical research show that specific and critical knowledge diffuses through informal networks as well (Dahl & Pedersen, 2004).

Indeed, informal ties between firms represent the fertile ground for the so-called 'information trade', according to which firms must first give useful information in order to obtain it (Rogers, 1982). Von Hippel (1987) considers informal information trade between firms as an important form of cooperative R&D, likely to occur in industries where proprietary knowledge is critical for firms' success.

Although such knowledge spillovers are recognized to be not a critical factor for firms' willingness to cluster (Krugman, 1991), they are an important form of knowledge transfer and their existence within clusters is undoubtedly linked to the one of informal networks. Scholars argue that formal ties among firms are important in explaining innovation exactly because they enable access to informal spillovers within a regional ecology (Owen-Smith & Powell, 2004, p. 9). This argument is motivated by the fact that a large portion of the knowledge exchanged across organizational borders is tacit in nature, which is informally transmitted by face-to-face interaction (Giuliani, 2010). It descends that informal inter-organizational networks represent interesting subjects of study for their pivotal role as conduits for information and knowledge diffusion.

Although several studies recognize the importance of informal networks for the dissemination of knowledge, they mostly fail in assessing the extent to which inter-organizational informal ties represent conduits of work-related knowledge.

The data belongs to an original dataset that we have built over time since the establishment of the ITC Pole of Abruzzo Region.

First results highlight that a considerable part of informal ties represents conduits of work-related knowledge.

The paper try to contribute to the literature by emphasizing the importance of informal inter-organizational networks; when studying industrial cluster as knowledge ecosystems, informal ties among cluster actors do exist and a considerable part of those are exclusively devoted to share work-related knowledge.

Keywords – Informal ties, inter-organizational network, knowledge sharing, knowledge ecosystem

Paper type – Academic Research Paper

1 Introduction

Knowledge sharing is nowadays a condition to innovate and, consequently, for the prosperity of firms. If this were not the case, firms would have sought geographic isolation and "locational patterns of innovative firms would be very different from what we observe" (Feldman, 1999, p. 19).

Geographical proximity grants firms a higher likelihood to innovate than isolated ones due to a knowledge spillover (Baptista & Swann, 1998; Beaudry & Breschi, 2003), having also a pivotal role in firm internationalization (Libaers & Meyer, 2011) and regional economic performance (Delgado, Porter, & Stern, 2014).

Despite the acknowledged importance of interorganizational networks to knowledge sharing, still little research has explored the relationship between social network properties and innovation (Fleming, King III, & Juda, 2007). As a consequence, the literature on industrial districts and clusters is characterized by an abundance of arguments on the effect of interorganizational ties on the performance of connected actors, but mainly lacks of empirical findings (Ferriani & MacMillan, 2017). Under this light, this study represents an attempt to explore the relationship between interorganizational networks and innovative performance, with a specific focus on informal networks.

Within industrial clusters¹, knowledge unevenly flows across organizational boundaries as knowledge sharing is a strongly selective process (Alberti & Pizzurno, 2015; Giuliani & Bell, 2005). Since part of this knowledge is exchanged via informal channels (Saxenian, 1994), the attempt of this study is a first exploration of informal relationships within a business network. Having the availability of longitudinal data, we perform our study on the ICT Pole of Abruzzo Region, an Italian high-tech cluster.

¹ At this stage we use the expression "industrial district" and "cluster" indistinctly to mean an agglomeration of business strongly or weakly connected in a geographical area.

In industrial cluster research, informal interorganizational networks represent interesting subjects of study, not only for their pivotal role as channel of conduits for information and knowledge diffusion, but also because of their importance in nourishing and sustaining formal interorganizational relations. For instance, the network backbone of San Diego biotechnology cluster in California emerged from ties linking managers in the early stage of the cluster formation (Casper, 2007).

We first presents the case that aroused our curiosity and then the literature review; managerial implications and direction for further research are discussed.

2. The ICT Innovation Pole of Abruzzo Region

The ICT Innovation Pole – *Polo d'Innovazione ICT* in Italian – was established in 2011 to support the formation of an innovation cluster for territorial and industrial development of Abruzzo Region. Its establishment comes as an investment in innovation and research covered by the European Regional Development Fund (ERDF), fund established under the Regional Policy framework by the European Commission with the aim to correct economic and social imbalances between the regions of the European Union. The regional administration published a Public Notice calling for the formation of innovation poles with the goal of a strategic repositioning of the economy of Abruzzo Region in the national and international markets. The call was then attended by a group of 49 companies proposing the establishment of a high-tech cluster, the ICT Innovation Pole. Cappiello and Iapadre (2016) succinctly explain the story of the ICT Innovation Pole and the dynamic underlying its establishment and development.

With regards to the aims of the present study, the ICT Innovation Pole represents an interesting case at least for three reasons. First, innovation is extremely important for firms to be competitive in high-tech industries such as microelectronics and ICT due to fast-paced technological advances. For this reason, in this industry is particularly important for firms – especially for SMEs – to collaborate with peers to ensure their seat in the next round of innovation. In such context, it appears particularly interesting to investigate the effect of informal interfirm networks on innovative performance of firms. Second, in such high-tech industries innovative performance of firms is easy measurable by using innovation inputs (e.g. R&D expenditure) and outputs (e.g. patent counts, patent citations, and new products) (Hagedoorn & Cloudt, 2003). Third, the availability of longitudinal data since the cluster establishment makes the ICT Innovation Pole a unusual unit of analysis for studying the facilitative effect of informal interfirm networks existing prior cluster formation on subsequent formal innovation interfirm linkages.

For the purposes of this first observation of informal networks we analysed two surveys performed in 2015 and 2016. Network and firm-level data have been collected each year from which relational matrices have then been coded. In each yearly survey, among other questions, firm representatives were asked to indicate from the complete list of cluster members with which one they had established informal ties during the previous year, and whether the knowledge exchanged through such ties was work-related or not.

A first data analysis highlights that a considerable part of informal ties represents conduits of work-related knowledge. More specifically, in 2014 and 2015, 85% and 63%, of the informal ties constituting the informal network acted as conduits of work-related knowledge. In the same years, 60%, and 62% of the informal network was used to carry non-work related knowledge, respectively. Finally, in the same years respectively 45% and 25%, of inter-organizational informal ties acted as a conduit for both work-related and non-work-related knowledge.

3 Literature review and hypothesis development.

Several empirical studies recognize that firms acquire large amounts of information through informal communications (Owen-Smith & Powell, 2004; Powell, Koput, & Smith-Doerr, 1996; Saxenian, 1994). Despite some scholars argued that only general and low-value information can be shared through this kind of channels (Breschi & Lissoni, 2001), empirical research show that specific and critical knowledge diffuses through informal networks as well (Dahl & Pedersen, 2004). Communications between people facilitates knowledge sharing across organizational borders (Ring & van de Ven, 1994; Saxenian, 1990), a considerable part of which occurs through informal channels. Further, social cohesion around informal relationships ease knowledge transfer between individuals (Reagans & McEvily, 2003), and this applies to interfirm informal networks as well. Indeed, informal ties between firms represent the fertile ground for ‘information trade’, according to which firms must first give useful information in order to obtain it (Rogers, 1982). Von Hippel (1987) considers informal information trade between firms as an important form of cooperative R&D likely to occur in industries where proprietary knowledge is critical for firms’ success. Although such knowledge spillovers are recognized to be not a critical factor for firms’ willingness to cluster (Krugman, 1991), they are an important form of knowledge transfer and their existence within clusters is undoubtedly linked to the one of informal networks. Scholars argue that formal ties among firms are important in explaining innovation exactly because they enable access to informal spillovers within a regional ecology (Owen-Smith & Powell, 2004). This argument is motivated by the fact that a large portion of the knowledge exchanged across organizational borders is tacit in nature, which is informally transmitted by face-to-face interaction (Giuliani, 2010).

The existence of informal interorganizational networks is physiological in industrial cluster, as informal contacts are facilitated by spatial proximity. For instance, Huggins and Johnston (2010) found that investments in social capital – used to sustain knowledge-based collaborations – where more than double in firms co-located with their knowledge partners. Spatial proximity is clearly an important determinant of knowledge sharing, which is also why industrial districts exist (Feldman, 1999). Although knowledge diffuses among organizations in all industries, the intensity and effect of knowledge streams depends upon spatial proximity (Jaffe, Trajtenberg, & Henderson, 1993; Maskell & Malmberg, 1999). Examining the ‘paper trails’ of knowledge spillovers, Jaffe et al. (1993) found patent citations to be geographically localized. Propinquity has been found

to positively influence firm innovative performance, having a contingent effect together with network position (Whittington, Owen-Smith, & Powell, 2004). However, other scholars argue that spatial proximity does not drive the establishment of knowledge linkages as much as the latter depends upon each firm's absorptive capacity (Amin & Cohendet, 2004; Giuliani & Bell, 2005). Indeed, knowledge unevenly diffuses within clusters, flowing within sub-clusters consisting of firms with similarly high absorptive capacity (Giuliani & Bell, 2005). Being co-located was not enough also in the study of a footwear district in southern Italy by Boschma and Ter Wal (2007), where not all of the cluster actors were taking part in the local knowledge network. As opposed to Giuliani and Bell (2005), however, they found that firms' absorptive capacity was not influencing their position within the local knowledge network (Boschma & Ter Wal, 2007).

In short, what emerges from the presented literature is that i) clustered firms innovate more than isolated ones, ii) innovation is geographically localized, and iii) informal networks seems to be important channels for innovation-related knowledge diffusion.

As anticipated before, informal interorganizational networks represent interesting subjects of study, not only for their pivotal role as channel of conduits for information and knowledge diffusion, but also because of their importance in nourishing and sustaining formal interorganizational relations.

Existing ties between firms encourage and nourish the formation of subsequent linkages due to the availability of information about the knowledge partner. This effect is usually referred as *facilitative* (Ahuja, 2000a), in the sense that it shows firms the collaboration opportunities worth to be seized on the basis of prior contacts with knowledge partners (Gulati, 1995; Gulati, 1999). There is also a more *substantive* effect (Ahuja, 2000a), in the sense that existing ties between firms also nourish, for instance, the commercialization of firm innovations and their adoption by partners (Gulati, 1995; Gulati, 1999). For the sake of our discourse on informal networks and their effect for interfirm linkages establishment in the cluster formation process, we clearly focus on the facilitative effect of networks.

The facilitative effect of prior social ties is closely coupled with *knowledge-based trust* (Shapiro, Sheppard, & Cheraskin, 1992), which is established between firm building upon shared norms of equity and positive experiences. It is also for this reason that alliance formation between two firms is more likely to occur if they had prior alliance ties (Gulati & Gargiulo, 1999). The willingness of a firm to establish collaborative interfirm linkages also depends upon the awareness that the collaborative counterpart might have much to lose from engaging in opportunistic behaviors (Gulati, 1998), the so called *deterrence-based trust* (Shapiro et al., 1992). Within clusters, both knowledge-based and deterrence-based trust acquire more relevance as the density of interorganizational informal network grows. It is clear that the 'knowledge base' of trust enlarges as the informal network becomes denser due to experience sharing among actors: if a firm shares its experience with a certain knowledge partner with a third firm, said experience, although indirect in nature and in the form as it has been told, enriches the 'knowledge base' of the third firm about that knowledge partner. Likewise, deterrence-based trust acquires more relevance as the informal network becomes denser, as losses coming as

results of opportunistic behavior – loss of points of contact with actors, loss of the possibility of repeated collaboration, and loss of reputation (Gulati, 1998) – are associated with significantly higher costs of isolation. This is primarily due to the fact that, knowing each other and engaging in informal networking, cluster actors share negative experiences as well (i.e. gossiping), which might significantly lessen the existing knowledge-based trust of firms towards a given actor.

Kurland and Pelled (2000) define gossiping an activity involving few people in an organization who engage in informal and evaluative talks about another organizational member who is absent at that moment. Such definition of gossiping might be extended from intraorganizational to interorganizational settings without any loss of meaning, whereby few people who belong to different cluster actors engage in informal and evaluative talks – along the interorganizational informal network – about another cluster member. In business networks, such gossiping is generally more likely to occur then the business network is dense (Rooks, Tazelaar, & Snijders, 2011), which largely support the arguments presented above.

It is for the interplay between knowledge-based and deterrence-based trust, and because of them being influenced by gossiping, that informal interfirm ties are important for innovation-related collaborations among firms. It then becomes subject of interest in industrial cluster research for the investigation of the facilitative effect on the establishment of subsequent interfirm linkages.

The paper contributes to the literature by emphasizing the importance of informal inter-organizational networks for the diffusion of work-related knowledge. When studying industrial cluster as knowledge ecosystems, informal ties among cluster actors do exist and a considerable part of those are exclusively devoted to share work-related knowledge.

Building on this body of literature, would be interesting to analyze the relationship between the position of the actors in informal networks and their innovative performance. As the position of firms in the knowledge network positively relates to their innovative performance (Boschma & Ter Wal, 2007, Ferriani & Mac Millan, 2017), it is legitimate to hypothesize that the position in the informal network moderates this relationship. More specifically, since interfirm informal relations are pivotal in sustaining and nourishing knowledge-based collaborations, which, in turn, facilitates innovation, we expect cluster actors with high centrality in informal networks to outperform the ones with low centrality.

Indeed, since interorganizational relations between members in industrial districts often come as results of informal interpersonal relations (Inkpen & Tsang, 2005), a second attempt of study could be to examine the extent to which informal ties prior to cluster formation acted as a basis for the establishment of subsequent innovation-related formal relations among cluster actors.

References

- Ahuja, G. (2000a). The Duality of Collaboration: Inducements and Opportunities in the Formation of Interfirm Linkages. *Strategic Management Journal*, 21(3), 317–343.
- Ahuja, G. (2000b). Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study. *Administrative Science Quarterly*, 45(3), 425–455.
- Alberti, F. G., & Pizzurno, E. (2015). Knowledge exchanges in innovation networks: Evidences from an Italian aerospace cluster. *Competitiveness Review*, 25(3), 258–287.
- Amin, A., & Cohendet, P. (2004). *Architectures of Knowledge: Firms, Capabilities, and Communities*. Oxford: Oxford University Press.
- Baptista, R., & Swann, P. (1998). Do firms in clusters innovate more? *Research Policy*, 27(5), 525–540.
- Beaudry, C., & Breschi, S. (2003). Are firms in clusters really more innovative? *Economics of Innovation and New Technology*, 12(4), 325–342.
- Boschma, R. A., & Ter Wal, A. L. J. (2007). Knowledge Networks and Innovative Performance in an Industrial district: The Case of a Footwear District in the South of Italy. *Industry and Innovation*, 14(2), 177–199.
- Breschi, S., & Lissoni, F. (2001). Localised knowledge spillovers vs. innovative milieu: Knowledge "tacitness" reconsidered. *Regional Science*, 80(255-273).
- Casper, S. (2007). How do technology clusters emerge and become sustainable? *Research Policy*, 36(4), 438–455.
- Dahl, M. S., & Pedersen, C. Ø.R. (2004). Knowledge flows through informal contacts in industrial clusters: Myth or reality? *Research Policy*, 33(10), 1673–1686.
- Delgado, M., Porter, M. E., & Stern, S. (2014). Clusters, convergence, and economic performance. *Research Policy*, 43(10), 1785–1799.
- Feldman, M. P. (1999). The New Economics Of Innovation, Spillovers And Agglomeration: A review Of Empirical Studies. *Economics of Innovation and New Technology*, 8(1-2), 5–25.
- Ferriani, S., & MacMillan, I. (2017). Performance gains and losses from network centrality in cluster located firms: A longitudinal study. *Innovation*, 19(3), 307–334.
- Fleming, L., King III, C., & Juda, A. I. (2007). Small worlds and regional innovation. *Organization Science*, 18(6), 938–954.
- Giuliani, E. (2010). Clusters, networks and economic development: an evolutionary economics perspective. In R. Boschma & R. Martin (Eds.), *The Handbook of Evolutionary Economic Geography* (pp. 261–279). Cheltenham: Edward Elgar Publishing.
- Giuliani, E., & Bell, M. (2005). The micro-determinants of meso-level learning and innovation: Evidence from a Chilean wine cluster. *Research Policy*, 34(1), 47–68.
- Gulati, R. (1995). Social Structure and Alliance Formation Patterns: A Longitudinal Analysis. *Administrative Science Quarterly*, 40(4), 619–652.
- Gulati, R. (1998). Alliances and Networks. *Strategic Management Journal*, 19, 293–317.
- Gulati, R. (1999). Network Location and Learning: The Influence of Network Resources and Firm Capabilities on Alliance Formation. *Strategic Management Journal*, 20(5), 397–420.
- Gulati, R., & Gargiulo, M. (1999). Where Do Interorganizational Networks Come From? *The American Journal of Sociology*, 104(5), 1439–1493.
- Hagedoorn, J., & Cloudt, M. (2003). Measuring innovative performance: Is there an advantage in using multiple indicators? *Research Policy*, 32(8), 1365–1379.
- Huggins, R., & Johnston, A. (2010). Knowledge flow across inter-firm networks: the influence of network resources, spatial proximity, and firm size. *Entrepreneurship and Regional Development*, 22(5), 457–484.

- Inkpen, A. C., & Tsang, E. W. (2005). Social Capital, Networks, and Knowledge Transfer. *The Academy of Management Review*, 30(1), 146–165.
- Jaffe, A. B., Trajtenberg, M., & Henderson, R. (1993). Geographic localization of knowledge spillovers as evidenced by patent citations. *The Quarterly Journal of Economics*, 108(3), 577–598.
- Krugman, P. (1991). *Geography and trade*. Cambridge: MIT Press.
- Kurland, N. B., & Pelled, L. H. (2000). Passing the Word: Toward a Model of Gossip and Power in the Workplace. *The Academy of Management Review*, 25(2), 428–438.
- Libaers, D., & Meyer, M. (2011). Highly innovative small technology firms, industrial clusters and firm internationalization. *Research Policy*, 40(10), 1426–1437.
- Maskell, P., & Malmberg, A. (1999). Localised learning and industrial competitiveness. *Cambridge Journal of Economics*, 23(2), 167–185.
- Owen-Smith, J., & Powell, W. W. (2004). Knowledge Networks as Channels and Conduits: The Effects of Spillovers in the Boston Biotechnology Community. *Organization Science*, 15(1), 5–21.
- Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation. *Administrative Science Quarterly*, 41(1), 116–145.
- Reagans, R., & McEvily, B. (2003). Network Structure and Knowledge Transfer: The Effects of Cohesion and Range. *Administrative Science Quarterly*, 48(2), 240–267.
- Ring, P. S., & van de Ven, A. H. (1994). Developmental Processes of Cooperative Interorganizational Relationships. *The Academy of Management Review*, 19(1), 90–118.
- Rogers, E. M. (1982). Information Exchange Information Exchange and Technological Innovation. In D. Sahal (Ed.), *The transfer and utilization of technical knowledge* (105–123). Lexington: Lexington books.
- Rooks, G., Tazelaar, F., & Snijders, C. (2011). Gossip and Reputation in Business Networks. *European Sociological Review*, 27(1), 90–106.
- Saxenian, A. (1990). Regional Networks and the Resurgence of Silicon Valley. *California Management Review*, Fall, 89–112.
- Saxenian, A. (1994). *Regional advantage: Culture and competition in Silicon Valley and Route 128*. Cambridge Mass.: Harvard University Press.
- Shapiro, D. L., Sheppard, B. H., & Cheraskin, L. (1992). Business on a handshake. *Negotiation Journal*, 8(4), 365–377.
- Von Hippel, E. (1987). Cooperation between rivals: Informal know-how trading. *Research Policy*, 15, 285–305.
- Whittington, K. B., Owen-Smith, J., & Powell, W. W. (2009). Networks, Propinquity, and Innovation in Knowledge-intensive Industries. *Administrative Science Quarterly*, 54(1), 90–122.

Use of Knowledge Management Strategies in SMEs: a Radiography of the Romanian Context

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Abstract

Knowledge is considered one of the most important competitive resources of small and medium size enterprises (SMEs). In order to be effective, knowledge management depends in a large degree on the employees, both on those holding managerial positions, and on regular staff. Aiming to identify patterns of knowledge management (KM) approach in Romanian SMEs and their connection with company's human resource, the study applies an online survey with 108 SMEs from Romania. The study finds out that the majority of SMEs implemented KM practices derived from the problem-solving approaches of daily challenges and the knowledge handling procedures for employees. Also, the results indicate that 86,1% of the participants perceive knowledge and its management as valuable or highly valuable for their organization, highlighting a significant interest of SMEs in implementing more structured KM procedures and flows. Still, KM is a vague concept for and handled intuitively by most Romanian SMEs. These aspects hold back KM implementation, together with the lack of KM specialists and the need for additional human resources involved in KM. Overall, the study offers insights into the actual KM approaches adopted by Romanian SMEs, emphasizing the need of a better promotion among managers and practitioners of the conceptual and practical aspects related to knowledge management.

Keywords – knowledge management, small and medium-sized organizations, SMEs, human resources in SMEs, Romania.

Paper type – Academic Research Paper

1 Introduction

In the past decades, knowledge has become an important resource for organizations. Studies developed in all domains – public, business, as well as non-profit - have revealed that strategic knowledge management leads to organizational efficiency (Darroch, 2005; Mills & Smith, 2011; Valmohammadi & Ahmadi, 2015; Zack, McKeen & Singh, 2009). These positive outcomes are also registered in the case of smaller organizations (Cerchione, Esposito & Spadaro, 2015). Despite this overall benefit of knowledge management for companies, studies also reveal the need to deepen analysis to better understand the complex impact of knowledge management on various dimensions of business activities (Heisig, Suraj, Kianto, Kemboi, Perez Arrau & Fathi Easa, 2016), studies on knowledge management for small and medium sized enterprises (SMEs) being generally dispersed (Massaro et al., 2016).

Knowledge proves to be an important resource for all types of organizations (Alexandru et al., 2018; Bolisani & Bratianu, 2018; Bratianu, 2016). Controlling and using this strategic resource requires different approaches compared to tangible resources, the human factor playing an important role (Bolisani & Bratianu, 2018, p.5; Bratianu, 2018). These processes are even more complex considering the inner dynamics of knowledge, its temporal and spatial fluidity and its ability to transform itself as energy does (Bratianu & Bejinaru, 2019). These characteristics are also influenced by the human resources of an organization.

Therefore, it would be relevant that knowledge management strategies to thoroughly integrate human resources. This dimension is maybe even more important in SMEs, where employees have a significant impact on all business aspects, including determining a company to be an effective learning organization (Nolan & Garavan, 2016; Tesavrita & Suryadi, 2016).

Considering the tight relationships between the knowledge management strategies and the human resources of an organization, the present study aims to investigate patterns of knowledge management approach in Romanian SMEs and their connection with company's human resource. The study offers insights into the actual knowledge management practices in the Romanian SMEs, highlighting the need for promotion of the KM conceptual and practical aspects among Romanian managers and employees of SMEs.

2 Previous literature

2.1 Knowledge management in SMEs

When analyzing the status of knowledge management in SMEs, previous literature highlights some peculiarities. SMEs perceive the strategic value of knowledge and have improved their practices in the field of knowledge management (Cerchione, Esposito & Spadaro, 2015), but they manage knowledge in different ways compared to large organizations (Wee & Chua, 2013). Knowledge management provides SMEs a series of benefits, such as improved customer service, enhanced innovativeness, competitive advantage, access to and assimilation of external knowledge, etc. (Durst & Edvardsson, 2012; Edvardsson & Durst, 2013; Lee, Foo, Leong & Ooi, 2016; Wang & Yang, 2016). Previous research also highlights and SMEs see knowledge as a competitive resource, and their strategies aims to facilitate knowledge transfer (Alexandru et al., 2018).

Considering this positive framework, one would expect that knowledge management has become an important part of management strategies if not the core of management approaches in all types of organizations. One expects that knowledge management has become a planned strategic approach. But studies highlight two types of situations. There are organizations for which knowledge management is a deliberate strategy, while for others it develops in time, is emerging as a reaction to the organizational and environment evolution (Bolisani, Scarso & Zięba 2016; Van den Hooff & Huysman, 2009). Some organizations have an emergent knowledge management approach, while others have a deliberate/ planned approach.

An enhancer of SMEs competitiveness is the networking abilities, which are also related to the personal networking capabilities of the owner/manager (Jansen et al., 2013). Both online and offline networks, as well as personal and professional networks should be considered. In this way, the capitalization of business networks would lead to organizational development, including in processes related to the internationalization of SMEs (Vatamanescu et al, 2016; 2018). Therefore, relational capital could enhance competitiveness of SMEs.

2.2 Knowledge management approaches in the Romanian SMEs

A study developed in 2009 shows that the Romanian SME managers consider that innovation should be at the core of their activity, ensuring competitive advantage (Nicolescu, Ceptureanu & Ceptureanu, 2009). In this framework, they consider primarily new product development and incorporation of new technologies, rather than investing in human resources training – this last aspect is directly related with the size of the company (Nicolescu, Ceptureanu & Ceptureanu, 2009, pp. 958-959). Implementing knowledge management is primarily associated to enhanced innovation and improved competitive advantage by the managers of the Romanian SMEs (Ceptureanu, Ceptureanu, Zgubea, & Tudorache, 2012, pp.331-332; Ceptureanu, 2016, p.126). Knowledge is considered the main source of competitive advantage in the Romanian SMEs activating in knowledge intensive business sectors (Alexandru et al., 2018). Implementing knowledge

management is in most cases a result of the involvement of employees. The smaller the organization, the larger is the involvement of regular employees (Alexandru et al., 2018, p.1766).

In order to effectively implement knowledge management, the Romanian SMEs have to overcome some barriers, most of them related to the lack of understanding from their employees of their importance, low internal knowledge transfer or unfavourable organizational culture (Ceptureanu, Ceptureanu, Zgubea, & Tudorache, 2012; Ceptureanu, 2016). Therefore, more awareness of the importance of knowledge management among low-level employees and a strong organizational culture facilitating knowledge transfer and development would be beneficial.

Entrepreneurs value knowledge-related aspects of their employees in a high degree, especially competence, specialized knowledge and skills, as well as learning capability (Ceptureanu, 2015). This should explain the high level of training considered as means for organizational learning in young SMEs. Knowledge transfer within organization is also valued, while sharing with external parties is rather the exception (Ceptureanu, 2015). We mention that longer established Romanian SMEs, the degree of staff training is less valued (Ceptureanu, 2016). This data is somewhat in conflict with another study, showing that the larger the organization, the more training is provided; the main barrier for lack of training being the necessary financial resources (Martin, 2015, p.612). Enhanced training in SMEs through public policies and programs is considered key strategic approach to develop the knowledge economy in Romania (Hadad, 2017).

The larger the organization, the more experience, knowledge and abilities, as well as competences are valued. The only aspect evaluated higher than the previous ones by managers of SMEs is the sense of responsibility (Martin, 2015, p.610). Data suggests that the Romanian SMEs want primarily their employees to be highly reliable, and then capable of effectively caring out the tasks.

2.3 Knowledge management and the human resource

Organizations benefit from tangible and intangible resources. Knowledge is increasingly more important. Its management depends not only on the organizational capabilities and infrastructure, by the associated management strategies, but also on the employees of the organization. They are the producers, registrars, carriers, curators of knowledge. Nevertheless, it would be the role of the organization to integrate employees' knowledge into the social structure to obtain and develop organizational knowledge (Bolisani & Bratianu, 2018, p.23). A significant component of this mechanism is knowledge sharing. Considering the high importance of knowledge transfer to ensure the effectiveness of knowledge management strategies, a large part of the academic research concentrates on the processes associated to it. In most cases, non-human facilitators are considered, such as knowledge processes, knowledge innovation, technological infrastructure, or strategies (Massaro et al., 2016). Fewer studies focus on the human factor (Casimir, Lee & Loon, 2012; Chiu, Hsu & Wang, 2006; McCall et al., 2008; Teng & Song, 2011; Wang & Noe, 2010). The structured literature review of Massaro et al. (2016) identified the following human factors affecting knowledge management:

motivation, ambition, skills and absorptive capacity, decision-making capabilities, personal self-responsibility and knowledge, as well as a series of individual barriers.

The sharing behavior of employees is up to a certain degree influenced by knowledge management strategies, especially in the case of formal requests of knowledge (Teng & Song, 2011). But mostly, knowledge transfer depends on common values, shared beliefs, on the personal acceptance of sharing knowledge (McCall et al., 2008; Teng & Song, 2011), as well as on the perceived benefits (Chiu, Hsu & Wang, 2006). Also, the interaction between managers/owners and employees influences knowledge sharing, especially from the top downwards (Massaro et al., 2016).

It also depends on the dynamics of the interaction of the employees, in connection with the organizational culture (Alavi, Kayworth & Leidner, 2005; Chang & Lin, 2015; Intezari, Taskin & Pauleen, 2017). The wider professional environment might also enhance the knowledge sharing, by offering examples and social pressure (Alavi, Kayworth & Leidner, 2005). Prosociality of individuals is influenced by altruistic and egotistic factors – overall leading to an inclination to knowledge sharing at least among colleagues (Gagné, 2009; Sproull, Conley & Moon, 2013).

Another factor we mention is personal motivation (Matzler et al., 2011). Although motivation is intrinsic to an individual, human resources management, through staffing, job design, performance appraisal and compensation systems, managerial styles, and training, has a significant impact on knowledge sharing throughout the organization (Gagné, 2009).

3 Empirical assessment and results

Aiming to identify patterns of knowledge management approach in Romanian SMEs and their connection with company's human resource, the study applies an exploratory quantitative research with 108 small and medium size companies.

Consequently, an online survey was applied to collect data from a convenience sample of Romanian SMEs activating in various fields such as IT, marcom, professional consultancy and services (N = 108 participants), and SPSS statistical software was used to perform the data analysis and interpretation.

Results of the data analysis have shown that more than half (60.2%) of the 108 participant SMEs implemented different knowledge management practices as a reaction to the issues they have encountered in the daily contexts of their activity, KM practices derived from solutions to problem-solving approaches of daily challenges (51.9%) and knowledge handling procedures for employees (63%) prevailing in most of the cases.

Results indicated that 86,1% of the participants perceive knowledge and its management as valuable or highly valuable for their organization, although knowledge management proved to be a vague rather than a very familiar concept for 70.4% of the respondents.

In fact, the inferential statistics (detailed in Table 1) resulted from the analysis of variance computed on *KM_perceived_value* as factor, reveals that an increase in the

perceived value of knowledge and its management (*KM_perceived_value* factor) is significantly related with the increase in adoption of KM practices as following:

- Overall implementation of KM practices ($F = 4.673$, $p < 0.05$)
- KM practices derived from solutions to daily challenges ($F = 3.681$, $p < 0.05$)
- Knowledge handling procedures for employees ($F = 5.430$, $p < 0.05$)

Also, higher the factor *KM_perceived_value*, higher the KM awareness ($F = 2.927$, $p < 0.05$), and higher the firm's interest (/perceived need) of KM specialists ($F = 2.143$, $p < 0.05$) and additional employees involved in KM processes ($F = 2.678$, $p < 0.05$).

Table 1. ANOVA (ONEWAY by *KM_perceived_value* q1,2,4)

		Sum of Squares	df	Mean Square	F	Sig.
Overall implementation of KM	Between	20.089	10	2.009	4.673	.000
	Within	41.700	97	.430		
	Total	61.789	107			
KM practices derived from solutions to daily challenges	Between	23.128	10	2.313	3.681	.000
	Within	60.946	97	.628		
	Total	84.074	107			
Knowledge handling procedures for employees	Between	31.807	10	3.181	5.430	.000
	Within	56.823	97	.586		
	Total	88.630	107			
Need of KM specialists	Between	22.177	10	2.218	2.143	.028
	Within	100.369	97	1.035		
	Total	122.546	107			
Need of additional employees in KM processes	Between	20.825	10	2.082	2.678	.006
	Within	75.425	97	.778		
	Total	96.250	107			
KM awareness	Between	15.514	10	1.551	2.927	.003
	Within	51.403	97	.530		
	Total	66.917	107			

4 Conclusion and discussions

The study revealed that knowledge management strategies of Romanian SMEs emerge as a reaction to the encountered issues, KM practices resulting in most of the cases from problem-solving approaches of daily challenges, and knowledge handling procedures for employees. Also, the results indicate that 86,1% of the participants perceive knowledge

and its management as valuable or highly valuable for their organization, highlighting a significant interest of SMEs in implementing more structured KM procedures and flows.

Nevertheless, knowledge management is a vague concept for and handled intuitively by most Romanian SMEs. These aspects hold them back, together with the lack of KM specialists and the need for additional human resources involved in KM implementation. In fact, our study confirms the findings of Desouza and Awazu (2006), which emphasize the peculiarities of KM approach in SMEs, especially the dominance of informality and socialization in the knowledge creating cycle, the existence of common knowledge as a common frame of reference, and the people centered KM – need of KM specialist and need of additional employees in KM processes.

Exploring the Romanian context, the present study uncovers the main KM practices adopted by SMEs and the role KM plays in their process of transition from capital-based industrial economy to knowledge-based economy. The context and the findings of our study are similar to Serbia's case discussed by Uzelac et al (2018). Serbia's case revealed opposite behaviors of the SMEs from developed countries, in which knowledge is shared because it is power, comparing to SMEs from transitional countries, in which knowledge is hoarded because it is power (Uzelac et al., 2018). This could explain the differences revealed by our study in the adoption of KM practices in terms of KM perceived value and KM awareness. Because similarly to Serbia, Romania has a difficult, less structured and less organized environment, where KM practices are necessary to respond to the daily challenges, making the study of KM in SMEs relevant for the understanding of the big picture.

Last, but not least, the present study highlights the need for dissemination of the conceptual and practical aspects related to knowledge management among Romanian managers and communities of practice. On this point, we opine that academia might offer its support through presentations at business events and KM training sessions.

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References

- Alavi, M., Kayworth, T.R. and Leidner, D.E. (2005). "An empirical examination of the influence of organizational culture on knowledge management practices". *Journal of Management Information Systems*, Vol. 22, No.3, pp. 191-224.
- Alexandru, V.A. et al. (2018). "Knowledge Management Approaches of Small and Medium-Sized KIBS Firms: a Descriptive Analysis of Four Countries". In *Proceedings of IFKAD 2018*, Delft, pp.1758-1774.
- Bolisani, E. and Bratianu, C. (2018). "The emergence of knowledge management." In *Emergent knowledge strategies*, eds. E.Bolisani and C.Bratianu, Springer, Cham, pp. 23-47.

- Bolisani, E., Scarso, E., and Zięba, M. (2016) "How to Deal with Knowledge in Small Companies? Defining Emergent KM Approach", *International Journal of Learning and Intellectual Capital*, Vol. 13, No. 2-3, pp. 104-118.
- Bratianu, C. (2016). "Knowledge dynamics". *Management Dynamics in the Knowledge Economy*, Vol. 4, No. 3, pp. 323-337.
- Bratianu, C. (2018). "Intellectual capital research and practice: 7 myths and one golden rule", *Management & Marketing. Challenges for the Knowledge Society*, 13(2), 859-879.
- Bratianu, C. & Bejinaru, R. (2019). "The theory of knowledge fields: A thermodynamic approach", *Systems*, 7(2), 20, 1-12.
- Casimir, G., Lee, K. and Loon, M. (2012). "Knowledge sharing: influences of trust, commitment and cost". *Journal of Knowledge Management*, Vol. 16, No.5, pp. 740-753.
- Chang, C. L.-H. and Lin, T. C. (2015). "The role of organizational culture in the knowledge management process". *Journal of Knowledge Management*, Vol. 19, No. 3, pp. 433-455.
- Chiu, C. M., Hsu, M. H. and Wang, E. T. G. (2006). "Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories". *Decision Support Systems*, Vol. 42, No.3, pp. 1872-1888.
- Ceptureanu, S. I. (2015). "Knowledge Management in Romanian Young SMEs (Part 1)". *Review of International Comparative Management*, Vol. 16, No. S1, pp. 5-22.
- Ceptureanu, S. I. (2016). "Knowledge Management in Romanian SMEs". *Review of International Comparative Management*, Vol. 17, No. 2, pp. 123-129.
- Ceptureanu, S. I., Ceptureanu, E. G., Zgubea, F., & Tudorache, A. (2012). "Economic Survey on knowledge based management in Romanian companies". *Review of International Comparative Management*, Vol. 13, No. 2, pp. 325-336.
- Cerchione, R., Esposito, E., & Spadaro, M. R. (2015). "The spread of knowledge management in SMEs: A scenario in evolution". *Sustainability*, Vol.7, No.8, pp. 10210-10232.
- Darroch, J. (2005). "Knowledge management, innovation and firm performance". *Journal of knowledge management*, Vol.9, No.3, pp.101-115.
- Desouza, K.C., Awazu, Y. (2006), "Knowledge management at SMEs: five peculiarities, *Journal of Knowledge Management*", Vol.10, No.1,2006, pp.32-43.
- Durst, S., & Runar Edvardsson, I. (2012). "Knowledge management in SMEs: a literature review". *Journal of Knowledge Management*, Vol.16, No.6, pp.879-903.
- Edvardsson, I. R., & Durst, S. (2013). "Does knowledge management deliver the goods in SMEs?". *Business and Management Research*, Vol.2, No.2, pp.52-63.
- Gagné, M. (2009). "A model of knowledge-sharing motivation". *Human Resource Management*, Vol. 48, No. 4, pp. 571-589.
- Hadad, S. (2017). "Strategies for developing knowledge economy in Romania". *Management & Marketing*, Vol. 12, No. 3, pp. 416-430.
- Heisig, P., Suraj, O. A., Kianto, A., Kemboi, C., Perez Arrau, G., & Fathi Easa, N. (2016). "Knowledge management and business performance: global experts' views on future research needs". *Journal of Knowledge Management*, Vol.20, No.6, pp.1169-1198.
- Intezari, A., Taskin, N., and Pauleen, D. J. (2017). "Looking beyond knowledge sharing: an integrative approach to knowledge management culture". *Journal of Knowledge Management*, Vol. 21, No. 2, pp. 492-515.
- Lee, V. H., Foo, A. T. L., Leong, L. Y., & Ooi, K. B. (2016). "Can competitive advantage be achieved through knowledge management? A case study on SMEs". *Expert Systems with Applications*, Vol.65, pp.136-151.
- Marin, I. (2015). "Human resources insights regarding Romanian SMEs". In *Proceedings of the 9th International Management Conference "Management and Innovation for Competitive Advantage"*, November, pp. 606-613.

- Massaro, M., Handley, K., Bagnoli, C., and Dumay, J. (2016). "Knowledge management in small and medium enterprises: a structured literature review". *Journal of Knowledge Management*, Vol. 20, No. 2, pp. 258-291.
- Matzler, K., Renzl, B., Mooradian, T., von Krogh, G., and Mueller, J. (2011). "Personality traits, affective commitment, documentation of knowledge, and knowledge sharing". *International Journal of Human Resource Management*, Vol. 22, No. 2, pp. 296-310.
- McCall, H., Arnold, V. and Sutton, S.G. (2008). "Use of knowledge management systems and the impact on the acquisition of explicit knowledge". *Journal of Information Systems*, Vol. 22, No. 2, pp. 77-101.
- Mills, A. M., & Smith, T. A. (2011). "Knowledge management and organizational performance: a decomposed view". *Journal of Knowledge Management*, Vol.15, No.1, pp.156-171.
- Nicolescu, O., Ceptureanu, S., & Ceptureanu, E. (2009). "Knowledge Related Activities In Romanian Smes". *Annales Universitatis Apulensis: Series Oeconomica*, Vol. 11, No. 2, pp. 958-966.
- Nolan, C. T. and Garavan, T. N. (2016). "Human resource development in SMEs: a systematic review of the literature". *International Journal of Management Reviews*, Vol. 18, No. 1, pp. 85-107.
- Sproull, L., Conley, C. A., and Moon, J. Y. (2013). "Prosocial behavior on the internet". In *The social net: Understanding our online behaviour*, ed. Y. Amichai-Hamburger, Oxford University Press, New York, pp. 143-164.
- Teng, J.T. and Song, S. (2011). "An exploratory examination of knowledge-sharing behaviors: solicited and voluntary". *Journal of Knowledge Management*, Vol. 15, No. 1, pp.104-117.
- Tesavrita, C. and Suryadi, K. (2016). "Organization learning through effective knowledge sharing in SME's: A conceptual model". In *2016 IEEE International Conference on Management of Innovation and Technology (ICMIT)*, IEEE, pp. 203-207.
- Uzelac, Z., Celic, D., Petrov, V., Draskovik, Z., Beric, D. (2018), "Comparative Analysis of Knowledge Management Activities in SMEs: Empirical Study from a Developing Country", *Procedia Manufacturing*, Vol.17, pp/523-530.
- Valmohammadi, C., & Ahmadi, M. (2015). "The impact of knowledge management practices on organizational performance: A balanced scorecard approach". *Journal of Enterprise Information Management*, Vol.28, No.1, pp.131-159.
- Van den Hooff, B. and Huysman, M. (2009) "Managing knowledge sharing: Emergent and engineering approaches", *Information & Management*, Vol. 46, No. 1, pp. 1-8.
- Vatamanescu, E.-M., Zbucnea, A., Pinzaru, F. and Andrei, A.G. (2016). "The Impact of Relational Capital on SMES Internationalization. Leveraging Versus Offline Business Networking". In *European Conference on Knowledge Management*, Academic Conferences International Limited, pp. 926-935.
- Vătămănescu, E. M., Andrei, A. G., Gazzola, P., & Dominici, G. (2018). *Online Academic Networks as Knowledge Brokers: The Mediating Role of Organizational Support*. *SYSTEMS*, 6(2), 11.
- Wang, S. and Noe, R.A. (2010). "Knowledge sharing: A review and directions for future research". *Human Resource Management Review*, Vol.20, No.2, pp. 115-131.
- Wang, M. H., & Yang, T. Y. (2016). "Investigating the success of knowledge management: An empirical study of small-and medium-sized enterprises". *Asia Pacific Management Review*, Vol.21, No.2, pp.79-91.
- Wee, J.C.N. and Chua, A.Y.K. (2013) "The peculiarities of knowledge management processes in SMEs: the case of Singapore", *Journal of Knowledge Management*, Vol. 17, No. 6, pp. 958-972.
- Zack, M., McKeen, J., & Singh, S. (2009). "Knowledge management and organizational performance: an exploratory analysis". *Journal of Knowledge Management*, Vol.13, No.6, pp.392-409.

University Strategies for Developing an Entrepreneurial Ecosystem

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Abstract

The general objective of this research is to identify and argue which are the main strategies that a university can apply in order to develop an appropriate entrepreneurial ecosystem mainly throughout managing the knowledge processes, knowledge resources and knowledge actors. Firstly, the content of the qualitative analysis serves the purpose of designing the framework about the role a university can play for contributing to local economic and social growth. Thus we are mapping and arguing the essential components and processes for serving the role of a university in developing an entrepreneurial ecosystem. In this sense we are approaching concepts like: strategic knowledge processes, the components of the entrepreneurial ecosystem, the role the university can play in developing the mechanism of an entrepreneurial ecosystem. Quantitative research is based on a survey using questionnaires filled in by students enrolled in business administration area programs and special programs offered to all those interested in becoming entrepreneurs. There were registered a number of 202 valid questionnaires and then we processed them by using the specialized software package SPSS v.25. The quantitative analysis offers the possibility of identifying the main factors which influence the students entrepreneurial behaviour. By processing the data throughout Principal Component Analysis (PCA) we identified a set of 6 factors which are the most powerful in predicting the students success as future entrepreneurs. In the discussion section we will argue the significance of each factor. Combining these results with the university's resources (infrastructure, endowments, technology, human capital, intellectual capital, and knowledge) we concluded to a couple of strategies that universities might implement in order to develop an entrepreneurial ecosystem, starting with the perfecting of their main actors, which are the students.

Keywords – knowledge strategy, entrepreneurial ecosystem, entrepreneurial university, entrepreneurship, business strategies.

Paper type – Academic Research Paper

1 The Mission of the Entrepreneurial University

As a vector of nowadays society, education contributes to the development of social and economic domains which in turn contribute to raise the life-level of the individual. At this moment, universities are constraint to switch from knowledge adaptation processes to knowledge generative processes, and to further become entrepreneurial universities. From institutional perspective, there will be created a basic impact of acknowledging the actual state of universities' evolution towards the pattern of an entrepreneurial university which should be viewed as a strategic road, nowadays (Bejinaru, 2018; Volkmann et al., 2012).

It has been a while since entrepreneurial aspirations have reached the academic mainstream. The academic involvement in technology transfer, firm formation and regional development represent a step closer to the academic ideal which is the entrepreneurial university. "The entrepreneurial trend was also boosted by the success of the iconic "technopreneurs". Technology entrepreneurs such as Steve Jobs of Apple, Bill Gates of Microsoft, Jeff Bezos of Amazon, or Larry Page and Sergey Brin of Google have become the "poster children" of the entrepreneurship movement world-wide" (Mazzarol, 2014). As universities get closer to the entrepreneurial nucleus, the greater becomes the tension between the old missions -of research and teaching, and the new mission - of entrepreneurship (Block et al., 2014; Dima et al., 2017; Prelipcean & Bejinaru, 2016; 2018; Maroufkhani et al., 2018; Nabi et al., 2018; Sultan et al., 2016; Wells, 2017).

Presently, universities world-wide are the most powerful force for shaping the future generations of businessman, managers and entrepreneurs throughout the knowledge transfer and learning processes. Since 1947, when Harvard Business School has started the first course of entrepreneurship, this educational trend has been continuously gaining interest at a global scale and has been also considered that entrepreneurship will become "the major academic discipline for business education in the 21st century" (Bae, 2014; Bratianu et al., 2011; Mason & Brown, 2014; Sternberg, 2014; Volkmann, 2004).

In this sense, we can observe that educational programs on entrepreneurship exist world-wide but certainly are different from one university to another (Janssen, 2016). They basically divide into either mostly theoretically programs which focus on developing research competencies or mostly practical programs which target the developing of abilities like business planning, interpersonal skills, negotiation skills, creative thinking and others (Bejinaru, 2018). These facts explain why the facilitators which drive the learning are either academic teachers, working in higher education institutions, or practitioners, as businessman, managers or real entrepreneurs (Bejinaru & Prelipcean, 2017; Bejinaru, 2017; Fayolle & Redford, 2014; Sultan et al., 2016; Vatamanescu et al, 2017).

Certainly, at this point in time, we can say that entrepreneurial education programs have become more and more popular by each day. However, paradoxically to this trend, the question arises as to what is the main mission of the universities throughout these educational programs in the field of entrepreneurship, namely: to support the specialization of the students as future entrepreneurs, to increase the number of companies set up after the graduation or to facilitate the acquisition of adequate

knowledge, skills and behavior in order to successfully cope with the global business environment? (Prelipcean & Bejinaru, 2018)

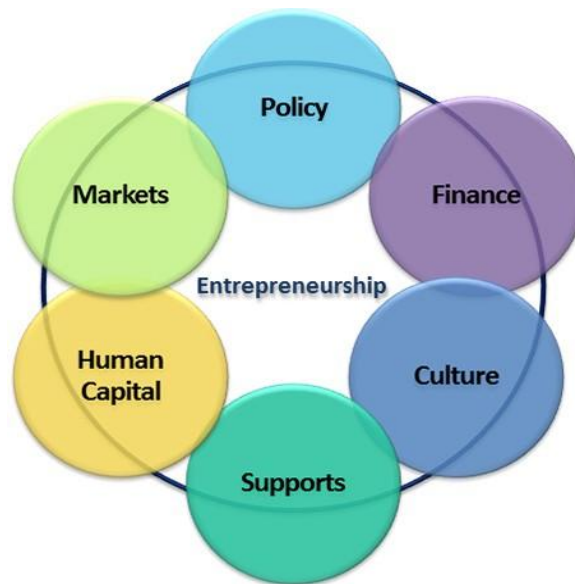
2 The Entrepreneurial Ecosystem

What we want to achieve through this research is to highlight the most propitious strategies that a university can apply in order to create an entrepreneurial ecosystem in the environment in which it operates. At this stage of our qualitative research, we want to map out and substantiate the potential of universities to develop an entrepreneurial ecosystem through the internal and external knowledge processes, knowledge resources and knowledge actors that they can manage. In this sense, we consider key concepts as the strategic processes of knowledge dynamics, the components of entrepreneurial ecosystems, and last but not least the role that the university can play in developing a framework for an entrepreneurial ecosystem in a region with a fairly economic low profile, where opportunities and potential abound (Gustafsson et.al., 2015; Hapenciuc et al., 2016).

To start with, an entrepreneurial ecosystem is a group of interdependent and interlinked elements that working together generate the dynamics of the entrepreneurial environment. The components of such an ecosystems are represented by individuals, groups, organizations, and institutions that have an influence on how these actors work and interconnect; in entrepreneurial ecosystems, these can be laws and policies or cultural norms (Maia & Claro, 2013; Mason & Brown, 2014; Stam, 2015). In this sense, we emphasize that an entrepreneurial ecosystem consists of a set of tangible and intangible resources and a multitude of actors characterized by an interdependence relationship that creates important synergies (Carvalho et al., 2010).

Daniel Isenberg (2011; 2014) is the creator of the Entrepreneurship Ecosystem Model (Figure 1) which, at start, consisted in 6 basic components, and to which step by step have been added several new components by passionate researchers of the domain (Hamilton, 2011; Maroufkhani et al., 2018; Suresh & Ramraj, 2012).

The Entrepreneurship Ecosystem Model relies on the dynamic and unhindered interaction between the six macro components, which according to their common mission, will generate the optimal conditions for entrepreneurs to collaborate and grow independently. Considering the six dimensions proposed by Isenberg, which are: policy, finance, culture, markets, supports and human capital, we appreciate that for our research is more appropriate to structure them as 3 dynamic areas, such as: the entrepreneurial framework (surrounding environment, the education, business environment and investment climate); the interacting actors, and the strategies regarding entrepreneurial support and culture. Related to the three elements, we shall provide further discussions about enhancing the working together of the involved actors within the entrepreneurial ecosystem.



*Figure 1. Entrepreneurial ecosystem 6 components model
(Isenberg, 2014)*

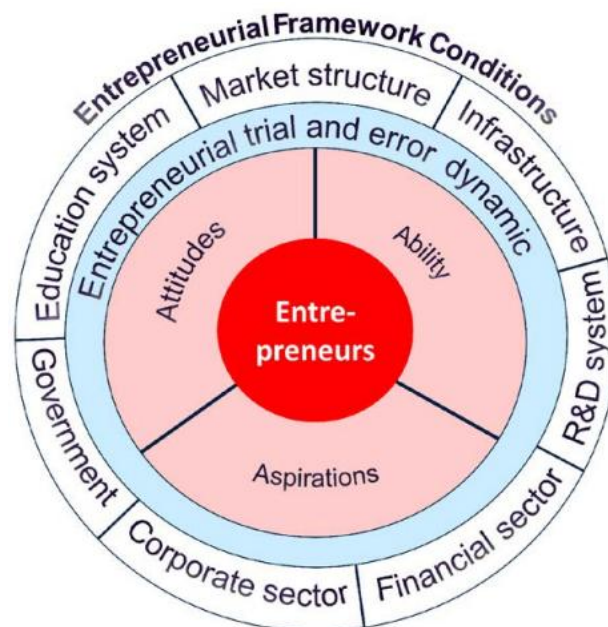
The current outlook on ecosystems is moving away from the context of the industrial organization economy, generally associated with Michael Porter from Harvard Business School, who takes the lead in gaining competitive advantage and profits while protecting new entrants and substitutes in a well-defined industry. In accordance with this traditional approach, the industries are comprised of competitors, suppliers and customers. From a strategic point of view, this perspective is limited because it does not pay enough attention to factors such as organizations that produce complementary products, the infrastructure on which the organization and the various institutions depend, individuals and interest groups that affect the organization as a whole. We believe that an ecosystem encompasses a wider and more complex environment in which organizations operate. In such an ecosystem we include the components of Porter's economic model and we propose to add new ones as potential and important players outside the competitive environment, namely social, political, or cultural forces (Bloom & Dees, 2008).

Entrepreneurial ecosystems are fundamentally based on interaction systems between several co-specialized, but hierarchically independent actors, many of whom are unknown to each other. At this point, co-specialization or multiple specialization means that different stakeholders play different roles - research institutions, start-ups, established businesses, and so on. In such a context, complementary skills and services are created and certainly depend on others to achieve their goals, which means that strategic management is paramount (Bratianu & Vatamanescu, 2017; Cantaragiu & Hadad, 2017; Stam & Spigel, 2016).

The basic feature of these entrepreneurial ecosystems lies precisely in the hierarchical independence described in the above rows as a release from the formal command lines so that each player can optimize its performance. The paradox and at the same time the

challenge that occurs in this context is mutual dependence which, on the one hand, limits you to what other actors in the ecosystem do, but on the other hand requires dynamic and permanent cooperation between the actors involved (Acs et al., 2017).

A different structure of the entrepreneurial ecosystem, presented in Figure 2, is suggestive for how is working the dynamics of the components inside. This entrepreneurial model relies primarily on new entrepreneurs who want to successfully exploit their abilities, aspirations and attitudes in this field. Entrepreneurial spirit is driven by the dynamics of the trial and error process. This means that real entrepreneurs will undertake certain risks when they start a business in order to check if the opportunity identified will be a good idea to make money or not. Even in the case of a failure, for a passionate entrepreneur, it is not the end but an opportunity to test a new idea. We believe that, this is how entrepreneurship dynamics works (Acs et al., 2017; Adejimiola & Olufunmilayo, 2009).



Source: adapted after (Acs et al., 2017, p.68)

Figure 2. The structure of the entrepreneurial ecosystem

3 Research Design and Data Analysis

3.1 Research design

The main research objective, of this research, is to explore through which strategies universities can develop their entrepreneurial ecosystem. In this scope, we undertook also a quantitative analysis upon the main actors within this framework, namely the students.

The students play multiple functions and are the major contributors to the success of this type of entrepreneurial ecosystem.

We developed the quantitative research throughout applying a questionnaire in order to investigate the main factors that predict the students success in the entrepreneurial ecosystem after graduation. The questionnaire was designed to reveal the students characteristics across a range of 6 dimensions like (1) personality traits, (2) achievement motivation, (3) attitude, (4) framework conditions, (5) skills and knowledge, (6) work experience in the entrepreneurship field; being adapted after a validated instrument of ECENT international project (ECENT, 2006).

Personal traits are necessary to investigate because they reflect the quality of interaction with others. The items in this group test the students ability of adaptation to changes, the reaction to changes, the behaviour towards others and the self-perspective while carrying out tasks. *Achievement motivation* section emphasize the students ways of working and their perception about their future accomplishment. The *attitude* section contains items which reveal the students' approach of business situations. The items about the *framework conditions* examine the students and their families approaches towards self-employment and knowledge about running a business. The dimension about *skills and knowledge* is actually revealing the key issues like basic business knowledge, financial planning, motivation methods, team-working abilities and skills for decision making. The sixth dimension regards the issues of *work experience in the entrepreneurship* field which is also relevant for the students trajectory as entrepreneurs (ECENT, 2006; Mahendra et al., 2017; Vatamanescu et al., 2017; Wells, 2017).

The data obtained from quantitative analysis will provide the testing of the following hypotheses:

H1: Students consider 'personal traits' to be a priority for entrepreneurial success

H2: Students consider 'achievement motivation' to be a priority for entrepreneurial success

H3: Students consider 'attitude' to be a priority for entrepreneurial success

H4: Students consider 'framework conditions' to be a priority for entrepreneurial success

H5: Students consider 'skills and knowledge' to be a priority for entrepreneurial success

H6: Students consider 'work experience' to be a priority for entrepreneurial success

After the hypotheses validation we will be able to better understand the factors revealed, according to their hierarchy and thus to estimate their influence on the students entrepreneurial behaviour. We consider these results as being useful for improving the learning experience, both through theory and practice, that universities deliver to their students.

3.2 Data Analysis

The next step for the data analysis was complying with the statistical methodology and thus we first assessed the accuracy of the method and employed the Bartlett and Kaiser-Meyer-Olkin (KMO) tests (Table 1). According to the values obtain to these tests

we have the validation for applying the principal component analysis method onto the collected data. The value of KMO is ,845 -which indicates a very good adequacy of the selected method. A value below 0,6 of the KMO test would have questioned the adequacy of the method. Both the Bartlett test and the KMO test show an excellent accuracy for using the principal component analysis for the present research.

Table 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.845
Approx. Chi-Square	1624.124
Bartlett's Test of Sphericity	df
	346
	Sig.
	.000

Further with the Principal Components Analysis, we selected the rotation option which is more advantageous because it maximizes the variance of the factors components and leads to smaller loadings of variables for each factor. The basic principle of this method is to extract the smallest number of components that represent as much as possible from the total information contained in the original data. The Principal Components Analysis helps us to interpret a smaller amount of data due to the fact that it leads to grouping together the variables with similar statistical evolution. We have to specify that using the Principal Components Analysis eliminates data redundancy and makes it much easier to read from a statistical point of view (Arkkelin, 2014). The final output makes the interpretation of the factors more pertinent. Following this protocol we obtained in the first rotation 6 factors explaining 69.925% of the responses enclosed in the original database.

In the case of Principal Components Analysis, a factor, represents a latent variable which should be named and referenced in order to be representative for the information embedded. The load structure of a factor may provide suggestions in this regard. Loading values greater than 0.6 are considered important, those below 0.4 are considered less significant. The higher load variables represent the mix of the initial variables that determine the factor, so become the most relevant in proposing the name of the factor. Conforming to this general condition we were allowed to further process a second rotation with an established number of factors in order to converge to the initial hypothesis of our research. Applying the presented rules we shall propose the factors interpretation considering primarily the components with the highest loadings. In Table 2 we present the reliability tests and Mean values for each factor, which we further discuss.

Table 2. Reliability Statistics of Factors

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Mean
Factor 1	,786	,788	4,35
Factor 2	,775	,784	4,30
Factor 3	,761	,769	4,22

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Mean
Factor 4	,758	,763	4,01
Factor 5	,746	,754	3,87
Factor 6	,722	,726	3,34

We consider that the hierarchy of the factors obtained as a result of the statistical processing and analysis represents the validation of the previously stated hypothesis:

- ✓ *H1: Students consider 'personal traits' to be a priority for entrepreneurial success; has been validated by Factor 4;*
- ✓ *H2: Students consider 'achievement motivation' to be a priority for entrepreneurial success; has been validated by Factor 3;*
- ✓ *H3: Students consider 'attitude' to be a priority for entrepreneurial success has been validated by Factor 5;*
- ✓ *H4: Students consider 'framework conditions' to be a priority for entrepreneurial success; has been validated by Factor 6;*
- ✓ *H5: Students consider 'skills and knowledge' to be a priority for entrepreneurial success; has been validated by Factor 1;*
- ✓ *H6: Students consider 'work experience' to be a priority for entrepreneurial success; has been validated by Factor 2;*

Considering the *Mean* values presented in Table 2, we can conclude on the hierarchy of the factors according to students perceptions which were registered throughout the questionnaires. Thus, the randomly distributed items within the questionnaire, have grouped in 6 factors, retrieved by the Principal Component Analysis, in the following hierarchical order.

Factor 1, with the highest Mean value=4,35 represents the '*skills and knowledge*' dimension. This fact confirms that the responding students acknowledge the importance of this category of education and are motivated in developing their '*skills and knowledge*'. This high value of the Mean could also suggest the fact that students fairly appreciate the strategic importance of education for their future career as entrepreneurs. This fact is commendable for the students and should be of critical interest for the university leadership.

Factor 2, registering the Mean=4,30 represents the students' '*work experience*' in the field of entrepreneurship. This factor is the surprise of research, because it comes second after education and might appear as a paradox. The explanation might have two directions; first, meaning that students have experienced the real business life, and acknowledged the advantages; second, students got tired of learning and are eager to start their working phase. Both motivations are forecasting positive effects for students.

Factor 3, having a Mean=4,22 posts on the third place the dimension of '*achievement motivation*' for the students future entrepreneurial success. This result can be associated to the perspective that these students are studying for their future, for becoming entrepreneurs. Being at the middle of the ranking, shows us that the power of

'achievement motivation' might have a great influence for succeeding as an entrepreneur. Thus, even if it is rather a self-developing dimension, universities should work on improving the motivational drivers for students.

Factor 4, that registered a Mean value of 4,01 reflects the importance of students' *'personal traits'* when speaking about the individual success as an entrepreneur. It is interesting to notice this dimension placed the fourth. Through these lenses, we appreciate that respondents balanced the *'personal traits'* with education and practice and considered them less important. Motivations may vary from lack of self-confidence, modesty, or rather a more pragmatic way of thinking which appreciates more specialized education and field experience than innate behavior.

Factor 5, *'attitude'* registered a Mean of 3,87 that is revealing a low perception about its influence upon the real success of the entrepreneur. It is a rather controversial result, as it is widely acknowledged that the "spirit" of the entrepreneur is a strong and restless force. The philosophy of the entrepreneurial spirit is the trial and error dynamics which is endless. We believe that having the appropriate *'attitude'* empowers the entrepreneur to never give up. For this case, maybe the young age and the context of the respondents provided this *'attitude'* limitation.

Factor 6, reflecting the *'framework conditions'* registered a Mean of 3,34 and ranked the last. It is obvious that the *'framework conditions'* are not a primordial issue for students entrepreneurial success. Respondents didn't award too much importance to their families approaches towards self-employment and knowledge about running a business.

Once more, according to the processed data, this is the hierarchy offered by students about the determinants of success as future entrepreneurs. The knowledge revealed from its interpretation must become basic pieces for the formulation of the university's educational and development strategy (Bejinaru, 2017; Bratianu & Bejinaru, 2017). The results provided by Principal Components Analysis have shown us the students' perceptions about their entrepreneurial potential. The final conclusion is that students perceive that their success will come rather from the university throughout education, learning and practicing skills than other determinants, like personal traits, family context, background experience, or attitude. The limits of the research consist in the narrow sample and context, which could be extended in a future research.

4 Conclusions

Throughout this research we focused on revealing the impact of entrepreneurship education on students' entrepreneurial intention. The results showed that entrepreneurship education will provide the basis of entrepreneurship notions, forming attitude, behavior, and mind set of entrepreneurs. According to the PCA results, entrepreneurship education is the main way to create business thinking and enhances self-efficacy of the university and students for growing the entrepreneurial ecosystem. Entrepreneurship education helps to train our university graduates so that they will cope with their future challenges and especially the unemployment condition of the country. During the last two decades, has

been recorded a substantial growth of entrepreneurship educational programs in most developed countries.

What we succeeded to identify is that the students vision upon the realities of the entrepreneurial ecosystem must be the cornerstone for the university strategies. Furthermore, the university has the 'strains'/the tools of modeling during the study cycles, in a considerable manner the behavior of the future entrepreneurs. Universities should do their best for increasing the entrepreneurial potential of its students in a dynamic ecosystem.

Through this work we brought to attention the dynamic interrelations between the university and the entrepreneurial ecosystem. Our aim was to highlight the university's mission of creating and developing the components of the entrepreneurial ecosystem by mainly shaping students' thinking and behaviors. We believe that through the action of generations of graduates, the university can be a dynamic exponential force and can contribute significantly to the creation of economic and social value (Bratianu & Bejinaru, 2019). In line with the ideas discussed in the paper, we maintain that the university has a central mission in terms of long-term strategy for the development of the entrepreneurial ecosystem.

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References

- Acs, Z.J., Szerb, L., Autio, E., & Lloyd, A. (2017) Global Entrepreneurship Index, powered by GEDI, Washington, D.C., USA.
- Adejimola, A.S., Olufunmilayo, T.O. (2009), "Spinning off an entrepreneurship culture among Nigerian university students: prospects and challenges", *African Journal of Business Management*, Vol. 3 No. 3, pp. 80-88.
- Arkkelin, D., (2014). Using SPSS to Understand Research and Data Analysis, Psychology Curricular Materials. Book 1.
- Bae, T. J. et al. (2014) The relationship between entrepreneurship education and entrepreneurial intentions: a meta-analytic review. In: *Entrepreneurship: Theory & Practice*, Vol. 38, No. 2, pp. 217–254.
- Blok, V. et al. (2014) Managing the improvement of entrepreneurship education programmes: a comparison of universities in the life sciences in Europe, USA and Canada. In: Fayolle, A. and Redford, D.T. (eds.) *Handbook on the entrepreneurial university*, Cheltenham/Northampton: Edward Elgar, pp. 64-90.
- Bejinaru, R. (2018) Assessing students' entrepreneurial skills needed in the knowledge economy, *Management & Marketing*, Vol. 13, No. 3, pp. 1119-1132.
- Bejinaru, R., Prelipcean, G. (2017) Successful strategies to be learnt from world-class universities, The 11th International Conference on Business Excellence Strategy, Complexity and Energy in changing times, 30-31 March 2017, Bucharest, University of Economic Studies, pp. 469-492.

- Bejinaru, R. (2017) Knowledge Strategies Aiming to Improve the Intellectual Capital of Universities, Management & Marketing. Challenges for the Knowledge Society, Vol. 12, No. 3, pp. 500-523.
- Bloom, P.N. & Dees, G. (2008) Cultivate your Ecosystem, Stanford Social Innovation Review Winter 2008.
- Bratianu, C., Bejinaru, R. (2019) Knowledge dynamics: A thermodynamic approach. 6th Business Systems Laboratory International Symposium, University of Pavia, 21-23 January 2019, Pavia, Italy.
- Bratianu, C., Bejinaru, R. (2017). "Knowledge strategies for increasing IC of the universities". In Lopez, I.T. and Serrasqueiro, R. (Eds.). Proceedings of the 9th European Conference on Intellectual Capital, Instituto Universitario de Lisboa (ISCTE), Portugal, 6-7 April 2017 (pp. 34-42). Academic Conferences and Publishing International, Reading.
- Bratianu, C., Vatamanescu, E.M. (2017). "Student's perception on developing conceptual generic skills for business: A knowledge-based approach". VINE Journal of Information and Knowledge Management Systems, Vol. 47, Issue, 4, pp. 490-505.
- Bratianu, C., Hapenciuc, V., Orzea, I., Bejinaru, R., Ghiuta, O. (2011) Strategic Thinking Dimensions in Emergent Economies Business Education, 8th International Conference on Intellectual Capital, Knowledge Management and Organizational Learning, The Institute for Knowledge and Innovation Southeast Asia (IKI-SEA) of Bangkok University, Bangkok, Thailand, 27-28 October 2011, vol.1, pp. 99-107, ISBN 978-1-908272-20-1
- Cantaragiu, R., Hadad, S. (2013) The Importance of Play in Overcoming Fears of Entrepreneurial Failure, Conference: 14th European Conference on Knowledge Management (ECKM) Location: Kaunas Univ Technol, Kaunas, LITHUANIA Date: SEP 05-06, 2013, Proceedings of the European Conference on Knowledge Management, Pages: 833-839.
- Davenport, T. H., Prusak, L., (2000) Working knowledge: How organizations manage what they know, Harvard Business School Press, Boston.
- Dima, A. M.; Hadad, S.; Luchian, I. (2017) Review on the dimensions of business-university alliances, Proceedings of 11th International Conference on Business Excellence - Strategy, Complexity and Energy in Changing Times Location: Bucharest, ROMANIA Date: MAR 30-31, 2017, Volume: 11 Issue: 1 Pages: 64-73.
- European Certificate in Entrepreneurship. (2006). *Are you an entrepreneur? User Guide*. Retrieved from [http://www.ecent.org/ecent.nsf/Alles/D17F5CECC94D4371C12573A000690FFB/\\$_le/User guide.pdf](http://www.ecent.org/ecent.nsf/Alles/D17F5CECC94D4371C12573A000690FFB/$_le/User%20guide.pdf)
- Fayolle, A., Redford, D.T. (2014) Stakeholder management and the entrepreneurial university. In: Fayolle, A. and Redford, D.T. (eds.) Handbook on the entrepreneurial university, Cheltenham/ Northampton: Edward Elgar, pp. 11-24.
- Global Entrepreneurship Research Association, GEM Global Report 2016/17, 2017. Available at: <http://gemconsortium.org/report/49812>
- Gustafsson, R., Jääskeläinen, M., Maula, M. and Uotila, J. (2015), "Emergence of industries: a review and future directions", International Journal of Management Reviews, Vol. 18 No. 1.
- Hamilton, E. (2011) "Entrepreneurial learning in family business: A situated learning perspective", Journal of Small Business and Enterprise Development, Vol. 18 Issue: 1, pp.8-26.
- Hapenciuc, C.V., Bejinaru, R., Roman, C., Neamtu, D.M. (2016) The Role Of HES Within The Evolution Of The Business Sector, EDULEARN- 8th annual International Conference on Education and New Learning Technologies Barcelona (Spain). 4th - 6th of July, 2016. ISBN: 978-84-608-8860-4.
- Isenberg, D. (2014). What an entrepreneurship ecosystem actually is. Harvard Business Review, 5.
- Isenberg, D., (2011). The entrepreneurship ecosystem strategy as a new paradigm for economic policy: principles for cultivating entrepreneurship, Babson Entrepreneurship Ecosystem Project, Babson College, Babson Park, MA, 2011 Available at:

- <http://www.innovationamerica.us/images/stories/2011/The-entrepreneurship-ecosystem-strategy-for-economic-growth-policy-20110620183915.pdf>
- Janssen F (2016). The mediating effect of entrepreneurial self-efficacy on the relationship between academic grade and entrepreneurial intention. Belgium: Louvain School of Management. Available at: <https://pdfs.semanticscholar.org/edac/562415456ca0f142a200b88c4b111e0911ff.pdf>
- Maia, C. and Claro, J. (2013), "The role of a proof of concept center in a university ecosystem: an exploratory study", *The Journal of Technology Transfer*, Vol. 38 No. 5, pp. 641-650,
- Mahendra AM, Djatmika ET, Hermawan A (2017). The Effect of Entrepreneurship Education on Entrepreneurial Intention Mediated by Motivation and Attitude among Management Students, State University of Malang, Indonesia. *International Education Studies* 10(9):61-69
- Maroufkhani, P., Wagner, R., Khairuzzaman W., Ismail, W. (2018) "Entrepreneurial ecosystems: a systematic review", *Journal of Enterprising Communities: People and Places in the Global Economy*, Vol. 12 Issue: 4, pp.545-564.
- Mason, C. and Brown, R., (2014) *Entrepreneurial Ecosystems and Growth Oriented Entrepreneurship*, OECD, Paris, 2014 Available at: <http://www.oecd.org/cfe/leed/Entrepreneurial-ecosystems.pdf>
- Mazzarol, T. (2014) 6 ways governments can encourage entrepreneurship, retrieved on April 4 at: <https://www.weforum.org/agenda/2014/12/6-ways-governments-can-encourage-entrepreneurship/>.
- Nabi G, Walmsley A, Liñán F, Akhtar I, Neame C (2018). Does entrepreneurship education in the first year of higher education develop entrepreneurial intentions? The role of learning and inspiration. *Studies in Higher Education* 43(3):452-467
- Prelicean, G., Bejinaru, R. (2018) University Agenda For Developing Students' Skills In The Knowledge Economy, *Strategica –International Conference – Sixth Edition*, "Challenging the Status Quo in Management and Economics", Bucharest: 11th -12th October, pp.600-610.
- Prelicean, G., Bejinaru, R. (2016) Universities As Learning Organizations in the Knowledge Economy, *Journal of Management Dynamics in the Knowledge Economy*, December 2016 vol.4, no.4, Issue14, pp. 469-492.
- Stam, E. (2015), "Entrepreneurial ecosystems and regional policy: a sympathetic critique", *European Planning Studies*, Vol. 23 No. 9, pp. 1759-1769.
- Stam, E., Spigel, B. (2016) *Entrepreneurial ecosystems*, Utrecht School of Economics Tjalling C. Koopmans Research Institute Discussion Paper Series 16-13.
- Sternberg, R. (2014) Success factors of university spin-offs: Regional government support programs versus regional environment. In: *Technovation*, Vol. 34, No. 3, pp. 137-148.
- Sultan M.F., Maqsood A, Shrif HM (2016). Impact of Entrepreneurial Education on Students Entrepreneurial Intentions. *KASBIT Journal of Management and Social Science* 9(1):131-153.
- Suresh, J. and Ramraj, R. (2012), "Entrepreneurial ecosystem: case study on the influence of environmental factors on entrepreneurial success", *European Journal of Business and Management*, Vol. 4 No. 16, pp. 95-101.
- Vatamanescu, E.M., Gazzola, P., Dinca, V., Pezzetti, R. (2017) Mapping entrepreneurs' orientation towards sustainability in interaction versus network marketing practices, *Sustainability* 9 (9), 1580.
- Volkman C., Tokarski, K. O. and Ernst K. (ed) (2012) *Social Entrepreneurship and Social Business: An Introduction and Discussion with Case Studies*, Wiesbaden etc.: Springer Gabler.

- Volkman, C. (2004), Entrepreneurship Studies – an Ascending Academic Discipline in the twenty-first Century, *Higher Education in Europe*, 29 (2), 177-185.
- Wells, P.J. (2017). The role of higher education institutions today. In Grau, F.X. (Ed.), *Higher education in the world 6. Toward a socially responsible university: balancing the global with the local* (pp.31-32). Girona: Global University Network for Innovation.

Knowledge Management Practices to Overcome Network-Level Knowledge Barriers: an Artificial Intelligence Powered Literature Review

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Abstract

The lack of appropriate knowledge management practices for networks has consistently been found to be the most critical failure factor of inter-organisational collaboration. Identifying the typical barriers in network-level knowledge sharing is essential for developing expedient knowledge management practices for networks. This paper contributes to the issue by examining what kind of knowledge management practices to overcome network level knowledge sharing barriers are presented in literature. The study applies literature review that is carried out with a scholarly literature-exploration tool powered by artificial intelligence. The results of the literature review reveal that the number of articles that especially address knowledge management practices to overcome network level knowledge barriers is surprisingly limited. Many of the articles brought up knowledge sharing as the key activity in networks' success, but left the question of how to reduce the knowledge barriers, and thus promote knowledge sharing in practice, unanswered. The paper concludes that there is a lack of articles that report research, developing or designing functional knowledge management practices that enable effective knowledge sharing on a network level. This underlines the existence of a research gap and the need for especially empirical research on the issue.

Keywords – Knowledge management practices, Knowledge sharing, Network, Knowledge barrier.

Paper type – Academic Research Paper

1 Introduction

Connecting and collaborating over organisational boundaries is an increasingly common way to pursue business benefits and synergy gains. Instead of standing on one's one against all others, organisations have more and more adopted networking with other

organisations as a strategy to improve their performance and competitive position. Through inter-organisational networking, organisations reach for additional knowledge resources in order to gain monetary benefits or to create new competence based on the knowledge shared in the network (Magnusson and Nilsson, 2003). This calls for effective knowledge sharing within the network, whereas disruptions in knowledge sharing reduce the performance of the network and reduce the expected benefits of the collaboration (Ke and Wei, 2007).

A factor disturbing the transmission of knowledge from source to recipient is called knowledge barrier (Riege, 2005; Szulanski, 2003). The presence of knowledge barriers diminish the likelihood of network members benefiting from the collaboration as they inhibit understanding and interpreting new information (Paulin and Suneson, 2012). With a view to assist the assessing and improving the existing practices regarding knowledge sharing and the identifying the possible bottle-necks Riege (2005) presents a categorization of knowledge barriers. Riege's (2005) categorization divides knowledge barriers into individual (e.g. personal attributes, experience and competence), organisational (e.g. cultural issues, lack of leadership) and technological (e.g. unrealistic expectations, lack of technical support). Riege (2005) points out that strategies and practices to overcome the knowledge barriers vary greatly depending on the organisation's attributes. The situation can be even more complex in the network context, as it elicits specific factors influencing the effectiveness of inter-organisational knowledge sharing.

Vuori et al. (2018) supplement Riege's (2005) general categorization focusing on the network level by identifying two more knowledge barrier categories that hinder effective knowledge sharing particularly in inter-organisational network context. These knowledge barriers are classified as network-specific and knowledge-specific. Network-specific knowledge barriers include network's cognitive proximity, geographical distance between the network members, lack of intermediary, and trust and strength of relationships (Vuori et al., 2018). For example, cognitive proximity (organisations having similar bodies of knowledge) makes it easier to absorb a network partner's knowledge, but as it may already be known to the receiver, the value of the knowledge shared may not be high (Wuyts et al., 2005; Nooteboom, 2006). In addition, Trust and strength of network relationships have an effect to the existence of knowledge barriers (Hislop, 2005; Solitander and Tidström, 2010): frequent interaction and reciprocity in knowledge sharing between the network members promotes trust and consequently decreases knowledge barriers.

Knowledge-specific knowledge barriers consist of the complexity, tacitness, stickiness and ambiguity of knowledge, and knowledge protection (Vuori et al., 2018). As an example of these, cultural differences elicited from, for example, occupational, national, organisational, or societal origin, may lead to diverse interpretations of knowledge making it complex for the network members to understand (Abou-Zeid, 2005; Korbi and Chouki, 2017). Network context also causes a boundary paradox (Quintas et al., 1997) for the member organisations, as while seeking external knowledge from the network they face the risk of exposing their own vital knowledge to others. This

emphasizes knowledge protection especially in cooperative networks, where the members are simultaneously collaborators and competitors (Corallo et al., 2012; Khamseh and Jolly, 2014; Salvatat et al., 2013; Solitander and Tidström, 2010). As a result, an overprotective attitude becomes a barrier for sharing even non-critical information within the network. Vuori et al. (2018) state that since knowledge sharing activities on an inter-organisational network level tend to be more complex than those on intra-organisational level these new knowledge barriers categories need attention.

A knowledge barrier can be either the existence of an explicit barrier or the absence of a critical success factor of knowledge sharing (Schwartz, 2007). The latter implies that if knowledge sharing is not supported efficiently, the probability of the presence of knowledge barriers increases. Therefore, fostering knowledge sharing in networks by applying suitable knowledge management practices enhances the network's chances to reach its goals. Vuori et al. (2018) continue by stating that identifying the typical barriers in network-level knowledge sharing is essential for developing expedient knowledge management practices for networks. However, a lack of appropriate knowledge management practices for networks has consistently been found to be the most critical failure factor (Ke and Wei, 2007; Trkman and Desouza, 2012).

This paper aims to increase the understanding regarding this research gap by examining those knowledge management practices aimed to remove knowledge barriers that hinder effective knowledge sharing in the network level. The research question is formulated as "What kind of knowledge management practices to overcome network level knowledge sharing barriers are presented in literature?" The study applies literature review that is carried out with scholarly literature-exploration tool which is powered by artificial intelligence (AI).

2 Literature review

2.1 Methodology and data gathering

Literature review is a time-consuming task for scholars, as the amount of journals and articles increases massively every year. In order to produce reliable results scholars need to invest a lot of their time just in finding the potentially relevant articles from the mass, let alone screening and reading them. Therefore, it is no wonder AI-powered search engines focused on searching and linking together scientific articles, such as Iris.ai (<http://iris.ai>) Meta (<http://meta.com>), and Semantic Scholar (<http://www.semanticscholar.org>), have been gaining researchers' interest in recent years. Resting heavily on visual representation they aim to provide scholars a multifaceted overview of relevant literature instead of just acting as citation indices like conventional database search tools (Extance, 2018; Fricke, 2018). Utilizing AI enables these tools to examine the full-text intelligently instead of looking at the mere keywords and titles, and therefore they find hidden connections, relationships and overlapping between papers (Fricke, 2018). They aim to save the users' time by quickly going through masses of open access research papers, grouping them in a form that provides a relevant and precise

overview of the topic, and also make full-text of the results easily accessible (Sentence, 2017). Some of these tools are free at least for basic queries, but some demand rather high cost for premium access in order to use more sophisticated filters and refining tools (Extance, 2018). The aptness and precision of these tools is for each user to determine, as, like any other search engine, they leave the interpretation and final analysis of the results to the user.

In this literature review we used the free version of Iris.ai. We provided its explore function the research question (“What kind of knowledge management practices to overcome network level knowledge sharing barriers are presented in literature?”) accompanied with 457 word text describing the research problem including keywords. Iris.ai extracted the most important words from the text, screened 5 million open access papers (including journal articles, conference articles, book chapters, theses) searching for contextual synonyms, and classified each relevant paper under different topics. This resulted in 387 papers grouped by their main concepts and subconcepts, visually grouped as a map, where larger shapes present stronger concepts with more subtopics. The map of this search is represented in Figure 1.

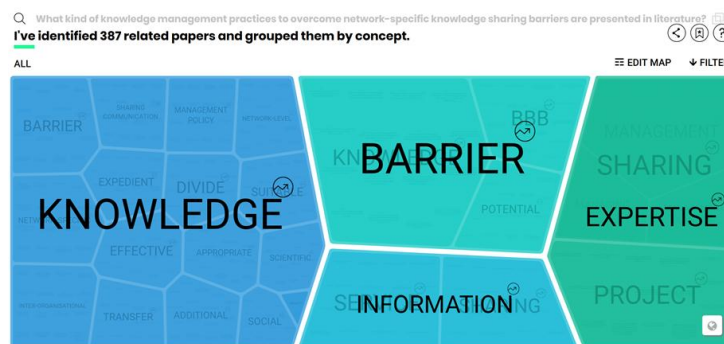


Figure 1. The map generated by Iris.ai, visually representing the paper's subjects and scope.

Each shape (e.g. “Knowledge” in Fig. 1) in the map presents the main concept of the papers grouped in this section. The second layer of shapes (e.g. “Transfer” in Fig. 1) are its subconcepts and possible further subtopics. The bottom layer is formed by relevant paper titles in each subconcept. By clicking the title of the paper the abstract, the metadata and the paper's overall relevance score calculated by Iris.ai can be reviewed.

Artificial intelligence can only do so much, and therefore also this search needed to be refined by human effort. We went through each main concept, subconcept and subtopic and checked for any duplicate papers. For example, all the articles in subconcept “Barrier” in the main concept “Knowledge” were duplicates of the subconcept “Knowledge” in the main concept “Barrier”, i.e. these subconcepts were identical and their articles were only counted in once. As a result the number of articles was reduced to 314. Then, again one main concept (e.g. “Expertise”) and subconcept (e.g. “Sharing”) at a time, we reviewed the papers by their title and abstract and assessed which of them

actually passed our search criteria i.e. could potentially provide answers to our research question. The Yield of our search is presented in Table 1.

Table 1. Number of articles (*duplicate categories, taken into account in the final n)

Concept	Subconcept	Topic	1 st screening	Final yield
BARRIER 41	BBB (blood brain barrier) 15			
	Knowledge 10*		1	
	Potential 15			
EXPERTISE 45	Project 15			
	Sharing 30	Management 13	1	
		Management planning 3		
		Managing 14	1	
INFORMATION 24	Service 15			
	Sharing 9		1	
KNOWLEDGE 204 (+10 duplicate articles in "Barriers")	Additional 12			
	Appropriate 13			
	Barrier 10*			
	Capacity 12			
	Divide 13		1	
	Effective 14		4	3
	Expedient 16			
	Inter-organisational 14		9	9
	Management policy 12			
	Network-level 16		7	3
	Network-specific 14		4	2
	Scientific 11			
	Sharing communication 14			
	Social 14			
	Suitable 16			
	Transfer 13			
n=314			n=29	n=17

This first round of screening resulted in 29 articles. On the second round all of these articles were read and re-grouped according to their topics. In this phase we eliminated 12 articles not passing the criteria to answer to our research question, which meant that the article did not discuss knowledge sharing or in more general terms knowledge management at the level of inter-organisational networks. Thus, in total 12 articles were excluded in the final screening either as it did not discuss organisational network or it didn't focus on knowledge sharing and/or knowledge management. For example, some of the excluded articles only focused on technical networks or they discussed only intra-organisational knowledge management. After exclusion, we ended up with 17 final articles that were taken to more profound review. These results are presented in the next section of this paper.

2.2 Results

By following the aforementioned data gathering process the literature review resulted in altogether 17 articles meeting the search criteria. Even though it can be argued that the use of AI in the literature review may have left out of the initial scope some relevant

articles and thus the final number of articles could be a couple of more articles, it still can be argued, that the total number of articles that especially address inter-organisational level knowledge sharing is surprisingly limited. Furthermore, even out of these 17 articles there were only few (in total 7 of the 17 final articles) that focused on identifying and developing practices that enhance inter-organisational knowledge sharing. Most of the seventeen articles that passed through the final screening phase focused only on identifying knowledge sharing as a key activity in networks' success, but they lacked the actual discussion on what are the functional knowledge management practices that can make the effective knowledge sharing happen in networks. Thus, there certainly exists a research gap. In next, we will concentrate on discussing those seven articles that at least some way brought up the potential practices to support inter-organisational knowledge sharing.

Conklin et al. (2013) focused on the role of individuals and social aspects in enhancing knowledge sharing in networks when they pointed out the important role of knowledge broker (KB). They argued that KB's help communities of practice (COPs) to evolve and they help people with similar interests or challenges to engage and exchange knowledge. In their two articles Leung et al. (2013, 2011) on the other hand pointed out more "technical" approach to enhance knowledge sharing in network when they argued that common "language" needs to be acquired within the network through suitable ontology development. With this approach they emphasized the use of mapping approaches, levels of automation and mediation methods to matching techniques. Bellini et al. (2016) proposed rather traditional ways to enhance knowledge sharing in networks by stating that "Collaboration, open communication, and trust are some partnering elements that imply effective knowledge transfer and, consequently, lead to successful outcome." However, they did not open up these in more detailed way.

Kess et al. (2007) was in fact the only article that really developed practices to enhance knowledge sharing in networks. However, they had studied knowledge sharing in the special case of outsourcing network relationships. Nevertheless, they argued that best practices for knowledge sharing were different kinds of meetings, accurate documentation and systems. They also emphasized the need for daily social interaction between key contact persons and the use of traditional communication channels like phone and e-mail.

The last two articles that in some extent discussed practices, were Capaldo (2014) and Lake and Erwee (2005). Capaldo's (2014) study brought up four viewpoints to knowledge sharing between network organizations. The first viewpoint was information sharing in terms of context specific knowledge, i.e. environmental information. Information sharing was mostly done between network's key actors and in a very informal way. Second viewpoint concentrated on knowledge transfer, and it was mostly related to expert-specific know-how that aimed at solving a certain problem at hand. Third viewpoint was in-house knowledge production, that focused more on intra-organizational aspects, and fourth viewpoint was knowledge co-production. This fourth viewpoint was the most interesting in the article, as it really took the interaction between the network actors into focus. It was also concluded in the article that effective knowledge sharing in the network needs personal relationships, functional macro culture, trust and reciprocity.

Lake and Erwee's (2005) research on knowledge exchange in a regional network focused on using the classic SECI-model of Nonaka and Takeuchi (1995) as a tool to understand more deeply network level knowledge sharing. They studied how tacit knowledge was made explicit at regional network level through fourteen embedded cases. In the article they formulated network level knowledge management as following: "Knowledge management in regard to networks involves cooperating across organisational boundaries to systematically find, select, organise, distil, present and share authorised information that meets the strategic and operational learning intent of all parties to a cooperation. The assumption in this definition is that all parties have in place strategic policies to protect unauthorised transfer of confidential information and those parties to the cooperation do not source unauthorised information, but do willingly share authorised information." As we can see from this definition, they emphasized not only the knowledge sharing aspect, but also the other side of the coin, knowledge protection. They used in their study the classic Nonaka and Takeuchi (1995) SECI-model, and brought up especially the difficulty in socialization phase of the model, as socialization needs e.g. trust between the interacting people and a shared "language", referring to shared schemas.

3 Discussion

Using AI-powered tool in the literature review most likely affected the limited relevance and the small amount of the articles passing the criteria in this study. However, using traditional databases and their search tools would have required a more rigid planning of the scope and criteria, as well as limiting the search to only small number of target journals and/or databases, as majority of the work would have been done by hand. The decision to use AI-powered Iris.ai opened up a possibility to design a more elaborate research scope and leave the most laborious part of search to the tool. In all, we conclude that even though the tool enabled us to quickly grasp a an overview on the topic, the contents of the results were not as accurate or relevant as we would have hoped for. However, in order to judge the actual aptness of the AI-powered tool used, a comparative study should be made using the traditional literature review search tools. Namely, it might not provide any more relevant articles to the subject, proving that the limited amount of relevant articles found by the AI-powered tool is not the actual issue, but the lack of research conducted regarding the topic.

What comes to the results of the literature review, the total number of articles that especially address knowledge management practices to overcome network level knowledge barriers was surprisingly limited. Some of the 29 articles passing the first round were irrelevant to the topic. Only 10 of the 17 articles surpassing to the final round discussed knowledge sharing in the network context, but their discussion of the matter was left on a very general and abstract level. Seven articles dealt with inter-organisational knowledge sharing to some extent, but even they did not take the discussion to a very precise level. Many of the articles brought up knowledge sharing as the key activity in networks' success, but left the question of how to reduce the knowledge barriers and thus promote knowledge sharing in practice unanswered. Based on our study we argue that

there is a lack of articles that report research, developing or designing functional knowledge management practices that enable effective knowledge sharing on a network level. This underlines the existence of a research gap and the need for especially empirical research on the issue.

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References

- Abou-Zeid, E.-S., (2005) "A culturally aware model of inter-organizational knowledge transfer", *Knowledge Management Research & Practice*, Vol. 3, No. 3, pp. 146-155.
- Bellini, A., Aarseth, W. and Hosseini, A., (2016) "Effective knowledge transfer in successful partnering projects", *Energy Procedia*, Vol. 96, pp. 218-228.
- Capaldo, A., (2014) "Network governance: A cross-level study of social mechanisms, knowledge benefits, and strategic outcomes in joint-design alliances", *Industrial Marketing Management*, Vol. 43, No. 4, pp. 685-703.
- Conklin, J., Lusk, E., Harris, M. and Stolee, P., (2013) "Knowledge brokers in a knowledge network: the case of Seniors Health Research Transfer Network knowledge brokers", *Implementation Science*, Vol. 8, No. 1, p. 7.
- Corallo, A., Lazoi, M. and Secundo, G., (2012) "Inter-organizational knowledge integration in collaborative NPD projects: Evidence from the aerospace industry", *Knowledge Management Research & Practice*, Vol. 10, No. 4, pp. 354-367.
- Extance, A., (2018) "How AI technology can tame the scientific literature", *Nature*, Vol. 561, No. 7722, p. 273.
- Fricke, S., (2018) "Semantic scholar", *Journal of the Medical Library Association: JMLA*, Vol. 106, No. 1, p. 145. <http://jmla.pitt.edu/ojs/jmla/article/view/280/595>
- Hislop, D., (2005) "The effect of network size on intra-network knowledge processes", *Knowledge Management Research & Practice*, Vol. 3, No. 4, pp. 244-252.
- Ke, W. and Wei, K.K., (2007) "Factors affecting trading partners' knowledge sharing: Using the lens of transaction cost economics and socio-political theories", *Electronic Commerce Research and Applications*, Vol. 6, No. 3, pp. 297-308.
- Kess, P., Torkko, M. and Phusavat, K., (2007) "Knowledge transfer for effective outsourcing relationships", In 2007 29th International Conference on Information Technology Interfaces, pp. 69-74.
- Khamseh, H.M. and Jolly, D., (2014) "Knowledge transfer in alliances: The moderating role of the alliance type", *Knowledge Management Research & Practice*, Vol. 12, No. 4, pp. 409-420.
- Korbi, F.B. and Chouki, M., (2017) "Knowledge transfer in international asymmetric alliances: The key role of translation, artifacts, and proximity", *Journal of Knowledge Management*, Vol. 21, No. 5, pp. 1272-1291.
- Lake, P. and Erwee, R., (2005) "Knowledge exchange in a regional network", *International Journal of Organisational Behaviour*, Vol. 9, No. 6, pp. 642-658.
- Leung, K., Lau, S. K., Fan, J. P., Kang, S. and Tsang, N., (2011) "An ontology-based collaborative interorganizational knowledge management network", In S. Rotchanakitumnuai & L. Kaewkitipong (Eds.), *The 11th International Conference on Electronic Business - Borderless E-Business for the Next Decade*, pp. 381-389.

- Leung, N. K., Lau, S. K. and Tsang, N., (2013) "An ontology-based collaborative inter-organisational knowledge management network (CIK-NET)", *Journal of Information & Knowledge Management*, Vol. 12, No. 1, p. 1350005.
- Magnusson, J. and Nilsson, A., (2003) "To facilitate or intervene? A study of knowledge management practice in SME networks", *Journal of Knowledge Management Practice*, Vol. 4.
- Nonaka, I. and Takeuchi, H., (1995) *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford university press.
- Nooteboom, B., (2006) "Learning and innovation in inter-organizational relationships and networks", *Center Discussion Paper Series No. 2006-39*, <http://dx.doi.org/10.2139/ssrn.903754>
- Paulin, D. and Suneson, K., (2012) "Knowledge transfer, knowledge sharing and knowledge barriers – Three Blurry terms in KM", *The Electronic Journal of Knowledge Management*, Vol. 10, No. 1, pp. 81-91.
- Quintas, P., Lefrere, P. and Jones, G., (1997) "Knowledge management: A strategic agenda", *Long Range Planning*, Vol. 30, No. 3, pp. 385-391.
- Riege, A., (2005) "Three-dozen Knowledge-sharing Barriers Managers Must Consider", *Journal of Knowledge Management*, Vol. 9, No. 3, pp.18-35.
- Salvetat, D., Géraudel, M. and d'Armagnac, S., (2013) "Inter-organizational knowledge management in a coopetitive context in the aeronautic and space industry", *Knowledge Management Research & Practice*, Vol. 11, No. 3, pp. 265-277.
- Schwartz, D.G., (2007) "Integrating knowledge transfer and computer-mediated communication: Categorizing barriers and possible responses", *Knowledge Management Research & Practice*, Vol. 5, No. 4, pp. 249-259.
- Sentence R., (2017) "Chan-Zuckerberg Initiative acquires AI-powered search engine Meta", *Search Engine Watch*. <https://searchenginewatch.com/2017/01/25/chan-zuckerberg-initiative-acquires-ai-powered-search-engine-meta/>
- Solitander, M. and Tidström, A., (2010) "Competitive flows of intellectual capital in value creating networks", *Journal of Intellectual Capital*, Vol. 11, No. 1, pp. 23-38.
- Sorenson, O., Rivkin, J. and Fleming, L., (2006) "Complexity, networks and knowledge flow", *Research Policy*, Vol. 35, pp. 994-1017.
- Szulanski, G., (2003) *Sticky Knowledge: barriers to knowing in the firm*, Sage Publications, London.
- Trkman, P. and Desouza, K.C., (2012) "Knowledge risks in organizational networks: An exploratory framework", *The Journal of Strategic Information Systems*, Vol. 21, No. 1, pp. 1-17.
- Vuori, V., Helander, N. and Mäenpää, S., (2018) "Network level knowledge sharing: Leveraging Riege's model of knowledge barriers", *Knowledge Management Research & Practice*, Dec 2018, pp. 1-11.
- Wuyts, S., Colombo, M. G., Dutta, S. and Nooteboom, B., (2005) "Empirical tests of optimal cognitive distance", *Journal of Economic Behavior & Organization*, Vol. 58, No. 2, pp. 277-302.

Ecosystem of Knowledge or Contamination of Knowledge? An Exploratory Analysis at the Boundaries of Scientific Domains

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Abstract

The “knowledge ecosystem” is a fascinating metaphor, which allows us to effectively depict the exchange of information and ideas between the knots of a more or less defined network of entities having similar aims and operating in the same environmental context. The ecosystem metaphor has been variously argued to be fitting with the interplay that

happens between different academic domains, which reciprocally share conceptual frameworks, empirical tools, and theoretical insights to push forward our knowledge about timely scientific issues. However, there is the risk that – far from bringing toward the establishment of a knowledge ecosystem – the exchange of information and ideas between different scientific disciplines triggers a process of knowledge contamination, which may produce unexpected drawbacks. In fact, knowledge contamination implies a sort of alteration of scientific domains which are more likely to draw research tools and approaches from other disciplines. Adopting an exploratory slant, this paper tries to investigate the interplay between management and two scientific domains which show an increasing influence on management studies, namely philosophy and neuroscience. A descriptive bibliometric approach was designed to shed light on the exchange of knowledge between management and these two disciplines. On the whole, the analysis concerned 199 scientific articles, 152 about the management-philosophy interplay and 47 about the neuroscience-management interplay. In this preliminary step of the research, the attention was focussed on the references made and the citations get by these items. Sticking to the exploratory nature of this research, we did not have research hypothesis guiding our excursion in the fields of knowledge ecosystem and knowledge contamination. Rather, we developed two assumptions, which steered our study. Specifically, it was thought that if the number of referenced articles belonging to the philosophy and neuroscience fields was equal or lower than the number of citing articles belonging to these two areas, then a knowledge ecosystem could be supposed to exist; alternatively, if the number of referenced articles belonging to the fields of philosophy and neuroscience was higher than the number of citing articles ascribable to these two areas, a knowledge contamination was expected to occur. The research findings supported the latter assumption, suggesting that management studies may be at risk of contamination from other disciplines. Further conceptual and empirical developments are required to fully disentangle the “knowledge contamination” issue in management studies and to identify the missing steps to the establishment of a knowledge ecosystem between management and related scientific disciplines.

Keywords – Knowledge ecosystem, Interdisciplinary research, Scientific Knowledge; Management; Contamination

Paper type – Academic Research Paper

1 Introduction

The “ecosystem” metaphor is gaining a growing prevalence in the management literature (Lusch, Vargo, & Gustafsson, 2016). In general terms, this concept involves an interpretation of organizations as knots of a large and interdependent network of entities (Taillard, Peters, Pels, & Mele, 2016), which share complementary resources and participate in value co-creation activities (Letaifa & Reynoso, 2015). It is worth noting that an ecosystem may be also composed of a network of networks (Aarikka-Stenroos & Ritala, 2017), which – either directly or indirectly – interact in their respective processes of value generation and dissemination (Järvensivu & Möller, 2009).

The ecosystem idea is especially fitting to depict how the members of different organizations operating in the field of higher education and academic research exchange and share their respective knowledge, paving the way for processes of “cross-fertilization” (Bartolo, Wicks, & Ott, 2002, p. 31) of their intellectual and cultural capital (Miller, Mcadam, Moffett, Alexander, & Puthusserry, 2016). However, in the last few years, knowledge ecosystems in the higher education setting have been characterized by a more or less significant homogeneity in terms of cultural and scientific affiliation of individual members (Bozeman & Corley, 2004). Current interdisciplinary networks, on the opposite, find their distinguishing competitive factors in the variety of members’ scientific domains (Vătămănescu, Andrei, Dumitriu, & Leovaridis, 2016).

Even though scholars and practitioners are paying a growing attention to the ecosystem perspective in order to investigate how knowledge networks are established between people who belong to heterogeneous scientific domains, still little is known about the risks that are brought by the propensity of members affiliated with a specific scientific area to prevail over others (Bordons, Morillo, & Gómez, 2004). Such a propensity may bring to conflicting – rather than collaborative – behaviors (Macfarlane, 2017). In this specific circumstance, far from paving the way for knowledge sharing and co-creation, the ecosystem approach may determine knowledge contamination, which is expected to degenerate into co-destruction of value (Cunningham, Menter, & O’Kan, 2018).

Drawing on these introductory notes, the paper tries to shed light on a specific instance of knowledge exchange between members of the academia affiliated with different scientific domains. Going more into detail, the attention will be focussed on the indirect transmission of knowledge which is typified by the dynamics of citations and cross-citations of articles published either in conventional channels of scientific publications – such as books, peer-reviewed journals, and conference proceedings – or in alternative channels, here included grey literature, by authors belonging to various scientific fields. Adopting an ecosystem standpoint and sticking to a descriptive bibliometric approach, we will investigate the interaction between scholars coming from different epistemological and ontological perspectives. In particular, the attention will be focused on the exchange of knowledge between scholars belonging to the “management” field with colleagues operating in the areas of “philosophy” and “neuroscience”. The decision to analyse these two fields was motivated by their conceptual proximity with management studies (see, among the others, Case, 2007; Mollona, 2009; Lindebaum, 2016; McDonald, 2018).

The paper is organized as follows. Section 2 briefly describes the research design and methodology: it delves into the research strategy which was arranged and used to collect the contributions that were included in this research; moreover, the approach which was devised to analyse available data is presented. Section 3 includes the main study findings: it is articulated in two subsections, one of which is dedicated to the exchange between management and philosophy, while the other concerns the management-neuroscience interaction. Section 4 critically discusses the research findings, acknowledging the limitations which affected this research. Lastly, Section 5 shed light on the main research

conceptual and practical implications, illuminating several avenues for further development.

2 Research design and methods

A systematic approach has been designed to collect the scientific contributions useful for the purpose of this research. In light of its comprehensiveness and extension (Aghaei Chadegani, et al., 2013), Elsevier's "Scopus®" has been identified as the primary source to search, select, and screen the relevant items to be included in this study. At the moment, *Scopus®* is one of the largest citation databases available to the scientific community. It indexes about 1,5 billions of citations, which are provided by more than 5,000 international and national publishers established in various areas of the World.

The research design was articulated in two steps. On the one hand, a specific query was devoted to the management-philosophy interaction. A generic query was run in the field "Title" of the main research interface of "Scopus®". Specifically, the word "philosoph*" was queried, without any limitation concerning publication year, type of publication, type of source, language, and authors' affiliation; however, in line with the aims of this study, a restriction was put on the scientific domain of the retrieved items: only contributions belonging to the sub-field "Business, Management and Accounting" were included in the research. On the other hand, we replicated the same approach to collect items concerning the management-neuroscience exchange. In this case, the word "neurosci*" was queried, introducing the same limitation criteria used for the previous query. In sum, this research design allowed us to elicit all contributions published by management scholars with a more or less direct reference either to "philosophy" or to "neuroscience". On the whole, we retrieved 1,410 items for the "management-philosophy" couple and 209 items for the "management-neuroscience" couple, for a total number of 1,619 records potentially relevant for the purpose of this research.

The authors agreed a set of selection criteria which inspired the preliminary screening of the collected records. First, since we were interested in the mutual exchange of knowledge between the disciplines contemplated in this study, we excluded all the items which did not report any citation by other scientific contributions. This criterion led to remove from the analysis about 4 in 10 items (38.9%) concerning the "management-philosophy" dyad and slightly less than a third (31.1%) of the records concerning the "management-neuroscience" interchange.

Second, the retained items were carefully screened in their title, abstract, and keywords by the authors. Three inclusion criteria were defined in order to guide the identification of relevant contributions to be included in this study: a) the items which improperly used the terms related to "philosophy" and "neuroscience", but did not include an analysis about the interdependences of management studies with these two disciplines were excluded as "out of topic"; b) the items which – even though embracing either the philosophy or the neuroscience perspective – did not focussed on management topics, but concerned wider economic themes, such as consumer behavior, regulatory and policy affairs, and macro-institutional issues – were removed as "out of scope"; and c) the items

which merely included a conceptual and/or theoretical digression on the use of methodologies and research approaches drawn by management scholars from other disciplines were discarded as “not relevant”.

The application of these criteria led to the inclusion of 152 contributions about the “management-philosophy” couple and 47 records concerning the “management-neuroscience” couple. The references made by retrieved papers have been classified – for each unit of analysis – in two groups: on the one hand, references to articles published by journals which were affiliated with the “management” subfield; on the other hand, references to articles published in journals which were listed either in the “philosophy” or in the “neuroscience” subfields. In addition, a cross-reference analysis was performed on the papers citing the records included in the analysis. Also in this case, the items were classified in two groups, according to their distinguishing scientific domain.

Although, in light of the exploratory nature of this research, we were unable to define clear research hypothesis guiding the steps of our study, we stuck to several *ex ante* assumptions, which triggered our research activities. We argued these assumptions from the insights suggested by the prevailing scientific literature (see, among others: Walsh, Weber, & Margolis, 2003; Gu, 2004; Schildt, Zahra, & Sillanpää, 2006; Nerur, Rasheed, & Natarajan, 2008). First, it was assumed that the higher the number of references to articles published in areas other than management, the greater the degree of knowledge exchange between different fields. Second, as far as the cross-citations’ analysis was concerned, we assumed that: *a*) if the number of referenced papers belonging to the philosophy and neuroscience fields was equal or lower than the number of referencing paper belonging to these two areas, then a knowledge ecosystem composed of management scholars and academics from either philosophy or neuroscience could be maintained to exist; on the opposite, *b*) if the number of referenced papers belonging to the fields of philosophy and neuroscience was higher than the number of referencing papers affiliated with these two areas, then a knowledge contamination was expected to occur.

3 Findings

3.1 The management-philosophy interplay

The vast majority of records concerning the management-philosophy couple which were included in this study consisted of articles published in peer reviewed journals (96.1%). In addition to them, 2 books (1.3%), 3 books’ chapters (1.9%), and 1 conference proceeding (0.7%) were taken into consideration. As expected, all the records involved in this analysis referenced at least 1 manuscript which belonged to the management field; besides, more than 9 in 10 items (92.1%) included at least 1 reference to articles ascribable to the “philosophy” subject area. Going more into detail, the average number of references to management studies was 36.6 ($\sigma=22.3$; min=1; max=108); otherwise, philosophy-based articles accounted – on the average – for 10.6 references ($\sigma=11.6$;

min=0; max=82). From this standpoint, it could be maintained that most of the records investigated in this study drew on philosophical insights to make their arguments.

The average number of citations for each record was 26.5 ($\sigma=43.1$), ranging from a minimum of 1 to a maximum of 286. Interestingly, citations in journals, books, or conferences whose main subject area was either directly or indirectly related to philosophy were much more infrequent as compared with citations get by management-rooted studies: on the one hand, the average number of citations from philosophical manuscripts was 0.28 ($\sigma=0.66$), ranging from a minimum of 0 to a maximum of 5; on the other hand, the average number of citations get by articles ascribable to the management discipline was 24 ($\sigma=38.8$), ranging from a minimum of 0 to a maximum of 284 references. In addition, it is worth noting that only 31 items (20.4%) were cited at least once in a source belonging to the philosophical area; alternatively, 98% of the analysed records were cited at least once in management-based sources.

These preliminary findings pointed out that, while the investigated records were likely to be more or less influenced by conceptual and practical arguments developed in the philosophical realm, they were not equitably effective in soliciting interest from philosophy scholars. In other words, far from leading to the establishment of a knowledge ecosystem, the interplay between the disciplines of philosophy and management seemed to result in a sort of contamination of management theories and tools with ideas and concepts derived from philosophical studies. The cross-tabulations reported below in Table 1 help in making this point. We classified available items in three groups: 1) items with a prevalence (66% or more) of references to philosophical sources; 2) items with a prevalence (66% or more) of references to management sources; 3) items with an evenly number of references to management and philosophical sources. We found that items with no citations from philosophical avenues largely prevailed in these three groups. In particular, more than one third of items with a prevalence of references to philosophical sources (71.4%) had no citations by philosophy-based journals; moreover, more than 4 in 5 items with an evenly distribution of management and philosophical references (80.5%) showed no citations by philosophical avenues.

Table 1. Cross-tabulation between groups of items and no. of citations in philosophical avenues

	<i>Citations by articles published in philosophical avenues</i>		
	0	1 or more	Total
Articles with prevalence of philosophy-based references	5	2	7
Articles with prevalence of management-based references	83	21	104
Articles with an even number of management- and philosophy-based references	33	8	41
Total	121	31	152

Source: Authors' elaboration

It is worth noting that a large part of the records which received at least one citation from articles published in philosophical journals and books were hosted in the *Journal of Business Ethics* (22.5%). Moreover, citations from philosophical studies were common among articles published in journals which were not solely focuses on management issues and showed an interdisciplinary slant, such as *Accounting, Organization and Society*, *Academy of Management Learning and Education*, and *Business Ethics Quarterly*. This result seems to suggest that philosophy scholars are more attracted from management studies with an interdisciplinary slant than from articles primarily focussed on management issues.

3.2 The management-neuroscience interplay

Slightly less than 9 in 10 items focussing on the management-neuroscience interchange which were contemplated in this research were published in peer-reviewed journals (87.3%). Besides, we retrieved 4 conference proceedings (8.5%), 1 book (2.1%) and 1 book's chapter (2.1%). All the records had at least 1 reference to articles published in avenues related to neuroscience; the same was true as far as references to studies published in the management field were concerned, with the sole exception of 1 article, which did not show any reference to management-based articles. In particular, the investigated items had, on the average, 33.1 references to neuroscientific sources ($\sigma=42.2$; $\text{min}=1$; $\text{max}=282$); alternatively, the average number of references to articles rooted in management was 21.2 ($\sigma=14.5$; $\text{min}=0$; $\text{max}=80$). Therefore, while in the management-philosophy exchange references to management studies prevailed over references to philosophy-based sources, in the management-neuroscience couple references to theories and tools rooted in neuroscience were more common than references to management studies.

The number of citations get by the analysed records ranged from a minimum of 1 to a maximum of 91 ($\mu=15.6$; $\sigma=21.2$). It is interesting to note that citations from management sources largely prevailed over citations from contributions hosted in avenues ascribable to the neuroscientific domain. On the one hand, the average number of citations which came from management-rooted studies was 11.9 ($\sigma=15.8$), ranging from a minimum of 0 citations to a maximum of 67 citations. On the other hand, the neuroscience discipline accounted – on the average – for 1.9 citations ($\sigma=2.8$), with the most cited manuscript scoring 13 citations and the less cited manuscript reporting no citations from neuroscientific sources.

Echoing the insights obtained from the examination of the management-philosophy interchange, we found that management scholars were likely to be influenced by conceptual and practical arguments elaborated by academics affiliated with neuroscientific disciplines; otherwise, neuroscience-based research turned out to be poorly receptive to insights and contributions proposed in the management field. Once again, a sort of knowledge contamination propagating from neuroscience to management seemed to appear; in fact, only spotted signs of knowledge exchange and co-creation between these two scientific domains were noticed.

The cross-tabulations reported in Table 2 support these considerations. Replicating the same approach used for the management-philosophy couple, we classified available items concerning the management-neuroscience interplay in three groups: 1) items with a prevalence (66% or more) of references to neuroscience sources; 2) items with a prevalence (66% or more) of references to management sources; 3) items with an evenly number of references to management and neuroscience sources. Surprisingly, items with no citations from neuroscientific sources were more common both in the group of articles with a prevalence of neuroscience-based references (56%) and in the groups of articles with a prevalence of management-based references (76%). Alternatively, items which scored at least 1 citation from papers rooted in the neuroscience realm prevailed among the group of articles with an even number of references to management and neuroscience sources (57%). From this point of view, it could be maintained that citations from studies based in the neuroscience domain were solicited by the mix of management theories and approaches with neuroscientific concepts and tools.

Table 2. Cross-tabulation between groups of items and no. of citations in neuroscientific avenues

	<i>Citations by articles published in neuroscientific avenues</i>		
	0	1 or more	Total
Articles with prevalence of neuroscience-based references	5	4	9
Articles with prevalence of management-based references	2	1	3
Articles with an even number of management- and neuroscience-based references	15	20	35
Total	22	25	47

Source: Authors' elaboration

Lastly, yet importantly, it is worth noting that a significant part of the articles which scored at least 1 citation from neuroscientific sources were published in scientific avenues which promoted critical thinking, the design of creative research strategies, and the adoption of non-traditional research methods, such as the *Journal of Management Inquiry* and *Academy of Management Perspectives*. On the opposite, papers published in traditional management sources were found to be less likely to report citations from articles rooted in the neuroscience discipline.

4 Discussion

The research findings should be contextualized to the main limitations which affected this study. First, we only focused on articles indexed in *Scopus*[®]; even though this decision restricted the breadth of our research, it did not significantly affect the relevance of our research, since *Scopus*[®] allowed us a comprehensive coverage of the current

scientific literature. Second, the descriptive approach taken to collect data and to interpret available evidence constrained the depth of our study; nevertheless, it was consistent with the exploratory purposes which inspired our research. Third, and lastly, the focus on the interplays between management and philosophy and between management and neuroscience was not exhaustive; however, it permitted us to obtain some preliminary insights to envision future conceptual and practical developments.

The research findings suggested that there is a relevant interconnection between both philosophy and management and neuroscience and management. On the one hand, we found that journals affiliated with the management area were likely to pay attention to philosophical issues, which were usually exploited as an alternative – and critical – perspective to enhance our understanding of timely management topics, such as leadership, inter-organizational relationship, sustainability, organizational resilience, and decision making (see, among others, Hassard, Kelemen, & Cox, 2007; Cunliffe, 2009; and Klikauer, 2011). However, it seemed that management journals were more open and inclusive as compared with philosophical-based avenues, which were less prone to make reference to conceptual and practical developments proposed by management sources. On the other hand, management studies were receptive toward tools and approaches coined in the neuroscience domain, which were used to delve into the main behavioural issues that currently challenge management knowledge, such as organizational learning, organizational loyalty, employees' empowerment, and organizational commitment (see, *inter alia*: Anrold, 2018; McDonald, 2018; and Jack, Rochford, Friedman, Passarelli, & Boyatzis, 2019). Nonetheless, only spotted evidence was retrieved about the propensity of neuroscience scholars to derive insights from management studies in order to nurture further conceptual and/or practical developments in their research field.

These results invite us to argue that a process of knowledge contamination is currently characterizing the interplay between management and other disciplines, such as philosophy and neuroscience. This is not consistent with the adoption of an ecosystem metaphor to unravel the exchange of knowledge and ideas between different scientific disciplines (Fraser, 2018). Rather, it suggests that relatively younger and softer disciplines – such as management (Drucker, 1974; Goldman, 2016) – are more likely to be influenced and shaped by scientific domains which show a more established tradition – such as philosophy – and a more solid and reliable empirical approach – such as neuroscience. Sticking to a Darwinist perspective, it seems that management studies are experiencing a third step of their evolution, which brings from positivism and constructivism to a mixed, co-evolutionary approach, that is deeply affected by contamination of traditional management theories and frameworks with insights generated in conventionally distant scientific domains (Khorasani & Almasifard, 2017).

5 Conclusions

It has been variously maintained that, while knowledge ecosystems may be crucial to improve the quality and the innovativeness of individual agents' activities, knowledge contamination may have relevant negative drawbacks on the viability of specific knots of

the networks. In fact, knowledge contamination implies a gradual fragmentation of the identity of the members of the ecosystem which are more likely to be influenced by other knots. This sets the conditions for the decay of their distinguishable contribution to the long-term sustainability of the ecosystem it-self. From this point of view, there is the risk that the process of knowledge contamination experienced by management studies may – in the long run – impair their ability to factually concur to the generation of distinctive and field-specific scientific knowledge. However, further developments are required to shed light on this issue. First of all, an expansion of this study is required, in order to enhance the reliability of the research findings and to illuminate the various facets of the interplay between management, philosophy, and neuroscience. Second, a deeper study involving a content analysis of the items included in this research is thought to pave the way for the collection of better insights about the implication of knowledge contamination produced by other scientific domains on management. Lastly, yet importantly, a larger number of disciplines should be contemplated in the research strategy and design, in an attempt to shed light on the generalizability of the results.

References

- Aarikka-Stenroos, L. and Ritala, P. (2017) "Network management in the era of ecosystems: Systematic review and management framework", *Industrial Marketing Management*, Vol. 67 No. 11, pp. 23-36.
- Aghaei Chadegani, A., Salehi, H., Yunus, M. M., Farhadi, H., Fooladi, M., Farhadi, M. and Ale Ebrahim, N. (2013) "A comparison between two main academic literature collections: Web of Science and Scopus databases", *Asian Social Science*, Vol. 9 No. 5, pp. 18-26.
- Anrold, G. M. (2018) "Combining conscious and unconscious knowledge within human-machine-interfaces to foster sustainability with decision-making concerning production processes", *Journal of Cleaner Production*, Vol. 179, pp. 581-592.
- Bartolo, L. M., Wicks, D. A. and Ott, V. A. (2002) "Border Crossing in a Research University. An Exploratory Analysis of a Library Approval Plan Profile of Geography", *Collection Management*, Vol. 27 Nos. 3-4, pp. 29-34.
- Bordons, M., Morillo, F. and Gómez, I. (2004) "Analysis of Cross-Disciplinary Research Through Bibliometric Tools", in Moed H. F., Glänzel W. and Schmoch U. (Eds.), *Handbook of Quantitative Science and Technology Research* (pp 437-456), Dordrecht: Springer.
- Bozeman, B. and Corley, E. (2004) "Scientists' collaboration strategies: implications for scientific and technical human capital", *Research Policy*, Vol. 33 No. 4, pp. 599-616.
- Case, P. (2007) "Ask not what philosophy can do for critical management studies", in C. Jones and R. T. Bos (Eds.), *Philosophy and Organization* (pp. 85-100), London: Routledge.
- Cunliffe, A. L. (2009) "The philosopher leader: On relationalism, ethics and reflexivity-A critical perspective to teaching leadership", *Management Learning*, Vol. 40 No. 1, pp. 87-101.
- Cunningham, J. A., Menter, M. and O'Kan, C. (2018) "Value creation in the quadruple helix: a micro level conceptual model of principal investigators as value creators", *R&D Management*, Vol. 48 No. 1, pp. 136-147.
- Drucker, P.F. (1974) "Management: Tasks, Responsibilities, Practices", London: Taylor and Francis
- Fraser, S. L. (2018) "What stories to tell? A trilogy of methods used for knowledge exchange in a community-based participatory research project", *Action Research*, Vol. 16 No. 2, pp. 207-222

- Goldman, G. A. (2016) "Multiparadigmatic, cooperative opportunities for the study of Business Management", *Management Dynamics*, Vol. 25, No. 3, pp. 2-15
- Gu, Y. (2004) "Global knowledge management research: A bibliometric analysis", *Scientometrics*, Vol. 61, No. 2., pp. 171-190
- Hassard, J., Kelemen, M. and Cox, J. W. (2007) "Disorganization theory: Explorations in alternative organizational analysis". London: Routledge.
- Jack, A. I., Rochford, K. C., Friedman, J. P., Passarelli, A. M. and Boyatzis, R. E. (2019) "Pitfalls in Organizational Neuroscience: A Critical Review and Suggestions for Future Research", *Organizational Research Methods*, Vol. 27 No. 1, pp. 421-458.
- Järvensivu, T. and Möller, K. (2009) "Metatheory of network management: A contingency perspective", *Industrial Marketing Management*, Vol. 38, No. 6, pp. 654-661.
- Järvi, K., Almpapoulou, A. and Ritala, P. (2018) "Organization of knowledge ecosystems: Prefigurative and partial forms", *Research Policy*, Vol. 47 No. 8, pp. 1523-1537.
- Khorasani, S. T. and Almasifard, M. (2017) "Evolution of Management Theory within 20 Century: A Systemic Overview of Paradigm Shifts in Management", *International Review of Management and Marketing*, Vol. 7, No. 3, pp. 134-137.
- Klikauer, T. (2011) "Management and emancipation – two opposing ideas: The Oxford Handbook of Critical Management Studies", *International Journal of Social Economics*, Vol. 38 No. 6, pp. 573-580.
- Letaifa, S. B. and Reynoso, J. (2015) "Toward a service ecosystem perspective at the base of the pyramid", *Journal of Service Management*, Vol. 26, No. 5, pp. 684-705.
- Lindebaum, D. (2016) "Building new management theories on sound data? The case of neuroscience", *Human Relations*, Vol. 69 No. 3, pp. 537-550.
- Lusch, R. F., Vargo, S. L. and Gustafsson, A. (2016), "Fostering a trans-disciplinary perspectives of service ecosystems", *Journal of Business Research*, Vol. 69, No. 8, pp. 2957-2963.
- Macfarlane, B. (2017) "The paradox of collaboration: a moral continuum", *Higher Education Research & Development*, Vol. 36 No. 3, pp. 472-485.
- McDonald, P. (2018) "Sustainability management: research insights from social cognitive neuroscience", *Business Strategy and the Environment*, Vol. 27 No. 8, pp. 1355-1367.
- Miller, K., Mcadam, R., Moffett, S., Alexander, A. and Puthusserry, P. (2016), "Knowledge transfer in university quadruple helix ecosystems: An absorptive capacity perspective", *R and D Management*, Vol. 46, No. 2, pp. 383-399.
- Mollona, E. (2009) "Sociology, philosophy and management: Maintaining and nurturing fruitful interactions", *Journal of Governance and Management*, Vol. 13 No. 3, pp. 245-247.
- Nerur, S. P., Rasheed, A. A. and Natarajan, V. (2008) "The intellectual structure of the strategic management field: an author co-citation analysis", *Strategic Management Journal*, Vol. 29, No. 3, pp. 319-336
- Schildt, H. A., Zahra, S. A. and Sillanpää, A. (2006) "Scholarly Communities in Entrepreneurship Research: A Co-Citation Analysis", *Entrepreneurship Theory and Practice*, Vol. 30, No. 3, pp. 399-415
- Taillard, M., Peters, L. D., Pels, J. and Mele, C. (2016) "The role of shared intentions in the emergence of service ecosystems", *Journal of Business Research*, Vol. 69 No. 8, pp. 2972-2980.
- Vătămănescu, E. M., Andrei, A. G., Dumitriu, D. L. and Leovaridis, C. (2016), "Harnessing network-based intellectual capital in online academic networks. From the organizational policies and practices towards competitiveness", *Journal of Knowledge Management*, Vol. 20, No. 3, pp. 594-619.
- Walsh, J. P., Weber, K. and Margolis, J. D. (2003) "Social Issues and Management: Our Lost Cause Found", *Journal of Management*, Vol. 29, No. 6., pp. 859-881.

Crowdfunding for Cultural Heritage Institutions: Some Insights from the French Context

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Abstract

Crowdfunding has recently emerged as a buzzword in the cultural and creative sector, mainly indicated as an alternative to the decrease of public funding (Bonet and Donato, 2011; Bertacchini et al. 2011). However, this issue is still not investigated in specific fields such as the cultural heritage sector that is yet reluctant to implementing crowdfunding campaign. This paper aims at filling this research gap by focusing on exploring the perception of crowdfunding in cultural heritage institutions by means of an empirical investigation of a relevant sample of organizations in France. The results of the research shed light on the uses and values of crowdfunding in this specific context, paving the way for future comparative research in a broader geographical areas.

Keywords – Cultural Heritage, Crowdfunding, fundraising differentiation

Paper type – Academic Research Paper

1. Introduction

Recently the debate on the necessity of alternative funding for the cultural heritage sector (Bonet and Donato, 2011; Bertacchini et al., 2011; Donato, 2013; Greffe, 2010), has been focusing on crowdfunding as a promising "alternative source of financing" (Chaboud et al., 2018; Yang et al., 2016; Stiver et al. 2015). This last approach has been indicated as particularly significant for the cultural heritage sector (Guesmi et al., 2016; Baujard, 2017). Although several specific crowdfunding platforms were launched for this sector,

cultural heritage organizations seems still reluctant in choosing this fundraising tool if compared to other cultural and creative sectors such as cinema or performing arts. Our research aims at answering this topic, exploring in particular the following main research question:

- Is crowdfunding a necessary financing tool facing the withdrawal of public authorities and fundraising traditional channels and facing financing requirements of a cultural institution in the heritage sector?
- What functions does crowdfunding represent for cultural institutions in the cultural heritage sector?

In order to answer these questions, the investigation analysed a representative sample of five cultural heritage organizations in France: the Centre des monuments nationaux, the Musée des Arts Décoratifs, the Réunion des Musées nationaux – Grand Palais, the Musée du Louvre and the Musée national Picasso in Paris.

After this introductory section, the theoretical basis of the research are presented in section two. Section three explains the research design and methodology, while section four presents and discuss the research results. The last sections draws some concluding remarks, discussing also the contribution of the results to the scientific and professional debates and proposing actions to overcome current limitations of the investigation.

2. Cultural heritage and funding: theoretical perspectives

Over the last decade, the cultural heritage sector has faced important financial challenges; this is due to different factors, mainly linked to the changes in traditional forms of funding.

As highlighted by Bonet and Donato (2011), the economic and financial crisis investing western economies starting from 2008, has had a significant impact also on the cultural heritage sector. Over the previous decades, economic support to the cultural and creative field had expanded, giving opportunities of significant investment in the preservation and enhancement of cultural assets. Policies supporting culture were particularly significant in some European countries, such as Italy (Trupiano, 2005), France (Timbart, 2005; Manda, Nicolescu, & Mortelmans, 2017) or Germany through the development of a *Kulturstaat*, where government strictly support the development and preservation of cultural heritage and cultural organizations (Scheytt, 2015). This abundance of funding was severely questioned when the general economic situation started to enter in the crisis: in a moment of scares funding, culture no longer was a stringent priority. This decrease of public funding to culture (Eurostat, 2011, 2015) led cultural organization (especially in the cultural heritage sector) to think of alternative forms of financing, to help them survive in times of economic downturn. A first option, could be identified in the creation of more frequent cooperation with the private sector (O'Brien, 2011; Borin, 2017). The decrease of traditional public forms of funding for the field could trigger a reflection on the need to reform the governance systems and management models of the cultural sector in order to make its different subjects more financially sustainable (Bonet and Donato, 2011), to increase public-private and multi-

stakeholder partnerships (Borin, 2017). In this framework, significant reflection was carried out on the need to conceive the cultural sector as a network of interdependencies and collaboration: in order to make it sustainable, the implementation of cultural ecosystem approaches has been advocated (Borin and Donato, 2015), based on a new vision of the field related to the ecology of culture approach (Holden, 2015).

Another alternative was based on the idea that cultural organizations need to differentiate the forms of financing (Borin, Donato and Sinapi, 2018) to address the inner fragility that characterizes the sector (Greffé, 2010). This approach underlined the need to create connections with other sources of funding, not only banks and traditional sponsors and individual donors but also with the citizens and communities, both real and “virtual”. Indeed, private donations have been decreasing in this period (Bertacchini et al., 2011; Donato, 2013) and they could no longer be considered a viable option to compensate the decrease of public funding. Exploring the potential of an involvement of citizens through small contributions has increasingly been considered a practical alternative. In this context, crowdfunding has emerged as a buzzword and has been indicated as a promising “alternative source of financing” (Chaboud et al., 2018; Yang et al., 2016), especially for those projects or sectors that encounter problems in accessing to traditional forms of capital. Crowdfunding could potentially be a viable way to deal with government budget cuts (Stiver et al. 2015), particularly for the cultural heritage sector (Guesmi et al., 2016; Baujard, 2017): the proliferation of crowdfunding platforms designed with the cultural and creative sector (e.g. Commeon) or even more specifically on the heritage sector (e.g. Dartagnans) seem to confirm this potential. However, cultural heritage institutions are sometimes reluctant to implement crowdfunding initiatives, especially if compared to other cultural and creative sectors such as cinema and performing arts.

3. Research Methodologies

In order to investigate the above mentioned research questions, the authors decided to adopt an inductive approach, because of its open-ended and exploratory nature that best fitted the investigation.

Qualitative methodology was selected given its suitability for shedding light on how the topics of the research were manifested in the research domain (Denzin et al., 2006) and on the basis of consideration of qualitative research as the most appropriate research method for investigating in-depth a phenomenon and its dynamics (Yin, 2014). The criteria of representativeness was at the basis of the selection of the research sample (Patton, 2002): authors decided to focus on cultural heritage institutions in France and in the Parisian area, thus including in the research sample two among the most important national heritage institution (Centre des Monuments Nationaux; the Reunion des Musee nationaux – Grand Palais), whose central branch is located in Paris, plus three main Parisian museums. The resulting sample includes five cultural heritage organizations: the Centre des monuments nationaux, the Musée des Arts Décoratifs, the Reunion des Musées nationaux – Grand Palais, the Musée du Louvre and the Musée National Picasso. These organizations are all located in Paris, and are world-recognized organizations in the

cultural heritage sector. In order to further meet the criteria of representativeness, the sample included both institutions that have already launched a crowdfunding campaign and ones that are planning but have not already launched a crowdfunding activity.

For each of the above-mentioned institutions, semi-structured research interviews were carried out, mainly with managerial or fundraising staff, in order to further investigate the research topics. The research protocol was amended when required during the interviews. The interviews were recorded, transcribed and manually coded. The chosen coding method was axial coding (Boeije, 2010; Charmaz, 2006; Glaser, 1978; Glaser & Strauss, 1967; Strauss, 1987; Strauss & Corbin, 1998), identifying three main axial codes related to the research questions and their related subcategories and verbatim. The results were finally confronted with the theoretical debate (developed in the preliminary analysis of the literature on the research topic).

The results of the research are presented in the following section, first providing more detailed information about the institutions of the research sample and then presenting and commenting the axial coding results.

4. Results of the empirical research: crowdfunding to compensate the decrease of public funding?

The empirical research consisted in a preliminary phase of selection and analysis of the cultural institutions and a second phase in which semi-structured research interviews were carried out with a selected sample of managers of the involved institutions. This later analysis, led to conclusions regarding the contributions to academic debate and practice.

4.1 Presentation: overview of cultural organizations in relation to fundraising strategies and crowdfunding

4.1.1 Centre des monuments nationaux (CMN)

The Centre des monuments nationaux (CMN) is a public cultural institution belonging to the Ministry of Cultural Affairs. Its main missions are to conserve, to preserve, to restore and enhance several national monuments located in different parts of France. The CMN is self-financed for the 82%, (Source: Annual Report, 2017). Over the last years, the CMN has experienced a significant decrease of public subsidies from the Ministry of Cultural (3.8 million euros between 2016 and 2017). At the same time, the CMN had an increase of expenses (+18,4M € in 2017), that they aim to partially cover through fundraising (more specifically, 600 000 euros for the functioning budget and 150 000 euros for the investments budget, used principally for restorations) employing a total of 3 staff members who are full-time on fundraising. While the central branch target mainly big sponsors and less private individuals, local administrators of peripheral branches (different cultural heritage sites located in France) focus on local public funds as well as on individual donors, especially for specific projects. The CMN has developed a specific

CF campaigns mainly through the platform My Major Company (collecting 40 000 euros in 2017) but major donations do not pass through the platform (340 000 euros in 2017). Four famous monuments were selected with different projects, budgets, and targets: the Pantheon, the Cité de Carcassonne, the Mont-Saint-Michel and the Domaine national de Saint-Cloud. In the chart below, the results of this operation demonstrate a real success in terms of financing objectives, people awareness to needs of the restoration of French heritage, as well as the media impact.

Table 1 - Results of the operation of CMN - My Major Company
(Source: Annual report, 2017)

Monuments	Number of patrons	Average donation	Donations total	Financing objective	Project financing
Panthéon	1 183	57,96 €	68 565 €	5 000 €	1 371 %
Mont-Saint-Michel	380	62,51 €	23 755 €	5 000 €	475 %
Carcassonne	391	52,61 €	20 569 €	20 000 €	103 %
Saint-Cloud	91	51,09 €	10 330 €	10 000 €	103 %
Total	2 045	60,25 €	123 219 €		

Following this positive result, MCN created its own CF platform, called “Ma Pierre A l’Édifice” (MPAE) with the objective of not only reducing costs, but also «to present several projects at the same time in such a way that our donors can have the choice and can turn their donations towards the most relevant project to them, from which they feel the nearest ». The main financial objectives of crowdfunding campaigns are usually determined to correspond to approximately 10% of the total budget.

4.1.2 Musée des Arts Décoratifs (MAD)

The Musée des Arts Décoratifs is classified as “association law of 1901”, and belongs to a non-profit association including the Musée des Arts Décoratifs, the Musée Nissim de Camond, the Library of the Arts Décoratifs, the Ateliers du Carrousel, and the Ecole Camondo. It incorporate therefore museums, pedagogic organisations and a library related to decorative arts, design, fashion, textiles, advertising and graphic design. Its mission is to share and to pass down knowledge in the above mentioned fields, while at the same time preserving, restoring and increasing its collections. Public subsidies consist in almost half of 30 million euros in the MAD budget 2017, while the following most important source of funds is sponsorship (5,6 million € in 2017, 19% of the total budget or the organization). Indeed, some projects need to be entirely financed by patronage to be produced. The organization employs three full-time staff with the objective to raise 6 million euros. They have strict links with the association of Friends of the MAD, middle and major French and foreign donors, and the International Committee. Though the MAD has never developed a crowdfunding campaign they have developed several participative fundraising activities, also creating a web page called “jedonneenligne.org”, inside MAD

website that allowed them to finance two acquisitions (collecting 10 000 euros in only three weeks).

4.1.3 Réunion des musées nationaux – Grand Palais (Rmn-GP)

The Réunion des musées nationaux – Grand Palais (Rmn-GP) is a public establishment with industrial and commercial functions under the supervision of Ministry of Cultural Affairs. In 2011, the RMN and the GP merged to create a broader international cultural organization specialized in museums. Similarly to the CMN, the RMN-GP collects and redistributes revenues from ticket entrance and shops of its museums. It manages places such as the Grand Palais, organises temporary exhibitions in these museums and manages museum shops. In short, the Rmn-GP performs both cultural and commercial tasks. With reference to its budget, the Rmn-GP is self-funded for approximately 80% (Source: Annual Report 2017). Public funding are nonetheless important and the organization has suffered a decrease of public subsidies (they currently have approximately 3,4 million euros). Donations and sponsorship income constitutes around 4,3 million euros with 63 patrons, sponsors and partners, although the objective of the patronage department of the Rmn-GP is around 5 to 6 million euros. To fundraising department employs eight persons in full-time, focusing mainly on financing temporary exhibitions and specific cultural projects. Sponsorship and donations are sometimes used also for operating costs.

Rmn-GP's fundraising department has so far not launched a CF campaign but they are considering launching one in 2019. Each of their associated museums could launch CF campaign independently. However, during the research the participants have clearly pointed out that the most efficient and important fundraising strategy is still the corporate patronage, hence CF campaigns could probably just be a collateral source of funding.

4.1.4 Musée du Louvre

The Musée du Louvre is a public museum that over the years has increasingly focused on the mission to become a welcoming and accessible museum. It is self-financed for approximately 70%, (Source: annual report in 2017). Over the last two years, the Louvre has witnessed a decrease of public subsidies till 4 million euros. On the contrary, the patronage incomes are up to 19 million euros: it has increased (+2,8M €) thanks to acquisitions and also in relation to the successful CF campaigns « Tous mécènes! ». The fundraising department (with a large team of fifteen people) has implemented a fundraising strategy focusing mainly on corporate patronage and individual donations ». The museum has an internal CF platform « Tous mécènes! » allowing publics to donate for specific projects of the museum. Louvre's strategies aim at developing ties between donors and the cultural institution through a privileged relation, sometimes established by means of the engagement in crowdfunding: «it was especially touching to see that above the donations collection, these campaigns have allowed to create a new link between the Louvre and its public. 50% to 70% of contributors are loyal and will donate for the next campaign, whereas some of them will finally integrate the Patrons Circle with major donors of the museum». In 2010, the creation of Louvre's own platform called "Tous

mécènes!" was based on the urgency to create and manage crowdfunding projects internally and driven by the objective of making participative financing sustainable in the long run. Since then, the Louvre has successfully implemented several crowdfunding campaigns (see table 8), such as the 8th campaign on the acquisition of *le Livre d'heures* of Francois Ist, a success in terms of collection of funds, number of donors, media and press coverage as well as in terms of innovation in the communication campaign.

Table 2 - report on the campaigns launched on the platform "Tous Mecenes!" since 2010
(Source: TM website)

Year	Type	Achieved objective	Set objective	Success rate	Nb of donors
2010	Acquisition of <i>Les Trois Grâces</i>	1 260 000 €	1 000 000 €	126%	7200
2011	Restoration of two masterpieces of Egyptian architecture	500 000 €	500 000 €	100%	1900
2012	Acquisition of two statuettes	800 000 €	800 000 €	100%	4500
2013	Restoration of <i>la Victoire de Samothrace</i>	1 000 000 €	1 000 000 €	100%	6700
2014	Acquisition of <i>Table de Teschen</i>	800 000 €	1 000 000 €	80%	4500
2015	Acquisition of <i>L'Amour essayant une de ses flèches</i> of Jacques Saly	680 000 €	600 000 €	113%	4300
2016	Reconstitution of funeral chapel of Akhetétep	500 000 €	500 000 €	100%	3300
2017	Acquisition of <i>Livre d'heures</i> of François I ^{er}	1 400 000 €	1 000 000 €	140%	8500
2018	Restoration of arc du Carrousel	330 000 €*	1 000 000 €	/	2041*

4.1.5 Musée national Picasso-Paris

Opened since 1985 thanks to the generous contribution of his heirs, the Musée Picasso is a national museum centered on a collections of artworks by the artist Pablo Picasso with the mission "to present the work of Picasso, to preserve and conserve his collection, and to contribute to the influence of the artist". The museum relays on a self-financed up to 70% of the total budget. Compared with other cultural institutions, the museum has incurred in minor decreases of public subsidies. However the institution has a decrease in sponsorship and donations. The fundraising department, composed only by two people, pursue the goal of collecting around 500 000 euros per year, that has proved to be very challenging for such a small team. There are no association of Friends of the Museum, especially due to a lack of human and time resources. For the same reason, the museum has still not considered a crowdfunding campaign. In addition, the available human resources have no specific competences on that. Moreover, CF projects usually raise not significant amounts of money that are not certainly covering the investment in time and energy of the staff. However, the managers were available to launch a CF campaign on other objectives, such as to make CF on an exceptional project beyond usual activities of the museum to stress the necessity of public's contributions. According to the interviewee «MP cannot function by thinking that all resources must come from an appealing to the contribution, to the generosity [...] it is not safe to let people think that the museum cannot manage its missions without a public contribution and [...] it is not true».

4.2 Crowdfunding: a viable alternative to traditional financing?

The preliminary analysis of the cultural heritage organizations confirmed that crowdfunding has emerged in the framework of the reflection of alternative financing tools for cultural heritage organizations. In the following phase of the research, the analysis focused on exploring this topic further, trying to understand if crowdfunding a necessary financing tool to deal with the withdrawal of public authorities and fundraising traditional channels, and what are the perceived functions of crowdfunding in cultural heritage institutions. These topics were addressed through semi-structured interviews with a selected sample of managers and fundraisers from the above mentioned institutions. The analysis of the results, carried out through manual axial coding, highlighted three main results that are presented in the following paragraphs.

A first result refers to the fact that crowdfunding is perceived neither as a necessary nor as an accessible financial tool. In particular, the categories indicate that although there was a change in almost all the sample institutions related to the decrease of public funding and increase of the expenses, crowdfunding is not considered as a viable alternative.

The interviewees argued that usually cultural heritage projects (especially those related to preservation or restoration) require important budgets that cannot be raised through crowdfunding. With the significant exception of the Louvre museum, the majority of crowdfunding campaigns raise amounts of funding that are insufficient, therefore not effective if compared with the efforts required to carry out a fundraising campaign. Furthermore, there are several barriers and drawbacks when implementing this type of fundraising: notably, the lack of resources, visibility of the institutions, competences as well as a clear identification of crowdfundable projects (see table 3). This results confirms the literature on the inefficiency of crowdfunding compared to other types of fundraising activities such as big individual donations and sponsorships.

Table 3 - Research results 1: CF as non-necessary and non-accessible financing tool
(Source: own elaboration)

Category	Sub-category	Nr. of Verbatims	Nr. Of Sources
Non-necessary and non-accessible financing tool	Scheduled and already financed crowdfunding projects	1	1
	Barriers to entry for crowdfunding market access:		
	- lack of resources (<i>cf Table 10 R2 – Investment in the campaign</i>)	-	-
	- lack of visibility	1	1
	- identification of CF projects	15	5
A complementary financing tool (then an alternative financing tool)	- lack of competences (communication & marketing, website & CRM, legal)	7	2
	Insufficient collected amounts	5	3
	Huge budgets for projects in cultural heritage sector (CF projects are part of them)	5	3
	Not the most efficient and profitable lever of resources	6	3

The second research result highlights how crowdfunding is often perceived as a useful communication tool. During the interviews it emerged that the key factors to ensure a successful crowdfunding campaign are related to a clear definition of the communication strategy, including a clear statement of the mission, value and identity of the project and the organization, and a clear identification of the networks of contacts and donors. Starting from this point of view the interviewees argued that crowdfunding is important for promoting a positive image of the organization, for increasing the commitment of the community so as to legitimate this fundraising practice amongst the cultural heritage communities and institutions (see table 4).

Table 4 - Research Result 2: Crowdfunding as communication tool
(Source: own elaboration)

Category	Sub-category	Nr. of Verbatims	Nr. Of Sources
1. Increasing notoriety & visibility			
	1. Target new publics (potential visitors and donors)	5	2
	2. Target potential patrons	3	1
2. Positive image			
	1. Dynamic cultural institutions	2	2
	2. Modern cultural institutions oriented towards innovation	2	2
	3. Expertise of cultural institutions on (popular) patronage	1	1
	4. Competitive cultural institutions positioned on a growing market and in the cultural environment	2	1
3. Legitimate the practice of participative financing by cultural institutions			
	1. Participation of the crowd to the CF campaign and demand from donors	4	2
	2. Participation of patrons and partners	5	2
	3. Importance of medias	3	2
	4. Influence of history about cultural institutions and their strategies (precursors)	5	3
	5. Obstacles due to the evolution of Culture in France (importance of public subsidies, distinction public – private funds, late professionalisation of Culture, dominance of historic patronage, perception of an elitist culture, self-censorship by cultural institutions)	7	1
4. Develop commitment of communities			
	1. Awareness of project & development of an affective link between donors and cultural institutions	4	2
	2. Building of a privileged relation between donors and cultural institutions	2	2
	3. Creating ambassadors and early contributors to increase the success rate in the early days of CF campaign	4	2

Finally, a third research result points out that crowdfunding is perceived also as a useful community-engagement tool, thus overcoming just communication of the specific project for which the crowdfunding campaign is carried out. For creating a successful

campaign, crowdfunders need to mobilize their entire community, both internally and externally to the cultural heritage institution. Internally, the crowdfunding team should be able to involve the staff of the organization in the crowdfunding activity increasing their sense of belonging and mobilizing them in the key stages and element of the project, so that they can become a lever to reach the existing communities of donors. Once the internal actions are completed, the crowdfunding activities could be used to further reinforce the current donors' sense of engagement through project's co-construction mechanisms. Crowdfunding could finally become a means to reach out to the broader "crowd", creating new communities around the projects and raising awareness about cultural heritage preservation and enhancement, thus also "educating the crowd" (see table 5).

Table 5 - Research result 3: Crowdfunding as a community-engagement tool
(Source: own elaboration)

Category	Sub-category	Nr. of Verbatims	Nr. Of Sources
1. Belonging to a community of donors or patrons			
	1. Shared values with cultural or geographic links to the CF project or the cultural institutions.	15	4
	2. Social connections and membership (get social capital)	5	3
	3. Necessary cohesive identity facing the social context	3	1
2. Appropriation by the crowd			
	1. Awareness on cultural heritage	12	4
	2. Commitment in CF projects and cultural institutions' activities (and feeling of being concerned for communities)	11	5
3. Co-construction between patrons and cultural institutions			
	1. Participation in CF campaigns	5	2
	2. Involvement of patrons in activities and maybe in the decision-making process of cultural institutions (PPPs)	5	1
4. Education of the crowd			
	1. Popularisation of patronage and awareness on donations to become new patrons	8	2
	2. Civic engagement and citizenship	6	4
	3. Responsibility towards projects and cultural institutions to become actors of cultural politics, cultural life and society	5	2

5. Conclusions

The objectives of this research were to explore the use of crowdfunding in the cultural heritage sector, investigating if it is perceived by cultural heritage organizations as a viable alternative to traditional forms of fundraising and what are the other uses and values that are associated to it.

The literature review highlighted indeed that over the last decade there was a significant decrease of public funding. This reduction of public budgets for culture affected in particular cultural heritage institutions that traditionally relied more on this source of financing due to the high costs and low return on investment typical of the cultural heritage sector. In this context, crowdfunding increasingly entered the financial discourse, especially after successful campaigns carried out by emblematic cultural heritage institutions such as the Louvre museum.

The research results however highlighted that using crowdfunding is not always appropriate nor convenient. In line with the literature on the broader cultural sector (Guesmi et al., 2016; Baujard, 2017; Viotto da Cruz et al., 2017), crowdfunding is implemented in the framework of broader fundraising strategies, targeting big donors and sponsors as well. Among this strategies, crowdfunding proves to be the less efficient due to its high human resources costs and low profitability; these characteristics are particularly significant for cultural heritage organizations. Therefore it is a corollary source of funding, not at all capable of substituting public funding nor over types of donations and sponsorships.

The analysis of the second research results instead shed light on the perception of the real value of crowdfunding for cultural heritage institutions. In line with literature finding, the results indicate that crowdfunding is an important communication tool, having an impact on the image of the organization and project changing the traditional “stale” perception of cultural heritage and linking it more with digital innovation and communication strategy. As argued by one of the interviewees, crowdfunding activities should be considered «as a real communication campaign and not as a fundraising campaign», «popularising an establishment» to the general public in a more disruptive way than classic institutional communication». Interviewees also underlined that crowdfunding is a communication tool that can develop non-financial outcomes (Chaboud et al., 2018), becoming a notoriety tool (Guesmi et al. 2016; Mollick, 2014).

The third result brings about more interesting research contribution: it indicates that crowdfunding is not just communication tool regarding the project and activities of the cultural organization but it is rather used as a community engagement tool, referring both to the internal and external community. While our literature review revealed that crowdfunding could gather a community around a project, the research results highlight that for the cultural heritage organizations of our sample it could work as a way to raise awareness about not just the project but the whole organization and more broadly to the importance of cultural heritage to society. Both internal and external teams can gather around a crowdfunding project to increase the perception of the relevance of local cultural heritage in the crowd.

These research results contribute both to the academic debate and to practice.

From the point of view of the academic debate, they highlight that cultural heritage crowdfunding has peculiar characteristics compared to other sectors of the cultural and creative field. While crowdfunding campaigns could be a significant financial tool for cultural and creative industries in general, measuring up to public funding amounts, in the cultural heritage sector they often remain marginal in the budget. Moreover, in contrast

with the literature on general crowdfunding for the cultural and creative sector, crowdfunding is perceived not only as a communication tool, but rather as a community-engagement tool around the whole cultural heritage field.

From the point of view of the practice, the results could dimension the expectations of using crowdfunding to substitute public funding and shed light on the importance of using it with other purposes, more related to the aims of cultural heritage institutions as mediators in the preservation and enhancement of a common identity.

The main limitation of the research are related to its limited geographical scale: the results could be therefore potentially tested in other areas, for example in other European countries where cultural heritage constitutes a significant component of the cultural and creative ecosystem.

References

- Baujard, C. (2017), "Du mécénat culturel au musée participatif: les motivations du public à financer la restauration de la Victoire de Samothrace au Musée du Louvre", *Marché et organisations*, n°2, p. 15-31.
- Bertacchini, E., Santagata, & W., Signorello, G. (2011), "Individual Giving to Support Cultural Heritage", *International Journal of Arts Management*. Vol. 13, Iss. 3, pp. 41-54.
- Boeije, H. (2010). *Analysis in qualitative research*. London: Sage.
- Bonet, L., & Donato, F. (2011). The financial crisis and its impact on the current models of governance and management of the cultural sector in Europe. *ENCATC Journal of cultural management and policy*, 1(1), 4-11.
- Borin, E. (2017). *Public-private Partnership in the Cultural Sector: A Comparative Analysis of European Models*. PIE Peter Lang.
- Borin, E., & Donato, F. (2015). Unlocking the potential of IC in Italian cultural ecosystems. *Journal of Intellectual Capital*, 16(2), 285-304.
- Borin E., Donato F. And Sinapi C. (2017). *Financial Sustainability of Small-and Medium-Sized Enterprises in the Cultural and Creative Sector: The Role of Funding*.
- Donato, F. (2013). *La crisi sprecata. Per una riforma dei modelli di governance e di management del patrimonio culturale italiano*, Roma: Aracne
- Chaboud, M. C., & Caseau, C. (2017), "Instrumental crowdfunding as a communication innovation: When a bank, a non-profit organization and a hotel project meet the crowd", *Journal of Innovation Economics & Management*, n°2, p. 89-111.
- Charmaz, K. (2001). Grounded theory. In R. M. Emerson (Ed.), *Contemporary field research: Perspectives and formulations* (2nd ed.) (pp. 335-52). Prospect Heights, IL: Waveland Press.
- Charmaz, K. (2002). Qualitative interviewing and grounded theory analysis. In J. F. Gubrium & J. A. Holstein (Eds.), *Handbook of interview research: Context & method* (pp. 675-94). Thousand Oaks, CA: Sage.
- EUROSTAT. 2011, *Cultural Statistics, Pocketbook*, Publications Office of the European Union, Luxembourg
- Gioia D. A., Corley K.G., Hamilton A. L., (2012), "Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology", *Organizational Research Methods*, vol. 16, p. 15-31

- Glaser, B. G. (2005). *The grounded theory perspective III: Theoretical coding*. Mill Valley, CA: Sociology Press.
- Grefe, X. (2010). Introduction: L'économie de la culture est-elle particulière?. *Revue d'économie politique*, 120(1), 1-34.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: Aldine de Gruyter.
- Guesmi, S., Delfosse, J., Lemoine, L., & Oliveri, N. (2016), "Crowdfunding et préservation du patrimoine culturel", *Revue française de gestion*, n°5, p. 89-103
- Holden, J. (2015). *The ecology of culture*. Arts and humanities research council.
- Manda, C. C., Nicolescu, C. E., & Mortelmans, D. (2017). FINANCING CULTURE INSTITUTIONS IN EUROPEAN CONTEXT. *SEA: Practical Application of Science*, 5(1).
- Mollick, E. (2014). The dynamics of crowdfunding: An exploratory study. *Journal of business venturing*, 29(1), 1-16.
- Scheytt, O. (2015). *Kulturstaat Deutschland: Plädoyer für eine aktivierende Kulturpolitik*. transcript Verlag.
- Stiver, A., Barroca, L., Minocha, S., Richards, M., & Roberts, D. (2015), "Civic crowdfunding research: Challenges, opportunities, and future agenda", *New Media & Society*, vol.17, n°2, p. 249-271.
- Timbart, O. (1984). The financing of culture in France. *Funding the arts in Europe.*, 3-20.
- Trupiano, G. (2005). Financing the culture in Italy. *Journal of Cultural Heritage*, 6(4), 337-343.

US vs. EU Regulatory Frameworks of Crowdfunding for the Arts and Culture

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Abstract

In the face of the dramatic shrinking of public and private funding, the cultural and creative sector is increasingly relying on crowdfunding around the world. This is especially true for the crowdfunding models of project-based donations and rewards (RC/DC), rather than longer-term equity and lending models. Yet international cultural and creative crowdfunding (CCCF) remains a fragmented and below-potential market, where a high number of diverse platforms operate at national or international level in a highly specialized manner, sometimes also with matching public funding. The reasons for the untapped potential of CCCF include a lack of transparency and capacity (of operators' financial practices) and of trust, coupled with quite differently binding (or favouring) national fiscal regulatory frameworks. This paper focuses on regulation by critically comparing and discussing the main features of the two major frameworks for CCCF activity, namely the USA and the EU. We begin by analysing the RC/DC development in both regions. This analysis emphasizes the legal and regulatory situations in both areas, and their possible impacts on CCCF operators. This review of the regulatory circumstances illustrates the current situation for national (and regional) policy surrounding RC/DC in contrast to other pre-sale or charitable fundraising revenues. In the final section, we outline the major areas over which regulatory action might be expected, including taxation and matching (subsidies), consumer and investor protection, and information provision. In most of these areas, public policy specific to CCCF is relatively under-developed. For each of these areas, we discuss critical design features for policy and, correspondingly, identify how efficiency and equity might be affected by policy. We conclude by recommending key policy priorities and suggesting directions for future research in this emerging arena.

Keywords: Cultural and creative industries; Reward-based and donation-based crowdfunding; Comparative regulation policy.

1 Introduction

Face to the global shrinking of public and private funding in the cultural and creative sector, in the last years crowdfunding has emerged as a valid alternative or complementary mode of funding the arts and culture. In addition to reasons for public support of institutions advancing public-goods aspects of research and development, strong rationales for subsidizing the cultural and creative sector frequently find support in theory and in practice (Throsby 1994). Whether it is Baumol and Bowen's (1965) cost disease arguments or public-goods aspects of many cultural resources, powerful normative arguments support subsidizing the cultural and creative sector – and crowdfunded ventures are no exception.

Crowdfunding in the cultural and creative sector (CCCF) is mainly oriented toward the financing of projects, rather than structural finance. CCCF usually takes the form of donation (DC) or reward crowdfunding (RC), where only in the latter case the backer expects a reward, either symbolic or in kind (e.g. limited editions, tours, networking sessions and prototypes), more rarely monetary. Developed initially and especially in the USA, but also in the UK and continental Europe, CCCF represents a market in significant expansion and evolution. CCCF is becoming increasingly important to finance cultural and creative projects and ventures, untapping entrepreneurial potential (Lazzaro 2017). Furthermore, it favors community involvement, market research and audience development, the sharing of information and promotion, besides the development of professional skills (De Voldere and Zeqo 2017). Yet, it is not free of barriers and risks.

If we look at the market of the CCCF, it looks quite fragmented in terms of platforms' business models, geographical distribution/concentration, relevance of CC sectors covered, available information, implied skills to operate and access this market, and, in particular, regulation, with distinct features of RC/DC compared to investment, or equity- and lending based, crowdfunding. In such a rapidly evolving marketplace, becomes then crucial to look at the two main areas interested by CCCF, namely the US and Europe, and to critically analyze and compare their respective regulatory frameworks. In this sense, the major contribution of this paper is to highlight current regulation aspects of CCCF from an economic perspective and through a comparative way of its two major markets, in order to offer policy recommendations to main stakeholders.

Our approach begins with an analysis of some fundamental features of RC/DC and the associated benefits and barriers (Section 2). After this conceptual description of the emerging RC/DC phenomenon, we turn to an assessment of the regulatory frameworks that may enhance CCCF benefits and limit CCCF barriers and risks in both the United States (Section 3) and the European Union (Section 4). The review of the literature and industry reports for the US and then for the EU highlight different priorities and approaches to regulating crowdfunding around the world. We provide a critical comparison of these regulatory frameworks in Section 5. This comparative lens leads to some policy recommendations as well as suggestions for future research in this field.

2 Benefits and barriers to CCCF expansion

The rapid emergence of RC/DC, especially for cultural and creative projects and ventures, points to many benefits and barriers. At its core, crowdfunding's key distinctive innovation owes to its dramatically lower transaction costs for fundraising associated with its online platform and associated technologies. The growth in crowdfunding as a preferred fundraising technology comes as some creators are better able to reach their market. The lower transaction costs can affect the intensive margins by lowering fundraising costs among existing contributors, which helps the viability of previously marginal projects as well as giving creators better 'market research' data from crowdfunding campaigns' performances. As lower transaction costs have expanded the size of the crowd, more interested contributors can be identified and previously unviable ('niche') projects can receive a "green light".

The advantages of the crowdfunding platform and approach have been touted at length elsewhere. Broader geographic distribution of financing for entrepreneurial projects often leads the list of crowdfunding's benefits (Sorenson et al. 2016). How crowdfunding platforms fit with a "world is flat" perspective on the global economy continues to receive scholarly attention (e.g. Agrawal et al. 2015, Giudici et al. 2018), with a preliminary conclusion that new venture financing is far less geographically concentrated under crowdfunding (Yu et al. 2017).

Crowdfunding research routinely shows that projects with better information describing their venture are more likely to succeed in their fundraising goals (Mollick 2014, Courtney et al. 2017). Lastly, allowing creators to collect better market research data through a crowdfunding campaign can yield great value to creators, including enhancing their odds of later receiving more traditional venture capital (Butticé and Noonan 2016, Xu 2017). In general, projects that receive a higher amount of pledged money through crowdfunding attract more subsequent interest from investors (particularly in the world of technology), although "this positive effect emerges (and becomes more intense) only when it is complemented by the presence of patents granted for the new product idea (Roma et al. 2017).

Advocates often point to crowdfunding's ability to "democratize funding" (Mollick and Robb 2016) and "levelling the playing field" (De Buysere et al. 2012). Spillovers from RC/DC to other more traditional forms of financing new ventures and IP protection remain important areas for future research. Bringing creators more directly in contact with their audience or crowd may offer benefits other than just improved market research.

Despite the rapid rise of RC/DC, it faces significant barriers and poses some serious risks. The most immediate issue, mentioned above, concerns information asymmetry and the lack of transparency. Although information asymmetry in fundraising is not exclusive to crowdfunding, merely shifting the marketplace to an online forum hardly resolves the matter. Although the growth of crowdfunding platforms suggests that either this concern is overstated or that there is a great deal of 'lemons' (Akerlof 1970) waiting for the crowdfunding opportunity, the fundamental challenge of better enabling transparency remains. Perhaps a bigger concern for crowdfunding is the moral hazard problem (Strausz

2017), or the possibility that creators fail to adequately deliver to their backers. Once funded, in most (all?) crowdfunding platforms, projects may face suboptimal pressure to deliver on their promises. Though reputational effects may be severe, one-off creators who simply scam the market before disappearing into anonymity pose a threat. Subtler, and potentially more threatening, are the biases that crowdfunding might support. Although it might promise to ‘democratize’ funding, its theoretical promise might be replaced by a reality of discrimination (Rhue and Clark 2016, Youkin and Kuppaswamy 2017) and other biases (Greenberg and Mollick 2017, Johnson et al. forthcoming).

Agrawal et al. (2014) find that crowdfunding is not geographically constrained and tends to support ‘market-for-superstar’-style distributions with fundraising highly skewed to a few creators. Crowdfunding capital may substitute for other traditional sources of financing, although this research continues to evolve (see, e.g., Roma et al., 2017; Yu et al., 2017). In addition, Agrawal et al. (2014) also observe a prominent role of friends and family in early stages of fundraising.

Ultimately, lacking a regulatory system in place at the outset, the crowdfunding approach enjoyed some rapid growth without (legal) barriers and associated compliance fixed costs (Calcagno and Sobel 2014). But unregulated growth can pose some risks, especially if participants in the crowdfunding marketplace are victims of fraud, predation, or bias, or if the inherent risk on the platform deters optimal investments. The absence of clear standards and stable regulation in these markets can dissuade creators and backers from participating, and it can lead to distortions. This may be especially true in Europe, at globally, where variation in national regulatory frameworks limit growth of what is essentially a global marketplace. The lack of harmonization between national systems stands as a major barrier. Compounding this lack of harmonization in regulatory systems are important differences in fiscal regimes, financial incentives, payment systems, intellectual property rights, data protection, professional standards, languages, and more. Crossing borders or switching among crowdfunding platforms can require significant adjustment costs. Market fragmentation in RC/DC crowdfunding, especially in a post-Brexit world, remains a serious barrier to its continued expansion.

3 CCCF regulatory framework in the USA

The fiscal regulatory framework governing donation- and reward-based cultural and creative crowdfunding ventures within the United States is still emerging. Though more limited than the European legal and regulatory framework(s) for maintenance of crowdfunding, the existing laws and regulatory climate in the United States provide opportunities and challenges for regulators and those engaging in CCCF. Prior reviews of crowdfunding regulation in the US explicitly focus solely on laws such as the JOBS Act of 2013 that only apply to equity-based crowdfunding. In short, the JOBS Act exempted crowdfunding from federal securities laws to allow small businesses to raise capital from a variety of sources that included using crowdfunding to sell securities to the general public (Securities and Exchange Commission 2018). Although, the law does not apply to RC/DC, it has inspired a number of state-specific exemptions to increase local investment

in small business both related to and separate from the arts.

US federal and state laws do touch on crowdfunding in a limited way. Federal law governing crowdfunding is contained within the Code of Federal Regulations. This federal code provides guidelines and requirements for issuers, intermediaries and funding portals of financial securities.¹ State laws regarding crowdfunding, on the other hand, generally aim to encourage local investment. Thus, they tend to include more provisions related to reward-based crowdfunding. States vary in policy areas such as the maximum income that can be received from equity-based crowdfunding ventures and the necessary ratio of investors pledging money from within the state itself. Explicit references to RC/DC by state agencies are rare. Relevant state codes apply exclusively to equity-based crowdfunding ventures. State-level regulation of CCCF only applies to ventures resulting in small businesses using equity-based crowdfunding; and RC/DC campaigns garner no special regulation.

Taxation of RC/DC remains an unclear and evolving situation in the United States. Government regulation and taxation of the crowdfunding platforms themselves depends on the company. For example, Kickstarter is a public-benefit corporation (which mixes tenets of profit maximization with concern for public benefit), while alternatives such as GoFundMe are for-profit companies. Although the tax treatment of these companies is straightforward, how to tax the crowdfunding ventures themselves – the creators, vendors, and investors – remains more complex. Generally, income accrued by artists and content creators on crowdfunding platforms is treated as taxable income by federal law (Metrejean and McKay 2015). Though seemingly straightforward, some questions remain over what sorts of expenses are deductible and how (if at all) the Gift Exclusion under Section 102(a) of the federal tax code can be utilized in relation to crowdfunding ventures. The former issue depends on whether the venture is deemed a business or a hobby (Metrejean and McKay 2015). In general, income accrued from crowdfunding ventures is treated as taxable income gained as the result of a business transaction at the federal level and, presumably, at the state level as well. When declaring income from crowdfunding ventures, no clear consensus exists for the timing of reporting. There is no guidance given at the federal level.

Other regulatory concerns about crowdfunding platforms focus on issues of intellectual property (IP), patent law, and intentional acts of fraud perpetrated via crowdfunding platforms. Roberts and Nowotarski (2013) observe that the nature of “crowdfunding compounds the general difficulties faced with any product launch in a crowded IP landscape with unprecedented exposure of projects at the very earliest stages.”

Fraud in reward-based crowdfunding captures considerable public attention in the United States. This includes acts of fraud (intentional or otherwise) and failing to deliver the rewards or perks promised by the crowdfunding project. According to one study (Mollick 2015), only around 9% of projects fail to deliver promised rewards, with the majority of those failures being from smaller projects and no noticeable links between failure rates and demographics such as education, gender and family status. Limited

¹ 17 C.F.R. § 227.100-503.

options exist for jilted investors to ensure reception of deliverables or a refund of their donation. Crowdfunding platforms generally refuse to refund money directly to investors when projects fail. Though frustrated backers of larger fundraising efforts occasionally undertake legal action. The lack of case law may be due to the high legal costs relative to the small donation amounts typically made to artists and vendors (Moore 2015). Regulatory frameworks for rewards-based crowdfunding in the US do not oversee the platforms themselves, but they do include general regulatory mechanisms for fraud (intentional or otherwise), such as consumer protections offered by the FTC and state attorneys general.

To conclude, the regulatory framework governing crowdfunding platforms in the United States is much looser for reward-based ventures than the stricter SEC laws governing equity-based investment in crowdfunded securities. The CFR contains no regulations strictly related to reward-based crowdfunding, and laws passed at the state level also fail to provide notable structure or guidelines for vendors and artists hoping to fundraise by using reward-based incentives. Some scholarly literature does address relevant issues such as gift exemption, IP theft, and fraud. But, by far, the regulation and its scholarly analysis are more plentiful for crowdfunding artists and platforms within the European Union.

4 CCCF regulatory framework in the EU

In Europe, the Cultural and Creative Sector (CCS) is defined by the EU regulation.¹ It is thus not surprising that the CCCF as such has been increasingly part of the policy agendas of the European Union as well as of its member countries. Policies are mainly aimed at (indirectly) improving the CCCF regulatory framework, besides its awareness and hence its adoption by users (De Voldere and Zeqo 2017).

Overall, crowdfunding regulation is mainly competence of member states, a number of which have developed specific legislations in the last couple of years. A harmonisation at the EU level is in fact not the rule, and so far there is no European crowdfunding legislation or ad hoc EU authority in charge of crowdfunding regulation, leading to a EU fragmented market (Patti and Polyák 2017). A major consequence of that is the hindering of cross-border crowdfunding (ECN 2017). As for RC/DC in particular, the EU is even less likely interested to play a harmonization role in its regulation (ECN 2017), as in RC/DC financial return, securities and financial markets stability are not involved. Regulation of RC/DC is quite unrestrictive or unspecific, and regulation requirements simply imply standard trade or business licensing (Patti and Polyák 2017). Contrary to IC, RC/DC is also excluded from the recent Proposal for a Regulation of the European Parliament and of the Council on European Crowdfunding Service Providers (ECSP) for Business,² because it does not deal with financial products and related information

¹ Regulation (EU) No 1295/2013 of the European Parliament and of the Council of 11th December 2013 establishing the Creative Europe Programme (2014 to 2020) and repealing Decisions No 1718/2006/EC, No 1855/2006/EC and No 1041/2009/EC.

² COM/2018/0113 final - 2018/048 (COD).

asymmetries.

At a more global level, the regulation of crowdfunding in general falls within the scope of the International Organization of Securities Commissions (IOSCO), like in particular the limitation of cross-border activities, due to different regulatory systems (De Voldere and Zeqo 2017). Yet in the last years the European Union, together with its member states, has become interested in the growing overall crowdfunding market and its potential, including them in a series of economic, financial and innovation policies.¹ Among them, the public consultation on the mid-term review of the Capital Market Union of 2017 by the European Commission,² which urges the strengthening and integration of EU capital markets and EU-wide supervision to favor the development of SMEs and hence job creation (ECN 2017), considers the role of Financial Technology (“FinTech”), including crowdfunding, as increasing efficiency and competition.

The EU approach toward RD/DC and more specifically CCCF regulation remains rather soft, by means of workshops and public consultations, communications, a Stakeholders Forum, reviews, reports and commissioned studies. In fact, besides fostering ‘hard’ regulation and fiscal incentives, policy makers can fulfill ‘softer’ roles toward CCCF, such as facilitators of the sharing of information, for instance on best practices, key performance indicators and market analysis, matchfunders, funders or owners of platforms, funders of research on crowdfunding and awareness campaigns, etc. (De Voldere and Zeqo 2017).

National regulatory frameworks differ in whether they treat specifically about crowdfunding or not (Patti and Polyák 2017) and the degree through which they facilitate or, on the contrary, restrain crowdfunding (De Voldere and Zeqo 2017). United Kingdom represent(ed) in the EU the most facilitating country, where more than 80% of European alternative finance is concentrated, followed by France, Germany, the Netherlands and Finland. Furthermore, the UK shows the highest average amount of money raised per campaign (Cambridge University 2016). Main features of UK’s most supportive policy include a progressive regulation and tax reliefs (CrowdfundingHub 2016).

RC/DC is diversely developed in the EU member states (ECN 2017).³ For instance, Belgium was among the pioneers and nowadays counts many platforms and a flourishing activity, contrary to Austria, Cyprus, Latvia and Lithuania, the latter even lacking any RC/DC platform. In Ireland RC/DC is quite developed and is the most diffused crowdfunding model, although the market is relatively small, and it is operated by local and Irish versions of international crowdfunding providers.

Since RC/DC does not generally imply financial investments and returns, similarly to the EU, national legislations are usually less concerned about it. National regulation measures for RC/DC are rather more limited and less impacted by the EU regulation with respect to IC for the reasons mentioned above (ECN 2017). These measures may be general, like mandatory licensing of (usually nationally) platforms, or concerning

¹ Such as the European Commission for Innovation Union, Capital Markets Union, the Green paper on long-term financing of the European economy and the Entrepreneurship 2020 Action Plan.

² COM(2017) 292 final.

³ However, available data on crowdfunding in the various countries may not be always complete.

payment service. In a number of EU countries crowdfunding may be also subject to other related national laws and regulations on anti-money laundering and anti-terrorism financing, consumer protection, privacy/personal data protection, advertising/marketing, intellectual property, fundraising and humanitarian agencies. Similarly, despite the absence of a EU crowdfunding harmonization, recently developing national crowdfunding regulations are often impacted by other, related EU regulations, such as those on data protection and consumer protection. As for the protection of backers, in Europe this falls under consumer protection regulation and in particular under Directive 1999/44/EC on the sale of consumer goods and their conforming, Directive 2011/83/EU on consumer rights and withdrawal on distance sales, and Directive 93/13/EC on unfair terms in consumer contracts (Gutiérrez and Sáez 2018).

Yet various exceptions to missing or reduced specific regulation of RC/DC exist in EU countries (ECN 2017). For instance, in the Czech Republic DC is subject to public collection requirements and scrutiny by the regional authority,¹ possibly refraining platforms from DC.

Despite the absence of crowdfunding harmonization in the EU, there are regulation similarities and/or cross-border activities between neighboring countries and in common language areas. Larger national crowdfunding markets are also the most interested by international (in/outbound) activity.

To conclude, RC/DC is the prominent crowdfunding model in a number of European countries. Noticeably, it is not regulated at the EU level and is rather the object of a variety of recent and developing national regulations, although these regulations tend to be general rather than specific about RC/DC. The practice of RC/DC is also quite varied across countries, as the associated business models of the operating platforms. The lack of regulation harmonization at the EU level favors a fragmentation of the crowdfunding market, leaving the sizes of national markets relatively small, and limiting crowdfunding crossing borders. Furthermore, a lack of a clear and comprehensive regulation favors uncertainty, hinders consumers' confidence, and hence the upscaling of the market. Therefore the majority of EU countries, especially the most experienced ones, are in favor of a regulation of crowdfunding and its EU harmonization, at the same time avoiding too heavy, non-transparent and onerous regulation. On the other hand, a minority of relatively less experienced countries (e.g. Malta, Slovakia, etc.) are in favor of a more liberal framework to facilitate the market expansion.

5 A critical comparison and policy recommendations

The review of regulatory frameworks in the US and EU is summarized in Table 1. Across several dimensions, the similarities and differences in regulatory approaches are apparent. Overall, considerable similarities exist, especially for this emerging technological platform and the body of regulatory law and practice still being developed. In contrast, the US and the EU display very different degrees of harmonization in

¹ No specific regulation instead exists for platforms.

regulatory frameworks within the continents. In the US, the lack of active state-level regulations (and the limitations on US state governments regulating interstate commerce, which CCCF often represents) leaves the federal government to establish CCCF-specific regulations. The result is a highly harmonized, and largely unregulated, single market for CCCF in the US. By contrast, the lack of a strong harmonizing effort at the EU level has allowed for diverging regulatory approaches by member European states.

Table 1: Comparison between US and EU regulatory frameworks for CCCF

Dimension	United States	European Union
Regulation of equity-based crowdfunding	JOBS Act (2013) to allow and regulate	Proposed EU regulation for ECSP
Regulation of RC/DC overall	Little or no special attention – just like any sale or donation	Little, but some member states regulate more stringently
Role of federal/EU-level regulation	Primary, yet largely silent	Soft, largely consultations
Role of state/national-level regulation	As taxing authority, offers some guidance	Primary, some fragmented markets and regulation
Taxation of creators	As income, generally ambiguous	Mixed, sometimes as sales
IP protection	No special policy	No special policy
Fraud protection	Like any other transaction; platforms self-regulate	Like any other transaction
Changes over time	Remains largely unregulated	Continues to evolve, especially at state level

5.1 Self-regulation

Crowdfunding for the investment world has drawn the attention of regulators, but the RC/DC operations remain “below the radar,” certainly in the US and across many EU member states. Gutiérrez and Sáez (2018) highlight the innovativeness of RC compared to investment-based crowdfunding. They show how the regulation of RC, which has developed in a legal vacuum, should not be assimilated into the rather regulated investment-based crowdfunding framework. In light of the limited scope of federal and state laws designed to regulate RC/DC, the crowdfunding platforms engage in some self-regulation.

5.2 Harmonization

Disparate regulatory frameworks create extra uncertainty and cost for creators engaging in crowdfunders. Moreover, by fragmenting the markets, the potential for crowdfunding to tap into larger marketplaces – larger crowds – is diminished. The ‘scale economies’ of crowdfunding are lost without harmonization across jurisdictions. Removing misunderstandings about crowdfunding platforms can help reduce frictions surrounding breached contracts when projects unintentionally fail to deliver (Ganatra 2015).

5.3 Intellectual property rights and fraud

Concerns about IP protection and fraud remain in the reward-based crowdfunding context. In both the US and the EU, more general laws to protect IP and protect against fraud continue to function and apply to crowdfunding; no special regulation exists. Whether that approach, coupled with self-regulation, will continue to be sufficient remains to be seen. Further, whether there are efficiency gains from alternative regulatory approaches is an open question. In the US, platforms and third-party information providers undertake considerable effort at self-regulation with respect to fraud. Issues about IP protection however, are another matter. Instituting better protections exist to attract innovators to share their ideas may enable further expansion of CCCF. Some scholars see existing patent protections for crowdfunding projects as inadequate for protection of artists.

5.4 Recommendations

Firstly, harmonizing the RC/DC crowdfunding regulatory regimes among the states holds the greatest promise to remove barriers for continued beneficial crowdfunding expansion. This especially applies to the EU, where different states' approaches limit the market size and pose additional complications, but it also can apply to the US.

Secondly, as new regulation comes into play for these emerging marketplaces, balance should be struck to encourage entrepreneurship. Especially for the creative and cultural projects, the unstructured and open nature of crowdfunding holds considerable promise. From a cultural perspective, diversity levels of procedural formalism across countries could also produce different effects of crowdfunding regulation on entrepreneurs (Stephen et al. 2009). Restricting entry of creators to crowdfunding platforms, perhaps by raising the bar for disclosure and other entry costs, may reduce instances of creator failure, but such screening would also limit entry to crowdfunding. Again, striking a balance between the openness and accessibility of these platforms for non-traditional artists and creators requires (implicitly) defining and accepting some risk tolerance for the marketplace as a whole.

More proactively, public officials could consider ways to leverage the strengths of crowdfunding platforms to improve their own policymaking and funding decisions. For instance, the power of crowdfunding platforms reach larger and more targeted population and elicit their preferences for various ventures can be used to inform public projects and goals. Matching funding programs can more directly link public funds to the will of the public (i.e., the crowd). Such an approach can complement other funding allocation rules to both allow public demand to help influence where public funds go and also potentially "crowd in" additional private support. Crowdfunding can promote the CCS and amplify public investment warrants additional attention.

Miao (2015) recommends several reforms to balance the need to protect IP while encouraging innovation in crowdfunding platforms. Allowing creators' crowdfunding campaigns as nonprejudicial disclosures as long as patent applications are subsequently filed promptly and clarifying experimental use exemptions for crowdfunding, for

instance, may be welcome improvements that encourage innovation without risking theft. Ganatra (2016) provides recommendations on future transparency and regulation for the emerging market of RC/DC.

6 Conclusions

Crowdfunding represents an important alternative, or complement, to the financing modes and sources of the cultural and creative sector. Furthermore, crowdfunding is relevant for its informative, promotional, co-creative and democratizing features. Rewards and donations, with their distinctive features, are the prominent models in CCCF. We have assessed the benefits and barriers of CCCF and RD/DC through the lenses of regulatory frameworks, the institutional instruments allowing, or supporting, crowdfunding to achieve its potentials and overcome its barriers. We have critically considered and compared the regulatory frameworks of the two main marketplaces, namely the US and the EU, in terms of involved authorities and respective roles, regulation intensity and specificity and degree of harmonization, together with other aspects of taxation, IPR and fraud.

CCCF presents a series of benefits and barriers, and crowdfunding's ability to achieve its potentials and overcome its barriers depends directly on how it is regulated. At the same time, over-regulation and excessive costs ought to be avoided. Limited regulation by public authorities may allow for self-regulation of operators, and hence contribute to openness, creativity, and accessibility in the CCCF marketplace. As for IPR, the practice of CCCF calls for more specific transparent regulation. A lack of harmonization within the EU and internationally may pose considerable challenges to CCCF and its expansion. In fact, while a non harmonized market may deter new entrants because of perspective profits face to bureaucracy costs, investments and market size, sufficiently liberalized single small markets may favor big international (or global) entrants, with consequent expansion of the market although with possible drawbacks, first of all in terms of diversity.

Recommendations point to a harmonization of RD/DC and CCCF, starting from the EU, and to a supportive, rather than oppressive, regulation, for instance enhancing transparency, stressing measures in favor of entrepreneurs, tolerating some levels of risk, and fostering more forms of public-private partnership.

Because of the distinct features and functioning of RC/DC with respect to other crowdfunding models, future research should deserve more separate and focused efforts, also based on available data. The study CCCF in particular allows to better disentangle the innovation component typical of creativity, and new collective creative patterns. Spillovers from RC/DC to other more traditional forms of financing new ventures and IP protection remain important areas for future research.

References

- Akerlof, G.A. (1970). The market for “lemons”: Quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 84(3), 488–500.
- Agrawal, A., Catalini, C. & Goldfarb A. (2014). Some Simple Economics of Crowdfunding. *Innovation Policy and the Economy*, 14: 63–97.
- Agrawal, A., Catalini, C. & Goldfarb, A. (2015). Crowdfunding: Geography, Social Networks, and the Timing of Investment Decisions. *Journal of Economics & Management Strategy*, 24(2): 253–274.
- Barnett, C. (2016). The Surprising State of Equity-Based Crowdfunding Post-JOBS Act. *Forbes*. Accessed August 29 2018. <https://www.forbes.com/sites/chancebarnett/2016/11/17/the-surprising-state-of-equity-crowdfunding-post-jobs-act>
- Baumol, W. J., & Bowen, W. G. (1965). On the performing arts: the anatomy of their economic problems. *American Economic Review*, 55(1/2), 495–502.
- Belleflamme, P., Omrani, N., Peitz, M. (2015). The economics of crowdfunding platforms. *Information Economics and Policy*, 33, 11–28.
- Butticè, V., & Noonan, D. (2016). “Do Not Bite More Than You Can Chew: The Side Effects of Crowdfunding on Entrepreneurial Performances. *Riunione scientifica nazionale AIIG*, 1–28.
- Calic, G. and Mosakowski, E. (2016), “Kicking Off Social Entrepreneurship: How A Sustainability Orientation Influences Crowdfunding Success”, *Journal of Management Studies*, 53(5): 738–767.
- Calcagno, P.T. and Sobel, R.S. (2014) “Regulatory costs on entrepreneurship and establishment employment size”, *Small Business Economics*, 42: 541–559.
- Courtney, C., Dutta, S., & Li, Y. (2017). “Resolving information asymmetry: Signaling, endorsement, and crowdfunding success.” *Entrepreneurship Theory and Practice*, 41(2), 265–290.
- CrowdfundingHub (2016), *Current State of Crowdfunding in Europe*, Amsterdam.
- De Buysere, K., Gajda, O., Kleverlaan, R., Marom, D. & Klaes, M. (2012). *A framework for European crowdfunding*.
- De Voldere, I. & Zeqo, K. (2017). *Crowdfunding. Reshaping the crowd’s engagement in culture*, European Commission, Brussels.
- Dushnitsky, G., Guerini, M., Piva, E. & Rossi-Lamastra, C. (2016). Crowdfunding in Europe: Determinants of Platform Creation across Countries. *California Management Review*, 58(2): 44–71.
- European Crowdfunding Network (2017). *Review of Crowdfunding Regulation*, Brussels.
- Franzen, Carl. (2012). Kickstarter Expects To Provide More Funding To The Arts Than NEA. 24 February 2012. talkingpointsmemo.com.
- Giudici, G., Guerini, M. & Rossi-Lamastra, C. (2018). Reward-based crowdfunding of entrepreneurial projects: the effect of local altruism and localized social capital on proponents’ success. *Small Business Economics*, 50(2), 307–324.
- Greenberg, J. & Mollick, E. (2017). Activist choice homophily and the crowdfunding of female founders.” *Administrative Science Quarterly*, 62(2), 341–374.
- Ganatra, J. H. (2015). When a Kickstarter stops: Exploring failures and regulatory frameworks for the Rewards-Based Crowdfunding Industry. *Rutgers UL Rev.*, 68, 1425.
- Gutiérrez M. & Sáez I. (2018). The Promise of Reward Crowdfunding. *Corporate Governance: An International Review*.
- Irish Department of Finance (2018). *Paper for Policy Committee on Crowdfunding*, Dublin.
- Johnson, M. A., Stevenson, R. M. & Letwin, C. R. (forthcoming). A woman's place is in the... startup! Crowdfunder judgments, implicit bias, and the stereotype content model. *Journal of Business Venturing*.

- Kappel T. (2009). Ex Ante Crowdfunding and the Recording Industry: A Model for the U.S. *Loyola of Los Angeles Entertainment Law Review*, 29: 375–385.
- Kickstarter (2018). Stats. Accessed 29 August 2018. <https://www.kickstarter.com/help/stats>
- Lazzaro E. (2017). Cultural and Creative Entrepreneurs. In Mickov, B., Doyle, J. E. (Eds.), *Culture, Innovation and the Economy*, Routledge, London, pp. 33–37.
- Metrejean, C. & McKay, B. (2015). Crowdfunding and Income Taxes. *Journal of Accountancy*. Accessed 28 August 2018. <https://www.journalofaccountancy.com/issues/2015/oct/crowdfunding-and-income-taxes.html>
- Miao, Li. (2015). Patent Issues of Crowdfunding – Exploring Patent Strategies of Crowdfunding Projects and the Need for Patent Reform (Master’s thesis). Munich Intellectual Property Law Center.
- Mollick, E. (2014). The dynamics of crowdfunding: An exploratory study. *Journal of Business Venturing*, 29(1), 1–16.
- Mollick, E. R. (2015). “Delivery rates on Kickstarter.” 2015 December 4. Available at SSRN: <https://ssrn.com/abstract=2699251> .
- Mollick, E. & Robb, A. (2016). Democratizing innovation and capital access: The role of crowdfunding.” *California Management Review*, 58(2), 72–87.
- Moore, C. (2015). “Kickstart my Lawsuit: Fraud and Justice in Rewards-Based Crowdfunding”. 49 *University of California-Davis Law Review* 383-424.
- Patti, D. & Polyák, L. (2017), *Funding the Cooperative City: Community Finance and the Economy of Civic Spaces*, Cooperative City Books, Vienna.
- Rhue, L. & Clark, J. (2018) “The Consequences of Authenticity: Quantifying Racial Signals and their Effects on Crowdfunding Success.” Available at SSRN: <https://ssrn.com/abstract=2837042>
- Roberts, G., & Nowotarski, M. (2013). “The IP issues of crowdfunding.” *Managing Intell. Prop.*, 229, 36-38.
- Roma, P., Petruzzelli, A., Perrone, G. (2017). “From the crowd to the market: The role of reward-based crowdfunding performance in attracting professional investors”, *Research Policy* 46(9): 1606-1628.
- Securities and Exchange Commission (2018). “Crowdfunding.” Accessed August 29. <https://www.sec.gov/spotlight/crowdfunding.shtml>
- Sorenson, O., Assenova, V., Li, G. C., Boada, J. & Fleming, L. (2016). Expand innovation finance via crowdfunding. *Science*, 354(6319), 1526-1528.
- Stephen, F., Urbano, D. & van Hemmen S. (2009). The responsiveness of entrepreneurs to working time regulations. *Small Business Economics*, 32: 259–276.
- Strausz, R. (2017). A Theory of Crowdfunding: A Mechanism Design Approach with Demand Uncertainty and Moral Hazard. *American Economic Review*, 107(6): 1430–1476.
- Throsby, D. (1994). The production and consumption of the arts: A view of cultural economics. *Journal of Economic Literature*, 32(1), 1–29.
- Xu, Ting. (2017). Learning from the Crowd: The Feedback Value of Crowdfunding. (January 15, 2017). Available at SSRN: <https://ssrn.com/abstract=2637699> or <http://dx.doi.org/10.2139/ssrn.2637699>
- Younkin, P. & Kuppaswamy, V. (2017). The colorblind crowd? Founder race and performance in crowdfunding. *Management Science*. 64(7), 2973–3468.
- Yu, S., Johnson, S., Lai, C., Cricelli, A. & Fleming, L. (2017). Crowdfunding and regional entrepreneurial investment: an application of the CrowdBerkeley database. *Research Policy*, 46(10), 1723–1737.

Dynamic Workshop-Design for Cooperative Innovation Thinking in a Circulating and Expanding Knowledge Transfer

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Abstract

Trade fairs, conferences and congresses serve to exchange expertise and knowledge. Often the existing potential cannot be used despite high concentration of knowledge carriers or is subject to barriers in the communication. This paper presents a proven design of an open workshop, which offers the possibility to involve the participants of such events for an interdisciplinary exchange, up to the targeted scientific, social or economic problem solving.

The design of the workshop will involve participants being led by a "step-by-step guide ("Workshop Tourguide"). By setting the framework and the specific request for individual ideas, the first step is to create an "Idea Market" that will be made visible to everyone. In a development loop, the ideas are verified and developed within the knowledge ecosystem in order to continue their work in groups. Through the process of making all ideas visible and accessible at all times, ideas are effectively enhanced in their quality. In the final step, the ideas in teams are worked out with the help of the "Proposal Design Canvas" and recorded for further development.

As it has been shown, by applying this design, empirical barriers to knowledge exchange and communication can be resolved in order to work cooperatively on solution proposals. The workshop design can be applied to dynamic and fluctuating events such as trade fairs, conferences and congresses in order to interrogate bundled knowledge, bring it together in a targeted manner and further develop it through grinding processes. The "Workshop Tourguide" serves as an adaptable template that can be used for all creative solution finding.

Keywords – cooperative innovation thinking, circulating knowledge, workshop-design, open innovation, knowledge transfer.

Paper type – Practical Paper.

1 Introduction: Knowledge driven ecosystems

During fluctuating events like trade fairs, international expert conferences or congresses, a huge amount of knowledge is compactly assembled in one place in a non-intersecting time. Most of the present knowledge provider cannot be interrogated or used due to parameters like time and unawareness of existing expertise. Further barriers like foreign languages or different terminologies are factors that prevent the participants from communicating and exchanging their ideas effectively. To request, document and expand the potential knowledge of such dynamic and temporary knowledge ecosystems, an equally dynamic and validated workshop design for cooperative innovation thinking was developed.

2 Framework: INTEGER-workshop

In framework of INTEGER (Intelligent Technologies for secure and Resilient cities and societies), a joint German-Japanese research project funded by the German BMBF (Federal Ministry of Education and Research), the Laboratory of Knowledge Architecture had to submit six Horizon proposals within 2019 and 2020. Another condition and goal of the project was the networking of international research institutions through personal contacts, which should lead to long-term knowledge links (Porter, 1998).

Thematically, the proposals focused on disaster resilience and management for European cities and societies. To supplement the consortium with partners with expertise and experiences in this specific field of science, the project included first responders and researchers from Japanese authorities and universities such as Waseda University, Osaka University and Toyohashi University of Technology. In order to benefit from a mutual exchange of knowledge and to develop initial project ideas for the proposals, a workshop-session was held in Tokyo. A variety of researchers from across Japan were invited to attend the workshop, but the participants were unable to attend the workshop during the same period. For this reasons, the event had to be extended, allowing all participants to attend the workshop at any time later date. Under these conditions, which equate to a trade fair or scientific conference, a workshop was designed to create as much knowledge transfer- and growth as possible.

3 Challenges of knowledge transfer in knowledge ecosystems

3.1 Elements of a knowledge ecosystem

The technical term "ecosystem" comes from the ecology and is explained with the "teaching of the household". Initially, the definition was limited to the study of organisms and their interactions in the environment. In the 20th century, the definition was extended to a global system of organisms and the inanimate environment as well as the climate. In current usage, the word "ecosystem" is used synonymous when individual elements in a closed space or system co-exist in symbiosis with each other and benefit from each other.

The term "knowledge ecosystem" is an approach in knowledge management with the aim of having a valid decision-making basis through the existing pool of knowledge. It is also assumed that new innovations emerge from a system of knowledge. The "knowledge ecosystem" consist, different to the business-, or innovation ecosystem, of actors from research institutes, innovators and technology entrepreneurs serve as knowledge nodes (Valkokari, 2015). Further Valkokari outlined, the relationship and connectivity of their elements (actors) is decentralized and earns synergies through knowledge exchange.

Comparable with the natural scientific consideration of the ecosystem, it is assumed that constituents of different species or genera together produce new ones. What is referred to a hybrid in the field of biology (such as the crossing of two plant breeds) can be translated for knowledge management as the "technical interface" that results from multidisciplinary within a closed system. The workshop can be seen as closed system, while the participants are the elements of the system. To make it ecological in terms of knowledge management, the workshop needs formats to make knowledge exchange possible to create innovative ideas in a collaborative way between the participants.

3.2 Practical challenges of knowledge exchange

If knowledge exchange is understood as a communication process (Schmiedgen, 2015), it takes place between the sender and the receiver (Shannon & Weaver, 1963). The transfer of knowledge occurs when the receiver decodes, interprets and cognitively processes the transmitted information (Garavelli et. al, 2002). In order to expose barriers of knowledge transfer that arise in practice, we conduct a series of qualitative telephone interviews. The three interview partners were industry representatives who transfer and distribute information across several companies for example within a supply chain. In order to cover a broad range of sectors, companies from different industries and with different scale were surveyed: a) electronic engineering: 12.000 employees, annual sales of 2,5 milliard euros (2017), b) handcraft interior construction: 250 employees, annual sales of 50 million euros (2016), c) software-development and consulting: 100 employees, annual sales of one-digit millions (2018). The following barriers were named or confirmed during the interviews a), b) and c). Only the barriers that can be transferred to trade fairs, conferences and workshops are listed:

Barriers of knowledge transfer	A)	B)	C)
• linguistic barriers: communication in foreign language with limited language skills. Usually in English as non-native language.	yes	yes	yes
• terminology: gap between technical languages, e.g. the differences between the terminology of an architect and an industrial designer. In some case the same terminology stands for different subjects.	yes	yes	yes
• subject distance: barriers due to lack of expertise in other areas, particularly in interdisciplinary projects (Chua, 2004).	yes	yes	yes
• insider language: use of internal language of a field of work, a department or an institution.		yes	yes
• withhold of knowledge: a participant holds back with information, because he fears that someone else take over the pronounced idea or withdraw his knowledge in order to misappropriate it elsewhere.	yes	yes	yes
• succession: lack of structure and coordination, while several participants has to communicate with each other (at the same time).			yes
• responsibilities: unclear responsibilities, who is allowed to decide or who can decide over whom.			yes
• Addresses barrier: knowledge exchange and agreements to / with wrong contact person or without the right participant being present.			yes

4 Double Diamond Design Model

The Double Diamond is a design process model developed by the British Design Council, showing four phases of developing a creative idea focusing on solving a problem. The double diamond shape results from the four phases: 1) discover, 2) define, 3) develop and 4) deliver (see *figure 1*). Starting point is a scientific, technological, entrepreneurial or social problem that needs to be solved. From there, the first diamond opens with the phase of *discovery*. In this first phase, research will be carried out on existing standards, fields of research and results, etc. This creates a wide range of possibilities and options that may contribute to problem solving. In the phase of *definition*, the collected information is filtered according to corresponding criteria and reviewed for relevance. The field of possibilities diminishes, but becomes more goal-oriented. After the problem definition, the second diamond opens again with the phase of *development*. This time, focus is on the concept development of the problem by considering different types of approaches. The second diamond is closed in the phase of *delivery*. Here, the different approaches through validation and testing lead to a successful implementation. This leads to the solution of the initial problem (Stickdorn & Schneider, 2010).

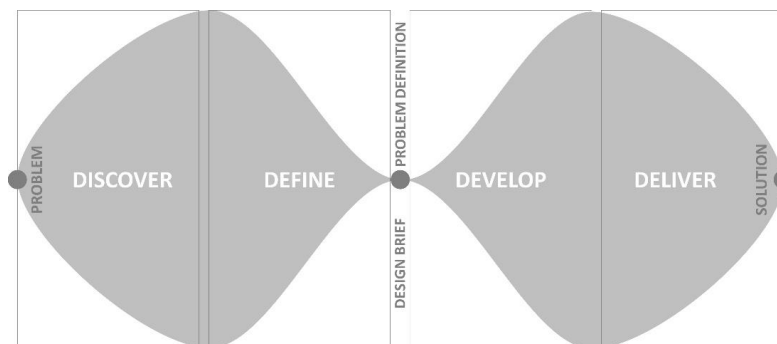


Figure 1: representation of the Double Diamond method by the British Design Council.

5 Use case of Double Diamond in framework of INTEGER

The use case in framework of INTEGER was the workshop for new knowledge for proposal development in Tokyo, a set target, that Quin et al. clarifies as the main outcome of a knowledge ecosystem (Quin et al., 1998). The ideas for proposal approaches would come from a supra-regional, interdisciplinary consortium. Therefore, the model of the Double Diamond has been extended to the bottom-up approach of co-creation, which helps to make the system of knowledge carriers as such more resilient (Anderson, 1999; Clippinger, 2004). Through the use of co-creation, the knowledge ecosystem experiences a characteristic which, according to Valkokari, belongs to the innovation ecosystem (Valkokari, 2015).

The set problem was to create a project idea suitable for the selected calls, which corresponded to the interests and expert opinions of the respective partners from the interdisciplinary participants who were present at different times. The workshop design was therefore based on the Double Diamond model (see figure 2), with intermediate steps being introduced, especially in the third phase, where the workshop is belonging to.

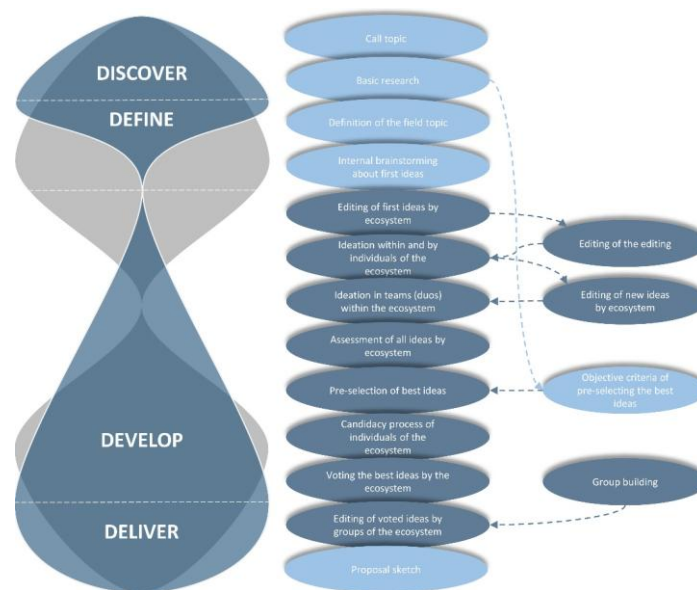


Figure 2: workshop design in comparison to the double diamond method

5.1 Phase 1- Discover

In preparation of the workshop, we scanned the call to identify the topic area and sub-topics. Then we created a keyword-cloud with all relevant keywords clustered to general terms such as “disaster management”, “resilience” and “preparedness”. Based on this, a basic search is carried out for each terminology as well as related topics and references of existing approaches, concepts, tools, products or services. The basic research also

established objective criteria that should serve as a basis for decision-making in the third phase.

5.2 Phase 2 - Define

After spreading out the field of opportunities, we filtered them by defining each topic, sub-topic and term of the state-of-the-art-research. Then we adjusted the definitions with the internal and external expertise of our partners, that will participate in the workshop.

To initiate a creative innovation thinking process, the participants need to pass the three spaces of “inspiration, ideation, implementation” (Brown, 2008). Starting with inspiration, we generated first idea outlines in an internally brainstorming session and formulating these ideas to half-page. These were displayed on posters, called “Project Sketches”.

To guarantee a uniform process for all participants on all workshop days, a “Workshop Tourguide” was designed and handed out to all as a booklet served as a step-by-step guide without the need for a workshop host (see *figure 3*). The first half (upper part) consists of a collection of all the necessary information, guidelines and pointers to the overall project: the INTEGER project, the European tenders and their main topics. The second half (below) names and describes the respective actions of the individual steps and illustrates them.

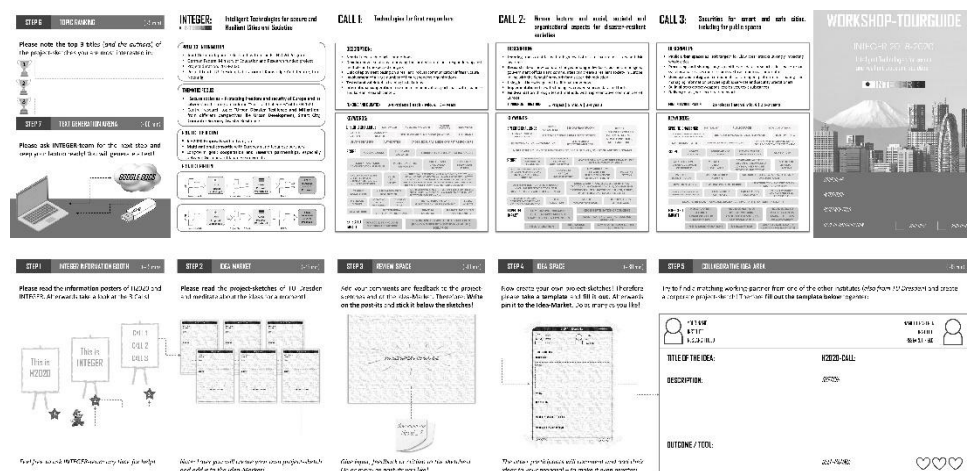


Figure 3: “Workshop Tourguide” as step-by-step-instruction.

In order to invite the right regional Japanese partners and to attend the workshop, we followed Kostoff's three criteria to select the right co-creators of an innovation that the potential partners had to fulfill: 1) multiple recommendations, 2) significant publications in the field and 3) literature citations (Kostoff, 2003).

5.3 Phase 3 - Develop

The third phase took place exclusively during the workshop in Japan and consists of seven steps. Prepared posters explained the workshop participants the set framework of innovation thinking textually and graphically at the “Information Booth”. At the “Idea Market”, the previously internally developed idea outlines were also made visible and accessible to all on posters. Referring to the phrase “learning by doing” (Rosenberg, 1976), Carayannis et al. points to the effect that continuous acquisition of knowledge has a cumulative impact on future innovation (Carayannis, 2003). Therefore, the shape of the Double Diamond gets extended by polishing through external expert loops at this point.

In the following, the carrier of knowledge of different disciplines, meaning the workshop participants, are referred to collectively as the “ecosystem”.

Step 1) At the “Review Space” the ecosystem gets instructed to give written feedback, comments and critics to the prepared idea outlines of the Idea Market basing on their expert knowledge. Therefore, they add their remarks via Post-it to the existing posters. This method should be made use of the honey-pot effect (Ott & Koch, 2012), after which a larger amount of participants organically accumulates where most interest arises. The quantity and quality of the ideation process as part of the innovation thinking (Brown, 2008) give conclusion of the quality of the idea as a whole. Because the comments are visible to all, they can be commented on by other experts in another loop.

Step 2) At the “Idea Space” the individuals of the ecosystem fill out a template with own ideas for innovations within the set framework and add it to the Idea-Market. The idea of the expert now circulates in the self-build knowledge ecosystem and expand the diversity of ideas. New participants of the event (workshop) will give feedback on this expert-idea, so that the idea gets validated in a short period of time and through an interdisciplinary jury.

Step 3) At the “Cooperative Idea Area” the individuals of the ecosystem get instructed to team up with one of the other experts to co-create a cooperative idea outline. Together they sketch their raw idea in the prepared placeholder in their Workshop Tourguide. If the idea is promising to both partners, they fill out a new template at the Idea Space (step 2) and add another draft to the Idea-Market. This step serves to bring together different disciplines of the ecosystem. Each individual of the ecosystem notes the idea drafts he and his personal field of research is corresponding the most into his Workshop Tourguide. After the event he can contact the authors of the drafts he is interested in for a prospective cooperation.

Step 4) Every individual of the ecosystem receives the same number of markers to mark the idea / ideas of the Idea Market that he finds the most interesting and promising. As a result, the ecosystem as a whole determines which ideas should be pursued further.

Step 5) The best ideas of the Idea Market get pre-selected by the workshop hosts. For this, the assessments of the ecosystem are counted. In addition, according to objective criteria previously defined in the phase of discovery of the Double Diamond, it is decided which ideas should be pursued. The objective criteria may arise, for example, from the questions: does the idea fit the call, is the idea realistically feasible, is there a suitable European partner for the idea?

Step 6) After the pre-selection there were still too many ideas left, as they all could have pursued. Therefore, everyone should audition in front of the ecosystem whose idea was selected. The idea provider had to answer the questions of the ecosystem, for instance: What is new about this idea? What makes this idea different from existing approaches? How should the idea be implemented, what resources and resources are needed?

Step 7) After the candidacy process of the individuals, the ecosystem was asked who wants to contribute to the individual project approaches. The projects with the most votes will be selected for the next step. At the same time processing expert groups are formed.

5.4 Phase 4 - Deliver

In the forth phase, the built expert groups of the ecosystem come together to continue to work on the project outlines. For this purpose, a digital template was developed, which should summarize and deepen the ideas to deliver solutions to the set framework in form of proposal sketches.

The digital template is based on the Business Model Canvas by Osterwalder and takes up the structure to describe a business idea and its implementation. This model is designed so that everyone can understand it with the help of segmentation and illustrations (Osterwalder and Pigneur 2010). To capture and deliver the solution to the set problem, the required content queries were segmented and presented as a customized version of the Business Model Canvas (BMC). The resulting "Proposal Design Canvas", in contrast to its model, contains all the scientific aspects of a proposal, which must be queried in the call and presented in the appropriate formality.









TITLE:		KEYWORDS: ① _____ ② _____ ③ _____	
CALL: 	SPECIAL CHALLENGE: 	PARTNERS: CORE: ① _____ ② _____ ③ _____	ADDITIONAL:  ① _____ ② _____ ③ _____
PROJECT IDEA: 		WORKPACKAGES:  WP ①: _____ WP ②: _____ WP ③: _____	
OUTPUT: 	IMPACT: 		
RESSOURCE: 			

Figure 3: Proposal Design Canvas based on the BMC by Osterwalder (2010)

6 Evaluation

The workshop design was used and tested within the time from January 15 to 20, 2019, in framework of INTEGER. After the implementation, conclusions could be drawn as to which barriers in communication or the exchange of knowledge with the design a) were remedied, b) mitigated and c) could not be improved. With reference to paragraph 3.2 (“practical challenges of knowledge exchange”), the list of known barriers and the effect of the workshop is showed below:

Barriers of knowledge transfer	remedied	mitigated	not improved
• linguistic barriers			
• terminology			
• subject distance			
• insider language			
• withhold of knowledge			
• succession			
• responsibilities			
• Addresses barrier			

The linguistic barriers (between English, German, Japanese) could be mitigated by the use of graphic elements to explain the project idea at the Ides Market. The templates for the development of an independent idea also prompted the participants to pin down the idea graphically. In principle, the existing linguistic barrier could not be eliminated, especially if facts of a specific discipline had to be explained.

The gap between the technical languages (architecture, social science, computer science) was inevitably closed by the participants in the workshop, because they formulated their ideas comprehensibly for all. Terminologies were also immediately questioned by other participants when used in an interim presentation. However, when developing their own project projects, specialist terminology was used especially in computer sciences, which subsequently had to be supplemented with an explanation.

The subject distance between disciplines persisted, as it could not be made up by the participants in the short course of the workshop.

Insider language, so using internal terms, was not present. This can be traced back to the fact that concepts were explained to the crowd as a whole or were visible to all participants on the posters. This has led to the renunciation of such language.

Objectively, no statement can be made as to whether knowledge was contained to the other participants. In general, it could be observed that the exchange of expertise was a general interest among all participants. Research institutes, universities and representatives of companies spoke openly about their own project experiences and gave hints to existing and comparable ideas on their part. Ideas were communicated transparently, especially in individual discussions with the participants.

The greatest added value of the workshop design is the simultaneous communication of a multitude of ideas. Participants were able to use the posters to find out about existing project ideas at any time, read their contents and read what others have left behind about

the idea as a feedback. The simultaneous communication of several participants was made possible by the permanent accessibility and visibility of all project ideas in one place.

The potential barrier to the question of responsibilities has been mitigated by the participants themselves. As each participant entered the workshop with an individual agenda, everyone knew what responsibility he wanted to take on in the proposals to be developed: the leading role of a project, a core role or as a supporting unit. By eliminating a hierarchy (the hosts have taken only one moderating role) there was little bias among the participants to express their opinion. Waseda University students, who also attended, were included in the workshop process and there was no barrier to the question of responsibility.

The barrier to the correct addressing of an issue has been almost completely eliminated by the workshop design. Through an initial mutual introduction of all participants the existing competences were known to everyone. However, the introductory round could not be repeated as often as possible during the workshop as soon as a new participant joined. The right addressing for a best possible exchange of knowledge nevertheless was possible. Each poster, as well as the Idea Sheets of the participants, was given a name so that the ideas could be traced back to the author. In the same way it was possible to track which participants left feedback at the Review Space. The real mediation of the matching participants took place through the hosts, who had a permanent overview through the visible connections (name on poster and nameplates for all participants).

7 Practical implementation

As a result of the workshop design, the Workshop Tourguide emerged. This guideline contains all the information you need to know about the project and the workshop process in a step-by-step lead. The Workshop Tourguide together with the poster presentation template and the Proposal Design Canvas provide the necessary means to carry out further workshops to generate ideas for writing a research project in a goal-oriented manner. In addition, the method can be applied wherever knowledge carriers come together in a condensed manner to map existing knowledge, to exchange ideas and to find technical interfaces in order to initiate an interdisciplinary project approach. The workshop design is expanded predestined to intergrade in fluctuating events such as trade fairs, international expert conferences, congresses or similar events with massive partake in independence of the problem that is to be solved in a scientific, theoretical or creative way.

8 Conclusions

The proposed workshop design for an expanding knowledge transfer allows a direct and indirect exchange of knowledge between experts from different disciplines within an unstable knowledge ecosystem. The basis in the form of the Workshop Tourguide gives

an understandable instruction for the participants of such a workshop, however, as it has been shown, moderation of the individual steps by hosts is required.

It has also been shown that new entrants must first be briefed and not be integrated directly into the current workshop process. Here we see pent-up demand. The conduction under real conditions has revealed that the direct exchange through community work in the form of the “Cooperative Idea Area” worked well and new ideas were generated. The indirect exchange of the “Review Space” also has added value for the project ideas. It should be emphasized that the quality of the proposals increases with each additional review loop and has been expanded by meaningful additions. For small numbers of participants, it should be taken into account that a separate loop should be added after the “Idea Space” in order to specifically encourage the grind of the new ideas.

A danger of the open and transparent design of the workshop is that participants can be biased if they comment on ideas what is visible for everyone. The anonymizing of the comments would circumvent this danger, but would have the disadvantage that the respective knowledge cannot be traced back and matched with suitable participants.

References

- Anderson, P. (1999). Complexity Theory and Organization Science, pp. 216-232.
- Brown, T. (2008). Design Thinking. Harvard Business School Publishing Corporation, p. 4.
- Carayannis, G., Gonzalez, E., Wetter, J. (2003). The Nature and Dynamics of Discontinuous and Disruptive Innovations from a Learning and Knowledge Management Perspective. In: The International Handbook on Innovation, Elsevier Science Ltd., p. 116.
- Chua, A. (2004). Knowledge management system architecture: a bridge between KM consultants and technologists. In: International Journal of Information Management 24 (1), p. 87-98. DOI: 10.1016/j.ijinfomgt.2003.10.003.
- Clippinger, J. (2004). The Biology of Business: Decoding the Natural Laws of Enterprise, San Francisco: Jossey-Bass.
- Garavelli, A. C., Gorgoglione, M. & Scozzi, B. (2002). Managing knowledge transfer by knowledge technologies. Technovation, 22(5), p. 271.
- Kostoff, R. N. (2003). Stimulating Innovation. In: The International Handbook on Innovation, Elsevier Science Ltd., p. 399.
- Osterwalder, A., Pigneur, Y. (2010). Business Model Generation, p. 15.
- Porter, M. E. (1998). Cluster and the new economics of competition. Harvard Business Review, 76(6), pp. 16.
- Ott, F. & Koch, M. (2012). Social Software Beyond the Desktop – Ambient Awareness and Ubiquitous Activity Streaming. It – Information Technology, 54(5), pp. 243.
- Quinn, J. B., Anderson, P., Finkelstein, S. (1998). New Forms of Organizing. In: H. Mitzberg & J. B. Quinn (Eds.), Readings in the Strategic Process: 362-274. Upper Saddle River, NJ: Prentice Hall.
- Rosenberg, N. (1976). On technological expectations. In: The Economic Journal, pp. 523.
- Schmiedgen, P. (2015). Wissensgemeinschaften in Wirtschaft und Wissenschaft. Knowledge Communities in Business and Science. TUDPress, p. 55.
- Shannon, C. E. & Weaver, W. (1963). The mathematical theory of communication. Urbana: University of Illinois Press, p. 5.

- Stickdorn, M., Schneider, J. (2010). *This is Service Design Thinking: basics – tools – cases*. Amsterdam: BIS Publishers, p. 9.
- Valkokari, K. (2015). Business, Innovation, and Knowledge Ecosystems: How They Differ and How to Survive and Thrive within Them. *Technology Innovation Management Review*, p. 21.

Strategic Networks and Innovative Performance: a Relational Design of Knowledge Sharing in Small and Medium-Sized Enterprises

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Abstract

The extant literature has often concluded that small and medium-sized enterprises (SMEs) are confronted with the lack of various resources (ranging from the tangible to the intangibles ones), a fact which determines them to act proactively and acquire the needed assets via different forms of collaboration with their counterparts. In this vein, the creation or affiliation to strategic networks have emerged as a fruitful path towards knowledge sharing as a reaction to fierce competition and with a view to enhance their competitiveness and renewal capacities, more specifically, their innovative performance. Starting from these premises, the current endeavour aims to advance some theoretical propositions depicting managers' multifaceted communication and interaction relationships with their prospective or extant partners in an endeavour to share relevant knowledge. By addressing varied forms and channels for knowledge sharing, the paper intends to assemble a coherent and comprehensive puzzle, theoretically positing the influence of a multifold relational design on SMEs innovative performance. Thus, it paves the way for a better understanding of the state of the field and avails new empirical research directions.

Keywords – Knowledge Sharing, Strategic networks, Small and medium-sized enterprises (SMEs), Relational design.

Paper type – Academic Research Paper

1 Introduction

The scrutiny of the innovative performance research has consistently brought to the fore that inter-firm boundary-spanning knowledge comes forward as a pivotal factor of innovation, especially in the case of small and medium-sized enterprises (SMEs) (Zeng et al., 2010; Franco and Haase, 2015; Vătămănescu et al., 2016a; Gomezel and Rangus, 2018). SMEs have exponentially opened up their borders via a diversity of collaboration (knowledge) networks, starting from the formal / formalized aggregations (i.e. strategic alliances, joint ventures, licensing, etc.) to informal / nonformalized ones, mainly based on deliberate managerial decisions and cemented by strong managerial relationships (Spekman et al., 2000; de Man and Duysters, 2005; Culpan, 2009; Andrade Rojas et al., 2018). The managerial decisions to move away from individualized business to a network-based approach substantially stem from the sheer awareness of their firms' state-of-the-art in terms of available resources, functional capabilities, knowledge on the market conditions, etc. (Soto-Acosta et al., 2016) and result in strategic endeavours for ensuring a common ground for knowledge sharing (both tangible and intangible) with potential allies (Franco and Haase, 2015; Păduraru et al., 2016; Vătămănescu et al., 2016b, 2017a,b). Here, the partners' joint and similar objectives stand for the driving force for SMEs becoming part of strategic networks with a view to increase their innovative performance within the industry of reference.

Filling knowledge gaps and acquiring new wells of knowledge are the most common denominator for engaging in strategic networks with upstream and downstream collaborators in the sector (Thorgren et al., 2009; Vătămănescu et al., 2017a). Such undertakings have been credited with success as a consequence of the establishment and development of strong inter-firm relationships among the key organizational actors (i.e., entrepreneurs, managers, CEOs, etc.), all the more so as the network springs as a relational platform for members willing to harness strategic renewal and innovation via learning and knowledge acquisitions (de Man and Duysters, 2005; Andrade Rojas et al., 2018; Vătămănescu et al., 2018; Vătămănescu and Pinzaru, 2018).

In this vein, managers' multifold relational designs (i.e., knowledge sharing via multifaceted interactions and forms of communication at the managerial level) have directly influenced the roots and routes of knowledge sharing with their counterparts given that the process has been recognised as a determinant of competitiveness and, at the same time, as one of the main challenges faced in networks (Păduraru et al., 2016; Vătămănescu et al., 2016a,b). As a set of fine-grained and mainly unique practices and methods, the sharing mechanism from a relational perspective imprints an intricate nature to the interactions and relationships among network members. Moreover, the relational design of knowledge translation within strategic SMEs networks poses even more

challenges as the cooperative form is mostly dynamic in that partners' collaboration relies on the exchange of certain resources, ideas, knowledge, while preserving their interdependence in additional areas. Managers in the network are the ones to decide what, where, when and how they are open to share, giving way to different levels of openness and commitment with a view to achieving the innovative performance targeted by their units.

Pursuant to Curado, Muñoz-Pascual & Galende (2018), the extant body of literature on whether and how firms can leverage relational capital and knowledge sharing for innovation is equivocal whereas the underlying processes responsible for mobilizing relational capital are yet to be deemed conclusive. That being the case and building on the previous depicted considerations, the present endeavour aims to advance novel propositions covering the relational antecedents of innovative performance within the context of strategic SMEs networks. The emphasis is laid on the relational design of knowledge sharing among network members (i.e., managers as firm's key players with direct access to various sources of firm knowledge).

The overall approach considers the deliberate bottom-up formation of strategic SMEs networks as a driver for boundary-spanning knowledge flows (Fukugawa, 2006; Thorgren et al., 2009). The envisaged communication and knowledge exchanges are either offline (in person), or online (ICT-based), either direct, or via an intermediary, and mostly founded on specific (business-centric / competitive) knowledge. All these knowledge sharing facets are expected to exert different effects on members' innovative performance which is understood – consistent with Thorgren et al., 2009 – by means of improving the competitive position, reducing costs, improving products or services, developing new products, and improving R&D effectiveness.

Furthermore, in order to dig deeper into the scope of SMEs strategic networks, we proceed by delineating between two different types of aggregations in line with Franco and Haase (2015). The authors advanced two groups of criteria to account for the choice of alliance associates: 1) criteria connected to the activity and business abilities, and 2) criteria correlated with the personality of the partner. Even though the current literature on the innovative performance has yet to consider such a particularization of strategic networks, embracing a specific approach may spring as a theoretical step forward a more intricate research model.

By corroborating these aspects, the remainder of the paper focuses on advancing some theoretical propositions describing the relationships among the twofold SMEs strategic networks, various types of knowledge sharing and the innovative performance. In this sense, it hews the path for further empirical studies aiming at assessing conceptual and structural models in specific sectors.

2 Theoretical propositions

The contemporary business world has become increasingly heterogeneous, competitive and globalised. In this front, the phenomenon of network creation is extensively viewed as critical to support and maintain a company's performance and

prosperity in the field of reference. Particularly within the settings of small and medium-sized enterprises (SMEs), business networks (with a particular emphasis on alliances) could be specifically valuable in that they favour the attainment of competitive advantages and strategic objectives.

A study conducted by Rivera-Santos, Rufin and Wassmer (2017) stated that one of the main drivers why small companies engage in strategic networks is to enhance their competitive status when going up against opponent firms. They concurred that companies frequently frame and employ their alliance portfolios as devices to adapt within the competitive context in order to outline the style of the competition. The alliance portfolios of the companies can also be moulded by competition and therefore portray the effect of a multifaceted process in which strategically acting enterprises develop alliance assignments during the time by embarking into both offensive and defensive alliances shaped mainly by the managers within a rational strategy process (Wincent and Westerberg, 2005). Commonly, firms are coerced to reshape the structure of their alliance portfolios so that they can enhance their competitive status face to their opponents in a business area or just to settle their competitive edge (Elmuti and Kathawala, 2001).

Another investigation developed by Kmiecik and Michna (2018) underlined that when business rivalry in a market is serious, a company should struggle to acquire, transform, and harvest knowledge when it comes to the actions initiated by the competitors. By cultivating a wider spectrum of knowledge abilities via strategic networks, SMEs can gain and integrate market knowledge more effectively and efficiently (Vătămănescu et al., 2017a.b). On the contrary, when competitive fervour is reduced, companies may be hesitant to expand knowledge management practices by apprehending such an endowment as unessential and inefficient.

Based on the findings of these studies, we advance the following main propositions with its two derivatives (in line with Franco and Haase's, 2015 twofold criteria):

P1. A high level of competition in the field has a positive influence of the formation of SMEs strategic networks.

P1A. A high level of competition in the field has a positive influence of the formation of SMEs strategic networks based on criteria related to the activity and business abilities.

P1B. A high level of competition in the field has a positive influence of the formation of SMEs strategic networks based on criteria associated with the personality of the partner.

To numerous organizations, a fruitful collaboration within networks and a suitable framing of interorganisational contacts is a subject of survival (Vuori, Helander and Mäenpää, 2018). Within the economic context of the 21st century, the cases of networks that have been established solely for the purpose of sharing knowledge is continuously increasing. Ioanid et al. (2017) reinforce the view that strategic networks offer the chance for dialogue to distinct groups with important capacity of knowledge sharing that in other contexts would be reluctant to relate. In line with Iturrioz, Aragon and Narvaiza (2015) initiating business contacts and ties amid network members decreases the expenses invested in joint efforts, easing dialogue and knowledge transfer.

Abou-Zeid (2005) addressed the channels for social knowledge transfer in both online and offline environments: such as personnel transfer, electronic mail, groupware, telephone, video conferencing, face-to-face meetings, training seminars and courses, specialist knowledge transfer groups, communities-of-practice or communities of interest. In this front, a research carried out by Appel-Meulenbroek, Weggeman, and Torkkeli (2018) points out that one-on-one knowledge sharing cultivates collaboration and reinforces the strategic network. Here, SMEs managers are primarily accountable for the degree in which knowledge is distributed and exchanged among actors and for the level of energy channelled to gain and ascertain knowledge in order to boost communication within the strategic network.

Raposo, Ferreira and Fernandes (2014) affirmed that face-to-face/ in person interactions and geographic proximity with business partners are valuable factors which propel better access to information, certain specific knowledge exchanges and further they enforce innovative performance. When the study refers for example to the biotechnology sector companies, the authors support the idea that, in many situations where firms from this sector are assembled into clusters, they are able to generate more innovative performance in comparison with the context when they are geographically dispersed (Raposo et al., 2014).

Consequently, founded on the extant literature implying the existence of connections between strategic networks, knowledge sharing channels and innovative performance, the following propositions are formulated:

P2. SMEs strategic networks have a positive influence on SMEs innovative performance via the mediating effect of offline (in-person) knowledge sharing among members.

P2A. SMEs strategic networks based on criteria related to the activity and business abilities have a positive influence on SMEs innovative performance via the mediating effect of offline (in-person) knowledge sharing among members.

P2B. SMEs strategic networks based on criteria associated with the personality of the partner have a positive influence on SMEs innovative performance via the mediating effect of offline (in-person) knowledge sharing among members.

Vuori et al. (2018) underlined that knowledge networks can be restricted or accessible, can differ in geographical diffusion and dimension, thus partners are expected to communicate one-on-one or through ICT. Their study also envisioned that some of the most important elements when assessing the process of knowledge sharing within a strategic network refer to geographical range which accounts, to some extent, for the usage of ICT. An investigation performed by Popa, Soto-Acosta and Martinez-Conesa (2017) denoted that within the precise situation of SMEs, targeted online influx and outflux of knowledge are even more pertinent to deliver sustainable advantage and innovative performance in face of competition as this type of organizations are confronted with harsher means pressure.

In another perspective, a survey of 150 Finnish technology-intensive firms showed that ICT-based knowledge sharing has a positive effect on innovative performance, but

presents in the same time high levels of accidental and intentional knowledge leakage (Ritala et al., 2015).

Given these aspects, we presume that:

P3. SMEs strategic networks have a positive influence on SMEs innovative performance via the mediating effect of online (ICT-based) knowledge sharing among members.

P3A. SMEs strategic networks based on criteria related to the activity and business abilities have a positive influence on online (ICT-based) knowledge sharing among members.

P3B. SMEs strategic networks based on criteria associated with the personality of the partner have a positive influence on online (ICT-based) knowledge sharing among members.

According to the extant literature, the trust in business partners has been widely researched in the sphere of SMEs and uncovered to be prominent, probably the most significant influencer of alliance achievement within this business area (Thorgren et al., 2009). Concurrently, the assumption of a high level of commitment is liable to catalyse the associates' actions in the spirit of a genuine partnership (Valkokari et al., 2012).

Keszei (2018) argue that strategic network empowerment can increase knowledge sharing in a direct way. The effort to sustain the predisposition of SMEs managers from strategic networks to share directly what they know is essential to the continuous creation of superior new product development performance. The study also accentuates that firms should build up organisational cultures where managers' knowledge-sharing willingness (using direct approaches) with their counterparts within the scope of a strategic network is of paramount importance.

Further, according to Sulistiyani and Harwiki (2015), the affiliation of a SME to a strategic network is positively related to the fact that the managers get more encouraged to contribute their knowledge about their own businesses to members, groups and companies within the respective network. This co-relation where companies share their own practices and methods could increase the creation of new ideas and the development of new opportunities that could propel the advancement of innovation capabilities and innovative performance.

Studies have proved that inter-organizational collaboration within a network of partners can be an important driver for innovation performance. For instance, the inquiry led by Andrade Rojas et al. (2018) has recommended that when proficient business collaborations furnish more eclectic assemblages of information and skills, it is more plausible that the expected gains of innovation can be completed at basic costs. They continue by affirming that a central aspect within a business alliance supports the organization in its access to multifarious competences and resources, as a result of its open links with various business allies. Direct knowledge sharing empowers a business to a more favourable comprehension of market necessities and to product creation, thus entertaining the interests of the stakeholders (Castela et al., 2018). Castela et al. (2018) underlined that companies in a central position in the intra-sector or cross-sector network sharing information about their own businesses are more inclined to be innovative.

Given these considerations, we advance the following propositions:

P4. SMEs strategic networks have a positive influence on SMEs innovative performance via the mediation of direct knowledge sharing among members.

P4A. SMEs strategic networks based on criteria related to the activity and business abilities have a positive influence on SMEs innovative performance via the mediation of direct knowledge sharing among members.

P4B. SMEs strategic networks based on criteria associated with the personality of the partner have a positive influence on SMEs innovative performance via the mediation of direct knowledge sharing among members.

Natalicchio et al. (2018) enforced these aforementioned findings in that, due to the lack of strategic resources and long-range development plans, SMEs managers rely on their abilities and the chemistry with potential partners to a great extent in their endeavour to strengthen knowledge sharing processes, thus counting less on a mediator's role. Nevertheless, as trust and commitment between prospective partners emerge as long-term processes which are expected to influence the development of a strategic network (Păduraru et al., 2016; Vătămănescu et al., 2016b) with a positive influence on direct knowledge sharing, resorting to an intermediary tasked to share knowledge among the members of the respective strategic network may arise as a suitable innovative solution in certain contexts.

The mental closeness and intensity of the partnership are often founded on direct interaction between parties (Vuori et al., 2018), yet there are cases where an intermediary can advance confidence and assign network resources in a favourable way for all the involved sides. Which is more, sometimes, the absence of an intermediary can develop into a fundamental knowledge obstacle in the network frame of reference (Myllärniemi et al., 2013).

Therefore, in the light of the abovementioned arguments, we formulate the following propositions:

P5. SMEs strategic networks have a positive influence on SMEs innovative performance via the mediating effect of the usage of an intermediary (a certain partner from the network) to share knowledge among members.

P5A. SMEs strategic networks based on criteria related to the activity and business abilities have a positive influence on SMEs innovative performance via the mediating effect of the usage of an intermediary (a certain partner from the network) to share knowledge among members.

P5B. SMEs strategic networks based on criteria associated with the personality of the partner have a positive influence on SMEs innovative performance via the mediating effect of the usage of an intermediary (a certain partner from the network) to share knowledge among members.

A study conducted by Curado, Munoz-Pascual and Galende (2018) showed that, within a more and more complex business environment, knowledge sharing within the inter-organizational realms plays a consistent part in the growth of organizational learning skills. Knowledge is an essential component which maintains an effective and efficient decision-making process and consequently knowledge sharing could support the

generation of competitive advantage and innovation via multifold information exchange (Vătămănescu and Pinzaru, 2018).

Hernandez-Espallardo et al. (2018) contended that companies within the same sector are more inclined to provide business-centric knowledge regarding the product series, technology, operating systems, business models, and management patterns in order to benefit from common knowledge and gain competitive advantage.

Given these considerations, the following propositions can be put forward:

P6. SMEs strategic networks have a positive influence on SMEs innovative performance via the mediating effect of sharing competitive (business-centric) knowledge among members.

P6A. SMEs strategic networks based on criteria related to the activity and business abilities have a positive influence on SMEs innovative performance via the mediating effect of sharing competitive (business-centric) knowledge among members.

P6B. SMEs strategic networks based on criteria associated with the personality of the partner have a positive influence on SMEs innovative performance via the mediating effect of sharing competitive (business-centric) knowledge among members.

3 Discussion and further research avenues

The formulation of the aforementioned theoretical propositions was meant to pave the way for integrative empirical endeavours liable to address intricate conceptual and structural models covering the case of SMEs strategic networks.

In this front, the paper adds to the extant literature on the topic in several ways. Firstly, it proposes a comprehensive framework for the relational design of knowledge sharing among network members. To the best of our knowledge, this is among the first undertakings simultaneously discussing offline (in person) and online (ICT-based), direct and intermediate, and business-centric / competitive knowledge exchanges.

Secondly, the study differentiates between two types of strategic networks - i.e., based on criteria connected to the activity and business abilities, respectively on criteria correlated with the personality of the partner. Such a disentanglement in the context of knowledge sharing flows and innovative performance is unprecedented and opens up new avenues for further research.

Thirdly, all the theoretical propositions assume the mediating effect of multifaceted knowledge sharing in the relationship between strategic networks and SMEs innovative performance, setting the premises for a further thorough investigation of the underlying and probably interlinked relational processes.

Even though the current endeavour is prone to become a step forward towards the comprehension of SMEs innovative performance within the context of a fierce competition, the main limit resides in its merely theoretical nature, thus calling for future in-depth analyses.

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References

- Abou-Zeid, E.-S. (2005) "A culturally aware model of inter-organizational knowledge transfer", *Knowledge Management Research & Practice*, Vol. 3, No. 3, pp. 146-155.
- Andrade Rojas, M.G., Ramirez Solis, E.R. and JianJun Zhu, J. (2018) "Innovation and network multiplexity: R&D and the concurrent effects of two collaboration networks in an emerging economy", *Research Policy*, Vol. 47, pp. 1111–1124.
- Castela, B.M.S., Ferreira, F.A.F., Ferreira, J.J.M. and Marques, C.S.E. (2018) "Assessing the innovation capability of small- and medium-sized enterprises using a non-parametric and integrative approach", *Management Decision*, Vol. 56, No. 6, pp. 1365-1383, <https://doi.org/10.1108/MD-02-2017-0156>.
- Culpan, R. (2009) "A fresh look at strategic alliances: research issues and future directions", *International Journal of Strategic Business Alliances*, Vol. 1, No. 1, pp. 4-23.
- Curado, C., Muñoz-Pascual, L. and Galende, J. (2018) "Antecedents to innovation performance in SMEs: A mixed methods approach", *Journal of Business Research*, Vol. 89, pp. 206–215.
- de Man, A.-P. and Duysters, G. (2005) "Collaboration and innovation: a review of the effects of mergers, acquisitions and alliances on innovation", *Technovation*, Vol. 25, No. 12, pp. 1377-1387.
- Elmuti, D. and Kathawala, Y. (2001) "An overview of strategic alliances", *Management Decision*, Vol. 39, No. 3, pp. 205–217.
- Franco, M. and Haase, H. (2015) "Interfirm alliances: a taxonomy for SMEs", *Long Range Planning*, Vol. 48, pp.168-181.
- Fukugawa, N. (2006) "Determining factors in innovation of small firm networks: a case of cross industry groups in Japan", *Small Business Economics*, Vol. 27, No. 2, pp. 181-193.
- Gomez, A.S. and Rangus, K. (2018) "An exploration of an entrepreneur's open innovation mindset in an emerging country", *Management Decision*, Vol. 56, No. 9, pp. 1869-1882, <http://dx.doi.org/10.1108/MD-04-2017-0382>.
- Hernandez-Espallardo, M., Osorio-Tinoco, F. and Rodriguez-Orejuela, A. (2018) "Improving firm performance through inter-organizational collaborative innovations: The key mediating role of the employee's job-related attitudes", *Management Decision*, Vol. 56, No. 6, pp. 1167-1182, <https://doi.org/10.1108/MD-02-2017-0151>.
- Ioanid, A., Deselnicu, D.C. and Militaru, G. (2017) "The impact of social networks on SMEs' innovation potential", *Procedia Manufacturing* 22, pp.936-941.
- Iturrioz, C., Aragon, C. and Narvaiza, L. (2015) "How to foster shared innovation within SMEs networks: social capital and the role of intermediaries", *European Management Journal*, 33, pp. 104-115.
- Keszei, T. (2018) "Boundary spanners' knowledge sharing for innovation success in turbulent times", *Journal of Knowledge Management*, Vol. 22 Issue: 5, pp.1061-1081.
- Kim, B., Kim, E., Kim, Y. and Cho, JY (2018) "Where to find innovative ideas: interdependence-building mechanisms and boundary-spanning exploration", *Knowledge Management Research & Practice*, Vol. 16, No. 3, pp. 376-387.
- Kmiecik, R. and Michna, A. (2018) "Knowledge management orientation, innovativeness, and competitive intensity: evidence from Polish SMEs", *Knowledge Management Research & Practice*, <https://doi.org/10.1080/14778238.2018.1514997>.

- Myllärniemi, J., Vuori, V., Helander, N., Ilvonen, I., Okkonen, J., & Virtanen, P. (2013) "The role of an intermediary organisation in collaboration: How can an intermediary enhance value co-creation?" *International Journal of Applied Systemic Studies*, Vol. 5, No.1–2, pp. 3–21.
- Natalicchio, A., Messeni Petruzzelli, A., Cardinali, S. and Savino, T. (2018) "Open innovation and the human resource dimension: An investigation into the Italian manufacturing sector", *Management Decision*, Vol. 56, No. 6, pp. 1271-1284, <https://doi.org/10.1108/MD-03-2017-0268>.
- Păduraru, T., Vătămănescu, E.-M., Andrei, A.G., Pînzaru, F., Zbucea, A., Maha, L.G. and Boldureanu, G. (2016) "Sustainability in Relationship Marketing: An Exploratory Model for the Industrial Field, *Environmental Engineering and Management Journal*, Vol. 15, No. 7, pp. 1635-1647
- Podmetina, D., Soderquist, K.E., Petraite, M. and Teplov, R. (2018) "Developing a competency model for open innovation: From the individual to the organisational level", *Management Decision*, Vol. 56, No. 6, pp. 1306-1335, <https://doi.org/10.1108/MD-04-2017-0445>.
- Popa, S., Soto-Acosta, P. and Martinez-Conesa, I. (2017) "Antecedents, moderators, and outcomes of innovation climate and open innovation: An empirical study in SMEs", *Technological Forecasting & Social Change*, Vol. 118, pp. 134–142.
- Raposo, M.L., Ferreira, J.J.M. and Fernandes, C.I. (2014) "Local and cross-border SME cooperation: effects on innovation and performance", *Revista Europea de Direccion y Economia de la Empresa*, Vol.23, pp.157-165.
- Ritala, P., Olander, H., Michailova, S. and Husted, K. (2015) "Knowledge sharing, knowledge leaking and relative innovation performance: an empirical study", *Technovation*, Vol. 35, pp.22-31.
- Rivera-Santos, M., Rufin, C. and Wassmer, U. (2017) "Alliances between firms and non-profits: a multiple and behavioural agency approach" *Journal of Management Studies*, Vol. 54, No.6, pp. 854-875.
- Soto-Acosta, P., Cismaru, D.-M., Vătămănescu, E.-M. and Ciochină, R.S. (2016) Sustainable Entrepreneurship in SMEs: A Business Performance Perspective", *Sustainability*, Vol. 8, No. 4, Art. 342, <http://www.mdpi.com/2071-1050/8/4/342>.
- Spekman, R., Isabella, L. and MacAvoy, T. (2000) *Alliance Competence – Maximizing the Value of Your Partnerships*, John Wiley & Sons, New York.
- Sulistiyan, R. and Harwiki, W. (2015) "How SMEs build innovation capability based on knowledge sharing behavior? Phenomenological approach", 3rd Global Conference on Business and Social Science -2015, Kuala Lumpur, Malaysia. *Procedia – Social and Behavioral Sciences* 219, pp.741-747.
- Thorgren, S., Wincent, J. and Ortqvist, D. (2009) "Designing interorganizational networks for innovation: An empirical examination of network configuration, formation and governance", *Journal of Engineering and Technology Management*, Vol. 26, pp. 148–166.
- Valkokari, K., Paasi, J. and Rantala, T. (2012) "Managing knowledge within networked innovation", *Knowledge Management Research & Practice*, Vol. 10, No. 1, pp. 27-40.
- Vătămănescu, E.-M., Pînzaru, F., Andrei, A.G. and Zbucea, A. (2016a) "Investigating SMEs sustainability with partial least squares structural equation modeling", *Transformations in Business & Economics (TIBE)*, Vol. 15 No. 3, pp. 259-273, <http://www.transformations.knf.vu.lt/39/article/inve>.
- Vătămănescu, E.-M., Zbucea, A., Pînzaru, F. and Andrei, A.G. (2016b) The Impact of Relational Capital on SMEs Internationalization. Leveraging Online Versus Offline Business Networking, in *Proceedings of the 17th European Conference on Knowledge Management*, eds. S. Moffett and B. Galbraith, Academic Conferences and Publishing International Limited, Reading, UK, pp. 926-935.
- Vătămănescu, E.-M., Andrei, A.G., Nicolescu, L., Pînzaru, F. and Zbucea, A. (2017a) "The Influence of Competitiveness on SMEs Internationalization Effectiveness. Online versus

- Offline Business Networking”, *Information Systems Management*, Vol. 34, No. 3, pp. 205-219, <http://www.tandfonline.com/doi/full/10.1080/10580530.2017.1329997>.
- Vătămănescu, E.-M., Gazzola, P., Dincă, V.M. and Pezzetti, R. (2017b) “Mapping Entrepreneurs’ Orientation towards Sustainability in Interaction versus Network Marketing Practices”, *Sustainability*, Vol. 9, No. 9, Art. 1580, <http://www.mdpi.com/2071-1050/9/9/1580/html>.
- Vătămănescu, E.-M., and Pînzaru, F. (eds.) (2018) *Knowledge Management in the Sharing Economy. Cross-Sectoral Insights into the Future of Competitive Advantage*, Springer International Publishing, Cham.
- Vătămănescu, E.-M., Andrei, A.G., Gazzola, P. And Dominici, G. (2018) “Online Academic Networks as Knowledge Brokers: The Mediating Role of Organizational Support”, *Systems*, Vol. 6, Art.11, doi:10.3390/systems6020011.
- Vuori, V., Helander, N. and Mäenpää, S. (2018) “Network level knowledge sharing: Leveraging Riege’s model of knowledge barriers”, *Knowledge Management Research & Practice*, <https://doi.org/10.1080/14778238.2018.1557999>.
- Wincent, J. and Westerberg, M. (2005) “Personal traits of CEOs, inter-firm networking and entrepreneurship in their firms: investigating strategic SME network participants”, *Journal of Developmental Entrepreneurship*, Vol. 10, No. 3, pp. 271–284.
- Zeng, S.X., Xie, X.M. and Tam, C.M. (2010) “Relationship between cooperation networks and innovation performance of SMEs”, *Technovation*, Vol. 30, No. 3, pp. 181–194, <http://dx.doi.org/10.1016/j.technovation.2009.08.003>.

Managing Unintended Reverse Knowledge Transfer for Enhancing R&D Performance of Parent Company

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Abstract

The purpose of our study is to examine the impact of reverse knowledge transfer from foreign subsidiaries to parent companies on the latter's R&D performance, based on a questionnaire survey of Japanese companies.

Based on intensive review of existing studies on global R&D and reverse knowledge transfer, we try to advance the current literature by examining issues that have been unaddressed: what are the type of knowledge and mechanism of knowledge transfer from subsidiaries to parents? In particular, we focus on the transfer of "tacit knowledge" as well as "unintended" transfer and investigate their impacts on the parents' R&D activities and related performance.

To pursue the purpose, we conducted a questionnaire survey of more than 3,000 Japanese MNCs with overseas subsidiaries. The result showed the following points. First, concerning the type of knowledge, the transfer of tacit technological knowledge as well as market-related knowledge has a significant positive impact on the parents' R&D performance. Second, regarding the pattern of reverse knowledge transfer, unintended knowledge transfer has a positive effect on the parents' R&D performance to a certain point before turning negative. In other words, there is an inverse U-shaped relationship between unintended reverse knowledge transfer and R&D performance of the parent companies.

Keywords – foreign subsidiary, unintended knowledge creation and transfer, reverse knowledge transfer, tacit knowledge, R&D Performance

Paper type – Academic Research Paper

1 Introduction

The purpose of our study is to examine the impact of knowledge transfer from foreign subsidiaries to parent companies on the latter's R&D performance, based on a questionnaire survey of Japanese companies.

Prior studies on global R&D management traditionally assumed that knowledge and capabilities within multinational corporations (MNCs) would flow in one direction, along the hierarchical structures, from parents down to subsidiaries. After the 2000s, however, many scholars and practitioners have shown increasing interest in an active role of foreign subsidiaries in the process of knowledge creation and transfer within MNCs (e.g. Hakanson and Nobel, 2000; Frost, 2001; Zhou and Frost, 2003).

Knowledge transfer from subsidiaries to parents is often referred to as “reverse” transfer. While existing studies have deepened our understanding about the conditions under which the reverse knowledge transfer takes place and boosts the parents' R&D performance (e.g. Piscitello and Rabbiosi, 2004; 2006; Ambos, et al., 2006; Schotter and Bontis, 2009; Rabbiosi, 2011; Rabbiosi and Santangelo, 2013; Driffield, et al., 2016), there is a dearth of study on the types of knowledge transferred from subsidiaries to parents and the patterns of the transfer. In our study, we will pay attention to these missing aspects to demonstrate the importance of the transfer of tacit knowledge and “unintended” pattern of knowledge transfer from subsidiaries to parent companies.

The contents of this paper are as follows. In next section 2, we review existing studies on global management, especially on the reverse knowledge transfer in global R&D operation. In section 3, we explain research method and show research results. In section 4, we discuss about the results to derive some implications. The final section 5 is conclusion.

2 Literature Review

2.1 Meta-national perspective and the concept of reverse knowledge transfer

The study builds its theoretical foundation upon the “meta-national” perspective of global management (Doz and Santos, 1997; Doz, Santos and Williamson, 2001) that advocates the possibility of knowledge and value creation all around the world including developing countries. It also underscores the significance of sharing and utilizing such knowledge and value globally for firms to achieve a competitive edge over its rivals.

Based on the perspective, various streams of studies on globalization management have been developed, ranging from identifying the factors and effects of intra-MNC knowledge flows (Harzing and Noorderhaven, 2006) to the kind of agency relationships between parents and subsidiaries (Mudambi and Navarra, 2004). Among those studies, one of the most prevalent issues is knowledge transfer from subsidiaries to parent companies (e.g. Hakanson and Nobel, 2000; Frost, 2001; Zhou and Frost, 2003; Ambos, et al., 2006; Piscitello and Rabbiosi, 2006; Schotter and Bontis, 2009; Rabbiosi, 2011; Rabbiosi and Santangelo, 2013). It is often referred to as “reverse” knowledge transfer, in

contrast to the “forward” knowledge transfer in which knowledge flows from parents to their subsidiaries.

On the topic of the reverse knowledge transfer, its impact on the parent company’s R&D activities and the conditions under which it creates significant impact have been examined from various perspectives. For instance, Piscitello and Rabbiosi (2004) established that foreign R&D activities of Italian MNCs had a positive impact on the innovative performance of their parent companies. Hakanson and Nobel (2000) analysed technology transfer from foreign subsidiaries of Swedish MNCs back to their home operations and found supporting evidence for reverse technology transfer under the condition that subsidiaries had a global mandate to develop specific know-how. Ambos et al. (2006) also explored the conditions under which reverse knowledge transfer can affect the R&D capability of parent companies. Their empirical survey results indicated that the competitive strength of the host countries of subsidiaries, the strategic role of subsidiaries and the absorptive capacity of parent companies matter.

More recently, Rabbiosi (2011) examined the impact of the coordination mechanism, such as subsidiary autonomy and communication pattern, between subsidiary and parent company on reverse knowledge transfer. Their findings showed that the combination of high autonomy and personal communication as well as low autonomy and electronic-based communication positively affect the extent of reverse knowledge transfer. While Rabbiosi and Santangelo (2013) clarified that subsidiary age is an important determinant of parent company benefits from reverse knowledge transfer, Driffield, Love and Yang (2016) found the subsidiary location and parent-subsidiary distance as significant factors.

2.2 The type of knowledge and the pattern of knowledge transfer

A review of the existing literatures on global R&D management shows increasing importance of reverse knowledge transfer as a factor that could facilitate R&D activities of the parent company in home country. While they have deepened our understanding about the conditions under which reverse knowledge transfer takes place and boost the parents’ R&D performance, there is a dearth of research on the type of knowledge and mechanism of transfer from subsidiaries to parents. According to the knowledge-based theory, firms exist because they offer conditions for more efficient management of knowledge structures and processes than market transactions (Grant, 1996). One central characteristic of organizational knowledge is its “tacitness”, that is, the degree to which it can be codified or articulated. Assumed to be sticky, tacit knowledge is deemed as a potential source of advantage (von Hippel, 1994) because, unlike explicit knowledge, it is inimitable and appropriable (Spender and Grant, 1996). Firms therefore are superior to markets in their ability to organise processes and structures to integrate both tacit and explicit knowledge across different epistemic communities (Hakanson, 2010). Applying the knowledge-based perspective, we postulate in this study that knowledge that is created in foreign subsidiaries and transferred to their parents could come in different forms, such as technological or market information. Technological knowledge includes product and process knowledge, and could be tacit or explicit.

Considering that foreign subsidiaries are often faced with a different environment from that of the parent company at home, it is assumed that the subsidiary can create and transfer unique knowledge as an epistemic community that is not expected in advance. In this sense, knowledge transfer from foreign subsidiaries is not always conducted in an intended fashion, but rather knowledge can be transferred in an unintended manner.

In this paper, we build on the intersection of “meta-national” and “knowledge-based” perspectives to examine the dynamics of knowledge creation in foreign subsidiaries and the effect of their unintended knowledge transfer on the R&D activities and performance of the parent companies.

3 Research

3.1 Research Method

To investigate the impact of reverse knowledge transfer on the parents’ R&D performance, a questionnaire survey was conducted by the National Institute of Science and Technology Policy, a research arm of the Ministry of Education, Science and Technology in Japan. The questionnaires were delivered to 3,029 overseas subsidiaries of Japanese MNCs and returned from 672 subsidiaries.

Using the data collected from the survey, we performed two multiple regression analyses. First is about the impact of the types of knowledge and second is about the impact of the patterns of knowledge transfer on R&D performance of parent companies. In both analyses, we set country and industry which subsidiaries belong to, size (the amount of R&D expenditure) of subsidiaries, their role in global R&D operations and autonomy of R&D activities as control variables.

2.2 Results

Our regression analysis yield several interesting results, as presented in Table 1 and 2.

Table 1. Relationship between the type of knowledge transferred and the contribution to parent company's R&D performance

	Contribution to parent company		
	1	2	3
Transfer of explicit K			0.170 (1.846)
Transfer of tacit K			0.230* (2.049)
Transfer of product-related K			0.008 (0.078)
Transfer of process-related K			-0.021 (-0.245)
Transfer of market and customer K			0.232** (3.293)
R&D performance of local subsidiary		0.210** (3.258)	0.163** (2.908)
R&D expenditure	0.041 (0.245)	0.049 (0.297)	0.014 (0.096)

R&D intensiveness	0.053 (0.315)	0.056 (0.344)	-0.020 (0.144)
Major R&D activity	-0.308 (-4.753)	-0.260** (-3.989)	-0.100 (-1.668)
Degree of autonomy	-0.181 (-2.825)	-0.213** (-3.357)	-0.169** (-3.085)
Country dummy	-0.040 (-0.618)	-0.021 (-0.330)	-0.085 (-1.522)
Industry dummy	-0.145 (-2.262)	-.130* (-2.057)	-.119* (-2.087)
Observations	224	224	221
R2	0.137	0.178	0.413
Adjusted R2	0.114	0.151	0.379

Note: **: p<0.01, *: p<0.05

First, the impact of knowledge transfer from foreign subsidiary to parent company is different depending on the type of knowledge. The result shows that the transfer of tacit technological knowledge as well as market-related knowledge have significant positive impacts on the parents' R&D activities ($p<0.05$ and $p<0.01$, respectively), while explicit knowledge transfer itself does not demonstrate such significant effect (see Table 1). This finding is important for R&D managers as they should consider how to convey sticky knowledge difficult to be coded and articulated.

Table 2. The impact of unintended knowledge transfer on the contribution to the parent company's R&D Performance

	Contribution to parent company		
	1	2	3
Unintended knowledge transfer			-0.003 (-0.029)
Squared term of unintended knowledge transfer			-0.275* (-2.479)
R&D performance of local subsidiary		0.210** (3.258)	0.210** (3.043)
R&D expenditure	0.041 (0.245)	0.049 (0.297)	0.051 (0.288)
R&D intensiveness	0.053 (0.315)	0.056 (0.344)	0.054 (0.306)
Major R&D activity	-0.308** (-4.753)	-0.260** (-3.989)	-0.250** (-3.615)
Degree of autonomy	-0.181** (-2.825)	-0.213** (-3.357)	-0.121 (-1.773)
Country dummy	-0.040 (-0.618)	-0.021 (-0.330)	-0.048 (-0.707)
Industry dummy	-0.145* (-2.262)	-.130* (-2.057)	-0.077 (-1.150)
Observations	224	224	192
R2	0.137	0.178	0.217
Adjusted R2	0.114	0.151	0.179

Note: **: p<0.01, *: p<0.05

Second, concerning the pattern of knowledge transfer, the unintended reverse knowledge transfer itself has no significant impact on parent company's R&D performance. However, the squared term of the unintended knowledge transfer from foreign subsidiary to parent has a significant negative impact on the parent's R&D activities ($p < 0.05$) (see Table 2). In other words, there is an inverse U-shaped relationship between unintended reverse knowledge transfer and R&D activities of the parent companies. This implies that the degree of unintended knowledge transfer from subsidiaries renders a significant positive impact on the parent's R&D activities up to a certain point, beyond which it becomes negative.

4 Discussions

The results of this study have demonstrated that the reverse knowledge transfer from foreign subsidiary can actually be beneficial to their parent company's R&D activities, but the effect seems to be different depending on the type of knowledge transferred from subsidiary. The transfer of tacit knowledge as well as market-related one is found to have a higher impact on the subsidiary's contribution to the parent than that of explicit knowledge. These findings are an important contribution to the current literature which lacks investigation into the type of knowledge in the reverse knowledge transfer.

Also, our research results have implied the possibility and challenge of "unintended" knowledge transfer from foreign subsidiary to parent: it can facilitate R&D activities of parent company, but too much transfer has an adverse effect. These are also expected to advance the knowledge on reverse knowledge transfer in the field of global R&D management. Future research may therefore build upon these results to investigate the underlying factors and ascertain any moderating or mediating effect they may have on the relationship between unintended knowledge transfer and R&D performance of MNCs.

From a management perspective, our results suggest that global R&D managers should understand the fact that foreign subsidiaries can generate a variety of knowledge including technological and market, product and process, and tacit and explicit knowledge. Such knowledge should be regarded as critical resources that can enhance organizational capabilities of MNCs in the global context. To create and capture the value from such knowledge, the managers should make inventory of knowledge periodically for future use and transfer within a whole company, put in place appropriate knowledge management, establish ICT systems and, more importantly, a human interaction mechanism for facilitating the transfer of tacit knowledge created in foreign subsidiaries.

One of the most important implications for business managers is about the impact of unintended knowledge transfer. Considering that too less and too much transfer of unintended knowledge can harm R&D activities of parent company, R&D manager shall evaluate carefully which knowledge shall be transferred from foreign subsidiary to parent company.

For policy-makers, our results may promote a shift in mind set about relevance and issues of R&D globalization. Traditionally, the developed economies such as Western countries have concerned that R&D offshoring could lead to "hollowing out" of their

competitiveness (OECD, 1999; Driffield et al., 2016). Our findings imply, however, that R&D globalization does not necessarily erode the competitive advantage of the R&D capabilities in the home countries. Instead, with the appropriate management of knowledge resources and the relevant complementary assets, firms that engage in global R&D activities could bring higher productivity and growth benefits to their home economies.

5 Conclusions

Building on the theoretical ideas of “meta-national” and “knowledge-based” perspectives, we investigated the impact of knowledge transfer from foreign subsidiaries to parent company on the latter’s R&D activities. Our study adds value to existing studies on reverse knowledge transfer by focusing on issues erstwhile un-addressed: the types of knowledge and the patterns of knowledge transfer from subsidiaries to parent company.

Reverse knowledge transfer from foreign subsidiary can be beneficial to their parent company’s R&D activities, but the effect is different depending on the type of knowledge. Our study revealed that the transfer of tacit technological knowledge as well as market-related knowledge have significant positive impacts on the parents’ R&D activities. Also, the degree of unintended knowledge transfer from subsidiaries renders a positive impact on the parent’s R&D activities up to a certain point, beyond which it becomes negative.

To the best of our knowledge, this is the first study to explore the impact of such unintended knowledge transfer using empirical data, contributing to an area that is important but insufficiently studied in the current literature.

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References

- Ambos T.C., Ambos B., Schlegelmich B.B. (2006), "Learning from subsidiaries: An empirical investigation of headquarters' benefits from reverse knowledge transfers". *International Business Review*, vol. 15, pp. 294-312.
- Doz Y., Santos J. (1997), "On the management of knowledge: From the transparency of collocation and co-setting to the quandary of dispersion and differentiation", INSEAD working paper series, Fontainebleau.
- Doz Y., Santos J., Williamson P. (2001), *From global to metanational*, Harvard Business School Press, Boston.
- Driffield N., Love J.H., Yang Y. (2016), "Reverse international knowledge transfer in the MNE: (Where) does affiliate performance boost parent performance?", *Research Policy*, vol. 45, pp. 491–506.
- Frost T.S. (2001), "The geographic sources of foreign subsidiaries' innovations", *Strategic Management Journal*, vol. 22, n. 2, pp. 101-123.

- Grant R.M. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, vol. 17, pp. 109–122.
- Hakanson A. W., Nobel R. (2000), "Technology characteristics and reverse technology transfer", *Management International Review*, vol. 40-1, pp. 29-48.
- Hakanson L. (2010), "The firm as an epistemic community: the knowledge-based view revisited", *Industrial and Corporate Change*, vol. 19, n. 6, pp. 1801–1828.
- Harzing A.W.K., Noorderhaven N. (2006), "Knowledge flows in MNCs: an empirical test and extension of Gupta and Govindarajan's typology of subsidiary roles", *International Business Review*, vol. 15, n. 3, pp. 195–214.
- Mudambi R., Navarra P. (2004), "Is knowledge power? Knowledge flows, subsidiary power and rent-seeking within MNCs", *Journal of International Business Studies*, vol. 35, n. 5, pp. 385–406.
- Piscitello L. Rabbiosi L. (2004), "The impact of MNCs' foreign activities on the innovative performance of the parent companies", working paper, Politecnico di Milano, Milan.
- Piscitello L., Rabbiosi L. (2006), "How does knowledge transfer from foreign subsidiaries affect parent companies innovation capacity?" DRUID Working Paper No. 06-22.
- Rabbiosi L. (2011), "Subsidiary roles and reverse knowledge transfer: An investigation of the effects of coordination mechanisms", *Journal of International Management*, vol. 17, pp. 97-113.
- Rabbiosi L., Santangelo G.D. (2013), "Parent company benefits from reverse knowledge transfer: The role of the liability of newness in MNCs", *Journal of World Business*, vol. 48, pp. 160-170.
- Schotter A. Bontis N. (2009), "Intra-organizational knowledge exchange: An examination of reverse capability transfer in multinational corporations", *Journal of Intellectual Capital*, vol. 10, n. 1, pp. 149-164.
- Spender J.C., Grant R.M. (1996), "Knowledge and the firm: Overview", *Strategic Management Journal*, vol. 17 (Winter Special Issue), pp. 5–9.
- Von Hippel E. (1994), "Sticky information' and the locus of problem solving: Implications for innovation", *Management Science*, vol. 40, pp. 429–439.
- Zhou C., Frost T. (2003), "Centrifugal forces, R&D co-practice, and 'reverse knowledge flows' in multinational firms". Paper presented at AIB annual meeting, 5th–8th July, Monterey, California.

Open Innovation Practices for Product-Service Design

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Abstract

In the shift toward Servitization, the adoption of a Product Service System is a key element in ensuring competitiveness of firms. Nevertheless, an increasing attention must be put on Product Service Systems design, especially on the design of product and service components, together with the effective design of their interaction as a system.

The aim of this study is deepening the interrelationships between the adoption of Open Innovation practices and product-service design. The research involves a stratified sample of 9 companies adopting different categories and degrees of Product Service Systems. The research protocol was built in order to investigate the adoption of Open Innovation practices distinguished in inbound, outbound and coupled practices, with the aim of understanding if there are particular (set of) practices adopted within contexts characterized by different degrees of product-service design relevance. Analysis of results allowed to formulate three different theoretical propositions, linking the relevance and characteristics of Open Innovation practices to certain context of Product Service System adoption.

Keywords – Product Service System Design, Servitization, PSS Tactics, Case study.

Paper type – Academic Research Paper

1 Introduction

Business strategies focused on Product Service System (PSS) directly imply a redesign of the company's value proposition. In this context, PSS design of product-service relationship is a key topic; indeed, PSS can reach its potential only if designed and implemented by a series of firms constituting a focused network (Mont, 2002).

Understanding successful (and unsuccessful) elements in product-service innovation when designing a PSS is a key aspect for research on the topic as the main interest of academia and practitioners is no longer centred on the product sold and its characteristics, but rather on providing solutions (Geng et al., 2010; Song and Sakao, 2016). In their literature review, Reim et al. (2015) found that “scholars tend to discuss PSS business models and implications for implementation using five distinct sets of tactics” (p. 6). These tactical areas involve choices at an operational level for firms, following the decision of adopting a specific business model, and they refer to: *contracts, marketing, network, product and service design, sustainability*. Therefore, the choice of a particular business model will influence the set of available tactics and their importance, according to the context. Among the tactical areas identified, Product/service design plays a relevant role for what concerns Functionality and Customization.

Open Innovation (OI) is “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation, respectively” (Chesbrough et al., 2006). Another important strategy to ensure an effective design of PSS is adopting Open Innovation practices: in fact, the adoption of a perspective focused on OI, involving also the network related to PSSs' providers, allows to reach a wider all-encompassing perspective of the new value proposition.

The research paradigm of OI attracted through years a considerable number of contributions, even from different research fields (Gassman, 2006), involving other topics and dimensions of research such as strategy and leadership. Because of this growth, the topic caused a proliferation of theoretical studies and literature reviews (Elmquist et al., 2009; Huinzig, 2011; Kovacs et al., 2015): however, despite rising numbers of contributions, little has been done to investigate effective implementation of OI in companies (Huinzig, 2011).

Although the adoption of OI practices is a wide phenomenon in many different companies and contexts (Huinzig, 2011), scholars agree upon the existence of difficulties related to their systematic and shared implementation in the organizational context, mainly because of cultural barriers and resistance to change. (Gassman, 2006; Giannopoulou et al., 2011; Chesbrough and Brunswick, 2014).

When considering the adoption of OI practices for a meaningful exploitation of knowledge flows (inside and outside firms' boundaries), managers must take on new decisions related to time, modes, partners, and aims of cooperation (Huinzig, 2011).

2 Research aim and methodology

This work investigates the practices implemented by firms adopting PSS-related Business Models with a focus on collaborative innovation processes. The main research question is:

RQ. How do firms implement OI practices for product-service design?

The aim is conducting a holistic and contextualized investigation on the practical implementation of OI in PSS contexts, so the research is a multiple case study (Yin, 1984; Eisenhardt, 1989) that involved 9 firms and their PSS design processes and practices. Companies are dimensionally different, operates in diverse industries and can be classified in different categories and types of PSS, i.e. Product-Oriented, Use-Oriented and Result-Oriented (Tukker, 2004). These characteristics allowed us to deepen the analysis and to perform a better comparison.

We collected data through semi-structured interviews with a manager (or an equivalent role) in each of the involved companies. After a first set of questions focused on the description/classification of PSS offering (Reim et al., 2015), the interview aimed at understanding the implementation process of the considered PSS cases. First of all, we checked with interviewees for the presence or absence of OI practices according to a list derived from previous works in related literature (Van de Vraende et al., 2009; Battistella et al., 2017); then, we asked interviewees to measure the relevance of tactics connected to product-service design assigning a score (ranging from 1 to 5).

Finally, moving from both literature streams on OI and PSS, we derived a framework for the analysis of PSS design and innovation, matching it with OI practices, as emerging from the interviews.

Selection criteria brought to a stratified sample of firms, whose main characteristics are summarized in Table 1.

Table 1 Sample of selected PSSs

<i>Firm</i>	<i>Country</i>	<i>Industry</i>	<i>Net sales</i>	<i>Size</i>	<i>Contact</i>
PO_1	Netherland	Communications	NA	SME	Financial Manager
PO_2	Sweden	Household appliances	€ 12.92 bln	MNC	R&D Manager
PO_3	Japan	Material handling	€ 1.8 bln	MNC	Manager of After-sale services
UO_1	U.S.	Advertisement	€ 742 mln	MNC	Director of Bik sharing division
UO_2	Italy	Mobility	NA	SME	Fleet Manager
UO_3	Italy	Coworking spaces	NA	SME	Vice Director
RO_1	U.S.	Textile	€ 215 mln	MNC	Vice President of Product and Innovation Department
RO_2	Swiss	Engineering	€ 1.9 bln	MNC	IoT Manager
RO_3	U.S.	ICT	€ 5 bln	MNC	Business Development Manager

Firms in the sample are quite well differentiated according to net sales (from few millions to more than 10 billions), dimensions (3 SME and 6 MNC), industry and country.

3 Theoretical framework of analysis

3.1 OI Practices

Practices of OI have been the main object of analysis for this research. As reported above, they are related to how companies implement OI process: they include all activities and approaches (how these activities are conducted) that companies define, adopt, and deploy, to implement OI (Chesbrough and Crowther, 2006; van de Vrande et al., 2009) into innovation projects/efforts. Consequently, firms adopting more practices proved to be more open in the innovation process (Burcharth et al., 2014): nevertheless, implementation of OI practices and the “degree of openness” varies according to various factors, like specific contexts and strategies pursued by organizations.

According to literature (Battistella et al., 2017), different concepts have been developed to describe how companies put in practice OI: organisational modes (Bianchi et al., 2011), activities (Chesbrough and Brunswicker, 2014; Wynarczyk et al., 2013), methods (de Backer, 2008), and actions (Greco et al., 2015). According to Battistella et al. (2017), practices have been categorised according to three core process models of OI (Chesbrough and Crowther, 2006; West et al., 2014): “(1) outside-in process or Inbound Open Innovation, e.g. crowdsourcing, which allows to source and acquire expertise from the crowd; (2) inside-out process or Outbound Open Innovation, e.g. venturing that aims to create new ventures to sell company’s ideas and resources in the marketplace; and (3) coupled process or coupled Open Innovation, which combines knowledge inflows and outflows between actors such as in building R&D collaborations for joint innovation and exploitation.” (Battistella et al., 2017, p. 7) Table 2 summarizes all the practices retrieved from literature.

Table 2 Open Innovation practices derived from literature

<i>Practice</i>	<i>Definition</i>
<i>Inbound OI</i>	
Contracting with external R&D service / activity providers	Outsourcing / Purchasing R&D services / activities, both technical and scientific, from specialised providers
Crowdsourcing	The act of outsourcing a task in the problem solving process to an undefined crowd, in the form of an open call (Afuah and Tucci 2012), with the aim of obtaining new o reviewed ideas, services or content

External networking	It includes all activities used to acquire and maintain connections with external sources of new knowledge, both individuals and organisations, through both formal contractual collaborations and more general and informal activities
IP in-licensing / inward licensing of IP	Acquiring licenses and then access to external intellectual property rights (e.g., trademarks, patents, copyrights, etc.) via formal licensing agreements
Mass Customisation	“Production of products which have been customised by the customer, at production costs similar to those of mass-produced products”
Mergers and acquisitions	Operations that aim to absorb knowledge and external technology with faster establishment in new markets, while reducing costs and increasing the possibility of releases
Publicly funded R&D consortia	Participation in R&D consortia with other public or private organisations in which R&D activities are fully or partly funded by governmental organisations
Scouting / Searching for / Collecting information from external sources	In this practice are included for example searching internet for new trends or technology, reading technical magazines, collecting information from other organisations
Specialised services from OI intermediaries	Contracting services of intermediary organisations specialised in open innovation to act as intermediaries between a “searcher” – an organisation with an open innovation problem – and “solvers”
Innovation awards and competitions	Invitation to participate in an innovation context where submitting innovative ideas
University research grants	Funding of external research projects by researchers and scientists in universities to access external knowledge
User innovation	Following the theory by von Hippel (1986, 1988) the majority of new products and services are co-developed, or at least refined, by the end user
<i>Outbound OI</i>	
Commercialising / selling technologies	Sale of a market-ready novel product idea to a third party that facilitates the transfer of certain technology / knowledge through a network of contacts
Corporate venture capital or incubators	Offering supportive environments for entrepreneurs in order to develop potentially profitable ideas and to identify novel paths to exploiting technology
Donations to commons or non-profits	Donations to commons or non-profits (e.g., open-source communities) or making patents available for free, in order to support external R&D
IP out-licensing and patent selling / outward licensing of IP	Selling licenses for internal intellectual property rights (e.g., trademarks, patents, copyrights, etc.) to external organisations via formal licensing agreements or via single payment
Minority equity investments	Equity investments, e.g. in university spin-offs or in venture capital investment funds, to develop new projects (or companies) based on ideas originating within the company
Participation in public standardisation	Participation in standardisation activities via formal standardisation agencies (e.g., ISO) or informal standardisation consortia (e.g., OASIS)
Supplying R&D services / activities	Providing / Supplying R&D services / activities, both technical and scientific. It also includes making companies’ own innovations available to others (also for free) and actively participating in other's innovation projects
Venturing (Spin-offs and Spin-outs)	Starting up new ventures founded by company’s employees outside organisational boundaries, drawing on internal knowledge and allowing the exploration of new business to commercialise innovations not used internally, while minimising the negative impacts of entering in for the parent company

Coupled OI

Dyadic / joint co-creation / co-development	Involvement / Integration of one or multiple external innovation creators in a phase of the innovation process (i.e. generation, evaluation, development and/or testing of innovative ideas, products or services)
Joint ventures	Investing in independent joint ventures jointly with external partners, where risks and rewards are negotiated and shared formally
R&D collaborations and strategic / technology alliances / consortia	Cooperation (without equity involvement) between non-competing companies with the aim of pursuing a common innovative objective

Source: Battistella *et al.*, 2017.

3.2 PSS Tactics

In their literature review Reim *et al.* (2015) found that “scholars tend to discuss PSS business models and implications for implementation using five distinct sets of tactics.” (p. 6) These tactical areas involve choices at an operational level for firms, following the decision of adopting a specific business model. Following, the choice of a particular business model will influence the set of available tactics and their importance, according to the context.

Five tactical areas summarize all the key aspects of PSS business models: *contracts*, *marketing*, *network*, *product and service design*, and *sustainability*. For the purposes of our study, we selected only the tactics from the area of *product and service design*.

Table 3 summarizes the two selected tactics and their characteristics for the three different categories of PSS.

Table 3 Product and service design tactics derived from literature

		<i>Product Service System</i>		
		<i>Product-Oriented</i>	<i>Use-Oriented</i>	<i>Result-Oriented</i>
<i>Product and service design</i>	Functionality	<ul style="list-style-type: none"> • Easy to maintain • Easy to reuse • Improved reliability 	<ul style="list-style-type: none"> • Easy to maintain • Increased durability • Easy upgrading and remanufacturing • Reliable service provision 	<ul style="list-style-type: none"> • Significantly large opportunities • High flexibility
	Customisation	<ul style="list-style-type: none"> • Very limited 	<ul style="list-style-type: none"> • Some customization for large customers 	<ul style="list-style-type: none"> • High degree of customization

Source: Reim *et al.*, 2015.

Following, to each tactic was assigned a score from 1 to 4 representing its relevance in the cases considered.

4 Results of the analysis and discussion

The sample of 9 cases has been analysed in accordance with the framework presented in the previous section. Table 4 below summarizes results emerged from the analysis of cases, with OI practices retrieved together with relevant tactics for product and service design.

Table 4 Results of the analysis

		<i>Product-Oriented</i>			<i>Use-Oriented</i>			<i>Result-Oriented</i>		
		<i>PO_1</i>	<i>PO_2</i>	<i>PO_3</i>	<i>UO_1</i>	<i>UO_2</i>	<i>UO_3</i>	<i>RO_1</i>	<i>RO_2</i>	<i>RO_3</i>
<i>OI Practices</i>	<i>Inbound</i>									
	Contracting with external R&D/activities providers	X	X	X	X			X	X	X
	Crowdsourcing									
	External networking	X	X	X	X	X	X	X	X	X
	Inward licensing of IP				X	X			X	
	Mass customization	X								
	Mergers and acquisitions									
	R&D consortia				X	X				
	Collecting information from external sources	X			X		X	X		X
	Services from OI intermediaries									
	Awards and competitions									
	Research grants									
	User innovation	X					X			
	<i>Outbound</i>									
	Commercialising technologies		X	X						
	Corporate venture capital or incubators						X			
	Donations to commons or non-profit									
	Outward licensing of IP									
	Minority equity investments									
	Participation in public standardisation									
	Supplying R&D services/activities									
	Venturing									
	<i>Coupled</i>									

	Joint co-creation/co-development	X			X	X	X	X	X
	Joint ventures								
	R&D collaborations and strategic alliances	X			X	X	X	X	X
<i>PSS Tactics</i>	<i>Product and Service design</i>								
	Functionality	3	1	1	3	3	4	2	3
	Customization	4	1	1	1	1	2	2	3

What immediately emerges is that there is a weak adoption of outbound practices, which is mainly due to the importance of Intellectual Property (IP) in PSSs: indeed, this is what ensures a competitive advantage for firms focusing on a mixed offering of products and services.

Maintaining control (as far as possible) over IP is a key aspect for firms to secure their position over competitors: this is the case for example of car-sharing BM, where the technology implemented (linked to cars' functionality and ease of rent for customers) plays an important role for the success of the overall offering.

The only cases of firms commercialising technology are PO_2 and PO_3, but this is connected to the specific choice of companies of outsourcing all maintenance services to external partners: we can therefore state that in this case outbound practices give a non-negligible contribution to the adoption of the considered PSSs, but since there is no great relevance of *Functionality* and *Customization*, no inference can be made upon the adoption of these OI practices. Furthermore, the only other practices founded in those cases are connected to the provision of external activities and external networking, and are related again to the need of providing maintenance services.

The great majority of cases adopt coupled practices of OI, and both practices named "Joint co-creation/co-development" and "R&D collaborations and strategic alliances" are always recurring in pair. Only in PO_2, PO_3 and RO_3 these practices are not implemented, because in those cases PSS offering is almost entirely based on technologies internally developed, and firms operate in stable markets. Furthermore, these cases are showing the lowest degrees of importance for tactics related to Product and Service design.

Inbound practices are those mostly adopted, with Use-Oriented category presenting the highest number of practices involved. The "External networking" practice has been adopted by all companies involved in this study, and this allows to state that networking surely plays a key role in PSS adoption, even if with different extents. Considering that the Use-Oriented category is the one with the highest relevance of tactics linked to Product and Service design, we can therefore state that:

Proposition_1: the adoption of Open Innovation practices is particularly relevant in Product and Service design for Use-Oriented PSSs.

In Product-Oriented cases only the first company (PO_1) adopts a variety of practices, and is the only case implementing “Mass customization” and “User innovation”: the firm offers a new modular and fair smartphone, with a high degree of innovation, as demonstrated also by the highest scores in “Extent of innovation”, “Functionality” and “Customization” tactics. By comparing this evidence to the other two PO cases (with the lowest scores in the above tactics), we can see how the innovation potential of the offering and its “disruptive nature” highly influence the adoption of “invasive” OI practices, like for instance “Mass customization” and “User innovation”.

A similar result can be observed also for UO_3 case, where the firm’s offering is focused toward the provision of coworking spaces and is linked to the adoption of “User innovation” practice: this case presents the second-highest score for the tactics cited above, confirming what stated in the case of PO category, and allowing for a generalization of the results.

Since the cases presented above present the highest scores attributed to the tactics for Product and Service design, it is possible to make an inference on the relationship between the innovativeness of the offering and the adoption of OI practices, according to the following:

Proposition_2: the degree of innovativeness of the offering is a key determinant for the adoption of Open Innovation practices, and is closely linked to a higher degree of customer involvement in the design process.

UO_1 and UO_2 are the only cases where “R&D consortia” practice was retrieved: this is linked to the difficulties that a single firm faces when developing sharing-based BM, i.e. bike sharing (UO_1) and car sharing (UO_2). Some particular business models require a wide variety of competences and contributions to be effectively implemented, and it is crucial for firms understanding under which modes and conditions there can be a win-win cooperation with partners, in order to deliver the best offering and being competitive in markets that present a high degree of uncertainty and risk. This statement is supported also by the adoption of “Inward licensing of IP”, giving another evidence of how crucial is cooperation with partners in some PSS cases. According to this finding, we can derive a third proposition:

Proposition_3: cooperation with commercial partners through Open Innovation practices is a key requirement for the successfully delivering offerings based on the “sharing” formula.

Result-Oriented cases do not present particular trends nor specific and different practices: all three adopted both “Contracting with external R&D/activities providers” and “External networking”, proving that (as already stated) cooperating with peers and suppliers is a key element when providing solutions to customers instead of “stand-alone” products. RO_2 case is one of the few cases inwardly licensing IP: this is a case of an IoT solution in B2B market, an offering characterised by high innovative content, as proved by tactics related to this aspect.

5 Conclusions

Data gathered allowed us to conduct comparisons between the involved cases, and the performed analysis brought to the identification of interesting findings, which shed light of interrelationships between PSS adoption and OI practices implementation.

An interesting result emerging from the analyses performed is that there is no adoption (except few examples) of outbound OI practices in PSS-related BM, with the exclusive adoption of inbound and coupled practices, mainly concerning network and alliances constitution.

Another important result emerged is about a correlation (according to cases) between the innovative potential of PSS, depending on specific offering's characteristics, and a tendency toward openness and adoption of OI practices. Indeed, cases like PO_1 (modular smartphone) and UO_3 (coworking spaces), found out to be the more concerned toward OI and chances it offers, for example by involving customers and adopting mass customization solutions.

Furthermore, also cooperation with partners proved to be a key element when developing sharing-based offerings (e.g. bike-sharing and car-sharing).

Linking the two concepts of OI and PSS is important because it helps in understanding how PSS adoption and implementation can benefit from the employment of OI practises, according to different organizational forms and offerings.

Many studies focused on different aspects of OI, offering useful insights and proposing frameworks to support decision making: this work sets out a contribution for managerial and research implications by giving more detailed insights on how to deploy which open innovation practice. This research opens up a series of new and useful research directions for scholars, and a series of considerations for practitioners, linked to an effective exploitation of OI practices in the specific context of PSS.

References

- Annarelli, A., Battistella, C., Nonino, F., 2016. "Product Service System: A conceptual framework from a systematic review." *Journal of Cleaner Production* 139: 1011-1032.
- Baines, T.S., Lightfoot, H., Steve, E., Neely, A., Greenough, R., Peppard, J., Roy, R. et al. 2007. "State-of-the-art in product-service systems." *Proceeding of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture* 221(1): 1543-1552.
- Battistella, C., De Toni, A.F., Pessot, E., 2017. "Practicing Open Innovation: A framework of reference." *Business Process Management Journal*. Article in press.
- Bellantuono, N., Pontrandolfo, P., Scozzi, B., 2013. "Different practices for open innovation: a context-based approach." *Journal of Knowledge Management* 17 (4): 558-568.
- Beuren, F.H., M.G.G. Ferreira, and P.A.C. Miguel. 2013. "Product-service systems: a literature review on integrated products and services." *Journal of Cleaner Production* 47: 222-231.
- Burcharth, A.L.D.A., Knudsen, M.P., Søndergaard, H.A., 2014. "Neither invented nor shared here: the impact and management of attitudes for the adoption of open innovation practices." *Technovation* 34 (3): 149-161.

- Chesbrough, H. "Open Innovation: A New Paradigm for Understanding Industrial Innovation." In *Open Innovation: Researching a New Paradigm*, eds. H. Chesbrough, W. Vanhaverbeke, and J. West. Oxford University Press, Oxford, 2006.
- Chesbrough, H., Brunswicker, S., 2014. "A Fad or a Phenomenon? The Adoption of Open Innovation Practices in Large Firms." *Research-Technology Management* 57 (2): 16-25.
- Chesbrough, H.W., Crowther, A.K., 2006. "Beyond high-tech: early adopters of Open Innovation in other industries." *R&D Management* 36 (3): 229-236.
- Cook, M., T.A. Bhamra, and M. Lemon. 2006. "The transfer and application of Product Service Systems: from academia to UK manufacturing firms." *Journal of Cleaner Production* 14: 1455-1465.
- Dahlander, L., Gann, D.M., 2010. "How open is innovation?" *Research Policy* 39: 699-709.
- de Backer, K. *Open innovation in global networks*, OECD Publications, Paris, 2008.
- Eisenhardt, K.M., 1989. "Building theories from case study research." *Academy of Management Review* 14: 532-550.
- Elmquist, M., Fredberg, T., Ollila, S., 2009. "Exploring the field of open innovation." *European Journal of Innovation Management* 12 (3): 326-345.
- Enkel, E., Gassmann, O., Chesbrough, H., 2009. "Open R&D and open innovation: Exploring the phenomenon." *R&D Management* 39 (4): 311-316.
- Gassmann, O., 2006. "Opening up the Innovation Process: Towards an Agenda." *R&D Management* 36 (3): 223-228.
- Giannopoulou, E., Yström, A., Ollila, S., 2011. "Turning Open Innovation into Practice: Open Innovation Research through the Lens of Managers." *International Journal of Innovation Management* 15 (3): 505-524.
- Greco, M., Grimaldi, M., Cricelli, L., 2015. "Open innovation actions and innovation performance: A literature review of European empirical evidence." *European Journal of Innovation Management* 18 (2): 150-171.
- Huinzig, E.K.R.E., 2011. "Open innovation: State of the art and future perspectives." *Technovation*, 31: 2-9.
- Kovacs, A., Van Looy, B., Cassiman, B., 2015. "Exploring the scope of open innovation: a bibliometric review of a decade of research." *Scientometrics* 104 (3): 951-983.
- Lockett, H., M. Johnson, S. Evans, and M. Bastl. 2011. "Product Service Systems and supply network relationships: an exploratory case study." *Journal of Manufacturing Technology Management* 22 (3): 293-313.
- Mont, O. 2002. "Clarifying the concept of product-service system." *Journal of Cleaner Production* 10: 237-245.
- Park, H., and J. Yoon. 2015. "A chance discovery-based approach for new product-service system (PSS) concepts." *Service Business* 9: 115-135.
- Piller, F., West, J. "Firms, Users, and Innovation: An Interactive Model of Coupled Open Innovation", *New Frontiers in Open Innovation*, eds. H. Chesbrough, W. Vanhaverbeke, and J. West. Oxford University Press, Oxford, 2014.
- Reim, W., Parida, V., Örtqvist, D., 2015. "Product-Service Systems (PSS) business models and tactics - a systematic literature review." *Journal of Cleaner Production* 97: 61-75.
- Schramm, W.D. "How communication works." in *The Process and Effects of Mass Communication*, eds. W.D. Schramm. Urbana, University of Illinois Press, 1971.
- Tukker, A., 2004. "Eight types of product-service system: eight ways to sustainability? Experience from SusProNet." *Business Strategy and the Environment* 13: 246-260.
- Van de Vrande, V., de Jong, J.P.J., Vanhaverbeke, W., de Rochemont, M., 2009. "Open innovation in SMEs: Trends, motives and management challenges." *Technovation* 29 (6-7): 423-437.

- Velamuri, V.K., B. Bansemir, A.K. Neyer, and K.M. Möslin. 2013. "Product service systems as a driver for business model innovation: lessons learned from the manufacturing industry." *International Journal of Innovation Management* 17 (1): 1-25.
- West, J., Salter, A., Vanhaverbeke, W., Chesbrough, H., 2014. "Open innovation: The next decade." *Research Policy* 43 (5): 805-811.
- Wynarczyk, P., Piperopoulos, P., McAdam, M., 2013. "Open innovation in small and medium-sized enterprises: An overview." *International Small Business Journal* 31 (3): 240-255.
- Yin, R.K. *Case study research: Design and methods*, 2nd ed. Sage, Newbury Park, CA, Applied Social Research Method Series, 1994.

Knowledge Translation in the Football Industry: a Primary Study

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Abstract

Knowledge translation activated by knowledge-intensive organizations is supported by several factors among which intangibles assets. This paper aims at analysing knowledge translation and organisational performance in the football industry, discovering both the role of professional football players' skills transfer and determinants helping to achieve positive performance at organizational level.

The research question is answered through a quantitative method using both the multiple regression analysis and the network analysis. This research investigates the performance of the professional football players before and after the transfer process from a club (source organization) to another club (recipient organization) in order to analyse the intra-organizations dynamics.

We try to understand which factors are helping knowledge and specialist knowledge to be transferred and to contribute to the successful run of organisations in the football industry.

We show the need for the coexistence of variables' combinations to achieve the transferability of professional football players' capabilities and performance.

The results of this paper are for academic community, practitioners and policy makers as theoretical and practical advances.

Keywords: knowledge translation, drivers, performance, intangibles, football industry.

1 Introduction

Knowledge transfer processes and knowledge-intensive organizations are investigated under several perspectives (Argote et al., 2000; Lombardi, 2019; Secundo et al., 2019). In this scenario, the knowledge flows activated by several actors become a key issue analysing the interplay internal-external organizations context, recognizing phases and forms of knowledge translation (Graham et al., 2006; Seaton, 2002). Knowledge translation activated by knowledge-intensive organizations is supported by several factors (Krylova et al., 2016; Lönnqvist, Laihonen, 2017) among which intangibles assets (Wiig, 1997). In the football industry, intangibles assets also recognized as intellectual capital (IC) and it assume several forms: players, brands, taking part in specific competitions, information and communication technology (Trequattrini et al., 2017), along with improvements to business processes affecting performance and competitiveness. Thus, the impact of knowledge translation and the identification of factors fostering knowledge transferring supports the successful run of contemporary organisations in all economic sectors.

In this direction, our research investigates the relationship between knowledge owned by human resources belonging to source organizations and its translation processes towards recipient organizations. Thus, this paper aims at analysing knowledge translation and organisational performance (Lombardi, 2019; Trequattrini et al., 2018) in the football industry, discovering both the role of professional football players' skills transfer and determinants helping to achieve positive performance at organizational level. This research is directed to discover factors of intra-organizations (professional football clubs) dynamics in the knowledge translation processes. Thus, we investigate how professional football players incorporate specialist knowledge during a staying period in a club (source organizations) and consequently how it is translated into the new club (recipient organizations) when professional football players are transferred.

The research question is answered through a quantitative method (Anderson et al., 2012; Bell et al., 2018) using both the multiple regression analysis and the network analysis (Carrington et al., 2005). Particularly, data are collected from professional websites and analysed through two phases. In the first phase, we identify our sample. In the second phase, we identify the professional football club performance before and after the players' transfer using the framework by Nakauchi et al. (2017). We understand which factors are helping knowledge and specialist knowledge to be translated and to contribute to the successful run of knowledge-intensive organisations in the football industry. Results of our analysis serves all economic sectors and are directed to academic and practical communities as well as to policy makers as theoretical and practical advances.

The remainder of the paper is organised as follows: Sections 2 and 3 examines literature. Section 4 presents the research methodology. Section 5 presents primary evidence, discussion and conclusions.

2 Knowledge Transfer and Knowledge Translation

Scholars investigate knowledge transfer intra and inter organizations (Argote, Guo, 2016; Chen et al., 2014; Gil, Carrillo, 2016; Jones, Mahon, 2018; Lombardi, 2019; Secundo et al., 2019) owing to its impact on organizational performance and business processes. Argote and Ingram (2000) stated that “Knowledge transfer in organizations is the process through which one unit (e.g., group, department, or division) is affected by the experience of another.”. Thus, knowledge transformation assumes several forms fostering replication and adaptation (Williams, 2007), becoming knowledge translation (Simeone et al. 2017).

Although knowledge is transferred among actors in several ways among which social practices (von Krogh, 2012), tacit vs explicit (Nonaka, Takeuchi, 1995), the knowledge flows is intended as the interplay internal-external organizations context, recognizing knowledge translation (Graham et al., 2006; Seaton, 2002). Simeone et al. (2017) asserted that knowledge translation “involves processing new knowledge, interpreting it according to the needs and interests of a specific organization and transforming it into forms that are more suitable for the specific organizational context of application”. Albino et al. (1998) argued that the knowledge transfer’s objective among individuals or organizations allow them to acquire new knowledge.

Additionally, Lombardi (2019) argued “The current knowledge economy highlights the relevance of understanding if knowledge is transferable as well as which are variables influencing organizational performance in all types of companies including start-ups companies requiring new forms of financial funds (Lombardi et al., 2016). Thus, KT into the organization and business processes is relevant to achieve high performance, innovation processes and competitive advantages.”. Thus, the understanding of factors or variables influencing KT is a key issue. For example, Milagres and Burcharth (2019) analyse KT in inter-organizational partnership, proposing main factors influencing KT among which macro-environmental (e.g. industrial policy, intellectual property regime), inter-organizational (e.g. synergy-seeking motives), organizational (e.g. capabilities, intangible resources, behavioural aspects and internal processes) and individual levels (e.g. motivation, emotions, learning behaviour). Thus, KT is investigated also in the measurement perspective among which the KT Curve exists (De Luca, Cano Rubio, 2019).

3 The role of human resources in knowledge-intensive organizations

In the knowledge economy (Powell, Snellman, 2004; Sullivan, 2000), the business management is increasingly concerned with intangible resources as fundamental assets increasing the total value of organisations in the long-term (Lombardi et al., 2016; Teece, Pisano, 1998). Knowledge is an intangible asset and it represents a resource capable of generating new knowledge (Stewart, Ruckdeschel, 1998). Thus, the process of knowledge creation and knowledge transfer inter and intra organisations have been covered by several studies (Ajith Kumar et al., 2009; Alipour et al., 2011; Guechtouli et al., 2012).

Knowledge transfer is a complex topic concerned with the organisation, creation, capture and distribution of knowledge, ensuring that it is available for future users (Lee, 2010).

In this direction, many scholars (Jacob, 2014; Lundvall, Rodrigues, 2002) examine knowledge and the strategic role of human capital (HC). HC represents a relevant determinant of corporate competitive advantage (Becker, 1964; Lev, Schwartz, 1971; Lombardi, Dumay, 2017; Nonaka, 1994) and it involves the set of abilities, capacities and knowledge owned by human resources within the organisation. Thus, the most successful companies manage human resources efficiently, providing incentives to invest in the skills' development.

Knowledge-intensive organizations base their activities on the interaction of intangible components (Aureli et al., 2019; Nikitina, Lapina, 2019). Thus, human resource management becomes a business strategy because competitive advantage is built on the ability and talent of a company's most productive staff (Becker, 1964). According to Becker (1964), a clear distinction between two types of human capital exists: general skills and firm-specific skills. Human resource general skills refer to abilities and expertise applied in very differentiated contexts, as they are highly flexible and adaptable. Human capital skills (firm-specific) refer to specific distinctive skills having an exclusive value related to the environment in which they were generated.

Thus, human resources are investigated in the light of their skills becoming knowledge workers (Blair and Kochan, 2002; Drucker, 1998; Tapscott, 1996; Blackler, 1995; Williamson, 1979). Groysberg (2012) states that HC (general type) can easily be transferred from one setting to another, while firm-specific human capital will only ever be productive in the environment in which it was formed. However, knowledge workers' skills used in to organizations allows identifying great talent workers called "stars workers" (Marshall, 1920; Rosen, 1983; Simonton, 1999). Thus, stars workers performance is transferable from one organisation to another (Groysberg, 2012).

Human resources are also recognized as "a source of competitive advantage in that it is competitively unique and makes a contribution to value and or cost. But whereas all core competencies are sources of competitive advantage, not all competitive advantages are core competencies" (Hamel, 1994, p.18). Companies, in order to safeguard a stable and lasting competitive advantage must counter the growing dynamism that characterizes the social, economic and political context. Therefore, the need to develop dynamic capabilities (Teece, 2007) or the ability to integrate, build and reconfigure internal and external resources and skills in response to rapid environmental changes is found.

Highly specific resources within the organisations cannot be transferred because they lose part of their value if used in a different context from the one in which they were created and accumulated (Dierickx, Cool, 1989). Therefore, if workers' skills can be easily transferred from one organisation to another organization, they are not a source of competitive advantage, since the consequence would be that individuals could leave their organisation at any moment and so deprive it of its acquired competitive advantage. With the emergence of the *War for Talent* (Florida, 2006; Groysberg, 2012), companies no longer make do with "second league players" and are busy attracting talented people with incentives such as paying them very high salaries. Modern organisations invest

considerable effort and resources into the process of recruiting, developing and retaining the most talented people, those with key skills, to contribute most in achieving high levels of performance (Tarique, Schuler, 2010).

4 Methodology

We use a quantitative methodology (Anderson et al., 2012) based on the multiple regression analysis and the network analysis (Carrington et al., 2005) to answer our research question as follow:

RQ1: What are factors of knowledge translation contributing to the successful performance of knowledge-intensive organisations?.

We define the football industry as the sector in which we conduct the analysis. Particularly, data are collected from the professional websites. Using the multiple regression analysis, the first phase of this research is directed to compose our sample selecting the football players that were moved in a new club in three seasons. In the second phase, the professional football club performance is identified before and after the player's transfer, to analyse performance's similarities and differences between inter-groups (professional football clubs). Additionally, this research investigates the performance of the professional football player before and after the transfer from a club to another club in order to analyse the intra-group dynamics.

Lastly, we use the framework by Nakauchi et al. (2017) to identify factors influencing the transferability of professional football players' capabilities and performance. This framework was chosen because it specifically focuses on the understanding of knowledge flows. The authors uses "five key aspects of KT within an organization: the knowledge itself, the knowledge recipient, the knowledge source, the relationship between the recipient and the source, and the structure of the network." (Nakauchi et al., 2017).

3.1 Research context, sample, data collection and analysis

The football industry is an entertainment sectors (Beech, Chadwick, 2004; Söderman, Dolles, 2013). In Italy, the football industry represents the main sport with 32 millions euros of fans and 4 millions euros of sport players (Report Calcio, 2018). Italian professional football contributes around 7% to the GDP and it is directed to produce goods and services for society. Thus, professional football clubs are assimilated to cultural enterprises and they are knowledge-intensive organizations (Aureli et al., 2019; Trequattrini et al., 2017) supported by the intangibles interactions.

To compose our sample we selected the population of professional football clubs participating to the "Big Five" Leagues (Report Calcio, 2018) in the European scenario, choosing all strikers transferred during one season. We selected strikers participating to at least 50% of European Leagues' matches, retrieving the market value of two seasons. Additionally, we assumed related data for each striker useful to conduct the analysis. Thus, our sample is composed of around 3-4% of professional football players from selected clubs in the European scenario.

In this way, we applied the multiple regression analysis and the network analysis to our sample to investigate the knowledge translation phenomenon. Using the multiple regression method, we investigated the transferring process of professional football players through: i) Output Variable. We defined this variable as the difference between professional football players' performance before and after their transferring; ii) Input Variable. We defined this variable through the variables by Nakauchi et al. (2017) framework. Additionally, we're going to use the network analysis applied to data of our sample in the third phase of our research.

5 Primary evidence, discussion and conclusions

Using the Nakauchi et al. (2017) framework, this paper is based on the quantitative approach to understand factors affecting the transferability of professional football players' capabilities and performance. Particularly, we answer the question: "*RQ1: What are factors of knowledge translation contributing to the successful performance of knowledge-intensive organisations?*".

Through primary evidence of our quantitative analysis, we firstly assume that there are not positive correlations data. Thus, the KT of professional football players is not confirmed. Such results mainly depend from the context in which players are working. In fact, professional football companies are systems producing goods and services for society. Their resources have to be combined efficiently to achieve fixed objectives.

Thus, professional football clubs are entertainment companies identified also as knowledge-intensive organizations (Aureli et al., 2019; Trequattrini *et al.*, 2017) based on the intangible assets interaction (players, brands, taking part in specific competitions, information and communication technology). Professional football clubs have a high roles specialization and they need of high flexibility and auto-coordination in the several phases of matches.

Thus, organizational model of professional football clubs is similar to small and medium enterprises (SMEs) ones in which several requirements exists. Particularly, they need qualified human resources (Becker, 1964; Lev, Schwartz, 1971; Lombardi, Dumay, 2017; Nonaka, 1994), advanced and specific competences, human resources able to cover several rules in the light of small dimensions and the activity's interdependence. Hence, interaction among intangibles resources in the professional football clubs justifies the influence of activities and results of a player on the team performance. In this perspective, team performance and player performance depend from the ability of the team members (all players) to assume well-organized and coordinated working behaviours.

The results of the analysis provide both theoretical and practical contributions to the existing literature (Argote, Guo, 2016; Chen et al., 2014; Gil, Carrillo, 2016; Jones, Mahon, 2018; Lombardi, 2019; Nakauki et al., 2017; Simeone et al. 2017). Interestingly, our results can be used academic community, practitioners and policy makers as practical advances supporting the knowledge translation theories. The limitations of our paper derive from the analysis of only the striker figure among the football players' roles.

Future research is directed to complete the analysis and to investigate and compare more football seasons and different champions all over the world.

References

- Albino, V., Garavelli, C. and Schiuma, G. (1998), "Document Knowledge transfer and inter-firm relationships in industrial districts: the role of the leader firm", *Technovation*, Vol. 19 No. 1, pp. 53-63.
- Ajith Kumar, J. and Ganesh, L. S. (2009), *Research on knowledge transfer in organizations: a morphology*, *Journal of Knowledge Management*, Vol. 13, No. 4, pp. 161-174.
- Alipour, F., Idris, K. and Karimi, R. (2011), *Knowledge creation and transfer: Role of learning organization*, *International Journal of Business Administration*, Vol. 2, No. 3, p. 61.
- Anderson, D., Sweeney, D., Williams, T., Camm, J. and Cochran, J., (2012) *Quantitative methods for business*, Cengage Learning EMEA, London.
- Aureli S., Giampaoli D., Ciambotti M., Bontis N. (2019), "Key factors that improve knowledge-intensive business processes which lead to competitive advantage", *Business Process Management Journal*, Vol. 25, No. 1.
- Argote L., Ingram P. (2000), *Knowledge Transfer: A Basis for Competitive Advantage in Firms*, *Organizational Behavior and Human Decision Processes*, 82(1), pp. 150-169.
- Argote L., Guo J.M. (2016), *Routines and transactive memory systems: Creating, coordinating, retaining, and transferring knowledge in organizations*, *Research in Organizational Behaviour*, Vol. 36, pp. 65-84.
- Barney, J.B. (1986), *Organizational culture: can it be a source of sustained competitive advantage?*, *Academy of Management Review*, Vol. 11, No. 3, pp. 656-665.
- Barney, J. B. (1991), "Firm resources and sustained competitive advantage", in *Journal of Management*, Vol. 17, No. 1
- Becker, G.S. (1964), *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, University of Chicago Press, Chicago.
- Beech, J. and Chadwick, S. (Eds) (2004), *The Business of Sport Management*, Pearson Education, Harlow.
- Blackler, F. (1995), *Knowledge, knowledge work and organizations: An overview and interpretation*, *Organization studies*, Vol. 16, No. 6, pp. 1021-1046.
- Blair, M.M. and Kochan, T. A. (Eds.) (2002), *The new relationship: Human capital in the American corporation*, Brookings Institution Press, Washington, DC.
- Carrington, P. J., Scott, J., Wasserman, S. (Eds.). (2005). *Models and methods in social network analysis* (Vol. 28). Cambridge university press.
- Chen C.J., Hsiao Y.C., Chu M.A. (2014), *Transfer mechanisms and knowledge transfer: The cooperative competency perspective*, *Journal of Business Research*, 67, pp. 2351-2541
- De Luca P., Cano Rubio M. (2019), *The curve of knowledge transfer: a theoretical model*, *Business Process Management Journal*, Vol. 25, No. 1
- Dierickx, I. and Cool, K. (1989), *Asset stock accumulation and sustainability of competitive advantage*, *Management Science*, Vol. 12, No. 35, pp. 1504-1511.
- Drucker, P.F. (1998), *On the profession of Management*, Harvard Business School Press, Cambridge, MA.
- Florida, R. (2006), *The flight of the creative class: The new global competition for talent*, Collins, New York.

- Graham, I.D., Logan, J., Harrison, M.B., Straus, S.E., Tetroe, J., Caswell, W. and Robinson, N. (2006), "Lost in knowledge translation: time for a map?", *Journal of Continuing Education in the Health Professions*, Vol. 26 No. 1, pp. 13-24.
- Gil A.J., Carrillo F.J. (2016), Knowledge transfer and the learning process in Spanish wineries, *Knowledge Management Research and Practice*, Vol. 13, No. 1, pp. 60-68
- Groysberg, B. (2012), *Chasing stars: The myth of talent and the portability of performance*, Princeton University Press, Woodstock, Oxfordshire.
- Guechtouli, W., Rouchier, J. and Orillard, M. (2012), *Structuring knowledge transfer from experts to newcomers*, *Journal of Knowledge Management*, Vol. 17 No. 1, pp. 47-68.
- Krylova, K.O., Vera, D., Crossan, M. (2016), Knowledge transfer in knowledge-intensive organizations: the crucial role of improvisation in transferring and protecting knowledge, *Journal of Knowledge Management*, Vol. 20, No. 5, pp. 1045-1063.
- Hamel, G., "The concept of core competence" in G. Hamel, A. Heene (eds.), *Competence-based competition*, John Wiley & Sons Inc., Chichester, 1994
- Jacob, M.C. (2014), *The first knowledge economy: human capital and the European economy, 1750–1850*, Cambridge University Press, United Kingdom.
- Jones N.B, Mahon J.F. (2018), Knowledge transfer and innovation, Taylor&Francis.
- Lee, M.C. (2010), *Knowledge-Based New Product Development through Knowledge Transfer and Knowledge Innovation*, in Howlett, R., J. (2010), *Innovation through Knowledge Transfer*, pp. 303-320
- Lev, B. and Schwartz, A. (1971), *On The Use of the Economic Concept of Human Capital in Financial Statements*, *The Accounting Review*, Vol. 46, No. 1, pp. 103-112.
- Lombardi R. (2019), Knowledge transfer and organizational performance and business process: past, present and future researches, *Business Process Management Journal*, 25(1).
- Lombardi R., Dumay J., *Guest editorial: Exploring corporate disclosure and reporting of intellectual capital: Revealing emerging innovations*, *Journal of Intellectual Capital*, vol. 18, n. 1, 2017, pp. 2-8.
- Lombardi R., Dumay J., Lardo A., Trequattrini R., *Modern trends for the strategic use of Intellectual Property Rights: dynamic IP portfolio management, open innovation and collaborative organizations*, in *Managing Globalization. New Business Models, Strategies and Innovation of Firms*, Cambridge Scholars Publishing, 2016, pp. 114-137.
- Lönnqvist, A., Laihonen, H. (2017), Management of knowledge-intensive organisations: What do we know after 20 years of research?, *International Journal of Knowledge-Based Development*, Vol. 8, No. 2, pp. 154-167.
- Lundvall, B.A. and Rodrigues, M.J. (Eds) (2002), *The New Knowledge Economy in Europe: a strategy for international competitiveness and social cohesion*, Edward Elgar Publishing Limited, Cheltenham, UK.
- Marshall, A. (1920), *Principles of Economics*, Macmillan for the Royal Economic Society, New York.
- Milagres R., Burcharth A. (2019), Knowledge Transfer in Interorganizational Partnerships: What Do We Know?, *Business Process Management Journal*, Vol. 25, No. 1.
- Nakauchi, M., Washburn, M. and Klein, K. (2017), Differences between inter- and intra-group dynamics in knowledge transfer processes, *Management Decision*, 55 (4), 766-782.
- Nikitina, T., Lapiņa, I. (2019), Creating and managing knowledge towards managerial competence development in contemporary business environment, *Knowledge Management Research and Practice*, Vol. 17, No 1-2, pp. 96-107.
- Nonaka, I. and Takeuchi, H. (1995), *The knowledge-creating company*, Oxford University Press, New York.
- Peteraf, M.A. (1993) "The cornerstones of competitive advantage: a resource-based view", *Strategic management journal*, Vol. 14, No. 3, pp. 179-191.

- Powell, W.W. and Snellman, K. (2004), *The knowledge economy*, Annual Review of Sociology, Vol. 30, pp. 199-220.
- Raven, R. P., Verbong, G. P., Schilpzand, W. F., & Witkamp, M. J. (2011). Translation mechanisms in socio-technical niches: a case study of Dutch river management. *Technology Analysis & Strategic Management*, 23(10), 1063-1078.
- Rosen, S. (1981), *The economics of superstars*, The American Economic Review, Vol. 71, No. 5, pp. 845-858.
- Seaton, R.A.F. (2002), "Knowledge transfer", Strategic tools to support adaptive, integrated water resource management under changing conditions at catchment scale - a co-evolutionary approach, The AQUADAPT project, Bedford.
- Secundo G., Toma A., Schiuma G., Passiante G. (2019), Knowledge Transfer in Open Innovation: a classification framework for Healthcare Ecosystems, *Business Process Management Journal*, Vol. 25, No. 1.
- Simeone, L., Secundo, G., Schiuma, G. (2017), Knowledge translation mechanisms in open innovation: the role of design in R&D projects, *Journal of Knowledge Management*, 21 (6), 1406-1429.
- Simonton, D.K. (1999), *Origins of genius: Darwinian perspectives on creativity*, Oxford University Press, New York.
- Stewart, T. and Ruckdeschel, C. (1998), *Intellectual capital: The new wealth of organizations*, Performance Improvement, Vol. 37, No. 7, pp. 56-59.
- Sullivan, P.H. (2000), *Value driven intellectual capital: how to convert intangible corporate assets into market value*, John Wiley & Sons, Inc., New York, USA.
- Söderman, S. and Dolles, H. (Eds) (2013), *Handbook of Research on Sport and Business*, Edward Elgar Publishing, Cheltenham.
- Taylor G.R. (2005), *Integrating Quantitative and Qualitative Methods in Research*; University Press of America, Oxford, UK.
- Tapscott, D. (1996), *The digital economy: Promise and peril in the age of networked intelligence*, McGraw-Hill, New York.
- Tarique, I. and Schuler, R. S. (2010), *Global talent management: Literature review, integrative framework, and suggestions for further research*, *Journal of World Business*, Vol. 45, No. 2, pp. 122-133.
- Teece, D.J., Pisano, G.P. and Shuen, A. (1997), *Dynamic Capabilities and Strategic Management*, *Strategic Management Journal*, Vol. 18, No. 7, pp. 509-533.
- Teece, D.J. (2007), "Explicating Dynamic Capabilities: the Nature and Microfoundations of (Sustainable) Enterprise Performance", in *Strategic Management Journal*, vol. 28, pp. 1319-1350.
- Tomé E, Naidenova I, Oskolkova M (2014). Personal welfare and intellectual capital: The case of football coaches. *J Intellect. Cap.* 15(1):189-202.
- Trequattrini R., Lardo A., Cuozzo B., Cano Rubio M. (2017), Intellectual Capital as driver for controlling managers' performance: an innovative approach, *Management Control*, Franco Angeli, Fascicolo 3, pp. 123-142 (ISSN 2239-0391)
- Trequattrini R., Massaro M., Lardo A., Cuozzo B. (2018), "Knowledge transfer and managers turnover: impact on team performance", *Business Process Management Journal*, Vol. 25, No. 1, pp. 69-83.
- Von Krogh, G. (2012), "How does social software change knowledge management? Toward a strategic research agenda", *The Journal of Strategic Information Systems*, Vol. 21 No. 2, pp. 154-164.
- Wernerfelt, B. (1984), "A Resource-Based view of the firm", in *Strategic Management Journal*, Vol. 5, No. 2, pp. 171-180

- Wiig, K.M. (1997), Integrating intellectual capital and knowledge management, Long Range Planning, Vol. 30, No. 3, 1997, Pages 399-405.
- Williams, C. (2007), "Transfer in context: replication and adaptation in knowledge transfer relationships". Strategic Management Journal, vol. 28, pp. 867-889.
- Williamson, O.E. (1979), *Transaction-cost economics: the governance of contractual relations*, Journal of Law and Economics, Vol. 22, No. 2, pp. 233-261

The Assessment of a Technological System to Develop a New Organizational Model for Elderly People' Assistance

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Abstract

Recent technological advancements have induced significant changes in the whole society, and thus in workplaces and lifestyles. A drastic reduction in physical activity has been documented by recent scientific investigations, with consequences on human postural attitudes. It is a fact that, in any given moment of the life, human body has a "posture" can be static (resting) or dynamic (walking). Moreover, when people assume poor postures during the day, their body become more susceptible to injuries (Aartun, 2014). Recent epidemiological data stated that back pain starts early in life and that prevalence rates increased rapidly during adolescence, reaching adult levels around the age of 18 (Jeffries, 2013). Furthermore, several authors considered long retained erroneous positions as a possible cause of postural diseases which do contribute, in their opinion, to the development of pathological forms (Shalavina, 2013).

With this evidence, prevention should have a central role in order to avoid damage and pain in day-to-day life (Cardon, 2004; Calvo-Munoz, 2012), but it is poorly practiced in the majority of countries, even in the Western world. This paper analyses through a holistic approach the effects of knowledge translation (Simeone et al, 2017) adopting new technologies in healthcare system and in particular exploring how the interaction among health complex system's stakeholders in open innovation processes can influence the co-creation value in health lifestyle process. A pilot project has been carried on with the

involvement of 432 people in Apulia Region, including the management of residence for elderly people, physicals, elderly patients and their families and medical professionals. The study analysed previous database on the use of technologies in health care organizations and it brings to light the fact that chronic populations is growing, so the necessity to ward diagnosis of chronic diseases became an important aspect to reduce the costs in the Healthcare assistance.

Keywords – Knowledge transfer, open innovation, design, knowledge translation

Paper type – Academic Research Paper

1 Introduction

The evolution of Information Technologies (IT) opens new scenarios in the healthcare systems: novel technology, such as inertial sensors, smartphone, low-cost video/depth camera, pressure sensors and motion ambient sensors, offer an innovative approach that can efficiently capture, analyse and share movement data and may provide an easy-to-implement fall risk assessment (Mancini et al, 2010; Mukhopadhyay et al, 2015; Kumari et al, 2017). In the last years, a wide range of sensor technologies have been used in fall risk assessment in older adults (Sun et al, 2018), but technology transfer is often a complex process that requires cooperation between organizations and within the various departments of a receiving organization.

In this paper we analyse how new technologies have been implemented strategically to promote knowledge transfer (Seaton, 2002) through a participatory approach, interpreting needs of health organizations and stakeholders and, therefore, contributing to empowerment social change. In this scenario the health care organizations, open, adaptive and collaborative systems, are capable of developing deep partnerships with patients, their families and the community benefits from offered services, improving thus the effectiveness and efficiency of medical care. To achieve this, it is necessary to implement a holistic approach in which patients are active co-creators of knowledge transfer and where they can acquire knowledge from another one (Albino et al, 1998).

A pilot project has been carried on with the involvement of 432 people in Apulia Region, including the management of residence for elderly people, physicals, elderly patients and their families and medical professionals. The study analysed previous database on the use of technologies in health care organizations and it brings to light the fact that chronic populations is growing, so the necessity to ward diagnosis of chronic diseases became an important aspect to reduce the costs in the Healthcare assistance. The empirical investigation focuses on the fact that late life cognitive impairment and physical impairment are leading causes of disability, falls, institutionalization, and death among the elderly (Marengoni et al, 2009). These cognitive and physical impairments in late life are inter-related through shared pathophysiological mechanisms and could probably be manifestations of a single complex phenotype, even if a chronic condition, by itself, is not the only deficit that increases frailty (Panza et al, 2015).

During ageing, falls are the most common cause of injury in the elderly and they are a common, serious, growing public health problem (Kannus et al, 2005). The high incidence, long-term effects, and costs of falls will affect our healthcare system: over the next 20 years, the number of falls and the associated costs are projected to increase substantially (Florence et al, 2018). Consequently, in this research we implement an organizational and technological model that aimed to create the behaviours and perceptions of elder individuals in to health and safety in, developing a new distinctive way of thinking, approaching and solving problems (Buchanan, 2004) among all the stakeholders.

2 Background

During the last years, social innovation ideas have increasingly been considered as a key factor in the Europe Strategy 2020 which does emerge by bench-marking in countries that have faced up this problems with the goal to identify the best practices in the field of health education at school and to evolve them in relation to our interdisciplinary approach. When dealing with studies on health in the educational field, the institutions cannot keep the subjects involved apart and they should be considered as what they actually are: the bonds of a network aiming to semantically and socially strengthen the ties.

As stated by the World Health Organization (WHO), individuals have the right to claim back their own health and they must not delegate responsibility by blindly trust medical advice, because physicians need patients who are fully aware and prepared to tackle the therapies advised. In order to obtain this result, the subjects involved need to understand each other and each one's needs. Full reciprocal understanding can be possible starting from a common language, easily comprehensible by all the subjects involved. For this reason, the research group has decided to adopt a socially innovative strategy (see Fig. 1).

At the core of the concept of social innovation lies the active involvement of citizens into public service delivery. This involvement is often referred to as “co-creation” (Voorberg, 2014). Social innovation and co-creation are “magic concepts” (Pollitt and Hupe, 2011; p. 642), which during the last years have been embraced as new modernization or reform strategies for the public sector. Social innovation implies processes of exploration and implementation of new ideas about how a society deals, as political community, with a number of vital challenges; like the growing ageing of the population, the budgetary crises, the quality of our educational system, or the regeneration of socially and economically deprived cities and regions (Mulgan, 2009).

3 Methods

3.1 Research Approach

The questionnaire was created for exploratory purposes and based on common, non-specialised language. The aim was to measure if the participants are familiar with notions related to correct posture and if they pay attention to the spinal column in everyday contexts (while sitting, standing and working).

3.2 Sample

Forty hundred and thirty-two people in Apulia Region, including the management of residence for elderly people, physicals, elderly patients and their families and medical professionals, have been enrolled for the purpose of the present study.

3.3 Data Analysis

We considered as dichotomous variables the possible answers, assuming good postural behaviours as value 1 and incorrect behaviours as value 0. The higher the score the better was the knowledge on correct postural behaviours. The data on postural behaviours during work and daily activities were reported as mean and standard deviation and they expressed the percentage of mistakes. The educational level and the technology use as categorical variables were reported as percentage. We tested the relationship among the continuous variables and the categorical variables with crosstabs. We finally performed a non parametric test, in particular the Kruskal-Wallis H test, in order to determine if there was statistically significant difference between the level of education (none, high school and university) on the score. All statistical analyses were completed using IBM SPSS version 23 (with the level for statistical significance set at $\alpha = 0.05$).

4 Results

In Table 1 we reported the mean and standard deviation for the variables workBehav, dailyBehav and adultScore which respectively represent the postural behaviours during work and daily activities and the overall score obtained for the questionnaire. The histograms of the three variables showed the distribution of frequency response. The Kolmogorov-Smirnov Test checked for the normal distribution: since all the variables were statistically significant, we rejected the null hypothesis and the variables were not normally distributed.

Table 1 Frequency distribution for continuos variables workBehav, daily Beahav and adultScore

	N	Minimum	Maximum	Mean	Standard Deviation
workBehav	432	,00	1,00	,2617	,27692
dailyBehav	432	,08	,83	,3796	,14152
adultScore	432	2	13	9,08	1,969
Valid Cases (listwise)	432				

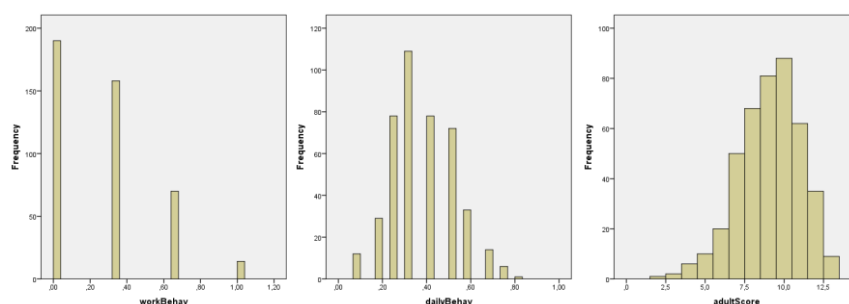


Figure 1 Frequency distribution histogram of Descriptive Variables for continuos variables workBehav, daily Beahav and adultScore

The two categorical variables (techUse and eduLevel) were reported in Table 2 and 3 respectively as percentage.

Table 1 TechUse variable as percentage

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid No	94	21,8	21,8	21,8
Yes	338	78,2	78,2	100,0
Totale	432	100,0	100,0	

Table 2 EduLevel variable as percentage

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid None	54	12,5	12,5	12,5
High School	296	68,5	68,5	81,0
University	82	19,0	19,0	100,0
Totale	432	100,0	100,0	

The relationship among the categorical variables and the continuous ones was analysed in terms of crosstabs with chi-squared test.

The results showed that there was a significant association among the educational level (independent variable) and the knowledge on correct postural behaviours at work, daily and overall (dependent variables: workBehav, dailyBehav, adultScore). In addition,

we found a relationship between the use of technology and daily postural behaviours (Figure 2) and between the use of technology and the total score, as showed in Figure 3.

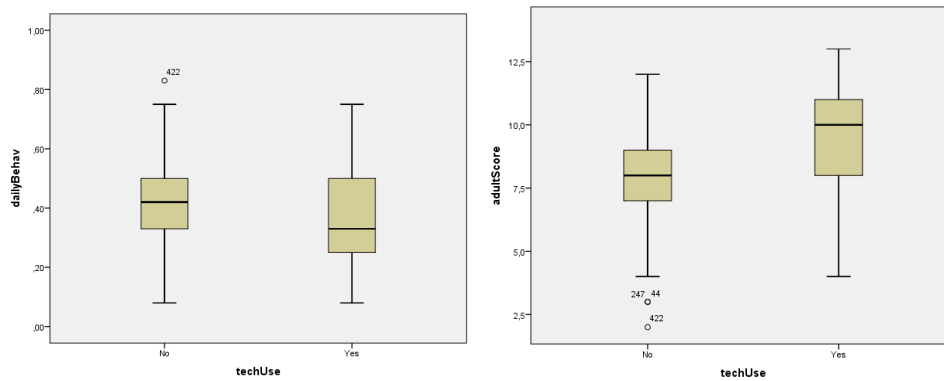


Figure 2 Box plots of dailyBehav and adultScore according to techUse

Finally, the results for the Kruskal Wallis H Test showed that there was a statistically significant difference among the level of education on correct postural behaviours (as reported in Table 4 and 5).

In particular, we observed that high educational level corresponded to higher knowledge and attention, as depicted in Figure 3.

Table 4 Kruskal Wallis H Test

	eduLevel	N	Mean Ranks
workBehav	None	54	224,06
	High School	296	223,10
	University	82	187,70
	Totale	432	
dailyBehav	None	54	261,73
	High School	296	222,23
	University	82	166,03
	Totale	432	
adultScore	None	54	176,56
	High School	296	210,61
	University	82	264,05
	Totale	432	

Table 5 Results for the Group Variable: eduLevel

	workBehav	dailyBehav	techUse	adultScore
Chi-quadrato	6,255	21,836	10,332	18,528
gl	2	2	2	2
Sign. asint.	,044	,000	,006	,000

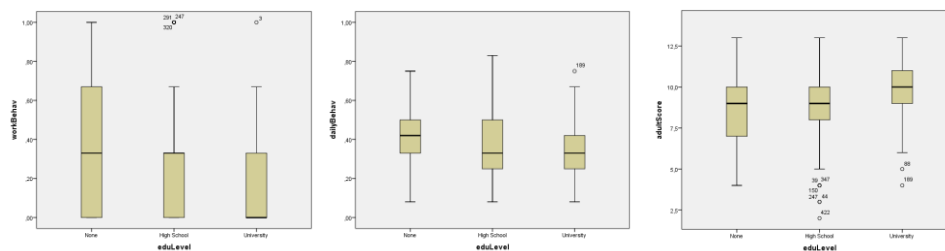


Figure 3 Box plotsof workBehav, dailyBehav and adultScore according to eduLevel

5 Discussion

The current society is characterised by a great variety of ICT tools, which are rapidly spreading, and they are used for disseminating information and building social ties (Castells, 2004). However, in line with the features of the present age, the consequences of this phenomenon are two-fold (Bauman, 2011): on the one hand, individuals have numerous tools enabling them to acquire a huge amount of just-in-time information and to reach a great number of contacts; on the other hand, the huge amount of information available to them and the efficiency of transmission usually determine a loss in the quality of contents and also affect the uptake of contents themselves, as effective learning requires accurate reasoning, which in turn may be time-consuming.

The speed characterising the network and consumption society plays a crucial role in the selection process, with people tending to select information according to personal mood rather than logical and critical thinking. Similarly, the strengthening of ICT enables users to add contacts to their networks in a faster and more efficient way than ever before: smart phones, iPad, iPod, tablets, computers, internet, instant messaging applications, social network websites, etc., all integrate users into large and thick networks. These tools, though, are spreading up to a point that they tend to prevail direct personal ties, determining a preference for indirect communication.

The speed of information and social exchanges significantly reduces the chances to examine contents and relationships which would be possible, instead, through regular and direct contacts between subjects. As a result, individuals are more informed but at the same time very confused, given the lack of control over the genuineness of information, as well as the lack of spaces for social discussion on the validity of information.

6 The relationship between knowledge and innovation

The Triple Helix of development and innovation shows the correlation between the helices dynamics of “university–industry–government relations” that drives knowledge and innovation in the global knowledge economy and society (Etzkowitz and Loet, 2000). We suggest that advanced knowledge-based economy and advanced democracy have increasingly similar features, in the sense of combining and integrating different knowledge modes and different political modes. The relationship between knowledge and

innovation from our viewpoint it makes sense, not to treat knowledge and innovation as interchangeable concepts.

In this context is born a new paradigm the Quadruple Helix of the development and innovation where the correlation between “media-based and culture-based public” as well as to “civil society”. Knowledge and innovation policies and strategies must acknowledge the important role of the “public” for a successful achieving of goals and objectives. On the one hand, public reality is being constructed and communicated by the media and media system. On the other hand, the public is also influenced by culture and values. Knowledge and innovation policy should be inclined to reflect the dynamics of “media-based democracy,” to draft policy strategies. Particularly when we assume that traditional economic policy gradually (partially) converts into innovation policy, leveraging knowledge for economic performance and thus linking the political system with the economy, then innovation policy should communicate its objectives and rationales, to the public, to seek legitimization (legitimacy) and justification (Colapinto and Colin, 2012).

The PoSE project objective in his evolution reinforce the increase of the people diagnosed with postural disease and improve a new model to provide a support system able to guide the physician decisions, if reached, allows from the social point of view:

1. to increase quality of life of patients and to reduce the much more serious occurrence of diseases related.
2. to contribute to the affordability of health care systems in reducing the costs of complications due to undiagnosed postural disease
3. to reduce the number of accidents, workplace, etc. postural disease and its related direct and indirect social costs.

According to Europe 2020 strategies for growth and job, this study became a novel approach to co-create value in health care system. The methodological approach adopted must be multidimensional and interdisciplinary, with the involvement of medical, epidemiological, engineering, sociological and economic expertise, addressing the complexity of the patient from all viewpoints, not reducing it, yet analyzing, understanding, rearranging and managing it in an organic manner.

This experience follows the HORIZON 2020 strategy - quadruple helix development and innovation, in which the citizen (end-user in our case) plays a crucial role. The study stimulates social innovation by transferring research results from the closed industrial laboratory towards real life contexts where citizens and users become co-developers.

In this scenario we can evaluate the socio-economic perspective. Traditionally economic evaluations involve the identifying, measuring and valuing both the inputs (costs) and outcomes (benefits) of alternative interventions (Pommier, 2010). The inputs and the outcomes included in this study depend on both the questions being addressed and the perspective of the study. For example, in our study, the education sector in a health promotion intervention (PoSE) may be compared to other uses, such as the teachers time for prevention, or the use of alternative equipment in terms of value for life-style. The main steps that will be developed through the project for a balanced socio-economic evaluation will be:

- Life-style of students and families in the school life (input);

- Digital divide of students and families (input);
- Level of education (input).

The focus of these results will be relevant in term of professional training, assessment of new technologies and adaptation of operational procedures for a health promotion intervention, like Postural Education at School.

The objective of this pilot work is thus to disseminate our findings and experiences on how school system should rethink their innovative processes under the requirement of value co-creation. As Hannon emphasized, the needed innovation must arise from the joint work of skilled and creative practitioners, co-creating with their learners, and actively engaging parents and caregivers in order to meet the challenges we face in reshaping schools for the future (Hannon, 2009). Thanks to our program, we enhanced the involvement of citizens in the management of their healthcare process for a new frame of value creation (Fig. 6). We were able to involve school management, physical education teachers, students and their families and medical professionals in an holistic model that aimed to create the behaviors and perceptions of individuals in to health and safety in schools and to conceive the school as a workplace tailored to the needs of the students and teachers.

The preliminary results of this study showed a new competitive space for industrial and social growth. However, in order to compete effectively, managers need to invest in knowledge industry for the new infrastructure capabilities, as well as new functional and governance capabilities that are centered on co-creation through high-quality customer-company interactions and personalized co-creation experiences (Prahalad and Ramaswamy, 2004).

6 Conclusion

The interviews showed the importance of dialogue. If you deal with education, regardless of the target, it is necessary that not only doctors, but the whole social environment of the patient and what is involved with a culture of accountability, communication and attention to itself and to the other.

The challenge we proposed here is certainly difficult, mainly because the sources of health information are too many and in most of the cases in conflict with each other, creating confusion both in medical and educative professionals. However, studies of sociology highlight the fact that the construction of a system of communication exchanges between social actors can create the basis for a common language and positive feedback for effective cooperation.

References

- Aartun E.; Degerfalk A.; Kentsdotter L.; Hestbaek, L. (2014). Screening of the spine in adolescents: inter - and intra - rater reliability and measurement error of commonly used clinical tests. BMC musculoskeletal disorders 15(1): 37.

- Aartun, Ellen, et al. "Screening of the spine in adolescents: inter-and intra-rater reliability and measurement error of commonly used clinical tests." *BMC musculoskeletal disorders* 15.1 (2014): 37.
- Bauman, Z. (2000). *Liquid Modernity*. Cambridge; (2005). *Liquid Life*. Cambridge; (2006) *Liquid Times: Living in an Age of Uncertainty*. Cambridge.
- Berger, P.L.; Luckmann, T. (1966). *The Social Construction of Reality: A treatise in the sociology of knowledge*. Peguin Books.
- Bortone, I., Argentiero, A.; Agnello, N.; Sabato, S. S.; Bucciero, A. (2014, June). A two-stage approach to bring the postural assessment to masses: the KISS-Health Project. In *Biomedical and Health Informatics (BHI), 2014 IEEE-EMBS International Conference on* (pp. 371-374). IEEE.
- Bortone, I.; Argentiero, A.; Agnello, N.; Denetto, V.; Neglia, C.; Benvenuto, M. (2014). The PoSE Project: An Innovative Approach to Promote Healthy Postures in Schoolchildren. In *E-Learning, E-Education, and Online Training* (pp. 49-57). Springer International Publishing.
- Calvo-Munoz, I.; Gomez-Conesa, A.; Sanchez-Meca, J. (2012). Preventive physiotherapy interventions for back care in children and adolescents: a meta-analysis. *BMC musculoskeletal disorders* 13.1: 152
- Calvo-Muñoz, Inmaculada, Antonia Gómez-Conesa, and Julio Sánchez-Meca. "Preventive physiotherapy interventions for back care in children and adolescents: a meta-analysis." *BMC musculoskeletal disorders* 13.1 (2012): 152.
- Cardano, M. (2011). *La ricerca qualitativa*. Il Mulino.
- Cardon, G.; Balaguà F. (2004). Low back pain prevention's effects in schoolchildren. What is the evidence? *European spine journal*. 13.8: 663 - 679
- Cardon, Greet, and F. Balague. "Low back pain prevention's effects in schoolchildren. What is the evidence?." *European spine journal* 13.8 (2004): 663-679.
- Castells, M.: (2004) *The Network Society: A Cross-Cultural Perspective*, Cheltenham, Edward Elgar Pub.
- Castells, Manuel. *The network society A cross-cultural perspective*. Edward Elgar, 2004.
- Corbetta, P. (1999) *Metodologia e tecniche della ricerca sociale*. Il Mulino.
- COST B13 European guidelines for the management of low back pain 15. (2006). *Eur Spine Journal* (Suppl 2): S125 - S297.
- Etzkowitz, H.; Loet, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. *Research Policy*. 29, 109–123.
- Florence, Curtis S., et al. "Medical costs of fatal and nonfatal falls in older adults." *Journal of the American Geriatrics Society* 66.4 (2018): 693-698.
- Hannon, V. (2009). 'Next Practice' in education: a disciplined approach to innovation. *Innovation Next Practice*. See The Innovation Unit website: www.innovation-unit.co.uk
- Horak, Fay B. "Clinical assessment of balance disorders." *Gait & posture* 6.1 (1997): 76-84.
- Jeffries, L.J.; Milanese, S.F.; Grimmer-Somers, K.A. (2007). Epidemiology of adolescent spinal pain: a systematic overview of the research literature. *Spine*. 32(23):2630 – 2637.
- Jeffries, Leah J., Steve F. Milanese, and Karen A. Grimmer-Somers. "Epidemiology of adolescent spinal pain: a systematic overview of the research literature." *Spine* 32.23 (2007): 2630-2637.
- Kannus, Pekka, et al. "Prevention of falls and consequent injuries in elderly people." *The Lancet* 366.9500 (2005): 1885-1893.
- Kumari, Preeti, Lini Mathew, and Poonam Syal. "Increasing trend of wearables and multimodal interface for human activity monitoring: A review." *Biosensors and Bioelectronics* 90 (2017): 298-307.

- Mancini, Martina, and Fay B. Horak. "The relevance of clinical balance assessment tools to differentiate balance deficits." *European journal of physical and rehabilitation medicine* 46.2 (2010): 239.
- Marengoni, A., et al. "The impact of chronic multimorbidity and disability on functional decline and survival in elderly persons. A community-based, longitudinal study." *Journal of internal medicine* 265.2 (2009): 288-295.
- Mathie, Merryn J., et al. "Accelerometry: providing an integrated, practical method for long-term, ambulatory monitoring of human movement." *Physiological measurement* 25.2 (2004): R1.
- Mukhopadhyay, Subhas Chandra. "Wearable sensors for human activity monitoring: A review." *IEEE sensors journal* 15.3 (2015): 1321-1330.
- Mulgan, J. (2009). *The art of public strategy*. Oxford: Oxford University Press.
- Panza, Francesco, et al. "Targeting cognitive frailty: clinical and neurobiological roadmap for a single complex phenotype." *Journal of Alzheimer's Disease* 47.4 (2015): 793-813.
- Pollitt, C.; Hupe, P. (2011). *Talking About Government: The role of magic concepts*. *Public Management Review*, 13(5), 641-658.
- Pommier, J.; Guevel, M.R.; Jourdan, D. (2010). Evaluation of health promotion in schools: a realistic evaluation approach using mixed methods. *BMC Public Health* 10.1: 43
- Prahalad, C. K.; Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. *Journal of interactive marketing*, 18(3), 5-14.
- Riding, R.; Rayner, S. (2013). *Cognitive styles and learning strategies: Understanding style differences in learning and behavior*. Routledge.
- Shalavina, A. "Qualitative and quantitative assessment of the state of the posture of junior school children." (2013).
- Shalavina, A.S. (2013). Qualitative and Quantitative Assessment of the State of the Posture of Junior School Children. *World Applied Sciences Journal*. 27 (7): 860 - 862.
- Sun, Ruopeng, and Jacob J. Sosnoff. "Novel sensing technology in fall risk assessment in older adults: a systematic review." *BMC geriatrics* 18.1 (2018): 14.
- Voorberg, W.; Bekkers, V.; Tummers, L. G. (2014). A systematic review of co-creation and co-production: Embarking on the social innovation journey. *Public Management Review*, Forthcoming.
- Wen, Chi Pang, et al. "Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study." *The Lancet* 378.9798 (2011): 1244-1253.
- Wren, Tishya AL, et al. "Efficacy of clinical gait analysis: a systematic review." *Gait & posture* 34.2 (2011): 149-153.

Open Innovation and Start-up Development. The C(h)aos Problem

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Abstract

Open innovation is a relevant approach to support the development of established companies as well as startups in the contemporary economy. Entrepreneurs are increasingly using this approach to develop new products, services and processes fostering the rule that collective intelligence wins against the single innovator. Interestingly, public bodies are increasingly supporting the development of open innovation tools to assist companies. Many regions are supporting the development of accelerators to support the development of startups. Thus, open innovation is used both by private firms and public bodies.

In the Region Friuli Venezia Giulia, in the northeast of Italy, the local Government has developed a program to support start-uppers creating specific tools dedicated to helping new entrepreneurs to fine tune their business ideas. The program's name is Imprenderò, and it offers various free educational as well as consulting services to promote the entrepreneurial culture, teach the basics of management, organization, accounting, and business planning, and help start-uppers to define their strategy, and build their investment plan and budget.

This paper employs a mixed method approach, to analyze both quantitative as well as qualitative data coming out from the program. Data are collected during the years 2011-

2012. The study employs a multiple case study approach, using the Culture-Ambience-Organization-Strategy (CAOS) model by Paoloni (2011), to deepen variables that affect the opportunity brought by open innovation approaches, trying to understand also the differences between male and female entrepreneurs.

Interestingly enough, the effectiveness of the program appears to be strongly related to some variables. More precisely: culture and competitive ambiance, as well the organization and strategy decided by the start-uppers influence the effectiveness and efficiency of open innovation tools.

The study is novel and useful for several reasons. First, it allows first to detect variables that influence the likelihood of venture opening, with particular reference to the knowledge transfer to and from start-ups, also considering the gender issue. These results can build within existing literature review on entrepreneurship, as well as knowledge management. Additionally, the case study methodology can gather insights about how entrepreneurs have embraced difficulties in providing managerial suggestions. The overall results might be useful for policymakers to develop concrete actions to support entrepreneurship. Finally, the sample may be considered relevant since the program granted free access to everybody, and therefore covered the all population of the single area analyzed.

Keywords – CAOS model, Strategy, Knowledge Transfer, Open innovation, Start ups

Paper type – Academic Research Paper

1 Introduction

Open innovation is a vital approach to support the development of established companies as well as start-ups in the contemporary economy. Entrepreneurs are increasingly using this approach to develop new products, services and processes fostering the rule that collective intelligence wins against the single innovator (Secundo *et al.*, 2019). According to the literature, the Public Sector should play an active role in supporting and promoting private entrepreneurship, which is considered essential to reach economic growth (Dal Mas, Massaro, *et al.*, 2019; Intarakumnerd and Goto, 2018; Spiegler and Halberstadt, 2018). Interestingly, public bodies are increasingly supporting the development of open innovation tools to help companies as well as the creation of new business ventures. Examples include hackathons among entrepreneurs, public entities and NGO to support tourist development (Marangon *et al.*, 2018); the creation of accelerators to support the development of start-ups (Bagnoli *et al.*, 2018); the organization of dedicated financed entrepreneurship and mentoring programs (Cincera *et al.*, 2018; Price and McMullan, 2012) for instance in Malaysia (Mustapha and Subramaniam, 2016), North America and Europe (Braidford *et al.*, 2013; Dal Mas, Paoloni, *et al.*, 2019; Matulova *et al.*, 2018; Varela-Candamio *et al.*, 2018). Thus, open innovation is used both by private firms and public bodies. Starting from this premise, this study aims to analyse the knowledge transfer to and from companies and start-ups in open innovation initiatives developed by public entities, with a special reference on companies created and run by women.

2 Literature review and research question

The role of both public as well as private sector is considered relevant in supporting the creation of start-ups (Massaro *et al.*, 2018). Entrepreneurship is claimed to be a vital element to stimulate growth and development of any country, and women entrepreneurs play a significant role in the economic development. More in details, according to the literature they can help to stabilize the economy particularly during the periods of economic crisis or recession (Musaazi *et al.*, 2015; Mustapha and Subramaniam, 2016; Ramadani *et al.*, 2015; Roy and Lahiri-Roy R., 2010; Sowmya *et al.*, 2010), as they are often seen as “engine change” (Cohen and Huffman, 2007). Entrepreneurship and its required hard as well as soft skills have been included in several academic curricula (Lans *et al.*, 2014; Massaro *et al.*, 2014), this means that several countries across all continents have emphasized and promoted entrepreneurship to support their economies (Mustapha and Subramaniam, 2016).

Open innovation approaches have been used to foster the stimulation of new business ideas, the networking among potential entrepreneurs, startupper, existing organizations, and public entities, thus helping the creation of new business ventures, especially in complex environments (Bagnoli *et al.*, 2019; Marangon *et al.*, 2018).

In open innovation approaches, knowledge transfer from and to startupper, existing companies, universities and research centers, ... has been considered as a vital element to ensure the success of the open innovation initiative (Secundo *et al.*, 2017, 2019).

Considering the relevance of open innovation in fostering the creation of new business ventures, and the importance of the knowledge transfer process, our research question is:

RQ: *how does the knowledge transfer to and from companies and start-ups work in open innovation initiatives developed by public entities, with a special reference on companies created and run by women?*

To do so, we gather both qualitative and quantitative data from a programme run in the Region Friuli Venezia Giulia, Italy, financed by the local government and the European Social Fund in 2011-2012, to foster the creation of new business ventures.

3 Research context

We gathered data for our study in the Region Friuli Venezia Giulia of Italy, in the years 2011-2012. Those years were critical for existing companies as well as for new business ventures, with a particular emphasis for companies run by women. In 2010, the public registry enrolled 133 thousand new companies with employees, with 1.700 fewer units than in 2009. Most of the new ventures were classified as individual firms, with 71% driven by male entrepreneurs, and only the remaining 29% by women. Female ventures were mainly about commercial activities (almost 40% of the total) and other services (over 33%) (ISTAT, 2012). In Friuli Venezia Giulia, the situation was in line with the national picture. The number of start-ups decreased radically in the period 2007-2011, with the only exception of 2010 (Unioncamere Friuli Venezia Giulia, 2012), with

28% run by women. Fields with significant female involvement were personal care services (50%), hospitality and food (45%) and agriculture (33%).

4 Methodology

Our research uses a mixed method approach. More precisely we carry on our analysis using an explanatory sequential method, that start with a quantitative study and then conduct qualitative research to deeper explain the quantitative results (Creswell, 2014).

4.1 Quantitative data collection

The first step relates to the quantitative analysis. We analysed structured data collected from a program called “Imprenderò.” The project offered to potential start-uppers free workshops, courses, mentoring, as well as consultancies, to define their business ideas and develop their business plans. The program aimed also to keep connected entrepreneurs-to-be together with various entities: existing companies, public bodies, universities and incubators. The project is considered relevant since it was developed in Italy during the crisis by a public organization (the Region Friuli Venezia Giulia) to foster entrepreneurial activities, as recommended by the literature to promote entrepreneurship and keep various stakeholders connected.

We analysed 418 fully developed business plans, and we followed up the participants with a phone interview to get detailed information about the participant and the eventual opening of the initiative.

We gathered data about the opening of the initiative, the previous working condition of the potential entrepreneur (in terms of employment condition and experience in the same sector) and the complexity of the initiative (measured by the forecast investments and the number of required employees).

4.2 Qualitative data collection

After gathering the quantitative data, we analysed some case studies (Yin, 2009) using a revised version of the CAOS model of micro entrepreneurship by Paoloni (Dal Mas, Paoloni, *et al.*, 2019; Demartini and Paoloni, 2013; Paoloni, 2011; Paoloni and Demartini, 2012; Paoloni and Dumay, 2015), to understand the knowledge transfer to and from the various dimensions of the model: the factor C (about the characteristics of the entrepreneur), the factor A (about the ambience where the company operates), the factor O (the organizational and managerial aspects), and the factor S (the strategy conceived by the organization).

We decided to use the framework of the CAOS model because it allows to map the characteristics of the entrepreneur, of the managerial organization, as well of the external competitive environment.

The following figure shows the CAOS rectangle in its revised version.

Figure 1. The CAOS Rectangle

Personal characteristics of the entrepreneur (C)	The ambience/environment in which the micro-enterprise operates (A)
Organizational and managerial aspects (O)	Strategy (S)

5 Results and Discussion

5.1 Quantitative data

The results of the Imprenderò program show that 61% of the people involved started their businesses. 196 business plans were developed by women (46%), and only 73 of them opened the venture (37%). This means that there is a significant difference between men and women. 44% of the participant had previous experience in the same sector/industry of the new venture. 56% of the persons in the sample was employed at the time of the questionnaire, while 32% was unemployed by less than one year and 12% was unemployed for more than one year.

Moreover, the results show how women have much more difficulties in starting new ventures if their employment condition finds an extended period of inactivity. Interesting, not having a previous working experience in the same sector is not a limit both for female and male entrepreneurs. Women are much more sensitive to the complexity of the initiative compared to male entrepreneurs, considering both the total investment as well as the number of employees to start up the venture.

5.2 Qualitative data

The interviews with several participants using the CAOS model to map the initiatives allowed to use to analyse the factors that can influence the opening of a new firm, focusing on the knowledge transfer in the program, seen as an open innovation initiative.

5.2.1 The personal characteristics of the entrepreneur

The interviews showed that collective classes and project works helped the potential entrepreneurs not only to analyse their business ideas and to avoid crucial mistakes, but they were precious chances to get to know each other and benefit from someone else's experience.

Luciana, who opened her own bar, said *"The part of the classes I enjoyed more was the coffee break – The teachers and mentors of the program were just great, but the best part was exchanging ideas with the other participants. We all had different ideas, background, level of education and experiences, but we all were there to become entrepreneurs. Exchanging point of views helped me to see things from a different perspective, adding values and ideas to my initial thoughts."*

In some cases, people who got to know each other during the classes for the first time later became business partners.

For instance, Sara, educator, stated: *"My business idea was about opening a restaurant involving disabled people as workers. Dealing with kids and adults with*

disabilities is my job, so I know exactly how to deal with them, how to motivate them. I love to cook but managing a restaurant is another story. I was lucky enough to meet Giulia, a professional chef. She liked the idea at once, and now we have found a location to let our dream become true! Merging my and Giulia's knowledge and experience will be the key."

5.2.2 The ambience/environment in which the micro-enterprise operates

The knowledge coming from the competitive environment appeared to be relevant to enhance the efficacy of the program. Participants who got in touch with other companies, universities, and public entities had a better performance in class and in opening their venture.

Renzo, a pharmacist working for a local hospital stated: *"My business idea was born seeing that we wasted too many expensive drugs due to their packaging. Once open, most liquid drugs (to be injected) must be used at once, and if the patient needs just half of it, the other half is thrown away. I talked to my chief and with the director of our University spin-off, and we discussed the business idea together. They are very much supportive and provide me with data and trials. Their knowledge is precious to me, and to my journey as a new born entrepreneur!"*

Arianna works as a consultant for several art galleries, but she wanted to open a small factory in her grandmother's town to produce the local "grissini" (breadsticks), following her grannie's recipe. She stated: *"My Granma's grissini were among the best memories of my childhood. I loved the idea of producing them in limited quantities and selling them in small deli shops. However, my only starting point was the recipe. The local university, faculty of agriculture and food, was so much supportive. They provided me with data and with ideas about the production processes. I am so happy I decided to involve them; they know everything about the market. And the upcoming Expo [Expo Milano 2015, n.d.r.] and the interest towards the "slow food" way of life is surely a plus to support my start-up."*

5.2.3 The organizational and managerial aspects (O)

The organizational and managerial aspects were also positively influenced by the knowledge transfer coming out from the program.

Anita, who opened a workshop where she sold products from local producers and artisans [to read the full story of Anita see Dal Mas et al, 2019] declared: *"What I learned during the classes and seminar was so important to me to develop my idea. I have no employees; however, I needed feedbacks and tips on how to structure my processes (what and how to buy, which contracts to be used, how to deal with clients, how to advertise my shop's initiative, ...). I will forever thank the teachers and mentors for all the knowledge they transfer to me: thanks!"*

Same as Andrea, who opened his restaurant. He said: *"As a professional cook, I know exactly how to work. The kitchen has no secrets to me! But as an entrepreneur, I need to run all the company – from the financial side to the marketing side. I will have full responsibility of my initiative! The mentorship of Marco and Francesca helped me to*

define how to deal with all the processes that, as an employee, were unknown to me. Now I feel more confident, and I am learning by doing.”

5.2.4 The strategy

The strategy was surely influenced by the knowledge acquired during the program.

Barbara, who later opened an e-commerce about beauty and cosmetic products, stated: *“The program allowed me to learn from a Professor of a famous business school about the most recent marketing tools. I even didn’t know they existed, and how they could influence my sales! After discussing with him, I started to implement his tips and guess what, I could immediately see my visitors and conversion rate increase.”*

Roberta said: *“Among my group, I was the one with the clear business idea. I wanted to open a pizzeria in my dad’s former pastry shop. The teacher decided that during the project works, my mates who were still unsure about their possible start-ups would work with me. Well, this was the best gift ever! Discussing with them allowed me to think in a different way. There are too many pizzerias in my town, I had to differentiate my venture from the existing ones, and the brainstorming with them (whom I saw as potential and future clients of mine) allowed me to define a strategy. I am happy to say that I was able to open my restaurant afterwards, and things seem to go well. My former Imprenderò mates are the most welcome clients!”*

6 Conclusions

Our results show how the effectiveness of the open innovation program to enhance entrepreneurship appears to be strongly related to some variables. More precisely: culture and competitive ambiance, as well the organization and strategy decided by the start-uppers influence both the effectiveness and efficiency of open innovation tools. Start-uppers benefited from the program and its knowledge transfer in several ways. Unfortunately, the program also highlights the condition of female entrepreneurs, who experience more difficulties than men in opening their venture, especially if it requires massive investments and employees to coordinate, and if the female entrepreneur has been out from the labour market for an extended period of time.

The study allows to first detect variables that influence the likelihood of venture opening, with special reference to the knowledge transfer to and from start-ups. Additionally, the case study methodology can gather insights about how entrepreneurs have embraced difficulties providing managerial suggestions. The overall results might be useful to policymakers to develop concrete actions to support entrepreneurship. Finally, the sample may be considered relevant since the program granted free access to everybody, and therefore covered the all population of the single area analysed. Additionally, the select cases meet the definition of polar types (Yin, 2014) supporting the knowledge development within the research field.

References

- Bagnoli, C., Dal Mas, F. and Massaro, M. (2019), "The 4th Industrial Revolution and its features. Possible business models and evidence from the field", *International Journal of E-services and Mobile applications*, Vol. 11 No. 3.
- Bagnoli, C., Massaro, M., Dal Mas, F. and Demartini, M. (2018), "Defining the concept of business model. A literature review: Searching for a business model framework", *International Journal of Knowledge and System Science*, Vol. 9 No. 3.
- Braidford, P., Stone, I. and Tesfaye, B. (2013), "Gender, disadvantage and enterprise support - lessons from women's business centres in North America and Europe", *Journal of Small Business and Enterprise Development*, Vol. 20 No. 1, pp. 143–164.
- Cincera, J., Biberhofer, P., Binka, B., Boman, J., Mindt, L. and Rieckmann, M. (2018), "Designing a sustainability-driven entrepreneurship curriculum as a social learning process: A case study from an international knowledge alliance project", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 172, pp. 4357–4366.
- Cohen, P.N. and Huffman, M.L. (2007), "Working for the Woman? Female Managers and the Gender Wage Gap", *American Sociological Review*, Vol. 72 No. 5, pp. 681–704.
- Creswell, J.W. (2014), *A Concise Introduction to Mixed Methods Research*, Sage Publications, London, UK.
- Dal Mas, F., Massaro, M., Lombardi, R. and Garlatti, A. (2019), "From Output to Outcome Measures in the Public Sector. A Structured Literature Review", *International Journal of Organizational Analysis*, Vol. forthcoming.
- Dal Mas, F., Paoloni, P. and Lombardi, R. (2019), "Wellbeing of Women entrepreneurship and Relational Capital, A Case study in Italy", in Lepeley, M.T., Kuschel, K., Eijdenberg, E. and Pouw, N. (Eds.), *Exploring Wellbeing among Women in Entrepreneurship. A Global Perspective*, Routledge, London, p. forthcoming.
- Demartini, P. and Paoloni, P. (2013), "Implementing an intellectual capital framework in practice", *Journal of Intellectual Capital*, Vol. 14 No. 1, pp. 69–83.
- Intarakumnerd, P. and Goto, A. (2018), "Role of public research institutes in national innovation systems in industrialized countries: The cases of Fraunhofer, NIST, CSIRO, AIST, and ITRI", *Research Policy*, Elsevier, Vol. 47 No. 7, pp. 1309–1320.
- ISTAT. (2012), *L'imprenditorialità in Italia*.
- Lans, T., Blok, V. and Wesselink, R. (2014), "Learning apart and together: Towards an integrated competence framework for sustainable entrepreneurship in higher education", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 62, pp. 37–47.
- Marangon, F., Gon, M., Massaro, M. and Moretti, A. (2018), *Processi partecipativi nella progettazione turistica. Il caso del Forum per il turismo in Friuli Venezia Giulia*, Ambiente e Territorio, Forum Udine.
- Massaro, M., Bardy, R., Lepeley, M.T. and Dal Mas, F. (2014), "Intellectual capital development in Business Schools. The role of 'soft skills' in Italian Business Schools", *Proceedings of the 5th European Conference on Intellectual Capital*, Academic Publishing Limited, Reading, pp. 1–8.
- Massaro, M., Dumay, J., Garlatti, A. and Dal Mas, F. (2018), "Practitioners' views on intellectual capital and sustainability: From a performance-based to a worth-based perspective", *Journal*

of Intellectual Capital, Vol. 19 No. 2, doi:10.1108/JIC-02-2017-0033.

- Matulova, P., Maresova, P., Tareq, M.A. and Kuča, K. (2018), "Open Innovation Session as a Tool Supporting Innovativeness in Strategies for High-Tech Companies in the Czech Republic", *Economies*, Vol. 6 No. 4, p. 69.
- Musaazi, M.K., Mechtenberg, A.R., Nakibuule, J., Sensenig, R., Miyingo, E., Makanda, J.V., Hakimian, A., et al. (2015), "Quantification of social equity in life cycle assessment for increased sustainable production of sanitary products in Uganda", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 96, pp. 570–579.
- Mustapha, M. and Subramaniam, P. (2016), "Challenges and Success Factors of Female Entrepreneurs: Evidence from a Developing Country", *International Review of Management and Marketing*, Vol. 6 No. S4, pp. 224–231.
- Paoloni, P. (2011), *La dimensione relazionale delle imprese femminili*, (Angeli, F., Ed.), Milano.
- Paoloni, P. and Demartini, P. (2012), "The Relational Capital in Female Smes", *Journal of Academy of Business and Economics*, Vol. 12 No. 1, pp. 23–32.
- Paoloni, P. and Dumay, J. (2015), "The relational capital of micro-enterprises run by women: the startup phase", *Vine*, Vol. 45 No. 2, pp. 172–197.
- Price, A. and McMullan, L. (2012), "We don't need no education: The role of mentoring in the wider enterprise eco-system", *International Journal of Gender and Entrepreneurship*, Vol. 4 No. 2, pp. 55–74.
- Ramadani, V., Hisrich, R.D. and Gerguri, S. (2015), "Female entrepreneurs in transition economies: Insights from Albania, Macedonia and Kosovo.", *World Review and Entrepreneurship, Management and Sustainable Development*, Vol. 11 No. 4, pp. 391–413.
- Roy, A. and Lahiri-Roy R. (2010), "The story of Lijjat: Women's entrepreneurship and empowerment in India", *International Journal of Knowledge Cultural Change Management*, Vol. 9 No. 12, pp. 39–47.
- Secundo, G., Del Vecchio, P., Schiuma, G. and Passiante, G. (2017), "Activating entrepreneurial learning processes for transforming university students' idea into entrepreneurial practices", *International Journal of Entrepreneurial Behaviour and Research*, Vol. 23 No. 3, pp. 465–485.
- Secundo, G., Del Vecchio, P., Simeone, L. and Schiuma, G. (2019), "Creativity and stakeholders' engagement in open innovation: Design for knowledge translation in technology-intensive enterprises", *Journal of Business Research*, Elsevier, No. April 2018, pp. 0–1.
- Sowmya, D.V., Mujumdar, S. and Gallant, M. (2010), "Relevance of education for potential entrepreneurs: An international investigation", *Journal of Small Business and Enterprise Development*, Vol. 17 No. 4, pp. 626–640.
- Spiegler, A.B. and Halberstadt, J. (2018), "SHEstainability: how relationship networks influence the idea generation in opportunity recognition process by female social entrepreneurs", *International Journal of Entrepreneurial Venturing*, Vol. 10 No. 2, p. 202.
- Unioncamere Friuli Venezia Giulia. (2012), "Rapporto sull'economia del Friuli Venezia Giulia. I tempi lunghi della ripresa", pp. 1–33.
- Varela-Candamio, L., Calvo, N. and Novo-Corti, I. (2018), "The role of public subsidies for efficiency and environmental adaptation of farming: A multi-layered business model based on functional foods and rural women", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 183, pp. 555–565.

Yin, R.K. (2009), *Case Study Research: Design and Methods*, Sage Publications, Thousand Oaks, CA, 4th Ed.

Investigating the Digital Ecosystem of Explorative Learning in Industrial Service Enterprises: a Configurational Approach

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Abstract

As purveyors of knowledge-based services to the manufacturing sector, industrial service enterprises must deploy the information technology (IT) resources that, in combination with other non-IT resources and competencies, enable their capacity for organizational learning (OL), and for explorative learning in particular. In this context, we take a configurational approach to investigate the digital ecosystem of explorative learning in these firms to explain their competitive performance. The 'digital ecosystem' notion refers to the interplay between the three following configurational elements: 1) IT capabilities for exploration (IT infrastructure and e-business), 2) strategic capabilities for explorative learning, and 3) organizational size. The aim here is to identify the different causal configurations that account for the nonlinear complex interplay of these three elements as they jointly enable explorative learning and thus affect competitive performance. Survey data obtained from 92 industrial service enterprises were analysed with the fuzzy set qualitative comparative analysis (fsQCA) method in order to answer the following research question: What are the different digital ecosystem configurations for explorative learning that are associated to high levels of competitive performance? As it allows for equifinality, the fsQCA analysis identified six causal configurations that

characterize the sampled firms' digital ecosystem of explorative learning, two being equally associated with high innovation performance, and four being equally associated with high productivity.

Keywords – Explorative learning, IT capabilities, Strategic capabilities, Competitive performance, fsQCA.

Paper type – Academic Research Paper

1 Introduction

In a digital world that has shifted from a product-based to a knowledge-based global economy, one of the most important issues for strategic management and information systems (IS) researchers lies in identifying the effects of the firm's information technology (IT) resources that, in combination with other non-IT resources, enable its capacity for *organizational learning* (OL) (Andreu and Ciborra, 1996; Kane and Alavi, 2007). As purveyors of knowledge-based, high value-added services to the manufacturing sector (Bryson, Keeble and Wood, 1997), industrial service enterprises must answer a dual management challenge, namely the digitalization and globalization of their business environment by implementing a digital transformation strategy (Setia, Venkatesh and Joglekar, 2013). The strategic management of IT by these firms is thus meant to enable their learning processes and support their learning mechanisms (Raymond, Bergeron, Croteau and St-Pierre, 2015), and in so doing, to maintain or improve their competitive performance in terms of innovation and productivity (Aboal and Tacsir, 2018).

Strategic management and IS researchers have studied OL processes under two forms, namely exploration and exploitation (March, 1991; Kane and Alavi, 2007). *Explorative learning* essentially refers to the firm's acquisition of new knowledge or replacement of existing knowledge in its organizational memory, whereas *exploitative learning* refers to the firm's reuse, diffusion and refinement of its existing knowledge (Li and Huang, 2013). We focus on the first form in this study, since it is most conducive to achieving high levels of competitive performance in the highly turbulent environment in which most industrial service firms operate (Teece, Peterhaf and Leih, 2016).

From a capability-based view (CBV) of the firm's digital transformation (Easterby-Smith and Prieto, 2008), we focus here on what we term the *digital ecosystem of explorative learning*, that is, on the firm's IT capabilities for exploration, on its strategic capabilities for explorative learning, and on the extent to which and manner by which these capabilities, in combination, enable firms to attain high levels of competitive performance. In characterizing, contextualizing and valuing this digital ecosystem, we take a 'configurational' approach that is grounded in contingency theory instead of the traditional universalistic or 'best practices' approach (Doty, Glick and Huber, 1993). Furthermore, by identifying the 'capability configurations' of industrial service enterprises (Miller, Eisenstat and Foote, 2002), we allow for complex and nonlinear relationships as well as for 'equifinality', i.e. for the possibility for these firms to achieve high levels of competitive performance through different explorative learning paths and

from different starting positions in terms of their IT and non-IT resources (Gresov and Drazin, 1997).

As applied here, the configurational approach is based on the premise that there are specific combinations of the firm's IT and non-IT capabilities that enable its explorative learning processes and, in turn, positively influence its competitive performance (Fiss, 2011). Therefore, the research question to be answered by this study is the following: *In the context of industrial service enterprises, what are the different digital ecosystem configurations for explorative learning that are associated to high levels of competitive performance?* In answering this question through an empirical study of 92 Canadian firms operating in the industrial services sector, we hope to provide a deeper understanding of the nature and effects of the complex interplay between the firm's IT and explorative learning capabilities in this context.

2 Theoretical and empirical background

In integrating concepts and insights obtained from the configurational approach, from the CBV and from the strategic IT management literature, we wish to contribute to OL theory and to the closely-related 'absorptive capacity' theory (Sun and Anderson, 2010). We also wish to contribute to OL practice as it is enabled by IT strategic management in an industrial service context. In order to do so, we initially propose that competitive performance depends on specific configurations of the three elements – in this case, IT capabilities for exploration, strategic capabilities for explorative learning, and firm size as the contextual contingency – that, together, compose the firm's digital ecosystem of explorative learning. We define a configuration as a specific combination of elements that together generate the outcome of interest – in this case, competitive performance. This proposition leads us to empirically validate a research model that is based on the configurational approach, as presented in Figure 1, and as further explained below.

2.1 IT capabilities for exploration

IT capabilities are defined herein as the organization's ability to 'mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities' (Bharadwaj, 2000, p. 171). More specifically, these capabilities include the IT assets of the firm such as the computing technologies and applications platform that constitute its 'IT infrastructure' (Ajamieh, Benitez, Braojos and Gelhard, 2016). Organizational IT capabilities also include the IT competencies that allow a firm to enable its business processes as well as its knowledge management through its use of IT (Joshi, Chi, Datta and Han, 2010), that is, through its 'e-business' capabilities (Zhu, 2004). Now, certain IT infrastructure and e-business capabilities may be categorized as being either mainly explorative or exploitative through the notion of 'IT ambidexterity' (Lee, Sambamurthy, Lim and Wei, 2015), in line with Levinthal and March's (1993) conceptualization of how firms pursue either exploration or exploitation. Herein, we focus on explorative IT infrastructure and e-business capabilities as the IT capabilities for exploration of interest.

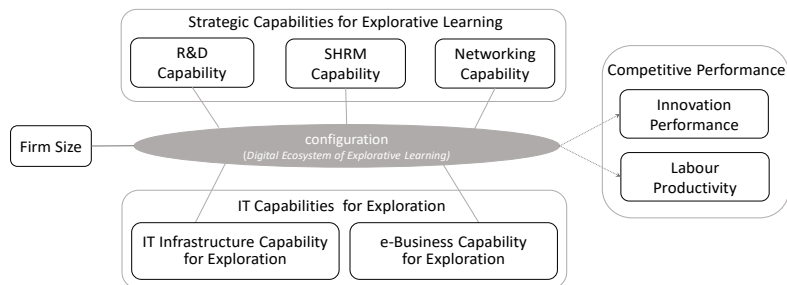


Figure 1: Research model on the digital ecosystem of explorative learning

2.2 Strategic capabilities for explorative learning

Defined as ensembles of accumulated knowledge and competencies that enable the firm to deploy its assets and coordinate its activities (Desarbo, Di Benedetto, Song and Sinha, 2005), strategic capabilities are deemed to shape critical organizational outcomes such as innovation performance (e.g. Di Benedetto, DeSarbo and Song, 2008) and productivity (e.g. Hutton and Eldridge, 2019). Recalling that explorative learning is viewed as a ‘dynamic’ capability, the firm’s strategic capabilities may be envisioned as organizational capabilities that hierarchically underlie its dynamic capabilities (Grant, 1996). Three strategic capabilities, namely research and development (R&D) (Martínez-Senra, Quintás, Sartal and Vázquez, 2015), strategic human resource management (SHRM) (L’Écuyer and Raymond, 2017) and networking capabilities (Husain, Dayan, and Di Benedetto, 2016) have been identified in the literature as having close ties to OL.

In the industrial services sector, the R&D capability refers to the firm’s ability to acquire, assimilate, transform and exploit new knowledge, in conjunction with its human and intellectual capital and knowledge management competencies, in order to develop new services (service R&D) or improve the process by which existing services are rendered to manufacturing firms (process R&D) (Koschatsky and Stahlecker, 2010). Now, this capability may also be considered as a proxy for the ‘learning’ dimension of the firm’s absorptive capacity (Lucena and Roper, 2016). In empirical research, the R&D capability has been observed to both enable and determine explorative learning (Bresman, 2013; Martínez-Senra et al., 2015).

The SHRM capability is defined as the firm’s capacity to develop, motivate and empower human resources in order to meet strategic goals in a dynamic, turbulent and sometimes hostile environment (L’Écuyer and Raymond, 2017). The SHRM capability has been found to interact with the OL in determining the performance of the HR function (Camps, Oltra, Aldás-Manzano, Buenaventura-Vera and Torres-Carballo, 2016). Further,

certain SHRM practices such as talent management, positively impact OL (Oltra and Vivas-López, 2013).

The networking capability is specific to the firm and indicates its ability to manage relationships with suppliers and other business partners (Human, and Naudé, 2009). The networking capability has been found to positively moderate the impact of explorative learning on competitive performance (Chung, Yang and Huang, 2015) and conversely, the OL capability has been found to positively mediate the impact of the networking capability on competitiveness (Husain et al., 2016).

2.3 *Competitive performance: innovation performance and labour productivity*

Viewed as a dynamic capability, OL has been studied in the strategic management literature with regard to its direct and indirect effects on performance (Easterby-Smith and Prieto, 2008). In particular, prior research has thus confirmed the positive impact of OL on the firm's innovation performance (Onağ, Tepeci and Başalp, 2014) and on labour productivity (Peters, Riley, Siedschlag, Vahter and McQuinn, 2018). As a result, we will focus on innovation performance and labour productivity as the competitive performance outcomes of interest.

2.4 *Organizational context of explorative learning: firm size*

In the services sector, firm size may be thought of as a proxy for certain aspects of the firm's organizational context, given the fact that smaller firms are generally found to be less-endowed than larger firms in terms of available resources and competencies (de Brentani, 1995; Nunes et al., 2010). Firm size thus constitutes a potentially important contingency for industrial service firms in developing their IT capabilities for exploration and their strategic capabilities for explorative learning (Chikweche and Bressan, 2018).

3 Methods

3.1 *Sample*

This study's data were culled from a benchmarking database that contains information on 92 industrial service enterprises located in Quebec, Canada. These enterprises offer knowledge-based high value-added services to the manufacturing industry, and in areas such as IT, human resources, R&D and logistics. The database was created by having the firms' top executives and IT manager answer a twenty-page questionnaire to gather wide-ranging data on the competitive performance and business practices of their firm. In exchange for providing this data, the firms obtained a comparative diagnosis of their strategic situation and competitive position. As the sampled firms' size varied from 4 to 146 employees with a mean of 31, they are SMEs (small and medium-sized enterprises).

3.2 Measures

The sampled firms' IT and strategic capabilities were assessed with surrogate measures taken from the extant IS and strategic management literatures. IT capabilities for exploration were assessed through the organization's IT infrastructure and e-business capabilities. These two capabilities were measured with summative indexes calculated from the number of IT-based and Web-based systems and applications such as rapid prototyping and e-business intelligence that are used by the firm mainly for explorative purposes (Raymond et al., 2015). The R&D capability was assessed through a commonly-used surrogate measure, namely the R&D budget per employee (Raymond and St-Pierre, 2010). The SHRM capability was measured by assessing the average level of development of ten high-performance HRM practices (Fabi, Lacoursière, Raymond and St-Pierre, 2010). The networking capability was measured by the number of the firm's partnerships with other organizations in domains such as marketing, R&D and service delivery (Raymond and St-Pierre, 2013). Innovation performance was assessed by the proportion of sales ascribed to new or modified services, a commonly used measure (Raymond and St-Pierre, 2010). Finally labour productivity was assessed with the financial measure frequently used by researchers and practitioners, i.e. the firm's gross profit per employee (Bryan, 2007).

4 Results

The research questions were answered by using fuzzy set qualitative comparative analysis (fsQCA), an appropriate method for small samples (Ragin, 2008). This method uses Boolean algebra to identify different configurations of elements or causal conditions that are associate to the same preferred outcome. The principal contribution of fsQCA lies in its ability to evaluate the relation between a configuration and an outcome. Analysis of our configurational framework was preceded by a direct fuzzy set 'calibration' of the research variables, as it is recommended when indexes and Likert-type scales are used for variable measurement (Liu, Mezei, Kostakos and Li, 2017). The descriptive statistics and calibration thresholds of the research variables are presented in Table 1.

Table 1: Descriptive statistics and calibration of the research variables (n = 92)

Configurational element	Fuzzy Set Calibration			mean	s.d.	min – max
	fully in	cross-over	fully out			
Firm Size ^a	40	25	10	31	27	4 – 146
R&D Capability ^b	3000	500	0	4525	12352	0 – 69747
SHRM Capability ^c	0.40	-0.05	-0.40	0.04	0.45	-0.81 – 1.43
Networking Capability ^d	5	2	0	2.5	2.7	0 – 12
e-Business Cap. for Explor. ^e	4	1	0	2.1	1.9	0 – 6
IT Infrastr. Cap. for Explor. ^f	4	1	0	2.7	1.5	0 – 4
Innovation Performance ^g	0.30	0.05	0.00	0.18	0.30	0.00 – 1.00
Labour Productivity ^h	0.67	0.33	0.10	0.41	0.44	-1.07 – 2.31

^a number of employees
^b R&D budget / number of employees
^c mean level of development of 10 high-performance HRM practices (standardized variables)
^d number of formal collaborations with customers, suppliers, consultants, universities and research centres
^e number of explorative activities that are realized by the firm through e-business applications and the Web
^f number of technologies and systems that are used by the firm for explorative purposes
^g sales of new or modified services / total sales
^h gross profit / number of employees (x 100 000 CAN \$)
<i>Nota.</i> Calibration thresholds: fully in = top quartile, crossover = median, fully out = bottom quartile.

The fsQCA method allows one to analyse the configurational elements that, together, are ‘sufficient’ to produce the chosen outcomes (Ragin, 2008). This method was thus applied to two sets of configurations: one for high innovation performance and another one for high labour productivity. In demonstrating equifinality and as presented in Table 2, the results of the fsQCA analysis identify six causal configurations, i.e. two sets of configurational elements (or causal conditions) equally associated to high levels of innovation performance (HI1 and HI2) and four sets equally associated to high levels of productivity (HP1, HP2, HP3 and HP4). The overall solution coverage indicates the proportion of cases that are covered by all reported configurations, whereas the overall solution consistency assesses the degree to which capability configurations are subsets of the outcome. In this study, the consistency cut-off point was set at 0.75, following Ragin’s (2008) recommendations.

Table 2: Configurations for high innovation performance and labour productivity

Configuration Configurational element	High Innovation Performance		High Labour Productivity			
	HI1	HI2	HP1	HP2	HP3	HP4
<i>Firm Size</i>	⊗		⊗	●	●	
<i>R&D Capability</i>	●	●				●
<i>SHRM Capability</i>	●	●	●	●	●	●
<i>Networking Capability</i>			●	●	⊗	⊗
<i>e-Business Cap. for Exploration</i>		●	●	●	⊗	⊗
<i>IT Infrastructure Cap. for Explor.</i>	●	●	⊗	●	●	●
Conditions tested						
Consistency	.780	.834	.835	.822	.779	.736
Raw coverage	.255	.314	.152	.215	.179	.120
Unique coverage	.034	.093	.050	.102	.084	.025
Overall solution consistency	.779		.800			
Overall solution coverage	.348		.402			

Legend. ● : presence of a core condition ● : presence of a peripheral condition
⊗ : absence of a core condition ⊗ : absence of a peripheral condition
blank: immaterial condition (“don’t care”)

The high-innovation performance configurations, HI1 and HI2, highlight the primary importance of strong R&D and SHRM capabilities ('core' conditions) and the secondary importance of a strong IT infrastructure for exploration capability ('peripheral' condition). Also, HI1 applies to small-sized enterprises whereas HI2 adds a strong explorative e-business capability as a core condition and is irrespective of firm size ('immaterial' condition). This would mean that neither of the two competing explanations of the size effect on innovation performance (Amara, Landry, and Doloreux, 2009), namely the positive effect of large size as an indicator of available resources, or the positive effect of small size as an indicator of firm flexibility, is at work here.

The first two high-productivity configurations, HP1 and HP2, highlight the primary importance of having strong SHRM, networking and e-business capabilities. Furthermore, HP1 is characterized by the lack of strong IT infrastructure capability in small-sized enterprises, whereas HP2 adds a strong IT infrastructure capability as a peripheral condition in medium-sized enterprises. The last two high productivity configurations, HP3 and HP4 are characterized by the presence of a strong SHRM capability and the absence of networking and e-business capabilities as core conditions as well as by the presence of a strong IT infrastructure capability as a peripheral condition. Also, HP3 applies to medium-sized enterprises, whereas HP4 requires a strong R&D capability as a core condition and is irrespective of firm size.

5 Discussion

In answering the research question, a fsQCA analysis allowed us to unveil different digital ecosystem configurations, that is, six causal 'recipes' of strategic capabilities for explorative learning, IT capabilities for exploration, and firm size that equally attain high levels of innovation performance and labour productivity. In line with the configurational approach, contingency theory and the CBV, these equifinal configurations manifest a 'gestalts' type of alignment or 'fit' between the firms' IT capabilities for exploration and strategic capabilities for explorative learning (Raymond and St-Pierre, 2013). Hence, instead of establishing linear relations between each of the digital ecosystem elements and the performance outcomes as the traditional variance approach does, the three sets of configurational elements of the digital ecosystem are analyzed in combination as they jointly affect the competitive outcomes (Fiss, 2011).

With regard to digital ecosystem configurations unveiled, one first notes that the SHRM capability is present in all configurations of both high innovation performance and high labour productivity, and may thus be deemed as a 'necessary' condition. This means that explorative learning benefits the firm in terms of its competitive performance to the extent that employees are strongly motivated and empowered to undertake exploration activities. Another strategic capability that appears to be necessary to achieve high innovation performance is the R&D capability. However, this capability does not appear to be necessary for high labour productivity. This points to the industrial service firms' difficulty in being both highly innovative and highly productive simultaneously, as these two outcomes are shown here to be achieved through very different capability

configurations. One might also surmise that productivity, as opposed to innovation, would benefit more from exploitative rather than explorative learning, and in particular from IT capabilities for exploitation such as enterprise resource planning (ERP) systems and e-commerce applications (Fabi et al., 2010).

With respect to the IT for exploration capabilities, a strong IT infrastructure is a peripheral rather than a core condition in the attainment of high innovation performance and high labour productivity, that is, it must be present but it is not ‘determinant’. A strong e-business capability for exploration is also present in one of the two high innovation performance configurations and in two of four high labour productivity configurations. In the high productivity case, the e-business capability appears to work in tandem with the networking capability, that is, when one is present the other is present (HP1 and HP2) and, conversely, when one is absent the other is absent (HP3 and HP4). This would be an indication that a ‘mismatch’ between these two capabilities for explorative learning (i.e. a strong networking capability with a weak e-business capability or vice-versa) would be detrimental to achieving high levels of productivity. This again points to the fact that by presuming IT capabilities to directly enable the firm’s learning processes and to linearly effect its performance independently of other non-IT capabilities, one is bound to have a more limited understanding of the true role and impact of these capabilities (Woodside, 2013).

In addition to its contribution to OL theory, our study also contributes to OL practice. That is, our findings may provide managers of industrial service SMEs (and those who assist them) with different digital ecosystem configurations that may be emulated with the aim of enabling their explorative learning processes and improving their competitive performance. Given the IT and non-IT resources at their disposal, these firms may envisage the capability configuration that best fits their specific business environment and organizational context.

References

- Aboal, D. and Tacsir, E., (2018) “Innovation and productivity in services and manufacturing: the role of ICT”, *Industrial and Corporate Change*, Vol. 27, No. 1, pp. 221-241.
- Ajamieh, A., Benitez, J., Braojos, J. and Gelhard, C., (2016) “IT infrastructure and competitive aggressiveness in explaining and predicting performance”, *Journal of Business Research*, Vol. 69, pp. 4667-4674.
- Amara, N., Landry, R. and Doloreux, D., (2009) “Patterns of innovations in knowledge-intensive business services”, *The Service Industries Journal*, Vol. 29, No. 4, pp. 407-430.
- Andreu, R. and Ciborra, C., (1996) “Organisational learning and core capabilities development: the role of IT”, *Journal of Strategic Information Systems*, Vol. 5, pp. 111-127.
- Bharadwaj, A. S. A., (2000) “A resource-based perspective on information technology capability and firm performance: An empirical investigation”, *MIS Quarterly*, Vol. 24, No. 1, pp. 169–196.
- Bresman, H., (2013) “Changing routines: A process model of vicarious group learning in pharmaceutical R&D”, *Strategic Management Journal*, Vol. 56, No. 1, pp. 35-61.
- Bryan, L.L., (2007) “The new metrics of corporate performance: Profit per employee”, *McKinsey Quarterly*, No. 1, pp. 56-65.
- Bryson, J.R., Keeble, D. and Wood, P., (1997) “The creation and growth of small business service firms in post-industrial Britain”, *Small Business Economics*, Vol. 9, pp. 345-360.

- Camps, J., Oltra, V., Aldás-Manzano, J., Buenaventura-Vera, G. and Torres-Carballo, F., (2016), "Individual performance in turbulent environments: The role of organizational learning capability and employee flexibility", *Human Resource Management*, Vol. 55, No. 3, pp. 363-383.
- Chi, L., Ravichandran, T. and Andreovski, G., (2010) "Information technology, network structure, and competitive action", *Information Systems Research*, Vol. 21, pp. 543-570.
- Chi, M., Zhao, J., George, J. F., Li, Y. and Zhai, S., (2017) "The influence of inter-firm IT governance strategies on relational performance: The moderation effect of information technology ambidexterity", *International Journal of Information Management*, Vol. 37, No. 2, pp. 43-53.
- Chikweche, T. and Bressan, A., (2018) "A systematic review of future research challenges and prospects of organizational learning research in small medium size enterprises", *Journal of Small Business & Entrepreneurship*, Vol. 30, No. 2, pp. 175-191.
- Chung, H.F.L., Yang, Z. and Huang, P.-H., (2015) "How does organizational learning matter in strategic business performance? The contingency role of guanxi networking", *Journal of Business Research*, Vol. 68, pp. 1216-1224.
- Cohen, W. M. and Levinthal, D. A., (1990) "Absorptive capacity: A new perspective on learning and innovation", *Administrative Science Quarterly*, Vol. 35, No. 1, pp. 128-152.
- de Brentani, U., (1995) "Firm size: Implications for achieving success in new industrial services", *Journal of Marketing Management*, Vol. 11, pp. 207-225.
- Desarbo, W.S., Di Benedetto, C.A., Song, M. and Sinha, I., (2005) "Revisiting the Miles and Snow strategic framework: uncovering interrelationships between strategic types, capabilities, environmental uncertainty, and firm performance", *Strategic Management Journal*, Vol. 26, No. 1, pp. 47-74.
- Deng, X., Doll, W.J. and Cao, M., (2008) "Exploring the absorptive capacity to innovation/productivity link for individual engineers engaged in IT enabled work", *Information & Management*, Vol. 45, pp. 75-87.
- Di Benedetto, C.A., DeSarbo, W.S. and Song, M., (2008) "Strategic capabilities and radical innovation: An empirical study in three countries", *IEEE Transactions on Engineering Management*, Vol. 55, No. 3, pp. 420-433.
- Doty, D.H., Glick, W. H. and Huber, G. P., (1993) "Fit, equifinality, and organizational effectiveness: A test of two configurational theories", *Academy of Management Journal*, Vol. 36, No. 6, pp. 1196-1250.
- Easterby-Smith, M. and Prieto, I.M., (2008) "Dynamic capabilities and knowledge management: an integrative role for learning?", *British Journal of Management*, Vol. 19, pp. 235-249.
- Fabi, B., Lacoursière, R., Raymond, L. and St-Pierre, J., (2010) "HRM capabilities as a determinant and enabler of productivity for manufacturing SMEs", *Human Systems Management*, Vol. 29, No. 3, pp. 115-123.
- Fiss, P., (2011) "Building better causal theories: A fuzzy set approach to typologies in organization research", *Academy of Management Journal*, Vol. 54, No. 2, pp. 393-420.
- Grant, R. M., (1996) "Prospering in dynamically-competitive environments: organizational capability as knowledge integration", *Organization Science*, Vol. 7, No. 4, pp. 375-387.
- Gresov, C. and Drazin, R., (1997) "Equifinality: functional equivalence in organizational design", *Academy of Management Journal*, Vol. 22, No. 2, pp. 431-452.
- Han, K., Chang, Y.B. and Hahn, J., (2011) "Information technology spillover and productivity: The role of information technology intensity and competition. *Journal of Management Information Systems*, Vol. 28, No. 1, pp. 115-145.
- Hess, T., Matt, C., Benlian, A. and Wiesböck, F., (2015) "Options for formulating a digital transformation strategy", *MIS Quarterly Executive*, Vol. 15, pp. 103-119.
- Human, G. and Naudé, P., (2009) "Exploring the relationship between network competence, network capability and firm performance: a resource-based perspective in an emerging economy", *Management Dynamics*, Vol. 18, No. 1, pp. 2-14.

- Husain, Z., Dayan, M. and Di Benedetto, C.A., (2016) "The impact of networking on competitiveness via organizational learning, employee innovativeness, and innovation process: A mediation model", *Journal of Engineering and Technology Management*, Vol. 40, No. 1, pp. 15-28.
- Hutton, S. and Eldridge, S., (2019) "Improving productivity through strategic alignment of competitive capabilities", *International Journal of Productivity and Performance Management*, Vol. 68, No. 3, pp. 644-668.
- Joshi, K.D., Chi, L., Datta, A. and Han, S., (2010) "Changing the competitive landscape: Continuous innovation through IT-enabled knowledge capability", *Information Systems Research*, Vol. 21, No. 3, pp. 472-495.
- Kane, G.C. and Alavi, M., (2007) "Information technology and organizational learning: An investigation of exploration and exploitation processes", *Organization Science*, Vol. 18, No. 5, pp. 796-812.
- Koschatsky, K. and Stahlecker, T., (2010) "The emergence of new modes of R&D services in Germany", *The Service Industries Journal*, Vol. 30, No. 5, pp. 685-700.
- L'Écuyer, F. and Raymond, L., (2017) "Aligning the e-HRM and strategic HRM capabilities of manufacturing SMEs: A 'gestalts' perspective", in *Electronic HRM in the Smart Era*, eds. T. Bondarouk, H.J.M. Ruël and E. Parry, Emerald Group Publishing, Bingley, United Kingdom, pp. 137-172.
- Lee, O.-K., Sambamurthy, V., Lim, K. H. and Wei, K. K., (2015) "How does IT ambidexterity impact organizational agility?", *Information Systems Research*, Vol. 26, No.2, pp. 398-417.
- Levinthal, D. A. and March, J. G., (1993) "The myopia of learning", *Strategic Management Journal*, Vol. 14, pp. 95-112.
- Li, Y.-H. and Huang, J.-W., (2013) "Exploitative and exploratory learning in transactive memory systems and project performance", *Information & Management*, Vol. 50, No. 6, pp. 304-313.
- Liu, Y., Mezei, J., Kostakos, V. and Li, H., (2017) "Applying configurational analysis to IS behavioural research: a methodological alternative for modelling combinatorial complexities", *Information Systems Journal*, Vol. 27, No. 1, pp. 59-89.
- López-Nicolás, C. and Meroño-Cerdán, Á.L., (2011) "Strategic knowledge management, innovation and performance", *International Journal of Information Management*, Vol. 31, pp. 502-509.
- Lucena, A. and Roper, S., (2016) "Absorptive capacity and ambidexterity in R&D: Linking technology alliance diversity and firm innovation", *European Management Review*, Vol. 13, pp. 159-178.
- March, J.G., (1991) "Exploration and exploitation in organizational learning", *Organization Science*, Vol. 2, No. 1, pp. 71-87.
- Martínez-Senra, A.I., Quintás, M.A., Sartal, A. and Vázquez, X.H., (2015) "How can firms' basic research turn into product innovation? The role of absorptive capacity and industry appropriability", *IEEE Transactions on Engineering Management*, Vol. 62, No. 2, pp. 205-216.
- Miller, D., Eisenstat, R. and Foote, N., (2002) "Strategy from the inside out: Building capability-creating organizations", *California Management Review*, Vol. 44, No. 3, pp. 37-54.
- Nunes, P.M., Serrasqueiro, Z., Mendes, L. and Sequeira, T.N., (2010) "relationship between growth and R&D intensity in low-tech and high-tech Portuguese service SMEs", *Journal of Service Management*, Vol. 21, No. 3, pp. 291-320.
- Oltra, V. and Vivas-López, S., (2013) "Boosting organizational learning through team-based talent management: what is the evidence from large Spanish firms?", *International Journal of Human Resource Management*, Vol. 24, No. 9, pp. 1853-1871.
- Onağ, A.O., Tepeci, M. and Başalp, A.A., (2014) "Organizational learning capability and its impact on firm innovativeness", *Procedia - Social and Behavioral Sciences*, Vol. 150, pp. 7708-7717.
- Peters, B., Riley, R., Siedschlag, J., Vahter, P. and McQuinn, J., (2018) "Internationalisation, innovation and productivity in services: evidence from Germany, Ireland and the United Kingdom", *Review of World Economics*, Vol. 154, No. 3, pp. 585-615.

- Ragin, C.C., (2008) *Redesigning social inquiry: Fuzzy sets and beyond*, University of Chicago Press, Chicago.
- Raymond, L., Bergeron, F., Croteau, A.-M. and St-Pierre, J., (2015) "Developing absorptive capacity through e-business: The case of international SMEs", *Journal of Small Business Management*, Vol. 53, No. S1, pp. 75-94.
- Raymond, L. and St-Pierre, J., (2010) "R&D as a determinant of innovation in manufacturing SMEs: An attempt at empirical clarification", *Technovation*, Vol. 30, No. 1, pp. 48-56.
- Raymond, L. and St-Pierre, J., (2013) "Strategic capability configurations for the internationalization of SMEs: A study in equifinality", *International Small Business Journal*, Vol. 31, No. 1, pp. 82-102.
- Setia, P., Venkatesh, V. and Joglekar, S., (2013) "Leveraging digital technologies: how information quality leads to localized capabilities and customer service performance", *MIS Quarterly*, Vol. 37, pp. 565-590.
- Sun, P.Y.T. and Anderson, M.H., (2010) "An examination of the relationship between absorptive capacity and organizational learning, and a proposed integration", *International Journal of Management Reviews*, Vol. 12, No. 2, pp. 130-150.
- Teece, D., Peteraf, M. and Leih, S., (2016) "Dynamic capabilities and organizational agility: Risk, uncertainty, and strategy in the innovation economy", *California Management Review*, Vol. 58, No. 4, 13–35.
- Wang, N., Liang, H., Zhong, W., Xue, Y. and Xiao, J., (2012) "Resource structuring or capability building? An empirical study of the business value of information technology", *Journal of Management Information Systems*, Vol. 29, No. 2, pp. 325–367.
- Woodside, A.G., (2013) "Moving beyond multiple regression analysis to algorithms: Calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data analysis and crafting theory", *Journal of business research*, Vol. 66, No. 4, pp. 463-472.
- Zahra, S.A. and George, G., (2002) "The net-enabled business innovation cycle and the evolution of dynamic capabilities", *Information Systems Research*, Vol. 13, No. 2, pp. 147–150.

The “Big Social Data” Paradigm: Definition, Key Features, and Applicative Contexts

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Abstract

The exponential growth of data existing on the web and generated by organizations and individuals, computer systems and digital devices, is opening new scenarios and opportunities for their exploitation, and new technological and managerial challenges are arising about the collection, transformation, storage, processing, usage, and visualization of such huge amount of data. The Big Data paradigm has therefore emerged as a socio-technical system that allows for offering innovative services in many data-intensive applications and domains. Within the Big Data field, the Big Social Data concept emerged as a relatively new phenomenon with multiple meanings and applications. According to the literature, the Big Social Data paradigm still lacks of a clear and shared definition. Thus, through a Systematic Literature Review, this paper aims at fulfilling this gap by providing a conceptualization of the Big Social Data paradigm that includes a possible definition, the distinguishing characteristics and properties, and some applications in real-life settings. Furthermore, by leveraging an existing taxonomy of data types, this paper proposes an extension that is specific for the Big Social Data domain, by introducing a new category of data type, namely “Digital Context Data”, which includes data related to the patterns of digital context dynamics. Finally, specifically for this new category of data type, two example applications in data-intensive domains (i.e. smart tourism and e-health) have been provided to demonstrate

how the Big Social Data paradigm can describe, both explicitly and implicitly, the patterns of digital context dynamics.

Keywords – Big Data, Big Social Data, Digital Context, Systematic Literature Review, Taxonomy (max 5 words)

Paper type – Academic Research Paper

1 Introduction

The exponential growth of data existing on the web, generated by organizations and individuals, computer systems and digital devices, opens new scenarios and opportunities for their exploitation, and creates new technological and managerial challenges related to their management and processing (Sivarajah et al., 2017). The Big Data paradigm has therefore emerged in recent years as a socio-technical system for acquiring, storing, managing and analysing data in flexible and efficient way, in the ultimate goal to offer innovative services in data-intensive applications and domains such as healthcare, banking, tourism, education, public administration, and intelligent manufacturing (Elia et al., 2018a).

From a data perspective, as much of social interaction is nowadays mediated by information technology and takes place in online social media, the emergence of extensive amount of user-generated contents has spread more widely and quickly, thus providing organizations with opportunities to obtain information and extract knowledge to generate value for individuals, companies, and territories (Elia et al., 2018b).

In this scenario, Big Social Data (BSD) that has been defined as “any high-volume, high-velocity, high-variety and/or highly semantic data generated from technology-mediated social interactions and actions in digital realm, and which can be collected and analysed to model social interactions and behaviour” (Olshannikova et al., 2017), has become an emergent research topic. BSD can be considered a particular category of Big Data argued to represent about 90% of all Big Data (Gandomi et al., 2015), and refers to large volumes of data generated by users and describing social behaviour and interactions in digital environments.

Theory background and studies related to BSD show that this paradigm has multiple meanings and still lacks of a clear and shared definition (Ward & Barker, 2013; Halavais, 2015). This paper aims at fulfilling this gap by providing a twofold contribution: i) a conceptualization of the Big Social Data paradigm by defining the key characteristics and properties; ii) a taxonomy of Big Social Data types by extending some previous researches on the topic.

The research methodology used for this study is the Systematic Literature Review (SLR), which is a rigorous and transparent form of literature review that includes the identification, the synthesis and the assessment of all available evidences, quantitative and qualitative, in the aim to generate a robust and empirically-derived answer to a focused research question. SLR encourages researchers to engage more critically with the quality

of evidence (Mallet et al., 2012), and represents a guide for the research process that ensures transparency of the review, breadth of studies included, objectivity, and reduction of implicit researcher bias (Gough and Elbourne, 2002).

The main finding of this paper consists in a conceptualization and definition of BSD paradigm that can help researchers to build proper methods for a purposeful processing and analysis of this specific typology of data. This contributes to face the emerging challenges related to the growth of human-generated data, which calls for novel tools, frameworks and methodological approaches as well as multidisciplinary expertise to exploit the potential value embedded in these sources of data (Olshannikova et al., 2017). A further contribution is related to the proposition of a taxonomy of Big Social Data types, with example applications in data-intensive domains (i.e. smart tourism and e-health).

This paper is structured as follows: sections 2 presents the literature background, section 3 illustrates the research methodology and the main steps of the Systematic Literature Review, whereas section 4 presents the main results achieved. Afterwards, section 5 introduces a taxonomy of BSD types and describes a possible application in two data-intensive domains (smart tourism and e-health). Finally, section 6 discusses the results achieved and highlights some limitations of the study, which can open new paths for further research.

2 Related Literature

Big Social Data was a concept developed by Lev Manovich (2011) and it gained great interest in research on digital culture and society. One of the earlier examples of BSD applications is presented by Procter et al. (2013), which illustrates how Twitter has influenced the movement during the 2011 London riots. Since then, besides the growing interests of researchers and practitioners on this topic, the concept of BSD has been defined and interpreted in many ways for various purposes, generating a large research debate on BSD definition and its main conceptual aspects. The analysis of the literature shows that the BSD have been considered as:

- the science that studies the relationships between physical data of the real world and data on social media (Ishikawa, 2015), or as a social science that through quantitative analysis methods studies the connections between information flows and human behavior (Pentland, 2014);
- the result of approaches based on social computing (Guellil, 2015; Nguyen, 2015; Tang, 2014), or as a result of what derives from the communicative practices (mediated by technology) of our daily life (Coté, 2014);
- a purpose-driven research approach for a society-oriented view, which leverages the shift of Big Data towards media, communication, cultural and computational social science to explore the digital humanities domain (Burgess & Bruns, 2012) and find new ways for enhancing the governance and organizational improvements (Housley, 2014).

- a methodology based on the combination of three elements (Bello-Orgaz et al., 2016) such as Big Data (as a processing paradigm), Social Media (as the main source of data), and Data Analysis (as a method to acquire new knowledge for users or companies).

To confirm this latter approach, Golbeck (2014) referred to the BSD paradigm to extract insights from social media data and online social interactions of people for descriptive and predictive purposes, with the ultimate goal to influence human decision-making in various application domains. Other researchers focused mainly on the application and utilization of data analytics techniques (Cambria et al., 2013; Bravo Marquez et al., 2014), reserving little attention to understand the real meaning and nature of BSD.

Thus, different interpretations and terms with which researchers refer to the “social” aspect of Big Data have emerged. The most common terms are “Social Big Data” (SBD) and “Big Social Data” (BSD), which are often used interchangeably and in any case are not clearly and uniquely defined. Among the definitions present in the literature, very few highlight BSD properties, methods of generation and possible uses. That one given by Olshannikova et al. (2017) describes the BSDs as “any high-volume, high-velocity, high-variety and/or highly semantic data that is generated from technology-mediated social interactions and actions in digital realm, and which can be collected and analyzed to model social interactions and behavior”. Nevertheless, the same authors state that the multidisciplinary and multi-dimensional nature of BSD challenges to the development of a better conceptualization and definition of the concept.

Another research issue related to BSD is the lack of a comprehensive list of data types that can be crucial for identifying research opportunities and practical means towards data-driven research (Olshannikova et al., 2017). Research contributions on this topic focus mainly on creating taxonomy of data types in the context of online social networks (OSN). Beye et al. (2012) identified nine data types by focusing on the goals of different OSN, whereas Schneier (2010) focused solely on the task of establishing a taxonomy without suggesting a structured methodology and without mentioning any details and foundation about the data types. Årnes et al. (2011) extended the latter work with short definitions and a list of examples for each category, without providing any details and explanations about the particular data types. Richthammer et al. (2014) followed a user-centric approach to propose a fine-grained taxonomy in which the individual data types are arranged hierarchically. Finally, Olshannikova et al. (2017) extended and re-organized latter research with a focus on Big Social Data and proposed a taxonomy with three category of data types describing respectively the self-representation in digital environment, the communication and knowledge creation/distribution through technology, and the patterns of digital social relationships.

From the above literature, two research gaps emerge: the first one relates to the absence of a clear and formal definition of Big Social Data, also in terms of key properties and key features; the second one is related to the development of a taxonomy of BSD data types and to the analysis of how the BSD paradigm can be applied in different data intensive domains.

In order to address these gaps, section 4 in the present work proposes a definition of BSD derived from a Systematic Literature Review, while section 5 presents a taxonomy that extends the spectrum of BSD data types.

3 Research Methodology

The research methodology adopted to carry out this study is based on a Systematic Literature Review (hereafter SLR). SLR is a rigorous and transparent form of literature review, which involves the identification, the synthesis and the assessment of all available evidences, quantitative and qualitative, in the aim to generate a robust and empirically-derived answer to a focused research question. SLR represents also a guide for researchers during the research process, and ensures transparency of the review, breadth of studies included, objectivity, and reduction of implicit researcher bias (Mallet et al., 2012; Gough & Elbourne, 2002). Besides, SLR encourages researchers to engage more critically with the quality of evidence (Mallet et al., 2012).

3.1 SLR process and its application

The process of SLR has been developed by following four key steps: search, selection, analysis, and synthesis (Keele, 2007; Centobelli et al., 2017; Günther et al., 2017). The search has been performed by considering two scientific databases (i.e. Scopus and Web of Science), and a query has been designed and executed to extract the research papers containing “big social data” OR “social big data” OR “big social media data” in the title, keywords or abstract. In table 1, extraction criteria are summarized as well as the results of the first step of the methodology.

Table 3. Extraction criteria for the search step

EXTRACTION CRITERIA	RESULTS
Keyword used	"big social data", "social big data", "big social media data"
Fields of the research	Title, Keywords, or Abstract
Data Range	Until 2018
Language	English
Document Type	Conference Papers, Articles, Book Chapters
Results from Scopus	218
Results from Web of Science	146
Duplicates	139
Total number of items	225

As for the selection step, a set of exclusion criteria (listed in table 2) has been applied to contain the research focus and reduce the number of candidate papers to be further analysed.

Table 4. Exclusion criteria for the selection step

ESCLUSION CRITERIA	N. OF ITEMS EXCLUDED
1. Items whose full text was not available	22
2. Format not compliant with the document type (Conference Papers, Articles, Book Chapters)	4
Total number of items remained	199

The remaining 199 resources have been examined in the third step of the SLR methodology, i.e. the analysis, through a qualitative study focused on the aims of the research presented, which included two tasks:

1. a term frequency analysis on abstracts to identify the key research topics in the BSD domain;
2. a qualitative study to extract any definition (proposed or referenced) on BSD in order to be mapped on the aforementioned research topics.

The first task (i.e. the term frequency analysis) generated 70 terms overall. Authors have considered mutual relationships between terms in order to group them and consequently have identified four key topics in the current BSD research literature, which are illustrated in Figure 1: Sources (i.e. places where BSD can be found), Properties (i.e. attributes and characteristics denoting the BSD), Technologies (i.e. methods and tools for BSD processing in order to generate value), and Value (i.e. effects and impacts of BSD in the applicative domains).

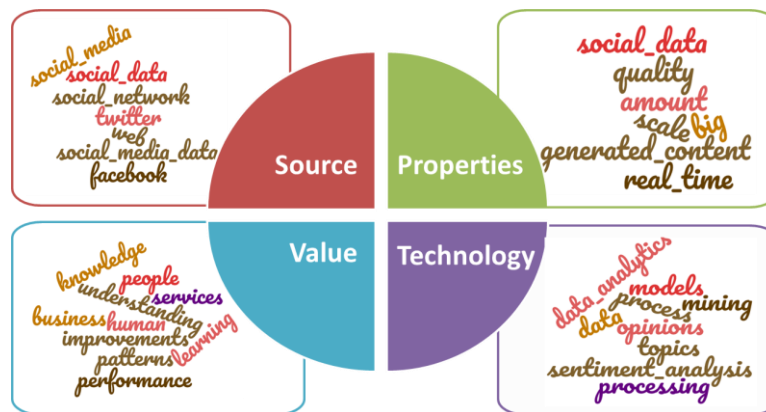


Figure 4. The four key research BSD topics and related most frequent terms

The second task (i.e. the extraction of BSD definitions and their mapping on the four research topics) generated 107 definitions overall, respectively extracted from 107 research items. Each definition has been properly extracted from the research item and analysed in order to map it along one or more research topics.

As for the last step of the SLR (i.e. the Synthesis), the authors and two experts operating in the Big Data domain have been involved in three meetings for a collective discussion. Before to join each meeting, all the participants had the time to analyse individually the research items, as well as to take some notes and comments to be shared

during the plenary sessions. The expected goal at the end of the third meeting was to harmonise all the contributions and provide a synthesis for reaching a consensual and formal definition of Big Social Data.

4 Towards a definition of Big Social Data

Most of the analysed research papers define BSD along the perspective of data sources, specifying that they represent “Big Data from social media sources”. Some of them provide a more detailed analysis, as the paper of Ishikawa et al. (2018) that defines BSD as a “collection of big data composed of real world data, open data and social data”. Other researchers define BSD as “multiple distributed sources but with a strong focus on social media” (Reuter et al., 2017), or as “social media applications or platforms that range from social networks, micro blogs, discussion forums, wikis to podcast networks, picture and video sharing platforms, ratings and reviews communities, social bookmarking sites, and avatar based virtual reality spaces” (Akter et al., 2016).

As for the properties characterizing the BSD, a remarkable group of definitions highlights the characteristics of Big Social Data in terms of data attribute, and emphasizes the well-known Big Data 3V model (Volume, Variety, Velocity). From this perspective, Bello-Organ et al. (2016) define Big Social Data as data characterised by “different formats and contents, their very large size, and the online or streamed generation of information”. Few other researchers as El Alaoui et al. (2018) add to the aforementioned model two other V-based properties (i.e. Value and Variability), while Olshannikova et al. (2017) underline the semantic richness of BSD.

Another group of definitions emphasizes the technological issues behind Big Social Data collection, management and processing. Bednár (2017) talks about “various data analytics methods and Big Data processing technologies”, while Peng et al. (2016) highlight the need of non-traditional techniques, tools, and methods to handle Big Social Data. Finally, Mukkamala et al. (2014) stress on the necessity to have proper methods, techniques and tools coming from computational social science.

In relation to the different forms of value that Big Social Data can generate, there is a noteworthy number of research papers in which BSD are referred as the means to offer new insights to understand deeper user’s social behaviour and interactions (i.e. Vepsäläinen et al., 2017). Besides, other researchers highlight value in terms of impacts on advancement on society, generation of relevant knowledge for users and companies, prediction of real-life outcomes, and generation of new opportunities to study city dynamics and urban social behaviour. More in particular, El Alaoui et al. (2018) refer to “the massive set of opinions that could be processed to determine people tendencies in the digital realm”, while Del Vecchio et al. (2018) discuss the possibility to improve “the effectiveness of the decision-making process, as well as in terms of sustainability”. Furthermore, few other researchers state that BSD value consists in providing “meaningful facts and actionable insights that go beyond traditional social science research methods” (Mukkamala et al., 2014) or in creating “unprecedented opportunities to study city dynamics and urban social behaviour” (Silva et al., 2013).

Thus, by considering the outputs of the synthesis step of the SLR, the core concepts of Big Social Data are represented by:

- the attributes of data in terms properties and characteristics (i.e. Volume, Variety, Velocity);
- the social media services and platforms as main data sources;
- the usage of proper technologies and non-traditional techniques, tools and methods to collect, manage and analyse such typology of data;
- the insights coming from the processing and analysis of data for creating social value, as well as for generating positive impact for companies and society.

Based on these considerations and evidences, the formal definition of Big Social Data proposed in this article is:

“Big Social Data is that subset of Big Data generated from people’s actions and interactions within social media services and platforms, properly collected and analysed to provide crucial insights into human behaviour, people’s preferences and relationships, social interactions and transformations, and real-life outcomes prediction”.

This definition is compatible with several groups of definitions analysed during the SLR process, and tries to harmonize different research efforts and applicative perspectives from which BSD has been studied in the last years. Furthermore, this definition stresses on BSD as human-generated data that is the key to make BSD concept clearer and distinctive within the general field of Big Data. Indeed, in accordance with Olshannikova et al. (2017), differently from machine-generated data that could be analysed through mere Big Data Analytics tools and applications, human-generated content requires more intelligent solutions to provide insight on people’s relationships, opinions and behaviours.

5 A taxonomy of BSD data types

As discussed in previous sections, besides the need for a clear and consensual definition of BSD, another research issue is related to the lack of a comprehensive list of BSD data types. As mentioned, Olshannikova et al. (2017), by enhancing previous research contributions, proposed a non-extensive taxonomy of BSD data types made by the following categories:

- Digital self-representation data, which refer to identity depiction and communicative body in digital environment;
- Technology-mediated communication data, which refer to data generated in bidirectional communication, as well as to knowledge creation and knowledge distribution through the usage of digital technologies;
- Digital relationships data, which refer to data that reveal patterns of digitally enabled social relationships.

Starting from the definition of Big Social Data proposed in the previous section, our purpose is to include data types that are functional to build and analyse a context from which disclosing valuable knowledge from BSD sources, in the form of human

behaviour, people's preferences and relationships, social interactions and transformations, real-life outcomes prediction.

In such a perspective, a new category of data type named "Digital Context Data" has been added to the classification proposed by Olshannikova et al. (2017). It grounds on the concept of "context", which refers to "any information that can be used to characterize the situation of an entity (a person, a place, or an object) that is considered relevant to the interaction between a user and an application, including the user and applications themselves" (Dey et al., 2000). According to this definition, the "context" is characterized by all those informational dimensions that are important to understand the dynamic interactions between users and applications, which constantly change and cannot be limited only to the knowledge of the location of the user itself. The informational dimensions that delimitate the boundaries of the context derive from the knowledge needs related to the BSD value function, which represents the "why" and "how" BSD contributes to generate value in the form of human behaviour, people's preferences and relationships, social interactions and transformations, real-life outcomes prediction. Once defined, the context can evolve based on the knowledge and insights discovered during the analysis; similarly, the original knowledge needs shaping the initial context can evolve and contribute to reshape the BSD value function.

Table 3 summarizes the core categories of the BSD domain, and describes the contribution that this paper aims at provide by referring to this specific issue.

Table 5. Taxonomy for BSD data types

CATEGORY AND DEFINITION	TYPES OF DATA
Digital self-representation data (Olshannikova et al., 2017) Data related to identity depiction and communicative body in digital environment	<i>Profile data:</i> <ul style="list-style-type: none"> - Login data (name/nickname/e-mail address and password); - Mandatory data (services and application required data like, for example, full name, citizenship, and birthday); - Extended data (profile pictures, education, tags of interests). <i>Self-published content</i> (e.g. personal documents, pictures, videos, interests): <ul style="list-style-type: none"> - Disclosed data (to the public); - Entrusted data (content sharing within trusted digital community). <i>Data published by the community</i> (e.g. pictures, narrations, videos, posts) and related to content shared by other users, which contribute to the digital identity creation.
Technology-mediated communication data (Olshannikova et al., 2017) Data related to two-way communication, knowledge creation and distribution through technology	<i>Private communication data</i> like instant 1-to-1 messaging and content sharing. <i>Public communication data</i> like 1-to-many messaging, commenting, information contribution, editing of existing entries. <i>Collaborative communication data</i> like many-to-many participatory content sharing, chats, video-conferences.
Digital relationship data (Olshannikova et al., 2017) Data that reveal digital social	<i>Explicit data:</i> Friendship data-Followee/Follower data; <i>Implicit data:</i> Data that is revealed through technology-mediated communication data (e.g. tweets could be analysed to infer connections)

relationships patterns	between people)
Digital context data Data that reveal the dynamic patterns in the digital environment that constitute the users' context.	Data produced automatically and derived from user's interactions within the digital environment, which continuous change according to the people's actions and interactions with other people and systems operating in the social media. This data can be <i>explicit or implicit (inferred)</i> and characterize the user's digital context in terms of: <ul style="list-style-type: none"> - Digital relationship data (Olshannikova et al., 2017); - Location related data (e.g. data from mobile/wearable devices); - Time related data (e.g. data on scheduled actions); - Interests, preferences, mood, and opinions.

Thus, Digital Context Data describe the users' context that may change over time, in terms of digital relationship data, location and time, interests, preferences, mood, and opinions. These data, which are often referred to as *digital exhaust* or *digital breadcrumbs*, are typically generated by devices, digital services or environments in which a user operates. Inferences can be made about individual and/or collective behaviour allowing an increasingly observation of actions and interactions of individuals in real time as well as over time (Watts, 2016).

Definitely, four BSD data types as multi-modal and heterogeneous types of data have been identified:

- Digital relationship data, as defined by Olshannikova et al. (2017) that reveals digital social relationships patterns, and refer to data about friendships/followers, business relationships, and networks analysis (Benhiba et al., 2017) along both the structural view (e.g. network topology, roles of nodes, communities and subgroups) and the dynamic view (e.g. time changes of the network's topology in terms of nodes and relationships);
- Location data from mobile or wearable devices expressing context-aware information, and related to geographical position (e.g. GPS), proximity-based connections (e.g. Bluetooth) or resources (e.g. applications);
- Time-related data referring to particular activities or scheduled actions (i.e. environment access, content generation, etc.);
- Individual's interests, preferences, mood, and opinions, expressed in textual or multimedia format (i.e. texts, tags, hashtags) and used to communicate specific individual or group behaviours, social interactions, and tendencies for a wide range of social-related insights.

Although data from these sources would characterize specific context dynamics conditions, it is still difficult to access and combine multiple data sources. Watts (2016) envisions an ad-hoc virtual environment as a facility that combines multiple streams of data, creating richer and more realistic portraits of individual behaviour and identity, while retaining the benefits of massive scale, called "social supercollider" that would bring new chances for realistic and consistent research outcomes.

5.1 Example of Digital Context data type in data-intensive domains

To understand better the relevance and the implications of identifying the Digital Context data category and its related data types, the description of two scenarios of BSD are described, by referring to two data intensive applications such as smart tourism and e-health.

Smart Tourism relies on extensive adoption of emerging technologies, such as social media and mobile technologies, smart devices and sensors to collect and exploit the huge amount of data for creating new value propositions (Gretzel et al., 2015; Sigala et al., 2012). Big Data applications in smart tourism are already mature, and different types of Big Data were successfully used in tourism research. User-generated contents in tourism (Li et al., 2018) are a “low cost” and easy access source of data, and they are mainly composed by online textual data (used for product reviews and blogs released on social media) and online photo data (posted on photo sharing websites or social networks). Online textual data can explicitly be generated by users to express their satisfaction and dissatisfaction towards tourism product or to share perspectives and experiences, thus providing valuable and unambiguous information for potential tourists. Besides, the same type of data conveys implicitly feelings, sentiment and mood of tourists, which can be measured to estimate tourist satisfaction in relation to other factors (i.e. guest experience) or to provide insightful implications for hospitality industry and marketing attractions (Guo et al., 2017). Online photo data uploaded by tourists contain useful information about users, locations and time; it is a rich source of Big Social Data for analysing tourist behaviour and popular tourism destinations, i.e. where to travel (Zhou et al., 2015), travel routes, i.e. how to travel (Kurashima et al., 2013), and tourism duration, i.e. how long travelling (Lee et al., 2014). On the other hand, device data as GPS and Bluetooth data provide massive high-quality data in tourism domain. Both of them can explicitly express tourist behaviour in terms of spatial, temporal and spatial-temporal behaviour. GPS data can be further analysed to propose efficient itineraries based on multiple GPS trajectories (Yoon et al., 2010), predict tourist next destinations (Zheng et al., 2017), or understand resident attitudes towards tourism (Ayscue et al., 2016).

For what concerns the scenario on e-health, benefits of Big Data application can be identified in the prevention of diseases, identification of modifiable risk factors for disease, and design of interventions for health behaviour change (Barret et al., 2013). According to Swam (2013), Big Data streams can be summarized in three categories, namely: (a) traditional medical data (e.g. EMRs, personal and family health history, medication history, lab reports, pathology results); (b) “Omics” data, which refer to large-scale datasets in the biological and molecular fields (e.g. genomics); (c) data from social media, which consist of signs and behaviours on how individuals or groups use the Internet, social media, mobile applications, sensor devices, wearable computing devices, or other technological and non-technological tools to better inform and enhance their health. The latter category refers extensively to what is known as Big Social Data and they can be mapped to the Digital Context category presented in our taxonomy. As described in Hansen et al. (2014), location-based information (derived from Global Positioning Systems, Geographic Information Systems, and other open source mapping

and visualization projects) explicitly generated by users are collected to provide information on the environmental and social determinants of health (Walker et al., 2017); disease outbreaks near a specific location was inferred from implicit location information (Jurgens, 2013). Also, user-generated content (UGC) within blogs and social networking services plays an important role in healthcare domain. Health-related UGC are used to assess disease spread in real-time or people sentiments and moods (Bhatia et al., 2019) or to facilitate discourse on non-emergency healthcare (Cassa et al., 2023); monitoring UGC can help to control the spread of infectious diseases via crowd surveillance (Bansal et al., 2016). Finally, Social Community Data can be collected or inferred from personal health data and advices shared amongst patients and consumers (Wicks et al., 2010).

6 Discussion and Conclusions

This paper focuses on providing a better conceptualization and a consensual definition of Big Social Data paradigm in order to help researchers to build proper methods for a purposeful processing and analysis of this specific type of data. This contributes to face the emerging challenges related to the growth of human-generated data, which calls for novel tools, frameworks and methodological approaches as well as multidisciplinary expertise to exploit the potential value embedded in these data sources. In order to reach this purpose a Systematic Literature Review has been conducted describing all the different phases that compose the research activity. The proposed definition represents a peculiar contribution in the current research debate in terms of BSD sources, attributes, technologies and social value as well as of BSD definition as human-generated data that differentiate BSD within the general field of Big Data.

A further contribution is related to the extension of a Big Social Data type taxonomy proposed by Olshannikova et al. (2017). A new category of data type has been introduced, namely “Digital Context Data” defined as data that reveal patterns of digital context dynamics. Example applications in data-intensive domains, such as smart tourism and e-health, have been provided in order to demonstrate how Big Social Data are already used to describe explicitly and implicitly patterns of digital context dynamics.

The implications of this result are valuable for both researchers and practitioners. The former are interested in developing further the distinguishing issues related to the BSD paradigm, as well as in a deeper analysis of data intensive domains to validate the definition provided in this paper. The latter can receive insights to purposefully design applications and services based on BSD to generate value for citizen, individuals, companies and territories, keeping in mind that BSD accessibility and privacy issues are still a central challenge as they may obstructs the utilization of BSD and the related exploration opportunities.

Further research is needed in two distinct directions: on one side, it could be useful to validate the definition proposed in relation of existing applicative researches. On the other side, it is still necessary to develop further the taxonomy of BSD data type with applications in more data-intensive domains.

References

- Akter, S., Bhattacharyya, M., Wamba, S. F., & Aditya, S. (2016). How does social media analytics create value?. *Journal of Organizational and End User Computing (JOEUC)*, 28(3), 1-9.
- Årnes, A., Skorstad, J., Michelsen, L. (2011). Social network services and privacy. Technical report, Datatilsynet.
- Ayscue, E. P., Boley, B. B., & Mertzluft, C. E. (2016). Mobile technology & resident attitude research. *Tourism Management*, 52, 559e562.
- Bansal, S., Chowell, G., Simonsen, L., Vespignani, A., & Viboud, C. (2016). Big data for infectious disease surveillance and modeling. *The Journal of infectious diseases*, 214(suppl_4), S375-S379.
- Barrett, M. A., Humblet, O., Hiatt, R. A., & Adler, N. E. (2013). Big data and disease prevention: from quantified self to quantified communities. *Big data*, 1(3), 168-175.
- Bednár, P. (2017, July). Conceptualization of social big data: Keynote. In 2017 12th International Workshop on Semantic and Social Media Adaptation and Personalization (SMAP) (pp. xxi-xxii). IEEE.
- Bello-Orgaz G, Jung JJ, Camacho D. (2016). "Social big data: recent achievements and new challenges". *Inf Fusion*.
- Benhiba, L., Loutfi, A., Abdou, M., & Idrissi, J. A. J. (2017). A Classification of healthcare social network analysis applications. *Biostec*, 2017, 978-989.
- Beye M, Jeckmans A, Erkin Z, Hartel P, Lagendijk R, Tang Q. (2012). Privacy in online social networks. In *Computational Social Networks: Security and Privacy*. Springer, London.
- Bhatia, S., Carrion, M., Cohn, E., Cori, A., Nouvellet, P., Lassmann, B., & Brownstein, J. (2019). Big brother is watching-using digital disease surveillance tools for near real-time forecasting. *International Journal of Infectious Diseases*, 79, 27.
- Bravo-Marquez F, Mendoza M, Poblete B. (2014) "Meta-level sentiment models for big social data analysis". *Knowl Based Syst.*;69:86–99.
- Burgess J, Bruns A. (2012). "Twitter archives and the challenges of "big social data" for media and communication research". *M/C J*.
- Cambria, E., Rajagopal, D., Olsher, D., & Das, D. (2013). "Big social data analysis. *Big data computing*", 13, 401-414.
- Cassa, C. A., Chunara, R., Mandl, K., & Brownstein, J. S. (2013). Twitter as a sentinel in emergency situations: lessons from the Boston marathon explosions. *PLoS currents*, 5.
- Centobelli, P., Cerchione, R., & Esposito, E. (2017). Knowledge management in startups: systematic literature review and future research agenda. *Sustainability*, 9(3), 361.
- Coté M. (2014). "Data motility: the materiality of big social data". *Cult Stud Rev*.
- Del Vecchio, P., Mele, G., Ndou, V., & Secundo, G. (2018). Creating value from social big data: implications for smart tourism destinations. *Information Processing & Management*, 54(5), 847-860
- Dey K. Anind, Abowd D. Gregory. (2000). Towards a Better Understanding of Context-Awareness.
- Elia, G., Solazzo, G., Lorenzo, G., Passiante, G. (2018a) "Assessing learners' satisfaction in collaborative online courses through a big data approach", *Computers in Human Behavior*, 133, 279–286.
- Elia, G., Polimeno, G., Solazzo, G., Passiante, G. (2018b) "A Creating Value for organizations through Big Data: a Framework based on a systematic literature review", *Proceedings of IFKAD 2018 - International Forum on Knowledge Asset Dynamics on "Societal Impact of Knowledge and Design"*, 4-6 July 2018, Delft, Netherlands.
- El Alaoui, I., Gahi, Y., Messoussi, R., Chaabi, Y., Todoskoff, A., & Kobi, A. (2018). A novel adaptable approach for sentiment analysis on big social data. *Journal of Big Data*, 5(1), 12.

- Gandomi A, Haider M. (2015). "Beyond the hype: big data concepts, methods, and analytics". *Int J Inf Manag.*
- Golbeck J. (2014) "Big social data predicting the future of you". *Executive Tallent Mag.*;5:12–4.
- Gough D. & Elbourne D. (2002) "Sytematic Research Synthesis to Inform Policy, Practice and Democratic Debate" *Social Policy and Society* 1, 3, 225-236.
- Gretzel, U., Sigala, M., Xiang, Z., & Koo, C. (2015). Smart tourism: foundations and developments. *Electronic Markets*, 25(3), 179-188.
- Guellil I, Boukhalfa K. (2015). "Social big data mining: a survey focused on opinion mining and sentiments analysis". In: 2015 12th international symposium on programming and systems (ISPS). New York: IEEE.
- Günther, W. A., Mehrizi, M. H. R., Huysman, M., & Feldberg, F. (2017). Debating big data: A literature review on realizing value from big data. *The Journal of Strategic Information Systems*.
- Guo, Y., Barnes, S. J., & Jia, Q. (2017). Mining meaning from online ratings and reviews: Tourist satisfaction analysis using latent dirichl et al location. *Tourism Management*, 59, 467-483.
- Halavais, A. (2015). Bigger sociological imaginations: Framing big social data theory and methods. *Information, Communication & Society*, 18(5), 583-594.
- Hansen, M. M., Miron-Shatz, T., Lau, A. Y. S., & Paton, C. (2014). Big data in science and healthcare: a review of recent literature and perspectives. *Yearbook of medical informatics*, 23(01), 21-26.
- Housley W, Procter R, Edwards A, Burnap P, Williams M, Sloan L, Rana O, Morgan J, Voss A, Greenhill A. (2014). "Big and broad social data and the sociological imagination: a collaborative response". *Big Data Soc.*
- Ishikawa H. "Social big data mining". (2015). Boca Raton: Taylor & Francis Group, CRC Press.
- Ishikawa, H., Kato, D., Masaki, E., & Hirota, M. (2018, September). Generalized difference method for generating integrated hypotheses in social big data. In *Proceedings of the 10th International Conference on Management of Digital EcoSystems* (pp. 13-22). ACM.
- Jurgens, D. (2013). That's what friends are for: Inferring location in online social media platforms based on social relationships. In *Seventh International AAAI Conference on Weblogs and Social Media*.
- Keele, S. (2007). Guidelines for performing systematic literature reviews in software engineering. In *Technical report, Ver. 2.3 EBSE Technical Report*. EBSE.
- Kurashima, T., Iwata, T., Irie, G., & Fujimura, K. (2013). Travel route recommendation using geotagged photos. *Knowledge and Information Systems*, 37(1), 37-60.
- Lee, I., Cai, G., & Lee, K. (2014). Exploration of geo-tagged photos through data mining approaches. *Expert Systems with Applications*, 41(2), 397-405.
- Li, J., Xu, L., Tang, L., Wang, S., & Li, L. (2018). Big data in tourism research: A literature review. *Tourism Management*, 68, 301-323.
- Mallett, R., Hagen-Zanker, J., Slater, R., Duvendack, M. (2012) "The benefits and challenges of using systematic reviews in international development research". *Journal of Development Effectiveness*, 4:3, 445-455.
- Manovich, L. (2011). "Trending: the promises and the challenges of big socialdata,".
- Mukkamala, R. R., Hussain, A., & Vatrappu, R. (2014, June). Towards a set theoretical approach to big data analytics. In *2014 IEEE International Congress on Big Data* (pp. 629-636). IEEE.
- Nguyen DT, Hwang D, Jung JJ. (2015). "Time–frequency social data analytics for understanding social big data". Cham: Springer.
- Olshannikova, E., Olsson, T., Huhtamäki, J., & Kärkkäinen, H. (2017). "Conceptualizing big social data". *Journal of Big Data*.

- Peng, S., Jiang, S., & Yin, P. (2016, November). Modeling and Propagation Analysis on Social Influence Using Social Big Data. In *International Conference on Security, Privacy and Anonymity in Computation, Communication and Storage* (pp. 279-291). Springer, Cham.
- Pentland A. (2014). "Social physics: how good ideas spread-the lessons from a new science". New York: The Penguin Press, Penguin Group.
- Procter, R., Vis, F., & Voss, A. (2013). Reading the riots on Twitter: methodological innovation for the analysis of big data. *International journal of social research methodology*.
- Reuter, C., Kaufhold, M. A., & Ludwig, T. (2017). End-user development and social big data—towards tailorable situation assessment with social media. In *New Perspectives in End-User Development* (pp. 307-332). Springer, Cham.
- Richthammer, C., Netter, M., Riesner, M., Sängner, J., & Pernul, G. (2014). Taxonomy of social network data types. *EURASIP Journal on Information Security*.
- Schneider B. (2010). A taxonomy of social networking data. *IEEE Security & Privacy*.
- Sigala, M., Christou, E., & Gretzel, U. (2011). *Web 2.0 in Travel, Tourism and Hospitality: Theory, Practice and Cases*. Ashgate Publishing, Farnham.
- Silva, T. H., De Melo, P. O. V., Viana, A. C., Almeida, J. M., Salles, J., & Loureiro, A. A. (2013, November). Traffic condition is more than colored lines on a map: characterization of waze alerts. In *International Conference on Social Informatics* (pp. 309-318). Springer, Cham.
- Sivarajah, U., Kamal, M. M., Irani, Z., & Weerakkody, V. (2017). Critical analysis of Big Data challenges and analytical methods. *Journal of Business Research*, 70, 263-286.
- Swan, M. (2013). The quantified self: Fundamental disruption in big data science and biological discovery. *Big data*, 1(2), 85-99.
- Tang J, Chang Y, Liu H. (2014). "Mining social media with social theories: a survey". *ACM SIGKDD Explor Newsl*.
- Vepsäläinen, T., Li, H., & Suomi, R. (2017). Facebook likes and public opinion: Predicting the 2015 Finnish parliamentary elections. *Government Information Quarterly*, 34(3), 524-532.
- Walker, R. J., Neelon, B., & Egede, L. E. (2017). Advancing the Understanding of Social Determinants of Health Through Geospatial Analysis.
- Ward, J. S., & Barker, A. (2013). Undefined by data: a survey of big data definitions. *arXiv preprint arXiv:1309.5821*.
- Watts DJ. (2013). Computational social science: exciting progress and future directions. *Bridge Front Eng*.
- Wicks, P., Massagli, M., Frost, J., Brownstein, C., Okun, S., Vaughan, T., & Heywood, J. (2010). Sharing health data for better outcomes on PatientsLikeMe. *Journal of medical Internet research*.
- Yoon, H., Zheng, Y., Xie, X., & Woo, W. (2010). Smart itinerary recommendation based on user-generated GPS trajectories. In *Proceedings of the 7th international conference on ubiquitous intelligence and computing*, Xi'an, China.
- Zheng, W., Huang, X., & Li, Y. (2017). Understanding the tourist mobility using GPS: Where is the next place? *Tourism Management*, 59, 267-280.
- Zhou, X., Xu, C., & Kimmons, B. (2015). Detecting tourism destinations using scalable geospatial analysis based on cloud computing platform. *Computers, Environment and Urban Systems*, 54, 144-153.

Defining RegTech: a Contribution for Academics, Authorities and Practitioners

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Abstract

Companies are required to be compliant to differing kinds of legal and regulatory obligations due to their differing business models and the extremely diverse products and services they offer. Today the question “what is RegTech” is still not properly addressed. This paper is discussing definitions in the literature that represent the meaning for academics, practitioners and Authorities to deliver the conceptual definition to be used in research and scientific literature. The mission of our research is to have a map of regulatory technology with relationships to the FinTech innovation for:

(i) financial stability;

(ii) prudential regulation, so protection of the customers;

We will conduct a systematic literature review in Scopus and ISI Web of Science, SSRN, Google Scholar and Microsoft Academic as well as advanced research of the contents provided consultancy firm involved in RegTech and Authorities. The keywords are “RegTech” AND “is” OR “aimed to” using an inductive coding counting the word indicated as a direct object aside from the verb inside each contribution.

This paper gives a definition of the regtech concept from consultants, academics and authorities expressing Regtech’s perimeter and compare results between academics, practitioners and authorities.

In our study we address the following questions:

(1) *What is RegTech?*
(2) *How is RegTech definition in the literature?*
(3) *Which topics and uses are discussed in the context of RegTech by actors involved?*
The theme is very new and the existing academic literature is today narrow in this field.

Keywords –Regtech, Finance, Innovation, Fintech, Digital Technologies

Paper type – Academic Research Paper

1 Introduction

Since the Global Financial Crisis the financial services industry has faced a growing amount of regulatory change, as both international and domestic legislators for improving the functioning of the industry and reduce systemic risk.

Regulators have moved towards a risk-based approach where access to data is key to prudential supervision. For financial institutions, all of this regulatory activity has meant cost increases, in terms of capital (e.g. Basel III), operations (e.g. human resources), or penalties.

On the last point alone, since 2008, banks penalties in the western world have been calculated in over \$242 billion (DW Arner 2016).

Arguably, academics, industry and regulators share an interest in reducing fraud. A range of stakeholders are interested in increasing transparency and creating monitoring processes.

An increasing number of FinTechs applying technology to the regulatory process appeared into the market. These firms have a mission: to take the cost out of regulatory processes, giving adequate monitoring of transaction and deliver valuable real-time risk information.

The interest about Fintech and in particular the newborn RegTech is very strong from regulators. FCA¹, the UK's financial market Authority, presented a new way for the regulation's approach, its "regulatory sandbox"².

The research motivation is to focus the perimeter of RegTech that is not clear despite the consensus on the major impact that regulatory technology, RegTech, will have on the financial services industry. Moreover, no common definition of RegTech has yet been derived between academics, practitioners and authorities. Today the question "what is RegTech" is still not properly addressed.

No complete descriptions have been made so far to extract a consensual meaning and a definition of RegTech. But the methodology and definitions used must be precise and uniform.

¹ Financial conduct authority

²Sandbox is defined as space where financial services companies are encouraged in cohorts to test new products without regulatory consequences including RegTech solution. Another objective is to understand the trend of regulation from the academics.

The objective of this study is to offer a definition of definitions proposed by main actors in academic, consultancy and authority world, in order to discover what is inside the word “RegTech” through coding of definitions. The definition is useful to monitor and to map so determine a perimeter of RegTech for improving regulation and the comply to regulatory matters.

Detailing our research questions are:

- (1) What is RegTech?
- (2) How is RegTech definition in the literature?
- (3) Which topics and uses are discussed in the context of RegTech by actors involved?

Our results include three components: a conceptual definition of RegTech that reflects its perception by literature, the main actors involved in the development of the definition of RegTech (namely organizations, concepts and locations) and the differences between the different authors selected clusters.

In the end, this leads us to the conclusion of the study, but also we propose and stimulate with ideas for future research.

For academics, specifically the mission of our research could be to have an organic map of RegTech regulations with relationships to the FinTech technological innovation.

”RegTech” goals include:

- (i) financial stability;
- (ii) prudential regulation, so protection of the customers;

2 Methodology

In this paper, we considered the absence of a universally recognized definition of “RegTech”, starting from there to propose a definition of the several definitions elaborated by main authors.

The method shall enable an exploratory approach towards the data with a systematic literature review.

For making the analysis and overlapping of similar concepts we follow the methodological guidelines our work from the following sources: Yin(1984) Zavolokina et al. 2016. We produce a conceptual definition of extracted definitions of RegTech, hence dividing them under three cluster as in the cited paper. We consider papers of academics, practitioners (consultancy firms and one manufacturer, Intel, one Law firm) and authorities as the base of our inquiry bause they present common peculiarity of approach. The applied method needs to acknowledge the not-neutral and not-objective features of some of the considered texts, in particular if provided from a financial institution and consultancy firm. We complete the analysis by developing a systematic literature review and a content analysis. So we distinguish three cohorts: academics, consultants and authorities to better manage the phenomenon.

Clearly all the considered papers are published by academics, consultants and authorities.

For the research of academics’ papers, we used the following services: Scopus, SSRN, Google Scholar, Web of Knowledge, advanced search on authorities and practitioners

involved in “RegTech”. In order to identify relevant articles, we conduct a keyword “RegTech” in a second step in the over-mentioned databases and over the internet.

The research of definitions of “RegTech” proposed by the consultant was conducted in a systematic way by searching the word “RegTech” on research engines conjointly with the internal research engine of the international websites of the main consultancy firms i.e. McKinsey, EY, Deloitte, KPMG, PwC, Accenture, Mc Kinsey. A similar method for search of authorities’ papers, along with looking for the references in the consultant and academics articles. We applied as well the following constraints: (1) dating to 31.12.2018 (without any lower time of beginning), (2) available in English.

Once all the papers with the presented methodology have been collected, they were analysed looking for a definition of “RegTech”.

Considering a paper or document dealing with RegTech, it is considered to provide a definition of RegTech if it uses sentences such as:

- “RegTech is”, “RegTech is defined” or other similar sentences introducing clearly a definition;
- “RegTech exist to”, “is about”, “involves” and similar expressions.
- the explanation of the term is inserted as a parenthetical element;
- The keyword for research is explained in the Appendix’s code matrix.

For each paper, is considered the first sentence that, with one of the previously reported structures, tries to introduce and define “RegTech”.

It is necessary because we need to be clear about the definition and a conditional sentence is not suitable for this aim.

For this motivation we have excluded those parts of definitions of “RegTech” that include terms such as “often”, “sometimes” or other similar adverbs: this because we considered as definitions only those presenting aspects that are considered necessary and universally present in RegTech.

To take this decision of analisys we have made a preliminary literarure review. The paper “Definitions, Dictionaries, and Meanings” by Swartz (Swartz, 1997) gives use of those methodological guidelines.

The main instrument for the creation of a definition applied in this paper is inductive coding.

The first step of the procedure, once collected all the definitions, has been to take one definition per time and extract from it all the concepts included.

This means that the definition of concepts has not been proposed a priori and then each definition analysed through it, but the concepts definition itself have been built starting directly from the definitions.

Concepts obtained were the less comprehensive possible, as long as the single concept had a useful meaning. For instance, the sentence “application of technology to regulatory activities” (Baxter, 2016) can be seen as the union of two concepts, “application of technology” and “in the definition of regulatory activities”, while the single concept of “application” was not considered to have a useful meaning for the definition of “RegTech” if considered alone.

On the other hand, concepts such as “facilitate” or “meet” have been considered as single concepts, because for instance “RegTech” is considered by certain definitions as “technologies designed to facilitate” (Aspen Institute, Modernizing digital financial regulation, 2017), hence the ability to facilitate is considered important.

Concepts have been extracted and collected in order to cover all the possible meanings of a definition: in this way, each definition can be back-built starting from the concepts collected.

This procedure has been iterated for all the definitions, collecting under the same cluster all the word or sentences describing the same concept using simply different words and synonyms. An example is “Use/application/adoption of - technology/technology solutions” in order to describe in different ways the application of technology.

In this way, each concept has a meaning substantially different from the others, providing mutually exclusivity between concepts. The second step of the procedure was to collect in a matrix all the definitions and concepts, in order to conduct different analysis, such as understand the frequency of a certain concept in the literature definition analysed.

Analysis and results will be explained in the next sections.

3. Analysis and Results

A total of 153 papers have been found with the proposed criterion.

The overall number of collected applying the methodology described definitions is 46.

(1) What are the primary actors that proposed a definition of RegTech over time?

The combination of regulatory issues, technological advances, information asymmetries between market participants, economic instabilities and market incompleteness on top created the ground for stimulating innovation on the crossroads of finance and technologies.

This phenomenon attracted the interest of several experts that published preliminary papers on “RegTech”. The primary actors that proposed a definition of RegTech are academics, consultants and authorities classified for their interest.

The first actor of RegTech to propose a definition of “RegTech” were a consultant: in 2015, a paper from EY defined “RegTech” as “proliferation of new applications regulating financial services directly on devices.” (EY, Who will disrupt the disruptors, 2015). Even if academics have not been the first to define “RegTech”, academics are still a fruitful family of actors providing a definition.

The earliest published definitions from an academic, Baxter, with the paper “RegTech, the application of technology to regulatory activities” in Duke law Journal (Baxter, 2016)

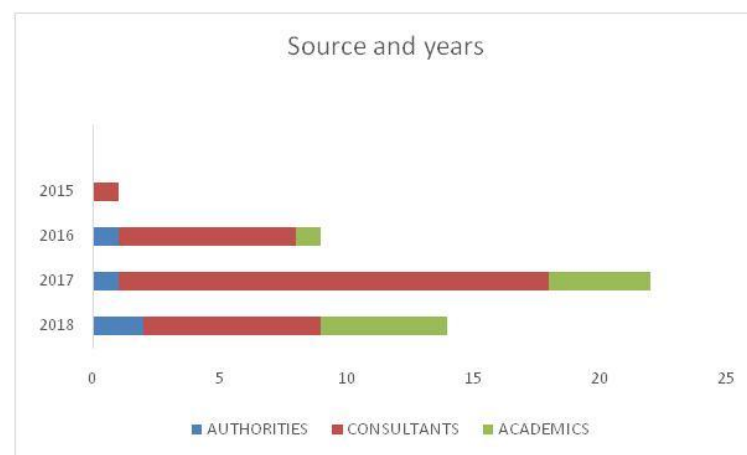
The last important cluster of authors is Authorities. The first authority to define RegTech was Financial conduct authority (FCA) in UK, which defined RegTech as “subset of FinTech that focuses on technologies that may facilitate the delivery of regulatory requirements more efficiently and effectively than existing capabilities” (FCA, Call for input on supporting the development and adopters of RegTech, 2016).

EU's EBA definition arrived in 2017 (EBA, Discussion Paper on Fintech, 2017).

Academics interested to define RegTech are mainly Professors of law, economics, and lawyers for consultant and members of Authorities. Management engineers and economists are now fully involved in this topic. Another important category of engineers involved are experts in computer science.

Looking at the whole sample from 2015 to 2018 in Figure 2, the attempts to defining "RegTech" increased in 2016, with a maximum of proposed definitions in 2017.

As previously anticipated, consultants are the most active in defining "RegTech", followed by academics and authorities.



(2) How is RegTech's definition in the literature?

RegTech has not a clear definition, till now but we can establish a definition based on the collected definitions from the most influent authors, namely academics, authorities and consultants. We provide an integrative perception out of the available definitions of "RegTech" presented in the industrial reports and scientific publications.

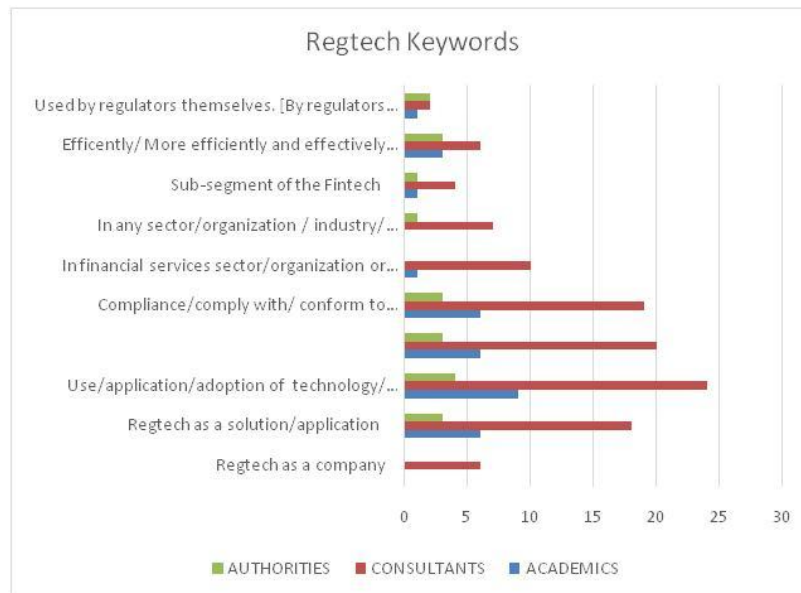
In this subsection, firstly, we present the list of gathered definitions of "RegTech" (Table 1 in the appendix) and afterwards, taking into account the features and concepts behind them, we propose an inclusive conceptual definition of the RegTech being reflected by the studied sources and extracted with inductive coding. It is interesting to consider, on the overall sample, which is the most frequent concepts in the proposed definitions.

RegTech is presented "as a solution or an application" in 26 (66,7%) of the collected definitions, while is presented "as a company" in 6 definitions (15,4%).

RegTech implies the use of technology and technology solution for 31 definitions (79,5%) and is involved "in the context of / application to regulation, regulatory requirements/ demand/ activity / challenges" for 27 authors (69,2%). Those two concepts appear together in 21 definitions (53,8%).

The application of "RegTech" for "compliance/comply with/ conform to compliance requirements" is considered by 31 definitions (69,2%) and what is still common in all the

categories are that RegTech can facilitate or even solve a certain issue (“facilitate/address /solve/alleviating the burden of/improve/help/ bring solution”) for 23 definitions (60%)



(3) Which topics are discussed in the context of RegTech by actors involved?

In this subsection, we will present how a certain concept is presented more or less frequently depending on the author cluster.

For academics:

The perception and the definition of RegTech provided by the academics are very wide and diversify in its definition. The overall contributes by academic authors are 11.

The most reported concepts by academics are the use of technology in 9 definitions over 11 and the application to regulatory environment appear together in 6 definitions over 11. At the same level are present the using for “compliance” and “RegTech as solution”

Academics are the only cluster of authors proposing the concepts of “Yield better regulation” (Arner et al, 2018), “Real time” (Cave, 2017) and “Support the application of advanced analytics approaches” (Arner et al, 2018).

There are four authors focusing specifically on IT solutions with an augmentation in 2018. Only one of them (Das et al, 2017) considers “innovation” as a necessary aspect of RegTech. Only three academic on 11 authors considers RegTech as something that is applied only by financial institutions (Das et al, 2017)(Yang et al, 2018) (Stepanko et al, 2018), while no other authors specify the sector of application of RegTech. None of the academic authors discusses if RegTech is a sub-segment of FinTech or not.

Along with this, none of them includes the definition of RegTech the concept of “Efficiency”. No function about risk management and KYC (Know you customers) were considered in the definition by academics.

RegTech is not reported by academics definitions as something directly applicable by regulators.

For the consultants:

The overall collected definitions by consultants are 31 and there is a high variety of proposed concepts.

In 9 over 31 definitions (around 30%), innovation plays an important role, both in terms of innovating technologies and innovative applications.

For 6 consultant authors (20% of the total consultant definitions), RegTech is a company, and for 18 of them (58%) is a solution or application. Likewise for the academics, the concepts of “use of technology” and application to “regulatory definition” are among the most present concepts in consultants’ definitions. Those two concepts appear together in 14 definitions (77%) and the regulatory definition for 65% of the definitions. Evaluating the sector of application of RegTech, consultants are not homogenous in their definitions: for 8 of them (30%) RegTech can be used by financial players only, while for 7 of them (22%) can be applied in all sectors. The other authors do not specify the application sector. One of the most important concepts for consultants is “compliance”, that is reported in 22 definitions (70%).

RegTech is supposed to “facilitate” the operations or” help” the companies for 20 consultants (65%). “Supervision” is a key point for only two consultants (Milken, RegTech opportunities, 2018, Only for 4 authors RegTech is a sub-segment of fintech.

For the authorities:

The collected definitions proposed by authorities were only 4, nevertheless showing interesting concepts. The authorities that proposed a definition are FCA and EBA, that proposed 2 definitions each.

Both of them consider “RegTech” as a solution (EBA, Fintech roadmap 2018) (FCA, Call for input on supporting the development and adopters of RegTech, 2016) (FCA, Co-operation Agreement 2017) and not as a company. The concept of “application of technology” is present in all the collected authorities’ definitions, and the concept of “applied to regulatory definition” in three of them. Hence,

compliance is present in three definitions, while “Reporting” is inserted in one definition only (EBA, Fintech roadmap FAQ, 2017).

One important concept reported by both regulators is the “Efficiency” that RegTech is required to bring or even improve in a company.

The last interesting peculiarity is that both authorities consider RegTech useful for regulators themselves (EBA, Fintech roadmap, 2018) (FCA, Co-operation Agreement, 2017).

3.1 RegTech's definition: analysis of matching points and divergence between actors.

It is useful to focus on concepts that are more heterogeneous among authors.

The first important question is whether RegTech can be considered a subset of FinTech.

The answers are very diversified and nowadays not uniform.

According to the FCA RegTech is a part of fintech: 'RegTech is a sub-set of FinTech that focuses on technologies that may facilitate the delivery of regulatory requirements more efficiently and effectively than existing capabilities.' (FCA, Call for input on supporting the development and adopters of RegTech, 2016).

The FCA's definition is taken also from several consultants and Academics as a stand alone definition or as a first step to build a new larger definition.

As well for a consultant firm, EY, that said that there is an "increasing number of FinTechs applying technology to the regulatory process" (EY, UK FinTech-On the cutting edge, 2016). Academics show a wider perspective of RegTech's phenomenon. We can consider some explicative example.

According to authors applied in finance like Colaert, "RegTech is sometimes viewed as a part of FinTech, although this view has – in our view rightly so – been criticized for giving a too narrow account of what RegTech stands for". (Colaert, 2018). On the other hand, Arner said: "Far from being a subset of FinTech, RegTech should be considered a connected but distinct phenomenon" (Dw Arner 2017). If RegTech is a part of FinTech is not already clear but could be propulsion for new studies.

We can argue that legal and the application of IT and specifically Artificial intelligence solution is also applied to other sector involved with compliance and risk. The border in RegTech is for us a bridge between finance, which is one of the first application in the literature, and other fields. For example RegTech application like Compliance and AML are not totally defined into a financial perimeter. In this case monitorTech, ReportTech, DataExchangeTech and the main branch *LegalTech* are strictly connected and this FCA reports about a subset of fintech.

Another important theme, in which there could be an incrementing of research, is the RegTech's sector of application.

We find two different views, all industry or for the financial system only. As explicative examples, we report two definitions, one reported by an academic and one by an authority: According to Das "RegTech as - A blend word of 'regulatory technology' that was created to address regulatory challenges in the financial services sector through innovative technology" (Das et al, 2017), so the specific sector of application of RegTech is the financial sector. On the other hand, according to EBA "[...] regulatory technology ('RegTech') is a commonly recognised term for technologies that can be used by market participants [...]", so the focus is on "market participants". Those are two examples: in our definition we found 12 definitions looking at RegTech as something dedicated to the financial sector, while 5 definitions considering RegTech as something proper of any sector.

But in other fields of research like the law schools RegTech is suitable for meet any regulatory requirement that has an information-gathering element is plausibly a candidate for RegTech innovation.

For example, Allen and Berrn(2018) many resources firms are required to manage existing native vegetation around their projects, and are increasingly using drones to do so.” Autonomous drones— already being used in mines in Western Australia—could be paired with artificial intelligence to identify vegetation loss or invasive species, removing human compliance managers.”

RegTech offers both opportunities and risks. It makes both compliance and enforcement with regulation more efficient. While often requiring a significant upfront investment, RegTech helps not only to meet existing regulations but some applications are designed to dynamically accommodate changes to the regulatory framework. The rapidity of regulatory change is often a big match. Automated compliance through RegTech reduces costs on the firm and regulatory side for auditing and surveillance of the firm.

3.2 Tentative for a common definition and new trends

The differences in definitions revealed by the literature review, underscore that there are definitional problems with RegTech. One of the last and complete contributions on this topic was provided in august 2018 from D. YANG AND M. LI, seems to add other elements about function and the definition of RegTech. “Technology-driven regulation can also help regulators understand innovative products and transactions, market manipulation, and risks closer to real time. “

The key to financial oversight is in data collection and monitoring. Its core concept comprises transparency, equality, and intelligence, so as to create a truly real-time and dynamic regulatory system.” (D. YANG AND M. LI 2018)

If Yang and Li in 2018 seem merge the Technology-driven regulation understand innovative products and transactions, market manipulation, and risks management to real time and regulatory approach based on financial oversight is in data collection and monitoring in this definitions are still lacking very relevant aspects like compliance, an overview of the dialogue between regulatory authorities and the other actors.

Compliance and the use of technology in the context of regulatory requirements, where a certain homogeneity among proposed definitions can be found.

RegTech, while incremental, is still in relatively early stages and follows in parallel as a subset of fintech. (Kaal, 2016).. RegTech takes into regulation richer and innovative technology “ instead RegTech for Anagnostopoulos (2018) refers to a sub-division of the fintech sector that focuses on technologies that may facilitate the delivery of regulatory requirements more efficiently and effectively than existing capabilities. “

A very particular “function” about RegTech is expressed by Bayón, P. S., & Vega, L. G. (2018) that affirm “RegTech is aimed at making financial regulation an efficient instrument to prevent and solve market failures in a technocratic and global economy presided over by the control and analysis of information flows, which have become the main sources of power and social development.” The new legal policy joined with

technology must ensure that the regulation removing not useful legal rules, while avoiding the creation of equally inefficient substitute rules”

This recall to the prevention and the market failures in a technocratic and global economy and considers that rules are more and more decided globally and the Author seems suggesting so the the control and analysis of information flow, are sources of “power and social development”.

The other author, Gomber(2018), proposes a new trend not for defining RegTech but for the technologies involved in RegTech that can help us to create a definition’s definition of regtech. For the author, RegTech can help human intensive jobs in regulatory and compliance process.

RegTech solutions involve technologies that aim to ease regulatory compliance and substitute for manual labor in standard regulatory and compliance processes.

This concept has inspired some start-ups pointed this goal as one of the principal advantages of its legaltech and RegTech solution for banks.

Substituting manual labour with RegTech in that specific case has the effect of lowering compliance cost for the banking.

Another stream of studies is about defining the role of Authorithies in RegTech.

The interesting point comes from a contribution “Regulators and SupTech Solutions Simone di Castri, Matt Grasser, and Arend Kulenkampff”, published by Bfa in August 2018 regulators are able to use RegTech “to process and analyze the data about Financial statements (balance sheet, cash flow, income statement), financial ratios (liquidity ratios, capital adequacy ratios),^{[1][2][3][4][5][6][7][8][9][10][11][12][13][14][15][16][17][18][19][20][21][22][23][24][25][26][27][28][29][30][31][32][33][34][35][36][37][38][39][40][41][42][43][44][45][46][47][48][49][50][51][52][53][54][55][56][57][58][59][60][61][62][63][64][65][66][67][68][69][70][71][72][73][74][75][76][77][78][79][80][81][82][83][84][85][86][87][88][89][90][91][92][93][94][95][96][97][98][99][100]} volume and value of transactions, number of transaction points to number of accounts and total balances”^{[1][2][3][4][5][6][7][8][9][10][11][12][13][14][15][16][17][18][19][20][21][22][23][24][25][26][27][28][29][30][31][32][33][34][35][36][37][38][39][40][41][42][43][44][45][46][47][48][49][50][51][52][53][54][55][56][57][58][59][60][61][62][63][64][65][66][67][68][69][70][71][72][73][74][75][76][77][78][79][80][81][82][83][84][85][86][87][88][89][90][91][92][93][94][95][96][97][98][99][100]}

In a rapidly evolving financial sector that lacks proper tools and infrastructure for supervision and monitoring by providing alternative processes and RegTech permits to central banks to develop appropriate regulations, by “facilitating a better understanding of new market participants and technologies”. Without RegTech central banks may not have the capacity to monitor the new services and additions in the financial system.

The negative aspect is instead that the regulators, with the diffusion of RegTech, are more likely to impose stricter and complicated regulations and this could be a problem for whom has not the infrastructure and scale to implement these solutions so regulation could lower costs with technology but also increasing costs with the multiplication of rules.

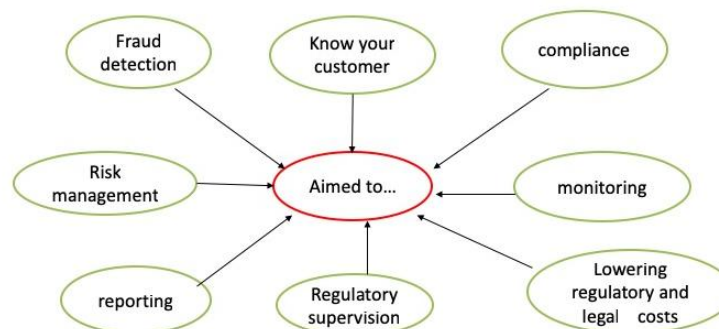
This scenario implies that the authorities should balance with new protection of the client, the technology could help the regulation but write a more complicated but also effective regulation, sources of financial and social development, there is the necessity to follow a new approach of collaboration between financial institutes, RegTech solution technology and Authorities.

We can argue finally that RegTech, in our evidence, is a solution or an application that implies the use of technology that provides technology solution involved “in the context of or in application to regulation, regulatory requirements challenges”.

The application of “RegTech” is suitable for compliance and to comply with regulatory requirements and RegTech can facilitate or even solve these issues given in a new and more complex world regulatory environment. and financial market proposes new needs and new technological solutions with the rapid fintech’s growing. It can be represented as in this graph.

The definition.

RegTech is: use of technology in regulatory field



RegTech is the use of technology in the context of regulatory field in compliance, fraud detection, lowering costs to comply to the regulation, know your customer, monitoring and managing the risk and reporting anomaly more than existing capabilities.

RegTech is the use of technology in the context of regulatory requirements in compliance, fraud detection, lowering costs to comply to the regulation, know your customer, monitoring and managing the risk and reporting anomaly more than existing capabilities. RegTech is born as a part of FinTech is used in the field of financial firms to regulators and for supervision by regulator but now is utilized in all the industries

4 Conclusion and future development

In this paper, we used an explorative and descriptive approach to address the term “RegTech”.

We think that could be a milestone to future RegTech’s study in order to create a perimeter of study for academics, practitioners and Authorities.

Possibilities of development include monitoring corporations, compliance with environmental regulations and real-time, and how technology could be used to improve not only regulation but also regulators and all industry itself.

We wish that our definition of RegTech should be the begin of new studies and elaboration by academics about defining the emerging phenomenon of RegTech.

References

- Dw Arner et Al. FinTech, RegTech, and the Reconceptualization of Financial Regulation (2016) <https://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?referer=https://www.google.it/&httpsredir=1&article=1817&context=njilb> and https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2847806
- E&Y Innovating with-RegTech (2016) [http://www.ey.com/Publication/vwLUAssets/EY-Innovating-with-RegTech/\\$FILE/EY-Innovating-with-RegTech.pdf](http://www.ey.com/Publication/vwLUAssets/EY-Innovating-with-RegTech/$FILE/EY-Innovating-with-RegTech.pdf)
- Mills et Al. "The State of Small Business Lending: Innovation and Technology and the Implications for Regulation" Harvard Business School (2016) http://www.hbs.edu/faculty/Publication%20Files/17-042_30393d52-3c61-41cb-a78a-ebbe3e040e55.pdf
- Toronto Centre What means financial supervision <http://res.torontocentre.org/guidedocs/FinTech%20RegTech%20and%20SupTech%20-%20What%20They%20Mean%20for%20Financial%20Supervision.pdf>
- There's a revolution coming Embracing the challenge of RegTech 3.0, kpmg, 2018
- Dong Yang & Min Li (2018) Evolutionary Approaches and the Construction of Technology-Driven Regulations, Emerging Markets Finance and Trade, 54:14, 3256-3271, DOI: 10.1080/1540496X.2018.1496422
- SWARTZ, Norman. Definitions, dictionaries, and meanings. 1997.
- ZAVOLOKINA, Liudmila; DOLATA, Mateusz; SCHWABE, Gerhard. FinTech-What's in a Name?. 2016.
- Gomber, Peter, et al. "On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services." *Journal of Management Information Systems* 35.1 (2018): 220-265.
- Dw Arner et Al. FinTech, RegTech, and the Reconceptualization of Financial Regulation (2016) <https://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?referer=https://www.google.it/&httpsredir=1&article=1817&context=njilb>
- E&Y Innovating with-RegTech (2016) [http://www.ey.com/Publication/vwLUAssets/EY-Innovating-with-RegTech/\\$FILE/EY-Innovating-with-RegTech.pdf](http://www.ey.com/Publication/vwLUAssets/EY-Innovating-with-RegTech/$FILE/EY-Innovating-with-RegTech.pdf)
- Mills et Al. "The State of Small Business Lending: Innovation and Technology and the Implications for Regulation" Harvard Business School (2016)
- RegTech Top 21 – A Global View of RegTech Innovation, Go medici, EY 2018
- RegTech's Fca website: <https://www.fca.org.uk/firms/RegTech>
- Toronto Centre What means financial supervision: <http://res.torontocentre.org/guidedocs/FinTech%20RegTech%20and%20SupTech%20-%20What%20They%20Mean%20for%20Financial%20Supervision.pdf>
- Research Conference "FinTech and RegTech: Possibilities, Threats and Risks of Financial Technologies"*, KnE Social Sciences, pages 182–189. DOI 10.18502/kss.v3i2.1541 (2018)
- Transatlantic institute, The future of RegTech for regulators, 2017
- Dong Yang & Min Li (2018) Evolutionary Approaches and the Construction of Technology-Driven Regulations, Emerging Markets Finance and Trade, 54:14, 3256-3271, DOI: 10.1080/1540496X.2018.1496422
- Fintech and RegTech: Impact on regulators and banks Ioannis Anagnostopoulos *Journal of Economics and Business* (2018)
- Swartz Norman. Definitions, dictionaries, and meanings. 1997.
- Arner, Douglas W., János Barberis, and Ross P. Buckley. "FinTech, RegTech, and the reconceptualization of financial regulation." *Nw. J. Int'l L. & Bus.* 37 (2016/2017): 371.

- Bayón, P. S., & Vega, L. G. (2018). An outlook on the role of Finance Regulation under the Fourth Industrial Revolution. *Archives of Business Research*, 6(10), 423-434.
- REGTECH STUDY European Landscape Sia partners 2018
- Baxter, Lawrence G. "Adaptive financial regulation and RegTech: a concept article on realistic protection for victims of bank failures." *Duke LJ* 66 (2016): 567.
- Colaert, Veerle. "RegTech as a response to regulatory expansion in the financial sector." (2018).
- Arner, Douglas W., et al. "FinTech and RegTech: Enabling Innovation While Preserving Financial Stability." *Georgetown Journal of International Affairs* 18.3 (2017): 47-58.
- Enriques, Luca. "Financial supervisors and RegTech: Four roles and four challenges." (2017).
- Cave, Jonathan. "Get with the Program: Fintech Meets RegTech in the Light-Touch Sandbox." (2017).
- Allen, Darcy WE, and Chris Berg. "Regulation and technological change." Australia's Red Tape Crisis, Connor Court Publishing, Australia, Forthcoming (2018).
- MCKINSEY, Capital Markets Infrastructure An industry Reinventing itself, 2017
- IIF, Future of risk management in the digital era, 2017
- EY, German fintech landscape opportunity for Rhein-Main-Neckar, 2016
- EY, Who will disrupt the disruptors, 2015
- EY, UK-FinTech-On-the-cutting-edge, 2016
- EY, financial-sector-regulation-act-implementing-twin-peaks-and-the-impact-on-the-industry, 2018
- DELOITTE, Global compliance and innovation trends in wealth management, 2017
- DELOITTE, The RegTech universe on the rise, 2017
- DELOITTE, future-of-regulatory-productivity powered by RegTech, 2016

Appendix

Table 1

DEFINITION INDEX	DEFINITION	SOURCE
1	RegTech is a contraction of the terms regulatory and technology, and it comprises the use of technology, particularly information technology (IT), in the context of regulatory monitoring, reporting, and compliance.	Arner et al., 2017
2	RegTech, the application of technology to regulatory activities [...]	Baxter, 2016
3	(RegTech) which is described as the use of technological solutions to facilitate compliance with and monitoring of regulatory requirements.	Colaert, 2018
4	[...] defines RegTech as - A blended word of 'regulatory technology' that was created to address regulatory challenges in the financial services sector through innovative technology.	Das et al, 2017
5	[...] application of technology to regulation ("RegTech"), it involves digitization of systems which in turn supports the application of advanced analytical approaches to yield better regulation	Arner et al, 2018
6	RegTech, as the use of IT in compliance and supervision/regulation is now labelled [...]	Enrique, 2017
7	[...] RegTech – automated and real-time provision of compliance-related information to regulators.	Cave, 2017

8	Regulatory technologies are a subsystem of financial technologies that ensure more effective implementation of regulatory requirements for participants of financial markets. RegTech reduces the cost of services for participants in the financial market and the costs of state regulatory bodies by reducing time costs and making the whole system more simple	Stepanko A. D. and Surnina K. S. 2018
9	RegTech – or regulatory technology – is emerging as a means to deploy current and emerging technology solutions to reduce the increasing costs of compliance for companies and to improve internal reporting and supervisory capacity for regulators.	Use of RegTech by Central Banks and its Impact on Financial Inclusion Evidence from India, Mexico, Nigeria, Nepal and the Philippines Gurung, N1 and Perlman, L2(2018)
10	RegTech refers to a sub-division of the fintech sector that focuses on technologies that may facilitate the delivery of regulatory requirements more efficiently and effectively than existing capabilities.	Fintech and RegTech: Impact on regulators and banks Ioannis Anagnostopoulos Journal of Economics and Business (2018)
11	However, we argue that RegTech is not a part of fintech; rather, they are related but in different domains. As narrowly defined, RegTech is the adoption and use of technology to help financial services firms to understand and comply with regulatory requirements more efficiently and effectively. Typical examples include regulatory reporting or compliance oversight of conduct through the processing of unstructured-language data. In a broad sense, RegTech refers to regulators taking advantage of technological innovations aimed at synchronizing with the digitized and automated financial sector, which ultimately produces technological solutions that streamline and improve regulatory processes. To realize a desired regulatory goal, regulators need to take certain measures, for instance, create a uniform data format, establish a compatible application programming interface (API), and develop a machine-readable monitoring mechanism. In these definitions, RegTech refers to the use of technology, especially information technology (IT), for regulation, reporting, and compliance.	Dong Yang & Min Li (2018) Evolutionary Approaches and the Construction of Technology-Driven Regulations, Emerging Markets Finance and Trade, 54:14, 3256-3271
12	Regulatory Technology (RegTech): Know-your-customer, fraud detection and collateral and risk management	McKinsey, Capital Markets Infrastructure An industry Reinventing itself, 2017
13	[...] RegTech space: they offer digital solutions that help banks manage and meet regulatory requests.	IIF, Future of risk management in the digital era, 2017
14	FinTechs operating in this segment offer solutions to financial services organizations to help them comply with regulatory requirements and manage regulatory risks. RegTechs also	EY, German fintech landscape opportunity for Rhein-

	cover the scope of user authentication [...] as well as security applications.	Main-Neckar, 2016
15	“RegTech,” a proliferation of new applications regulating financial services directly on devices.	EY, Who will disrupt the disruptors 2015
16	RegTech: [...] FinTechs applying technology to the regulatory process	EY, UK FinTech-On the cutting edge, 2016
17	RegTech which can be described as the adoption of innovative technologies to facilitate the delivery of regulatory requirements	EY, Financial sector regulation act implementing twin peaks and the impact on the industry, 2018
18	RegTech: Technology created to help financial services firms meet their compliance obligations efficiently [...]	Deloitte, Global compliance and innovation trends in wealth management 2017
19	RegTech offer solutions that use technology to solve compliance and regulatory issues	Deloitte, The RegTech universe on the rise 2017
20	RegTech collectively refers to companies that are harnessing emerging technologies to help institutions improve compliance	Deloitte, future-of-regulatory-productivity powered by RegTech 2016
21	RegTech is the innovative application of emerging technologies [...], to help companies conform to evolving compliance requirements and stay ahead of competition in a digital marketplace	Accenture, RegTech Keeping the customer first to gain a competitive advantage 2017
22	RegTech is defined as the innovative application of emerging technologies by organizations to adapt to changing compliance requirements more effectively and efficiently, mitigate risks due to non-compliance and gain competitive advantage	Accenture, RegTech for regulators 2018
23	RegTech solutions exist to address all manners of risk and regulatory challenges.	PwC, Get ready for fintech, 2017
24	RegTech - Companies who provide a technology-driven service to facilitate and streamline compliance with regulations and reporting as well as protect from employee and customer fraud.	KPMG, the pulse of fintech, 2016
25	RegTech, like FinTech before it, is about using technology to solve problems. More and more financial firms are using digital technology to help them with regulatory compliance.	Accenture, Strategy_Beware_Bespoke 2017
26	RegTech Technology that addresses regulatory challenges and facilitates the delivery of compliance requirements	CBInsights, The State of RegTech 2017
27	The term RegTech refers to a set of companies and solutions that marry innovative technology and regulation to address regulatory requirements across industries, including financial services.	BBVA, RegTech, the new magic word in FinTech, 2016

28	"RegTech can be defined as solutions or services aimed at dramatically increasing automation, efficiency and efficacy [...] alleviating the burden of compliance"	INTEL, Fintech collaboration how banks can leverage the power of RegTech 2017
29	classification of technology specifically addressing regulation and compliance issues in the financial industry.	Risk.net, RegTech, 2017
30	[...], RegTech is the innovative application of technology and new business concepts to the challenges firms face in managing regulatory risk and compliance	Protiviti, RegTech the new player in fintech, 2017
31	RegTech, the application of technology to regulatory compliance, [...]	Deloitte, RegTech Overview 2016
32	RegTech - technologies designed to facilitate compliance with regulatory requirements – [...]	Aspen Institute, Modernizing digital financial regulation, 2017
33	Emerging RegTech technologies, which address the challenges and opportunities of dealing with regulatory issues, [...]	Consultancy.UK, The 100 most innovative RegTech 2017
34	Regulatory technology, or "RegTech, the technological solution to issues which are within the regulatory sphere [...]	Willis Tower Watson, The 6 megatrends What concerns unite our global executive 2016
35	"RegTech" which we define as "the use of new technologies to solve regulatory and compliance requirements more effectively and efficiently"	IIF; RegTech in financial services Technology solutions for compliance and reporting 2017
36	We define RegTech as the use of emerging technologies by both financial institutions and regulators to manage compliance and supervisory challenges more efficiently and effectively.	Milken, RegTech opportunities, 2018
37	RegTech; a term used to describe a growing range of technologies designed to help institutions cope with the increasing compliance burden [...] and to ensure their back-end systems can provide the information required by regulators.	Hitachi, RegTech special, 2017
38	We would consider RegTech to be a subset of Fintech where technology and innovation are used to provide solutions that aid industry with their compliance burden and support regulators in their work.	HIS Markit, FCA future scenarios conference: IHS Markit scenario on wholesale markets, 2017
39	A subcategory of Fintechs or a close cousin, RegTechs (Regulatory Technology) [...] use of our current technology to bring innovative solutions to regulatory compliance burdens.	Initio, RegTech the regulatory toolkit, 2017
40	RegTech in financial services – a combination of Regulation and Technology used to describe the application of new technologies to the world of regulation and compliance – has emerged as a sub-sector of the technology industry in the last three years. This was fostered by the parallel development of	REGTECH STUDY European Landscape Sia partners 2018

	Big Data analytics and Artificial Intelligence which found a natural application given the vast amounts of data produced by banks.	
41	RegTech as a term is self-explanatory – it’s technology that helps financial services firms get better at dealing with regulation. As a key element of financial institutions’ drive towards digital transformation. Strengthen compliance and mitigate risk Reduce the fixed cost of compliance and increase efficiency Improve protection for customers But it can be more than that. Through direct improvements and freeing resources, RegTech also has the potential to: Provide valuable business insight Provide customers with better and faster service Drive new products and services	There’s a revolution coming Embracing the challenge of RegTech 3.0, kpmg, 2018
42	RegTech solutions will be ... providing a more automated, cost-effective way of meeting compliance and regulatory reporting needs. Integrated ‘compliance by design’ approach will be useful to achieve this objective.	RegTech Top 21 – A Global View of RegTech Innovation, Go medici, EY 2018
43	[...] regulatory technology (‘RegTech’) is a commonly recognised term for technologies that can be used by market participants to follow regulatory and compliance requirements more effectively and efficiently, and also used by national and EU authorities for supervisory purposes.	EBA, Fintech roadmap 2018
44	RegTech is a sub-set of FinTech that focuses on technologies that may facilitate the delivery of regulatory requirements more efficiently and effectively than existing capabilities	FCA, Call for input on supporting the development and adopters of RegTech, 2016
45	RegTech technologies that can be used for compliance and reporting requirements	EBA, Fintech roadmap FAQ, 2018
46	“Regulatory technologies”, or “RegTech”, is used to describe technologies used by regulates to comply with regulatory requirements more effectively and efficiently. It is also used to describe the deployment of technology by regulators themselves to achieve more efficient and effective oversight	FCA, Co-operation Agreement 2017

	Author class	Year of publication	Definition	Innovatio/innovative/Emerging/new	RegTech as a company	RegTech as a solution/ application	Use/application/adoption of technology/ technology solutions	Use of IT	In the context of/ application to regulatory requirements/ equirements/demand/activity /challenges	Manage / meet / delivery / conform/provision of /cope with	Monitoring	Reporting /provide information	Compliance/comply with/ conform to compliance requirements	Supervision	Facilitate/address /solve/alleviating the burden of/improve/help/ bring solution	Involves digitalization of systems / digital solutions	Support the application of advanced analytics approaches	Yield better regulation	Know-your-customer	Fraud detection/protection	Collateral	Risk management	In financial services sector/organization or banks	In any sector/organization / industry/ institution /company	Manage regulatory risk	User authentication	Security applications	Directly on devices	Stay ahead of the competition in a digital marketplace/ gain competitive advantage	Sub-segment of the Fintech	Efficiently/ More efficiently and effectively than existing capabilities	Solutions for increasing automation / automated	New business concepts	Real time	Used by regulators themselves. [By regulators to achieve more efficient and effective oversight / used	
A	2017	1				1	1	1	1		1	1	1																							
A	2016	2				1	1		1																											
A	2014	3				1	1			1	1		1		1																					
A	2017	4	1				1		1						1								1													
A	2018	5				1	1		1							1	1	1																		
A	2017	6				1		1	1				1	1																						
A	2017	7							1			1	1																				1		1	
A	2018	8					1	1								1	1						1						1		1				1	

C	2017	30	1		1	1			1			1								1	1							1						
C	2016	31			1	1		1				1																						
C	2017	32			1	1		1				1		1																				
C	2017	33			1	1		1						1																				
C	2016	34			1	1		1																										
C	2017	35	1		1	1		1				1		1													1							
C	2018	36	1			1			1			1	1							1							1			1				
C	2018	37			1	1			1		1	1		1							1													
C	2017	38	1			1						1		1							1						1			1				
C	2017	39	1	1		1		1				1		1													1							
C	2018	40	1			1	1	1	1			1			1	1					1							1						
C	2018	41						1	1	1		1	1			1	1	1	1		1	1		1		1		1	1	1				
C	2018	42				1			1		1	1			1	1												1						
P	2018	43			1	1		1				1									1							1			1			
P	2016	44				1		1	1					1													1	1						
P	2017	45			1	1	1	1			1	1																						
P	2017	46			1	1		1				1																1			1			
Tot			12	6	27	37	7	33	15	3	8	31	4	26	6	6	3	2	3	1	3	13	8	4	1	2	1	4	6	9	4	2	1	5

The concepts extracted and presented in Table 2 are better explained now. Consider a certain definition that shows one of the following concepts:

RegTech as a company: According to this definition, a RegTech is a company

RegTech as a solution/application: According to this definition, RegTech is defined as a solution or an application.

Use/application/adoption of technology/ innovative technology/ technology solutions: According to this definition, the concept of RegTech implies the application of technology.

Use of IT: According to this definition, the concept of RegTech implies a central use of IT solutions.

In the context of/ application to regulation, regulatory requirements/demand/activity /challenges: According to this definition, RegTech is implicitly linked to the regulatory environment.

Monitoring / Reporting / Compliance / Supervision: According to this definition, the concept of RegTech is related respectively with Monitoring, Reporting, Compliance or Supervision activity.

Involves digitalization of systems / digital solutions: According to this definition, the concept of RegTech is related to the digitalization of systems or the presence of digital solutions.

Support the application of advanced analytics approaches: According to this definition, RegTech by definition fosters the application of analytics approaches.

Yield better regulation: According to this definition, RegTech by definition has to foster better regulation.

KYC / Fraud detection/protection / Collateral / Risk Management: According to this definition, RegTech helps in KYC practices, counteract frauds and fosters collateral and risk management.

In the financial services sector/organization or banks: According to this definition, RegTech is related specifically to the financial industries and to the banks.

In any sector/organization/industry/ institution /company: According to this definition, RegTech is related to any industry or kind of company.

Manage regulatory risk: According to this definition, RegTech deals with the management of compliance risk.

User authentication / Security Applications: According to this definition, RegTech deals with user authentication practices and applications to improve security.

Directly on devices: According to this definition, RegTech is related to applications developed directly on devices.

Stay ahead of the competition in a digital marketplace/ gain competitive advantage: According to this definition, RegTech is by definition able to provide a competitive advantage.

Sub-segment of the Fintech: According to this definition, RegTech is a sub-segment of Fintech.

Efficiently/ more efficiently and effectively than existing capabilities: According to this definition, RegTech has to solve issues in an efficient way, or in a way more efficient than existent capabilities.

Solutions for increasing automation / automated: According to this definition, RegTech has to increase automation.

New business concepts: According to this definition, RegTech is new business concepts.

Real time: According to this definition, RegTech is/provides real time solutions.

Used by regulators themselves: This concept indicates “RegTech” as something useful for regulators. The concept hence can be seen as “Utility for regulators”

How Much Digital are the Italian Incubators? Level of Diffusion of Digital Technologies in Italian Certified Incubators

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Abstract

Digital entrepreneurship represents a relevant socio-economic and technological phenomenon that creates new spaces of opportunities where different kind of organizations can leverage digital technologies to shift the traditional mode of creating, supporting and doing business. Among these organizations, incubators should effectively exploit digital technologies to support the creation and development of innovative startups. Notwithstanding, some studies show that they have still a physical characterization of their operating activities and core initiatives and use digital technologies mainly for communication purposes, through their web sites and social media channels. Moreover, how much incubators and organizations like incubators use carefully digital technologies to support new entrepreneurial and innovation processes has not yet been analysed in literature. Based on these premises, the aim of this paper is

to shed light on how incubators are adopting digital technologies (with a focus on social networking sites) to support the process of creation of new ventures. A web-based document analysis methodology has been used to investigate the level of diffusion and adoption of digital technologies among Italian Startup Incubators using the information available on the websites of the analysed incubators. Results obtained show that, while the contents describing all the phases and issues of the incubation programs (e.g. modules and duration, number of calls, participating requirements, selection process, etc.) benefit of the usage of digital technologies in almost the incubators analysed, the core services for incubating the startups are delivered mainly through a face-to-face and physical approaches, with the unique (few) exception of services provided to submit online ideas and project proposals. Besides, most of the analysed incubators leverage digital technologies to give visibility to their partners and collaborators. Finally, a positive correlation has been found between the number of social media used and the intensity of usage. According to the value of these two variables, four archetypes have been proposed with a brief description and guidelines for the development of the digitalization processes of incubators.

Keywords –Digital Technologies, Social Media, Incubator, Italy

1 Introduction

Today, digital technologies have a significant impact on how new ventures are imagined, designed, launched and managed. Digital technologies permeate every organization, manufacturer and service as well as private and public organizations (Fischer and Reuber, 2011; Fitzgerald et al., 2014; Greenstein et al., 2013), and have the potential to open up fascinating innovation opportunities for entrepreneurs (Cohen et al., 2017; Yoo et al., 2010) to reshape the markets and society globally (Nambisan et al., 2017).

The resulting and relentless convergence among entrepreneurship and information-system related trends can be synthesized into the concept of digital entrepreneurship. It represents a relevant socio-economic and technological phenomenon that creates new spaces of opportunities where existing and potential entrepreneurs can leverage digital technologies to shift the traditional mode of creating and doing business in the digital era (Cohen et al., 2017; Giones and Brem, 2017; Nambisan, 2017; Nambisan et al., 2017).

Actually, digital entrepreneurship refers to the use of digital technologies and Internet to execute most of the processes required to launch a new venture (Giones and Brem, 2017), as well as to manage and implement the business operations with customers, intermediaries, or partners (Shabbir et al., 2016; Ismail et al., 2012).

Digital technologies support the new phenomenon of generativity (the ability of technologies to support the creation of new services and products). This creates opportunities for radically new business models. Entrepreneurs and innovators are adopting digital technologies to develop new forms of entrepreneurial actions that move beyond the traditional industry boundaries to include knowledge ecosystems and communities, thus accelerating the evolution of new ventures. Specifically, digitalization could enable organizations involved in knowledge and startup ecosystems in adopting

business models that are more and more open, allowing ideas and technologies to flow from outside the company and from within to the external environment (Urbinati et al., 2018). Among these organizations, incubators have still a physical characterization of their operating activities and core initiatives. Most of the incubators execute their main activities essentially in a face-to-face modality (Tapscott, 2014).

Digital technologies could leverage the way in which incubators pursues the entrepreneurship process with a pervasive effect on the rationale, processes and forms of entrepreneurship as well as on the stakeholders involved in the achievement of entrepreneurship goals.

In this vein, our interest is to investigate about the how much diffused are digital technologies within business incubators. Indeed, opportunities to create new firms/companies provided by the digital technologies are especially relevant when incubators are considered.

2 Literature background

According to a wider perspective proposed by Nambisan (2017) to highlight the multiple roles of digital technologies into the entrepreneurial process, digital entrepreneurship can be interpreted as the result of three distinct but related elements: digital artifacts, digital infrastructure and digital platforms. A digital artifact represents a digital component, an application, or media content that is part of a new product or service and offers a specific functionality or value to the end-user (Ekbis, 2009; Kallinikos et al., 2013). Digital infrastructure consists in digital tools and systems that offer communication, collaboration, and/or computing capabilities, such as cloud computing, data analytics, online communities, social-media, 3D printing, and digital makerspaces, to provide support to entrepreneurial activities. Digital platforms refer to shared, common sets of services as well as architecture that serves to host complementary offerings, including digital artifacts (Parker et al., 2016; Tiwana et al., 2010), and also software platforms that provide the core functionality shared by the modules, together with extensible codebase and interfaces to guarantee communication and interoperability (Tiwana et al., 2010).

The entrepreneurial process of a new company carried out within incubators can be articulated in three main stages: *desk*, *pre-market* and *market* (Byers et al, 2010; Elia et al., 2016). The activities characterizing each stage can benefit of the potential of digital technologies to share information, connect people, exchange knowledge, execute processes, organize resources, and coordinate tasks. In such digitally-enabled incubators, the access to new knowledge and the speed of transactions increase significantly, thus creating new spaces of opportunities that companies can take to connect with external and complementary partners for innovation purposes (de Reuver et al., 2018).

More specifically, *desk-stage activities* of the entrepreneurial roadmap, which represent the preliminary explorative phase aiming at preparing the venture creation, can leverage the access to specialized databases and reports on market technology and social trends to support the execution of scenarios scanning and the envisioning of new business opportunities. Besides, the usage of virtual collaboration and participative tools may

support the overall idea management process, from the collection of numerous proposals and insights to the selection of the most promising ones, from the enrichment of the business concept to the definition of the value proposition and revenue model. Afterwards, the usage of purposeful software for business planning and interactive simulations complete the support provided to the desk stage activities, in the overall context of the entrepreneurial process, together with the access to MOOC system to guarantee continuous learning process.

As for the *pre-market activities*, entrepreneurs can rely on the access to national and international databases for searching patents, leverage crowdfunding platforms to collect the required money, use crowdsourcing sites to outsource activities or complement competencies and team, or enlarge the network of partners. Also, by accessing and exploiting the intellectual capital services of the incubator, entrepreneurs can reserve and use internal knowledge-based facilities such as administration and legal (human capital), search for interested investors and partners (relational capital), or access to facilities and infrastructural assets for co-working (structural capital). Moreover, by accessing to remote digital infrastructures and platforms (i.e. mobile computing, 3D printing, additive manufacturing, cloud computing, Internet of things, big data, robotics, cybersecurity and blockchain) (European Commission, 2017), the new company can prototype products and services to meet the customers' demand, can experiment new technological features, can test the novelty and market potential of a business idea, and fine-tune the market offering. Besides, also the access to MOOC platforms may support the execution of pre-market activities, thus allowing people to learn and know, thus making their actions more effective.

Finally, *market activities* consisting in the operational aspects that guarantee a real presence of the new company in the market, can benefit of digital technologies to support the day-by-day operations and contribute to the venture growth. In particular, modern ERP systems and CRM platforms can provide the core services to support the execution of primary and supporting activities, web content management tools may ensure an updated presence on the web with e-commerce extensions, social media instruments may provide a valuable support to marketing strategies, artificial intelligence services and big data applications can extract insights to innovate the marketing offering and extend the market scope. Besides, integrated reporting suites and interactive dashboards reveal crucial to organize all data coming from the above mentioned systems and transform them into valuable information through which attracting the interest of potential investors in the final aim to create the right financial, organizational and market conditions for the overall venture expansion, but also to contact experts and professionals to receive a managerial support.

Definitely, digital technologies are defining new ways of collaborating, collecting and organizing resources, thus supporting the design of products and services, the execution of routine activities and tasks, the complex matching between demand and offer, and the development of innovative solutions (Markus and Loebecke, 2013), in the final aim to make innovation possible (Nambisan et al., 2017) and to provide an end-to-end support to the entrepreneurial process.

However, most of the incubators have still a physical characterization of their operating activities and core initiatives. They use digital technologies mainly for communication purposes, through their web sites and social media channels, and provide information about five key components that shape their structure and activities. They refer to (Clarysse et al., 2016): the strategic focus (i.e. the industry verticalization and the geographical scope of the accelerator); the programme package (i.e. the integrated set of contents and services for the startup incubation (i.e. training program, networking events, workshops, customer validation, investor pitch, office spaces); the funding (i.e. both the funds of the accelerator itself and the funds available for startups, including the information about the request of equity); the selection process (i.e. the screening of proposals to identify those ones with the highest market potential to be involved into the program); and the alumni service (i.e. the capacity to keep close and active relations with the companies that graduated from the programs to share their experiences within the new program editions and leverage the alumni network for mentorship and investment sources).

This information essentially refers to three complementary dimensions of the incubator, which are the content delivered, the services offered, and the network of relationships that can be exploited.

Most of the incubators, except for the information delivered through their web sites and social media channels, execute the desk-stage and pre-market activities (i.e. the core of the start-ups' incubation and acceleration process) essentially in a face-to-face modality, without taking advantage of virtuality, immediacy, relational proximity, knowledge exchanges, and spatial-temporal independence offered by the digital technologies (Tapscott, 2014). Some exceptions are: F6S.COM that offers online services to connect directly with accelerators, funds and investors, and search talents to complete the team; ANGEL.CO that provide online support to form the entrepreneurial team and find potential investors; STARTUPCOMPETE.CO that offers virtual spaces where aspiring entrepreneurs, mentors and advisors can connect each other and bring potential business ideas to market through idea competitions, pitch competitions, and business plan competitions; IBRIDGENETWORK.ORG that provide a customized virtual community to support idea discovery, people connection and collaboration, the development of early-stage technological projects, broadcasting of technology needs, discovering of matching technologies and partners, the connection to clients and investors, gaining of market insights.

An insight to social media technologies is necessary. Since social networking sites began allowing organizations to create profiles and become active members, organizations (as incubators) have started incorporating these strategies into their public relations programming. Social networking sites are the locus of relationships (Treddinick, 2006). So far, social networking sites should be used to foster relationship growth (Dugan, 2007). How much incubators and organizations like incubators use carefully social media to foster relationships has not yet been analysed in literature.

In light of these, aim of this paper is to shed light on how incubators are adopting digital technologies (with a focus on social networking sites) to support the process of creation of new ventures.

3 Methodology

This study is based on archival and documentary as secondary data. A web-based document analysis methodology has been used to investigate the level of diffusion and adoption of digital technologies among Italian Startup Incubators.

A dataset of information regarding the adoption and diffusion of digital technologies was carried out using the information available on the websites of the analysed incubators. The websites and the complementary sources were analysed for the presence of information related to the adoption of digital technologies supporting individuals, groups, and startup in the incubation process.

Qualitative research methodology is selected for purpose of the study. Qualitative data is the main priority; however, some quantitative data may be also investigated. Secondary data is collected from robust sources such as reports and websites. We select a list of Italian incubators from the official register of the Italian Minister for the Economic Development, and we study each incubators website to retrieve information about: location, size, governance structure, sector of specialization (if any), average number of incubated startups, services, list of adopted digital technologies, social networking profiles (Facebook, LinkedIn, Instagram, Twitter, Youtube).

After this, according to the goal of this research aimed at evaluating how much digital are the Italian certified incubators, the analysis continued in two steps.

First, we focused the analysis on the level of digitalization of the content delivered and services offered by the incubator, as well as of the network of relationships accessible through joining the incubator. In such a way, three main variables have been defined for this phase, which are the Digital Contents, Digital Services, and Digital Networks.

Digital Contents refers to how much deep and detailed are the information about the acceleration and incubation programs provided by using the digital technologies (e.g. web site, social media channels). This information concerns the programs' modules and duration, the number of calls launched to accept proposals, the participating requirements, the description of phases and criteria for the selection process, the specification of the industrial domains of references, the indication of the geographical focus and profile of the startups targeted, the information on the existence of pitching events or the possibility to use technological and physical infrastructures. Further information includes the typologies of services offered and the delivery modalities, the indications about the limits of investment to request, the possible percentage of equity owned by the accelerator / incubator in case of a successful incubation of the startup.

Digital Services refers to the level of support provided by the digital technologies to the process of incubation / acceleration. This can happen by offering candidates the possibility to submit online their ideas or project proposals, to refine (or enhance) the entrepreneurial idea through external suggestions and online comments, to access to virtual mentoring and use online simulators to develop the business plan and define the

business model, to use online services to recruit people and discovery skill to complete the team, to access to databases for market researches or patent searches. Further services include the online support and guide to choose crowdsourcing platforms and access to resources required for the business startup or outsource non-core activities of the new company. Other examples include the access to online learning modules, online mentoring for preparing the pitch presentation, online booking of co-working spaces, or remote access to technological infrastructure (e.g. Cloud Computing, 3D printing, simulators, IoT platforms, cybersecurity platforms, ERP, CRM, BI suites, digital marketplaces). Finally, digital services refer also to the possibility to access online to professionals for administrative support, legal support, international marketing support, networking support to interact with potential investors and partners, etc.).

Digital Networks refers to level of visibility and attention reserved to the networks of partners, investors, funders, mentors, alumni, teams and startups involved in past incubation / acceleration programs, as well as to the possibility to contact them directly through online links (e.g. web site address, e-mails, etc.).

According to the number of items covered and the level of details provided, the three variables (i.e. Digital Contents, Digital Services, and Digital Networks) are evaluated by using a three-item Likert scale (i.e. low, medium, and high).

Second, we performed a quantitative analysis on the diffusion and adoption of social networking sites visiting the incubators' profiles. We based the analysis by counting the number of social networking sites activated (e.g.: Facebook, LinkedIn, Twitter, Instagram And Youtube as those sites are considered as the top five most adopted social networking sites). We calculated the index of differentiation based on the number of single profiles activated for every of the five sites. The analysis was then detailed by visiting the activities performed in the month of February, counting the number of relationships (e.g.: number of page's likes for Facebook), the number of posts (per each profile activated) and the number of followers per each post. We aggregated those measures in the index of intensity of use, to better understand the extent of adoption of each social networking site.

3.1 Unit of analysis

In the last years, the Italian Government has issued several regulations and laws aimed to support and promote the creation and development of new innovative firms, namely the innovative startups. Recently, such normative about start-ups has been further enriched by a fundamental pillar.

In particular, the Law n.221/2012, which converted the Legislative Decree n. 179/2012, introduce the regulation of the so-called "Certified incubator for innovative startups". The Certified Incubators is a limited company or a cooperative able to offer "even in a non-exclusive way, services to support the creation or the development of innovative start-ups". Put differently, startups incubators are structures that, through the provision of specific business services and infrastructures, assist and support innovative start-ups in the growth and acceleration processes. To be a certified incubator, such organizations have to meet a set of requirements defined by article n. 5 of the Decree of the Ministry of Economic Development of 21 February 2013 (Table 1). The policy framework for

certified incubators has been improved and broadened in the period 2013-17 by further legislative interventions issued. Moreover, it is important to underline that the certification is a necessary condition for registering the incubator in the appropriate section of the business register and obtain some economic, financial and fiscal benefits. According to the regulatory framework, in order to obtain the certification, the incubators should show specific features (Table 1):

Table 1: Incubator Decree's requirements

Requirements	
Structural requirements	<ul style="list-style-type: none"> • The area dedicated to the incubator activities should be at least 400m² • presence of facilities, including real estate, suitable for hosting innovative startups, such as open spaces, labs for testing and/or development of prototypes, research equipments; • existence of equipments and tools suitable for supporting the activity of innovative start-ups, such as ultra-broadband access systems (10mps), meeting rooms, testing machines;
Managerial requirements	<ul style="list-style-type: none"> • portfolio of potential stakeholders, e.g. universities, research centers, supplier, customers, public institutions and financial partners that carry out activities and projects related to innovative start-ups; • presence of adequate and proven competence in supporting innovative start-ups (at least 10 years of experience in such field).

Further requirements were defined in order to prove that incubators, as well as their funders, have the proper competences, capabilities and experience to support innovative startups. For instance, it is required: i) at least 10 applications received in the last year; ii) the presence of 10 startups in the incubator with a total number of 30 employees, iii) a certain number of innovative start-ups that completed the incubation processes and operate in the market, iv) at least 3 registered patents or submitted patent applications in the last year by innovative start-ups currently incubated.

The possession of these requirements is self-certified by the legal representative of the incubator through a declaration signed at the time of application for registration.

Therefore, this research focuses on the certified incubators as the latter are crucial actors of the knowledge ecosystems and digital technologies can play a fundamental role in supporting innovative startups during their development processes. This is also in line with the requirements of the so-called Incubator Decree (DM, 2013/04/18).

4 Results

4.1 Descriptive

The population of Italian Certified Incubators is made up of 34 incubators. It is important to underline that data collection phase was in February 2019. As shown in the Figure 1, the most part of Italian Incubators is localized in the Northern of Italy (65%), while only 9% (3) in the Southern.

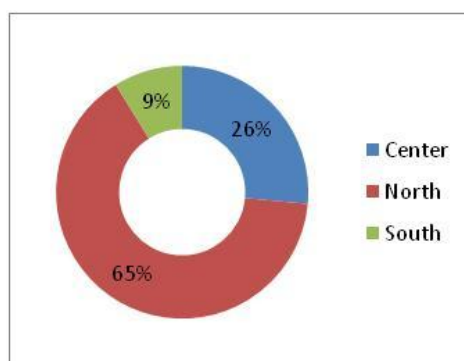


Figure 1: Geographical distribution of Italian Certified Incubators

Specifically, it is possible to note the Italian incubators are mainly focused on Lombardy (23,5%), followed by Lazio (14,7%) and Friuli Venezia Giulia 4 (11,8%)(Table 2).

Table 2: Regional distribution of Italian Certified Incubators

Regional distribution	
Lombardy	8 (23,5%)
Lazio	5 (14,7%)
Friuli Venezia Giulia	4 (11,8%)
Marche	3 (8,8%)
Piedmont	3 (8,8%)
Veneto	3 (8,8%)
Campania	2 (5,9%)
Emilia Romagna	2 (5,9%)
Liguria	1 (2,9%)
Sardinia	1 (2,9%)
Tuscany	1 (2,9%)
Trentino Alto-Adige	1 (2,9%)
TOT	34 (100%)

The majority of Italian certified incubators supports digital startups and/or startups that develop new innovative technologies (Figure 2).

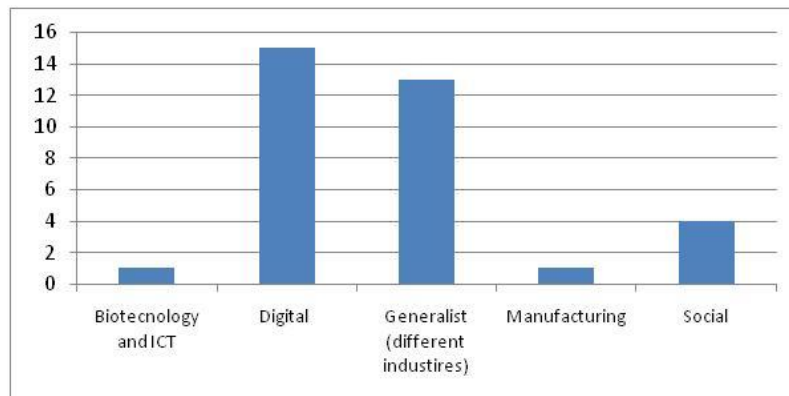


Figure 2: Industry focus of Italian certified incubators

In order to better investigate the digital level of Italian certified incubators, their websites were analyzed.

Unfortunately, one Italian incubator does not have an own website; as consequence, we perform this analysis only on 33 incubators.

In particular, we collect data about three different dimensions, namely digital services, digital contents and digital network. Put differently, the aim is to investigate whether and how much Italian certified incubators use digital technologies to support development and innovation processes of startups.

The following digital intensity index was calculated as:

$$\frac{\sum_i X_i(k)}{GTot}$$

$X_i(k)$ is the judgements about the incubators K -ith respect to the dimension i
 $i = 1, 2, 3$ (digital dimension considered)

$GTot$ = the potential maximum score that each incubator can obtained.

Table 3 shows the classification of Italian incubators on the basis of their digital intensity index.

Table 3: Classification of Italian certified incubators

Digital Intensity Index (%)			
A1	100	A18	66.67
A2	100	A19	55.56
A3	88.89	A20	55.56
A4	88.89	A21	55.56
A5	88.89	A22	55.56
A6	88.89	A23	55.56
A7	77.78	A24	55.56

A8	77.78	A25	44.44
A9	77.78	A26	44.44
A10	77.78	A27	44.44
A11	77.78	A28	44.44
A12	66.67	A29	44.44
A13	66.67	A30	44.44
A14	66.67	A31	44.44
A15	66.67	A32	33.33
A16	66.67	A33	33.33
A17	66.67		
Average	64.31		
Stand.dev	18.58		

As shown in Table 3, the digital intensity level ranges from 33.33 to 100, with a mean of 64.3. Focusing on the results shown in Table 3, it is possible to identify three different group, namely:

- the *best performers* that shows a Digital Intensity index that range from 100 to 66,67. This class is composed of the most of part of incubators;
- the *medium performers* that have a Digital Intensity index that range from 66,67 to 33,33;
- the *worst performers* that shows a Digital Intensity index that range less than 33,33.

In general, it is possible to claim that the most part of Italian incubators offer a low level of digital services (54,54%).The Digital network, that is the ability to support the establishment and the development of partnerships and collaborations through the website, appears to be a more considered digital dimension as the 42.42% of the Italian incubators show a high digitalization level (Figure 3).

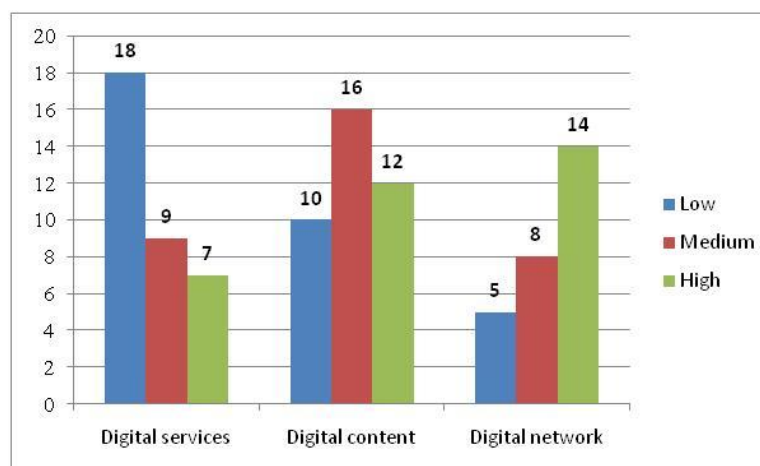


Figure 3: Digitalization level of Italian certified incubators

Such results are confirmed in the following. Specifically, focusing on the analysis of only two dimensions (Figure 4), namely digital services and contents, it is possible to note that the most part of the Italian incubators (21.21%) shows a very low digitalization level. On the contrary, only 3 incubators are able to offer a high level of digital services and contents (9.9%).

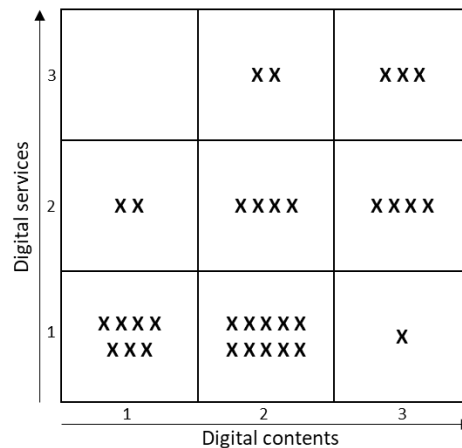


Figure 4: Level of digital services and contents provided by Italian Incubators

On the contrary, only 3 incubators are able to offer a high level of digital services and contents (9.9%). This shows that it is necessary to support the Italian incubators in the digitalization processes.

4.2 Social Media Analysis

Through the analysis of the website, we collect further data about the social media used and the related intensity of use which let to better evaluate the digitalization level of Italian certified incubators. In particular, two different indexes were calculated, namely index of differentiation and intensity of use.

The index of differentiation is defined as the number of social media adopted by the Italian incubators divided by the total number of social media identified, such as Facebook, Twitter, Instagram, LinkedIn, Youtube. It could vary from zero, if no social media is used, to 100 if the incubator uses all the SM investigated. For each incubator, the index of differentiation of SM was calculated (Table 5).

Table 5: Classification of Italian incubators in terms of differentiation level of SM adopted

Index of Differentiation			
A1	100	A18	80
A2	100	A19	60
A3	100	A20	60
A4	100	A21	60
A5	100	A22	60
A6	100	A23	60

A7	80	A24	60
A8	80	A25	60
A9	80	A26	40
A10	80	A27	40
A11	80	A28	40
A12	80	A29	20
A13	80	A30	20
A14	80	A31	20
A15	80	A32	0
A16	80	A33	0
A17	80	-	-
Average	65,45		
Stand.dev	28,84		

Results in Table 5 show that only 18.18% of Italian incubators has all the SM considered, although the most part of them (36.36%) has 4 SM out of 5. The mean value is equal to 65.45, showing that there is a good level of SM adoption among Italian incubators.

While the index of differentiation shows how many SM each incubator adopts, the intensity of use underlines if incubators make of it scarce or intensive use.

In particular, the intensity of use of social media was calculated as described in the following steps:

1) Analysis of the intensity of use on the social media considered by collecting data about the number of published posts, video, photos, comments, sharings, etc; 2) For each social media considered, the mean value of intensity of use was computed;

3) On the basis of the mean values calculated, different ranges of intensity were defined to support the codification by using Likert scale (very poor (1), poor (2), medium (3), significant (4) and very significant (5)).

4) Each incubator was evaluated on the basis of its intensity of use.

As shown in Figure 3, a strong positive relationship exists between Intensity of SM use and number of different SM used ($\rho = 0.794$). This result is confirmed also by the R^2 means that both the considered variables increase simultaneously.

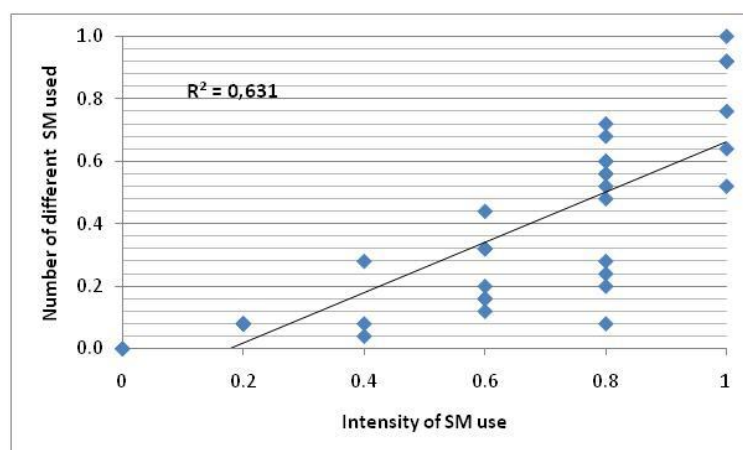


Figure 3: Correlation between index of differentiation and intensity of SM use

To investigate whether the correlation coefficient ($r = 0.794$) between the index of intensity of SM use and differentiation level of SM adopted is statistically significant, a t-test has been performed. The calculated t value is 2.354. As tabulated t value ranges $-1.697 < t < 1.697$, it is possible to reject the null hypothesis (H_0). More specifically, the empirical results show that the intensity of SM use and the differentiation level of SM adopted affect simultaneously each other. The higher the intensity of SM use, the higher the number of different SM adopted by Italian certified incubators and viceversa.

Following Cerchione and Esposito (2017) approach, it is possible to identify 4 areas limited by the average value of the two indices (Figure 4).

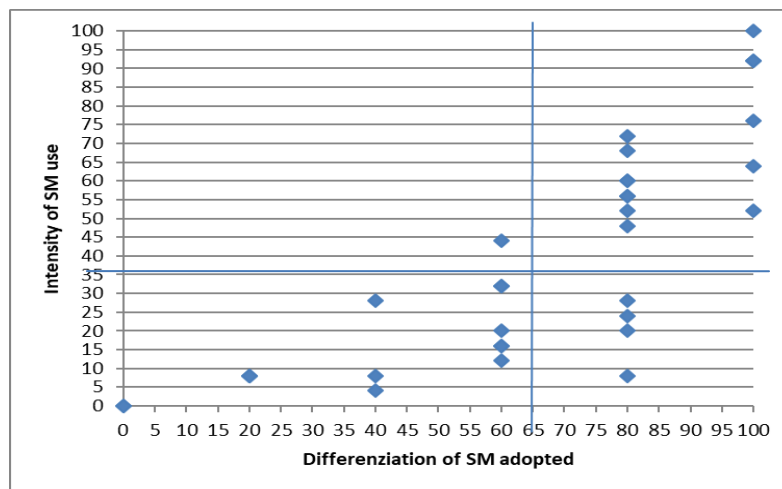


Figure 4: Correlation between index of differentiation and intensity of SM use

High-right located Italian certified incubators make intensive use of several different SM. High-left located Italian certified incubators make intensive use of few SM. Low-left located Italian certified incubators do not use the few resources at their disposal intensively. Low-right located Italian certified incubators do not use the many SM at their disposal intensively. These four areas identify different digitalization strategies adopted by Italian certified incubators (Figure 4).

According to these results and following Cerchione and Esposito (2017), it is possible to propose a taxonomy that synthesises the strategies of Italian certified incubators using different SM more or less intensively. Specifically, four strategies were identified: digital leaders, digital addicts, digital explorers, digital laggards.

Table 6: A classification of digital strategies of Italian Incubators

		Differentiation of SM adopted	
		Low	High
Intensity of SM use	High	Digital addicts (A2)	Digital leaders (A1)
	Low	Digital laggards (A3)	Digital Explorers (A4)

The digital leader is an incubator that recognize a strategic value to the SM and adopts several social media, exploiting them intensively (A1). The digital addict is an incubator that intensively uses the few SM adopted (A2). The incubators in this area by investing in the adoption of further SM can quite easily become a digital leader. The digital laggard is an incubator still does not fully understand the value of digital tools as it uses few SM and not intensively (Area 3). In this case, these incubators should invest both in the adoption of further SM and in the development of skills and capability to exploit them more intensively. Finally, the digital explorer is an incubator that, despite use a high number of SM, is still not able to exploit them intensively (Area 4). In order to become digital leaders, these incubators should invest in training and educational activities to improve their ability to effectively use the SM and, in general, the digital technologies.

5 Discussions and conclusions

This article is a first attempt to investigate the level of digitalization of the Italian certified incubators. This issue assumes a particular relevance in today's entrepreneurial economy (Thurik et al., 2013) where digital technologies play a crucial role in the process of ideation, design, launch and management of startups.

Moreover, the topic can be framed into the wider research area of digital entrepreneurship, which represents an impactful socio-economic phenomenon that is creating new opportunities for existing and potential entrepreneurs to leverage digital technologies for changing the way how companies can be founded, managed and developed (Cohen et al., 2017; Giones and Brem, 2017; Nambisan, 2017; Nambisan et al., 2017).

Therefore, this study aims at exploring and understanding how much digital these incubators are, by considering three dimensions of analysis such as the content, the services, and the network.

At this purpose, an analysis of the information publicly available on the web sites of the Italian certified incubators has been conducted in order to determine the level of digitalization of three key dimensions characterizing their core activity, such as the content delivered, the services offered, and the network of relationships accessible through joining the incubator. Moreover, considering the relevance of the social media in

the digital economy scenarios, a further analysis concerned the typology and the intensity of usage characterizing the social identity of the Italian certified incubators.

Preliminary results obtained show that, while the contents describing all the phases and issues of the incubation programs (e.g. modules and duration, number of calls, participating requirements, selection process, etc.) benefit of the usage of digital technologies in almost the incubators analysed, the core services for incubating the startups are delivered mainly through a face-to-face and physical approach, with the unique (few) exception of services provided to submit online ideas and project proposals. Besides, as for the network, most of the analysed incubators leverage digital technologies to give visibility to their partners and collaborators and, in several cases, they provide a rich description and contact information to establish a direct link with them.

Moreover, as for the social identity, a positive correlation has been found between the number of social media used and the intensity of usage. Besides, according to the value of these two variables, four archetypes have been proposed with a brief description and guidelines for the development of the incubator.

This research has implications for both researchers and practitioners. For the former, it represents a preliminary study on the Italian panorama of the certified incubators in the perspective to analyse their level of digitalization and provide possible insights to enhance their performance and increase their impact.

Looking at the practitioners, they can use this research to understand how increasing the virtualization of their activities, thus enlarging their strategic and operational scope, and becoming more aligned with innovative incubators operating at global level such as F6S.COM, ANGEL.CO, STARTUPCOMPETE.CO, and IBRIDGENETWORK.ORG.

This research has some limits that may open the space for further research. A first limit concerns the typology of analysis that has been carried out. Indeed, the desk analysis based on the information available on the web sites can be integrated with the analysis of further documentation available in the web, as well as with interviews with managers and key stakeholders of the incubators.

Another limit concerns the number of incubators considered in the analysis. Indeed, to compare a homogeneous sample of incubators, this research relies on the Italian certified incubators. All the certified incubators listed on the Italian Ministry of Economic Development have been considered, even if it is not possible to extend the results to the more complex phenomenon of digital incubation process. At this purpose, further research can be devoted to analyze other Italian incubators that are not formally certified by the government but can be substantially considered as valuable initiatives for startups creation.

Finally, a more detailed analysis on the relationships between the “digital profile” of the incubator and the performances achieved (e.g. in terms of number of incubated startups, amount of funds attracted by public and private stakeholders and investors, number of new jobs created, number of incubated companies operating successfully in the market) can be performed in the near future.

References

- Byers T. H., R. C. Dorf & A. J. Nelson, *Technology Ventures: From Idea to Enterprise* (McGraw-Hill, New York, 2008).
- Cerchione, R., & Esposito, E. (2017). Using knowledge management systems: A taxonomy of SME strategies. *International Journal of Information Management*, 37(1), 1551-1562.
- deReuver, M., Sørensen, C., & Basole, R. C. (2018). The digital platform: a research agenda. *Journal of Information Technology*, 33(2), 124-135.
- Dugan, K. (2007, July 29). Facebook can improve your media relations. Retrieved online April 12, 2019 from http://prblog.typepad.com/strategic_publicrelation/2007/07/facebook-can-im.html.
- Eckbia H.R. 2009. "Digital Artifacts as Quasi-Objects: Qualification, Mediation, and Materiality," *Journal of the American Society for Information Science and Technology* (60:12), pp. 2554-2566.
- Elia, G., Margherita, A., Secundo, G., & Moustaghfir, K. (2011). An "activation" process for entrepreneurial engineering education: The model and application. *Journal of Enterprising Culture*, 19(02), 147-168.
- Fischer, E., & Reuber, A. R. (2011). Social interaction via new social media: (How) can interactions on Twitter affect effectual thinking and behavior? *Journal of business venturing*, 26(1), 1-18.
- Giones, F., & Brem, A. (2017). From toys to tools: The co-evolution of technological and entrepreneurial developments in the drone industry. *Business Horizons*, 60(6), 875-884.
- Greenstein, S., Lerner, J., & Stern, S. (2013). Digitization, innovation, and copyright: What is the agenda? *Strategic Organization*, 11(1), 110-121.
- Ismail, M. A., Mahmud, R., & Hassan, I. S. (2012). Digital studio vs. conventional in teaching architectural design process. *Procedia-Social and Behavioral Sciences*, 64, 18-25.
- Kallinikos, J., Aaltonen, A., & Marton, A. (2013). The ambivalent ontology of digital artifacts. *Mis Quarterly*, 357-370.
- Markus, M. L., & Loebbecke, C. (2013). Commoditized digital processes and business community platforms: new opportunities and challenges for digital business strategies. *Mis Quarterly*, 37(2), 649-653.
- Nambisan, S. (2017). Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship. *Entrepreneurship Theory and Practice*, 41(6), 1029-1055.
- Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital Innovation Management: Reinventing innovation management research in a digital world. *Mis Quarterly*, 41(1).
- Parker, G., Van Alstyne, M., and Choudary, S. P. 2016. *Platform Revolution: How Networked Markets Are Transforming the Economy—And How to Make Them Work for You*, New York: W. W. Norton Publishing.
- Tapscott, D. 2014. *The Digital Economy Anniversary Edition: Rethinking Promise and Peril in the Age of Networked Intelligence*, New York: McGraw-Hill.
- Thurik, A. R., Stam, E., & Audretsch, D. B. (2013). The rise of the entrepreneurial economy and the future of dynamic capitalism. *Technovation*, 33(8-9), 302-310.
- Tiwana, A., Konsynski, B., and Bush, A. A. 2010. "Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics," *Information Systems Research*, (21:4), pp. 675- 687.
- Tredinnick, L. (2006). Web 2.0 and business: A pointer to the intranets of the future. *Business Information Review*, 23(4), 228-234.
- Urbinati, A., Chiaroni, D., Chiesa, V., & Frattini, F. (2018). The role of digital technologies in open innovation processes: an exploratory multiple case study analysis. *R&D Management*.

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research commentary—the new organizing logic of digital innovation: an agenda for information systems research. *Information systems research*, 21(4), 724-735.

Creating E-health Solutions: Looking through Combined Lens of Social Innovation and Knowledge Ecosystems

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Abstract

Our paper aims to re-interpret e-health at the intersection between the fields of Social Innovation (SI) and Knowledge Ecosystems (KE). In doing this, a systematic literary review about SI, KE and e-health was carried on, in order to identify common issues between the two selected fields of research. Taking into account the review results, we identified the notion of co-creation as the most effective in the investigation of e-health at the merging between SI and KE theoretical perspectives. The EMSE (Emergency Medical Service Ecosystem) model was, finally, examined within the provided theoretical framework.

Keywords – E-health, Social Innovation, Knowledge Ecosystems; Emergency Medical Service Ecosystem

Nature of the proposed paper: Academic Research Paper

1. Introduction

Nowadays, societies – at both national and regional level – as well as organizations – both for profit and not for profit – face several challenges that need for innovative solutions to the emerging problems. Among these, health and well-being are basic social needs, in both developed and underdeveloped countries (Sliwa et al. 2017). Particularly, within developed countries, current social challenges are associated with the ageing population and growing share of chronically ill people. Solving this problem requires

innovative solutions in health and social care as restructuring of care, housing, and monitoring of disease patients (Howaldt and Schwarz, 2010; Phills et al., 2008). The mentioned resolutions particularly emphasise the relevance of ICT in supporting health and health-related areas. The introduction of innovative approaches to help disabled people; the emergence of on-line self-help health groups; the use of distance learning systems to diffuse knowledge, as well as the adoption of technology to manage health problems, are all examples of the way technical innovations may be applied to overcome the emerging health challenges.

The integration of ICT in health services is referred as "e-health" (Waterson et al., 2012; Eysenbach & Jadad, 2001; Coile, 2000). E-health is interpreted by Eysenbach (2001, p. 1) as: *"an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology"*.

According to the above definition, e-health may be reasonably interpreted at the intersection between the fields of Social Innovation (SI) and Knowledge Ecosystems (KE).

Particularly SIs refer to *"innovative activities and services that are motivated by the goal of meeting a social need and that are predominantly developed and diffused through organisations whose primary purposes are social"* (Mulgan, et al., 2007, p. 8; Mulgan, 2006). Moulaert et al. (2005) discuss the following dimensions interrelated in SI: satisfaction of human needs, changes in social relations, and increasing socio-political capability and access to resources. Therefore, the nature of SIs is inevitable related to social problem touching group of people, while technological innovations can be supportive.

The context of our analysis – e-health – makes necessary to underline the differentiation between social and technological innovations, as social innovations perceived as institutional innovations, according to Brooks classification (Brooks, 1982), and context dependent (Howaldt & Schwarz, 2010). In the area of health policy, SI may, particularly, include the use of ICT, ICT enabling, on one side, the emergence of new business models, and term-oriented approaches to treatments (Dijkgraaf et al., 2009); and fostering, on the other side, the reduction of social gaps (Moore and Westley, 2011; Biggs et al., 2010; Murray et al., 2010).

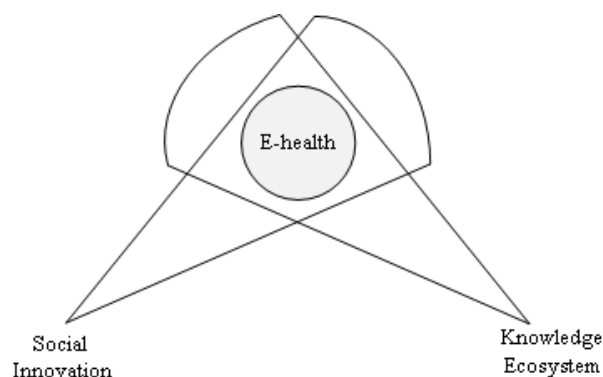
By the contrast, KE plays a crucial role in generating new knowledge and technologies (Valkokari 2015), in facilitating collective learning, and in speeding innovation diffusion (Clarysse et al. 2014). The multiplicity of actors involved in innovative and social activities, as well as the dense network of companies geographically clustered/localized and centered on the university for knowledge generation in KE, could explain the creation and the adoption of e-health solutions. As studies show, a knowledge-generating institution is a key player in commercialization and connecting network's actors (Clarysse et al. 2014).

According to the above, our paper aims to re-interpret e-health concept as the result of looking through the joined lenses of SI and KE. In doing this, a systematic literary review about SI, KE and e-health was carried on, in order to identify common issues between the two selected fields of research. Taking into account the review results, we identify the notion of co-creation as the most effective in the examination of e-health at the merging between SI and KE theoretical perspectives. The EMSE (Emergency Medical Service Ecosystem) model was, therefore, examined within the provided theoretical framework.

The remainder of the paper is formatted as follows. Firstly, section 2 describes the methodology employed in the study; section 3 then presents the results of both descriptive and analytical analysis; our theoretical perspective and EMSE model are described in section 4. Conclusions and Limitations of the study are, finally, presented.

2. Material and Method

Material collection was carried out through Business Source Premier (BSP), Web of Science (WoS), Scopus, and PubMed, which are considered, by the scholars, among the most comprehensive and authoritative scientific databases (Merli et al., 2018). After having examined several publications about SI, KE, and e-health, the idea of research approach was developed – as it is represented in Figure 1 – and research criteria were selected.



Source: own elaboration

Figure 1. Graphic representation of research approach

As Gough et al. (2012) pointed out; the first step of a systematic literary review is to define the keywords that better identify the relevant literature. Basing on the shared research approach, we selected criteria to cover the three main topics involved in our investigation: SI, KE and e-health. Since this paper aims to re-interpret e-health concept through the joined lenses of SI and KE, the following search strings were employed in all the databases:

1. (Social Innovation) AND (e-health);
2. (Knowledge Ecosystem) AND (e-health)

The research was conducted basing on each database functionalities.

In BSP, the field selected for search was "Title"; while in WoS Core Collection, it was "Topic" (including Title, Author Keywords, Abstract, Keyword Plus®). In Scopus the chosen field was "Title, Author Keywords, Abstract"; finally in PubMed "All Fields" (embracing: title, author, keywords, abstract).

In BSP, the search bring 4 hits for the first string - (Social Innovation) AND (e-health) - and 0 hits for the second string - (Knowledge Ecosystem) AND (e-health). Query in Scopus was the same. No results were found in both WoS and PubMed.

Therefore, we can claim that the issue of e-health is not analyzed within social innovation and knowledge ecosystem perspectives. This result contrasts with our expectations, as e-health solutions, thanks to information technology, should be targeted to solve social problems by knowledge sharing among involved actors.

Despite this, a descriptive and analytical analysis of the collected data is detailed in the following section.

3. Findings

3.1. Descriptive and Analytical Analysis of the Data

The 4 collected papers were all published between 2015 and 2017, supporting the idea that the proposed field of research is still nascent and unexplored. Table 1 synthesizes the most relevant information about the published articles referring to:

- the area of knowledge within which authors have published their researches;
- the year in which the articles were published;
- the countries of origin of each contribution;
- the journals in which authors have published their research;
- the type (theoretical or empirical paper) and the adopted methodology (qualitative or quantitative) of the papers.

Table 6 – Analytical categories for the selected papers

Ranking	Area of Knowledge	Year	Country	Journal	Type
1	Complex systems; Health system; Home Care Services; Social Innovation	2017	Germany	International Journal of Foresight and Innovation Policy	theoretical/qualitative
2	Design Science, Social innovation, E-health	2016	Netherlands	Conference Proceeding	empirical/qualitative
3	Social Innovation, IT, e-Health, Welfare, Empowerment	2015	Italy	Salute e Società	theoretical/qualitative
4	ICT, Socio-Technical Systems, Social Innovation	2015	Italy	Book chapter	empirical/qualitative

Source: own elaboration

Taking into account the few number of articles published about the topic, no information may be provided about the concentration/fragmentation of the papers, nor about the subjects involved in the examined field of research. It is a matter of fact,

however, that only one paper was published on an international, peer reviewed, and authoritative journal, namely in the *International Journal of Foresight and Innovation Policy*, the last one dealing with knowledge creation, diffusion and utilization in innovation policy.

The first contribution (Sliwa, et al., 2017) explores telecare as one of the practical applications in the field of e-health, able to introduce innovative solutions in supporting patients' wellbeing.

A system-centric framework is proposed to evaluate the interdependencies between telecare, the changing relationships, and the institutional context, thus re-calling the notion of operational and viable ecosystem with clearly defined actors. It is interesting to note that Sliwa et al. (2017) also underline the role of co-creation - together with community - and cooperation as enhancing quality and efficiency vantages. The reconfiguration of roles and relationships takes place through co-creation and knowledge sourcing (Sliwa et al., 2017, p. 176).

In 2016, de Reuver & Keijzer-Broers, analyzed how social innovations affect the Action Design Research (ADR) when chose as starting point, that means how the ADR approach should be adapted for projects driven by social innovation. In doing this, a service platform for health and well-being was launched and used for matching elderly and care providers. The result of this study proves that such artifact, as website, enhances information sharing about aging-in-place and creation of an online community. It also encourages elderly people to switch their role from passive into active. Moreover, the described case demonstrates the capability of properly designed project environment, which took the form of living lab. The designers of this solution involved into living lab: elderly and informal caretakers as end-users, municipality representatives as government, and companies operating healthcare databases as business representatives. In living labs the role of lead users is important, since they do not only provide feedback, but also participate as "co-generators of innovations" (Edwards-Schachter et al., 2012). This reasoning leads to recently popular concept of co-creation.

In the third paper, Clemente (2015) attempts to analyses the role of e-health in the processes of social change, with particular reference to the EU countries. In doing this, the author mainly focus on ICT as a strategic lever to innovate in health service systems, thus missing considerations about knowledge ecosystems and the way different actors may dynamically relate. Similarly, Ocelli (2015) stresses the role of ICT, even in a broad scope, showing collaborative information exchanges using ICT. To sum up the last sources, we observe that the links between social innovation and e-health may be pointed out as aiming to increase the democratization and transparency of healthcare system, as whole.

4. Suggestions for Future Research: Merging SI and KE in E-health

Given the limited number of papers collected, we performed a content analysis of the exiting literature about Knowledge Ecosystems and Social Innovation, identifying the notion of "co-creation" as recurrent word in both of the selected fields of research. The concept of co-creation is, therefore, crucial to understand the merged points of view into

e-health. In 2018, Ramaswamy and Ozcanb proposed a novel conceptualization of co-creation, based on interactions, more than on human actors coming together in activities. According to the authors, *"Co-creation is enactment of interactional creation across interactive system-environments (afforded by interactive platforms), entailing agencing engagements and structuring organizations"* (Ramaswamy and Ozcanb. 2018, p. 200). Focusing on interaction is, therefore, central in any process of co-creation, the last one entailing a multiplicity of interactive system-environments among persons and material entities (e.g., devices), afforded by technological platforms and enhanced by digital technologies.

As Prahalad and Ramaswamy (2004, p. 237) noted, *"It does not matter whether we are dealing with a consumer, an employee, an investor, or a supplier"*. Their main thesis was that *"the value creation process centers on individuals and their co-creation experiences"* (Prahalad and Ramaswamy, 2004, p. 14).

In introducing this new frame of reference, Ramaswamy and Ozcanb (2018) widen the traditional value creation system, by considering all the platform interactions that the increasingly digitalized world make available as set of interactions among the actors.

In accordance with the mentioned perspective, the concept of co-creation entails the notions of relationships and innovation, largely emphasized in the literature about KE and SI, as well.

Within the KEs, the creation of new knowledge bases on joint research work and collaboration (Valkokari, 2015). Similarly, the relevance of networks and collaboration, as effective driver of SI, was emphasized by many socio-economic scholars (Canestrino et al. 2019; Ridley-Duff and Bull 2018; Denning and Dunham 2010; Bakhshi and Throsby, 2010).

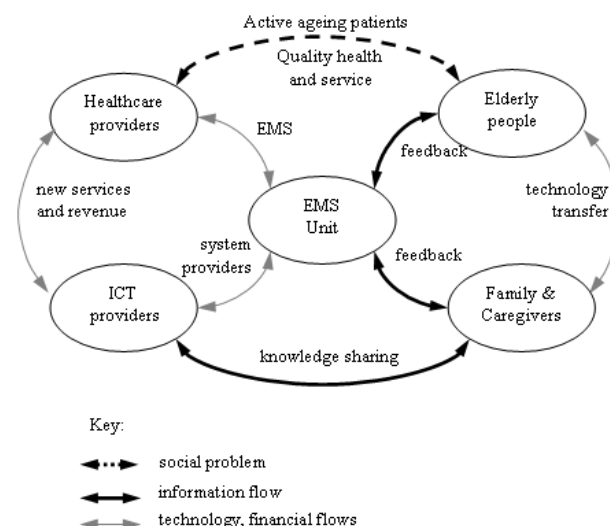
Depending on the above, exploring e-health, within the combined lens of SI and KEs, means to focus on the way all the actors co-create (value and knowledge) through relationship.

In order to support our idea, we assessed the Emergency Medical Service System (EMSS) model, developed by Sukkird and Shirahada (2015), as the most appropriate to explain e-health at the merging between SI and KE perspectives. The EMSS is defined as *"a system that provides for the arrangement of personnel, facilities, and equipment for the effective and coordinated delivery of health care services under emergency conditions (occurring as a result either of the patient's condition or of natural disasters or similar situations) and that is administered by a public or nonprofit entity with the authority and the resources to provide effective administration of the system"* or shortly as *"as a specific arrangement of emergency medical personnel, equipment, and supplies designed to function in a coordinated fashion"* (Moore, 1999, p. 325).

It entails two main groups of different actors creating an ecosystem. The first one is the group of *service receivers*: elderly, family member, and caregivers; the second one constitutes *service providers*, who can be divided in *healthcare service providers* (hospital, insurance company, EMS agent) and *IT service providers* (mobile company, technical support center). Each of them benefits from being the part of the ecosystem, but with different type.

Figure 1 depicts main flows that arise in this ecosystem. Referring to them, we adopted two different perspectives; a knowledge-based perspective, fitting with the conceptualization of KE; and a social-innovation-based perspective. From the KE perspective (knowledge and information flows) a direct knowledge sharing establishes between 'family & caregivers' and ICT providers. It is necessary to feed application (mobile technology) with data transferred to EMS unit. Next two kind of feedback exists among EMS unit and consumes (elderly people) and elderly supporters. Both of them refer to health monitoring and – if needed – emergency request. Apart of information flows, service improvement takes place between ICT providers and healthcare provides. The direct service delivery is triggered by EMS unit, and executed by healthcare providers.

Moreover, in accordance with the SI perspective; relevant connections establishes between healthcare providers and elderly people. It forms active ageing patients that improve quality health and service. The aspect of improving service, and therefore supporting realisation of main aim of the EMSE, also resides in relationship between healthcare providers and ICT providers.



Source: own elaboration based on (Sukkird & Shirahada, 2015)

Figure 1. Emergency Medical Service Ecosystem

Discussed EMMS model from combined two perspectives allows to observe synergy between SI and KE. These aspects supports each other e-health solutions.

5 Conclusions

This paper proposes a new theoretical perspective in the exploitation of e-health, arising from the merging of SI and KE standpoints. Basing on the results of our literature review, we identified the notion of co-creation as common issue in the examined field of

researches, thus enabling researchers to focus on the way new knowledge and social innovation are co-created through actors' relationships.

Our analysis should allow for detailed and meaningful explanation of the specificity of e-health by bringing out issues not fully revealed in existing scholarship, but highlighted separately in SI and KE literature.

Despite the many recent debates about Knowledge and Social Innovation ecosystems, as well as about other co-creation models, a more in-depth understanding of the multi-actor processes of value co-creation remains rather scarce. In the light of the existing gaps, we will concentrate on mechanisms and processes enabling creation (or emergence) of new e-health solutions. Hence, with this article, we provide significant novel insights about knowledge and Social Innovation ecosystems as structures enabling multi-actor value co-creation in e-health.

It is a matter of fact that our paper is at its nascent stage, thus the absence of empirical evidences is one of its main limitations. Another one is the absence of examination of the way co-creation of e-health solutions may be encouraged through the active participation of all the actors belonging to both the examined ecosystem.

Understanding ecosystems dynamics and the way knowledge and resources may be co-created and shared, in a concrete way, represent prominent future research directions.

References

- Bakhshi, H., & Throsby, C. D. (2010). *Culture of Innovation: An economic analysis of innovation in arts and cultural organisations*. Nesta.
- Biggs, R., Westley, F. R., & Carpenter, S. R. (2010). Navigating the back loop: fostering social innovation and transformation in ecosystem management. *Ecology and Society*, 15(2).
- Brooks, H. (1982). *Social and technological innovation*. In E. W. Colglazier Jr. & S. B. Lundstedt (Eds.), *Managing innovation* (pp. 9–10). Elmsford, New York: Pergamon Press.
- Canestrino, R., Ćwiklicki, M., Di Nauta, P., & Magliocca, P. (2019). Creating social value through entrepreneurship: the social business model of La Paranza. *Kybernetes*.
- Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A. (2014). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, 43(7), 1164–1176.
- Clemente, C. (2015). e-Health and social innovation. *Salute e Società*, (1), 101–114. <https://doi.org/10.3280/SES2015-001008EN>
- Coile Jr, R. C. (2000). E-health: reinventing healthcare in the information age. *Journal of Healthcare Management*, 45(3), 206–210.
- de Reuver, G., & Keijzer-Broers, W. J. (2016). Action Design Research for Social Innovation: Lessons from Designing a Health and Wellbeing Platform. Proceedings of International Conference on Information Systems (ICIS)
- Denning, P. J., & Dunham, R. (2010). *The innovator's way: Essential practices for successful innovation*. MIT Press.
- Dijkgraaf, E., Gijsbers, G., de Jong, J. M., Jonkhoff, W., Zandvliet, K., Treutlein, D. & van der Zee, F. A. (2009). *Investing in the future of jobs and skills: scenarios, implications and options in anticipation of future skills and knowledge needs: sector report other services*. European Commission.
- Edwards-Schachter, M. E., Matti, C. E., & Alcántara, E. (2012). Fostering Quality of Life through Social Innovation: A Living Lab Methodology Study Case: Social Innovation and Living

- Labs. *Review of Policy Research*, 29(6), 672–692. <https://doi.org/10.1111/j.1541-1338.2012.00588.x>
- Eysenbach, G., & Jadad, A. R. (2001). Evidence-based patient choice and consumer health informatics in the Internet age. *Journal of Medical Internet Research*, 3(2).
- Gough, D., Oliver, S., & Thomas, J. (2012). *Introducing systematic reviews*. Sage Publications.
- Howaldt, J., & Schwarz, M. (2010). *Social innovation. Concepts, Research Fields, and International Trends*. Dortmund: Sozialforschungstelle Dortmund. Retrieved from Sozialforschungsstelle Dortmund website: http://www.asprea.org/imagenes/IMO%20Trendstudie_Howaldt_englisch_Final%20ds.pdf
- Merli, R.; Preziosi, M.; Acampora, (2018) A. How do scholars approach the circular economy? A systematic literature review. *Journal of Cleaner Production*, 178, 703–722.
- Moore, L. (1999). Measuring quality and effectiveness of prehospital EMS. *Prehospital Emergency Care*, 3(4), 325–331.
- Moore, M. L., & Westley, F. (2011). Surmountable chasms: networks and social innovation for resilient systems. *Ecology and Society*, 16(1).
- Moulaert, F., Martinelli, F., Swyngedouw, E., & Gonzalez, S. (2005). Towards Alternative Model(s) of Local Innovation. *Urban Studies*, 42(11), 1969–1990. <https://doi.org/10.1080/00420980500279893>
- Mulgan, G. (2006). The process of social innovation. *Innovations: technology, governance, globalization*, 1(2), 145–162.
- Mulgan, G., Tucker, S., Ali, R., Sanders, B., & University of Oxford. (2007). *Social innovation: what it is, why it matters and how it can be accelerated*. London: Young Foundation.
- Murray, R., Caulier-Grice, J., & Mulgan, G. (2010). *The open book of social innovation*. London: National endowment for science, technology and the art.
- Occelli, S. (2015). *Socio-Technical Systems on the Move: Some Insights for Policy Activity*. In C. N. Silva (Ed.), *Emerging Issues, Challenges, and Opportunities in Urban E-Planning*, <https://doi.org/10.4018/978-1-4666-8150-7>
- Phills, J. A., Deiglmeier, K., & Miller, D. T. (2008). Rediscovering social innovation. *Stanford Social Innovation Review*, 6(4), 34–43.
- Prahalad, C. K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. *Journal of Interactive Marketing*, 18(3), 5–14.
- Ramaswamy, V., & Ozcan, K. (2018). What is co-creation? An interactional creation framework and its implications for value creation. *Journal of Business Research*, 84, 196–205.
- Ridley-Duff, R., & Bull, M. (2018). Solidarity Co-operatives: An Embedded Historical Communitarian Pluralist Approach to Social Enterprise Development?
- Sliwa, S. I., Brem, A., Agarwal, N., & Kraus, S. (2017). E-health, health systems and social innovation: a cross-national study of telecare diffusion. *International Journal of Foresight and Innovation Policy*, 12(4), 171–197.
- Sukkind, V., & Shirahada, K. (2015). Technology challenges to healthcare service innovation in aging Asia: Case of value co-creation in emergency medical support system. *Technology in Society*, 43, 122–128. <https://doi.org/10.1016/j.techsoc.2015.08.002>
- Valkokari, K. (2015). Business, Innovation, and Knowledge Ecosystems: How They Differ and How to Survive and Thrive within Them. *Technology Innovation Management Review*, 5(8).
- Waterson, P., Eason, K., Tutt, D., & Dent, M. (2012). Using HIT to deliver integrated care for the frail elderly in the UK: current barriers and future challenges. *Work*, 41(Supplement 1), 4490–4493.

Service Ecosystems: a Descriptive Review of the Existing Literature

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Abstract

This paper proposes a descriptive review of service ecosystems, as the first step of a systematic literary review aiming to improve the existing understanding of service ecosystems in the management field. For the purpose of this study, 188 articles were selected and examined according to the following analytical categories: 1) Areas of knowledge within which authors have published research on service ecosystems; 2) Years in which the articles were published; 3) Countries where authors have published research on service ecosystems; 4) Journals in which authors have published their researches; and 5) Type of paper and adopted methodology. According to the research's findings, a growing interest toward service ecosystems has been developed for the last ten years, especially referring with the two main areas of Decision Making and Ecosystems Management.

Keywords – Service ecosystems, Literary review, Decision Making, Ecosystems Management

Nature of the proposed paper: Academic Research Paper

1. Introduction

In today's competitive environment, more and more service firms are customer-oriented and focused on experience-based offering (Knutson et al., 2006), thus developing interactions with customers strongly support a joint process of value creation (Canestrino et al., 2018).

Within the field of service research, the Goods Dominant (G-D) logic, the Service Dominant (S-D) logic, and the Customer Dominant (C-D) logic were developed to depict the process of value creation from different perspectives. According to the G-D logic, exchange is mainly responsible for value generation (Vargo and Lusch, 2004). By the opposite, S-D logic emphasizes the role of customers in the process of value creation: far from being simple experiential services recipients, they turn into collaborative partners able to "co-create" value with the firm (Lusch et al., 2007; Vargo and Lusch, 2008a,b; Grönroos, 2011; Yi and Gong, 2013). The C-D logic (Heinonen et al., 2010) finally proposes a truly customer-centric focus according to which the value is formed by customers' life and experiences (Heinonen et al., 2013), as well as by their perception about reality and interactions with the others.

In most recent years, network and system perspectives are gradually adding to the existing paradigms in the understanding the way value is co-created in service domains (Meynhardt et al., 2016). Since services are intrinsically systemic and dynamic, the adoption of system perspectives enables both scholars and practitioners to explore the process by which goods, equipment, and people are harmonically integrated and interact co-creating value (Barile et al., 2016; Barile and Saviano, 2014).

According to the above, the notion of "ecosystems" establishes as a relevant conceptual candidate to capture the essential network dynamics in service domains (Lush et al., 2016). In the biological literature, ecosystems refer to those communities of organisms that interact, over time and space, with other organisms and other elements in the system. The resulting interdependence among the elements is necessary for the joint adaptability of the elements and works as source of dynamism of the system itself. Since markets, economies, and similar human systems are like natural ecosystems (Vargo and Akaka, 2009), scholars (Barile et al., 2016; Vargo and Lusch, 2016, Lusch et al., 2010, Vargo and Lusch, 2011) have identified the concept of a service ecosystem to capture their systemic dynamism. Vargo and Akaka (2012, p. 207) define a "service ecosystem" as "*a relatively self-contained, self-adjusting system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange*".

The adoption of the new perspective affected the way both services and value are created and delivered. As mentioned, customers embedded in a given ecosystem, are no longer mere passive recipients of service (Vargo and Lusch, 2008; Spohrer et al., 2008; Troisi et al., 2016), but resources integrators (Vargo and Lusch, 2016) for acquiring strategic advantages (Vargo et al., 2008). As Barile et al. (2017, p. 811) detail, service ecosystems are "*interactive networks of actively engaged actors sharing resources through technological tools and common rules toward common purposes*". Actors,

institutions and technology are identified as their main features (Vargo and Akaka, 2012; Vargo and Lusch, 2010) and their interaction as the main source of knowledge sharing and value co-creation (Canestrino et al., 2018).

While scholars agree about what service ecosystem is, the debate is still ongoing with reference to the areas of knowledge within which service ecosystems are investigated. Consequently, this paper aims to identify the research areas that prevail in Management Studies, answering to the following research question: what are the main areas of knowledge, belonging to Management, within which service ecosystems perspectives were mainly developed?

In order to answer to this research question, this paper proposes a systematic literature review. This last one is a type of secondary data analysis that *“that locates existing studies, selects and evaluates contributions, analyses and synthesizes data, and reports the evidence in such a way that allows reasonably clean conclusions to be reached”* (Denyer and Tranfield, 2009, p. 671). Since no systematic literary review was published about service ecosystems until now, our study aims to provide a more comprehensive analysis of the topic, enabling researchers to understand and to deal with the complexities of service ecosystems in different areas of knowledge.

The remainder of the paper is organized as follows. First, Section 2 describes the methodology employed in the study; section 3 presents the descriptive results of the analysis; limitations of the study and proposal for future research directions are presented in the section 4.

2. Method

A systematic literary review methodology includes several steps. First, the research questions were stated and guidelines developed for collecting the literature. Secondly, a plan for classifying, describing, and coding the literature was developed. As a final step, the literature was synthesized (Merli et al., 2018; Deyner et al., 2009; Tranfield et al., 2003).

The first step of this review was to define the keywords that would better identify the relevant literature. In order to collect the higher number of papers as possible, covering the variety of all the issues examined within the selected field of study, we adopted the keyword “service ecosystem” as research criteria.

This study uses the *Business Source Premiere* as database, which features full texts and searchable cited references for top journals covering a variety of business disciplines.

We selected the mentioned database in order to include the most widely used business and economic resources, as including 2.112 active full-text peer reviewed journals, and 3.507 full-text Journals and Magazines¹.

According to the database research functionalities, the keyword “service ecosystem” was searched in title, obtaining 673 documents, including articles, proceedings, reviews,

¹ Source: EBSCO webpage (last update, April 2019).

book reviews, editorial material, book chapters, meeting abstracts, notes, and letters¹. As recommended in the literature, only journal articles were selected, which improves the rigor and quality of a literature review (Vigolo et al., 2018; Orzes et al., 2018; Jia, Jiang, 2018). Subsequently, the application of the filter “type of publication”, namely “only academic papers”, allowed us to obtain 621 articles. Referring to the type of language used in research on service ecosystems, the most common is English (616), followed by Russian (2), French (1), Polish (1), and Spanish (1). This pattern meets our expectations, since the most of academic journals are English based, with English, as the most used language by researchers in the modern global academic community (Snyder et al., 2016). Taking into account the irrelevance of “other languages” of publication, we focused our research on English papers only, obtaining a total amount of 616 articles.

Figure 1 shows the research strategy we followed to identify the articles. After having defined the type and the language of the papers, additional inclusion criteria were adopted in order to screen them for the systematic review. We particularly focused on the area of knowledge within which the authors have published researches on service ecosystems, using Thesaurus to detect the papers in the management field. The final sample was, therefore, of 232 papers. After removal duplication, a final sample of 188 papers lasted.

Figure 1 synthesizes the research strategy adopted to develop our systematic literary review.

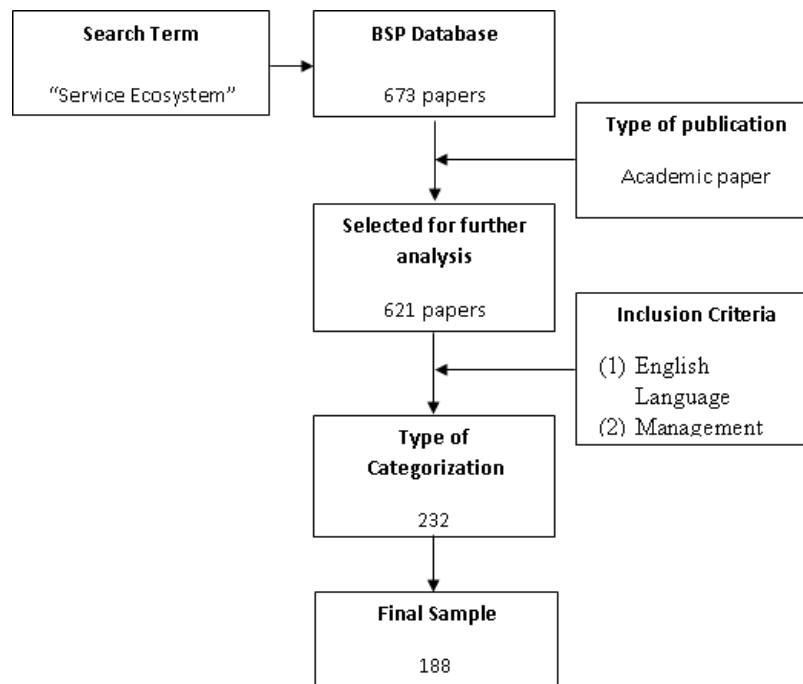


Figure 5 – Search Strategy to identify paper for the systematic literary review

¹ Last access to BSP for research was on March 11, 2019.

According to Rey-Marti et al., (2016), we established the following analytical categories:

- Areas of knowledge within which authors have published research on service ecosystems
- Years in which the articles were published
- Countries where authors have published research on service ecosystems
- Journals in which authors have published research on ecosystems
- Type (Theoretical or empirical paper) and adopted methodology (qualitative or quantitative)

3. Findings

3.1. Areas of knowledge within which authors have published research on service ecosystems

Table 1 shows the number of documents published in different knowledge areas, in Business Source Premiere (BSP). Since some papers belong to different Thesaurus categories, duplicates were removed, according to the linkage between the keywords (provided by the authors) and the selected categories. As mentioned, after the removal duplication, a final sample of 188 papers lasted. Particularly, 48 papers belong to the field of Ecosystem Management, 37 to Decision Making area of research, 19 to Sustainable Development, 12 to Stakeholder, and 12 to Environmental Management. Other researches areas follow the top five ranked with less (or equal) than 12 papers.

Table 7 - Areas of knowledge within which authors have published research on service ecosystems

Ranking	Research Area (Thesaurus)	N. publication
1	Ecosystem Management	48
2	Decision Making	37
3	Sustainable Development	19
4	Stakeholder	12
5	Environmental Management	12
6	Management	12
7	Customer Co-creation	8
8	Business Ecosystem	7
7	Land Management	6
10	Ecotourism	6
11	Resource Management	5
12	Strategic Planning	5
13	Customer Services	4
14	Service Industries	4
15	Value Creation	3
Total		188

3.2. Years in which the articles were published

Articles were also categorized according to the publication year. Our search shows the existence of the first paper mentioning “service ecosystem” in the title in 2001. The

article particularly focus on the changes in service ecosystems due to the urban sprawl of San Antonio, Texas, with the aim to determine whether LANDSAT MSS could be used to quantify the examined changes. Nonetheless, the number of documents published per year before 2009 is very low (max 5 per year).

Table 8 – Number of papers published between 2001 and 2019

Period of time	Year	N. of publications
First Period	2001	1
	2002	5
	2003	0
	2004	1
	2005	1
	2006	4
	2007	5
	2008	2
Second Period	2009	10
	2010	14
	2011	8
	2012	18
	2013	10
Third Period	2014	21
	2015	23
	2016	20
	2017	18
	2018	21
	2019	6
	Total	188

Table 3 shows the number of publications between 2001 and 2019. Last access for research on BSP was on March 11, 2019. It means that publications for the last year are still ongoing. Because of the mentioned, data about the papers published in 2019 were intentionally excluded by our comments.

In order to evaluate and better understand possible trends, we divided the whole period (with the exception of 2019) by three, investigating them through a content analysis.

The first period, defined between 2001 and 2008, consists of only 19 papers.

The interest on service ecosystems has increased time by time with a significant turning point in 2009, thus a second period was identified from 2009 to 2013. This period consists of 60 articles. It starts with the publication by Fisher, Turner and Morling (2009) aiming at offering a definition of ecosystem services likely to be operational for ecosystem service research and several classification schemes. During this period, the concept of service ecosystems begun to attract the attention of the scholars belonging to different fields of research, and turned into an important model for linking the functioning of ecosystems to human welfare. As consequence, great efforts were made by the authors to classify and detail ecosystem services, basing, on one side, on the characteristics of the ecosystems, and, on the other side, on the decision context for which the concept of ecosystem services is being mobilized (Fisher, et al., 2009). *Ecosystem Management*, with 19 articles published is the most important area of knowledge in the period. Management of natural resources, biodiversity, ecology, resources exploitation, pollution, and public

health are the most mentioned words in the articles published during the period, the authors addressing conceptual frameworks to the analysis of given geographical areas or industries. In 2009, for example, Garrik et al., (2009) developed a conceptual framework to examine factors enabling and constraining successful policy reform and implementation in market-based environmental water allocation, analyzing two case studies – namely Columbia (U.S.) and Murray-Darling (Australia) basins – where transactional approaches to environmental water allocation first emerged. Similarly, Green and Isacs (2009) carried out interregional comparisons of development and sustainable use of natural capital for Swedish regions and for two types of ecosystem services - pollution sequestration and recreational services - provided by three types of ecosystems: forests, agricultural landscape and wetlands services. Moreover, an attempt to link economics of ecosystems and biodiversity to the business and social risk arising from the overexploitation of natural resources is made by Sukhdev et al. (2011). The authors particularly underline the importance of a wider recognition of nature's contribution to human livelihoods, health, and security, discussing the annual loss of opportunities due to the overexploitation of global fisheries. *Decision Management*, with 15 articles published, is the second most important area in the period. Some relevant contributions are provided by Fisher et al (2009), as well as by Fontana et al. (2013), this last ones proposing a systematic framework that includes the ecosystem services as criteria into multi-criteria decision analysis (MCDA).

An additional speed up in the number of publications was registered by the 2014. The third period entails 103 papers (excluding 6 papers already published in 2019). Compared to the second period a growth of about 70% was registered in the published documents. The growing number of contributions belonging to the area of *Decision Making* (21 articles published) supports the increasing interest toward ecosystem services concerns in this area of knowledge.

Some relevant contributions are provided by the work of Geneletti (2015), proposing a conceptual approach to integrate ecosystem services (ES) effectively in Strategic Environmental Assessment (SEA), as well as by Ruckelshaus et al. (2015). Starting from the assumption that literature rarely assesses whether biodiversity and ecosystems services (BES) information is used effectively in decisions, the authors offer a framework for considering how information is effectively used decisions, illustrate its use to describe progress in the influence of BES values in several decision contexts, and qualitatively assess the strengths and weaknesses of this framework. One of the few contribution published in the field of management studies attempts to codify knowledge about service ecosystems in order to facilitate communication and decision making in this domain (Dobrica, 2018).

The area of *Ecosystem Management* remains relevant also in the third period with 14 articles published.

3.3. Countries where authors have published research on “service ecosystems”

According to our country analysis, articles from institutions in 37 different countries from five continents – America, Europe, Asia, Africa, and Australia - were identified. The U.S. (170) and China (84) represent the higher number of institutions, collaborating in the 40,31% of all the articles.

Europe is the continent with the higher contribution with 266 articles (42,24%) from 20 different countries, where UK with 57 (9,05% on the whole sample) papers, Italy with 42 (6,67% on the whole sample), and Germany with 35 (5,56% on the whole sample) are leading in the examined field of research. America is the second most important continent with 201 (31,91%) articles from 7 different countries. It is followed by Asia that participate in the debate with a total amount of 100 papers (15,85%) from 5 different countries. Among them China offers the higher contribution. Oceania and Africa are the continents with the lower participation with respectively 46 (7,3%) and 14 (2,38%) articles.

Table 3 shows the countries with the higher contribution in the research field. Ranking is limited to the top 8 countries, since a number of publications under 20 was not considered.

Table 9 – Countries with higher contribution in the field of “service ecosystems”

Ranking	Country	N. of Publications	Contribution to the field (% on the whole sample)
1	USA	170	26,98
2	China	84	13,33
3	UK	57	9,05
4	Italy	42	6,67
5	Germany	35	5,56
6	Australia	27	7,3
7	Finland	26	4,13
8	Sweden	20	3,17

3.4. Journals in which authors have published research on service ecosystems

Knowing about the journals that publish papers on “service ecosystems” is important for two main reasons: the first one is to understand which are the disciplines from which researches draw concepts and theories about service ecosystems; the second one is to become more familiar with scholars’ focus on the issue, thus suggesting the directions for further researches.

The 188 selected papers come from 59 different journals from diversified fields, such as economy (mainly ecological economics), and marketing. Among them, a huge concentration on only one journal prevails, with the 41,48% of the sample (78 papers) belonging to *Ecological Economics*. *Ecological Economics* Journal concerns with ecological science, economics, and the analysis of values, behaviors, cultural practices, institutional structures, and societal dynamics. Issues related to well-being, sustainability, and justice are emphasized to a great extent, as well as those focusing on the interplay between "nature's household" (ecosystems) and "humanity's household" (the economy).

By the contrast, a high fragmentation may be underlined for the residual 110 papers, with 46 journals publishing 2 articles, at least. The mentioned fragmentation may be interpreted as the results of the variety of subjects belonging to the issue of “service ecosystem”.

Table 4 shows the list of the journals that have published articles about “service ecosystems” between 2001 and 2019. Journals with less than 5 papers were not listed, as the number of publication considered irrelevant. Information about Impact Factor (IF), and SCImago rank were collected on the journal official website, as well as on SCImago Institutions ranking systems.

The IF provides scholars with an objective measure of the importance of different journals within a given category (Rey-Martí et al., 2016). In addition, SCImago is a prestige metrics based on the idea that not all the citations are the same. It provides a quantitative and qualitative measure of the Journal’s impact, basing on a similar algorithm as Google page rank.

As noted, 113 papers belong to only 6 different journals, the last ones all cited in SCImago. Analyzing the list, we find that *Ecological Economics*, with 78 articles, characterizes for the higher SJR (1,657), revealing the high quality of the scholars’ contributions in the examined field.

Table 10 – Journals publishing articles on “service ecosystems”

Ranking	Journals	Editor	N. publications	Impact Factor (IF)*	SCImago Journal Rank (SJR):
1	<i>Ecological Economics</i>	Elsevier	78	3,895	1,657
2	Forest Policy and Economic	Elsevier	8	2,496	1,010
3	Journal of Cleaner Production	Elsevier	8	5,651	1,47
4	Journal of Service Management	Emerald	7	3,414	1,49
5	Environmental Science & Technology	ACS Pub	6	6,653	0,18
6	Journal of Environmental Assessment Policy & Management	World Scientific	6	N.A.	0,35

*IF measures the average number of citations received in a particular year by papers published in the Journal during the two preceding years (Clarivate Analytics, 2019)

** SJR is a prestige metrics based on the idea that not all the citations are the same. It provides a quantitative and qualitative measure of the Journal’s impact (Elsevier Analytics, 2019)

Source: our elaboration (last access to data: April, 2019)

The *Journal of Service Management* follows *Ecological Economics* in term of SCImago rank. The journal focuses on service management research, focusing on the following categories: Business, Management and Accounting, Business, Management and Accounting (miscellaneous), Strategy and Management Tourism, Leisure and Hospitality Management¹.

¹ Source: Scimago homepage.

Comparing the two ‘best’ journals (in terms of SCImago ranks), a focus on ecology and economy seems to prevail, with the most articles belonging to *Ecological Economics*. It is a matter of fact that examining service ecosystems within business management studies is a still unexplored field. Despite this, new suggestions for further researches come from the existing gaps, aiming to improve the existing literature/theory and its applications in practice.

3.5. Type (Theoretical or Empirical papers) and adopted methodology (Qualitative, Quantitative or Mixed methods)

In order to provide a full understanding of the selected papers, they were categorized in Theoretical/conceptual and empirical; and between qualitative, quantitative, or mixed methods. Referring to the article types, the 41% of them is theoretical/conceptual (59% of the articles are empirical). With reference to the methodology, 50% of the whole sample is qualitative, followed by quantitative analysis (40%), and mixed-methods (10%). It seems, therefore, that a good balance exists among the selected papers’ type.

4. Conclusions

The aim of this work was to perform a systematic literary review about “service ecosystem” not developed before. For the purpose of this conference, the descriptive reviews was proposed, as the first step for a thematic exploitation of the issue, the last one emerging as a concept of a growing interest for scholars coming from management studies.

We, particularly, selected 188 articles and examined them according to the following analytical categories: 1) Areas of knowledge within which authors have published research on service ecosystems; 2) Years in which the articles were published; 3) Countries where authors have published research on service ecosystems; 4) Journals in which authors have published their researches; and 5) Type of paper and adopted methodology.

According to the research’s findings, a growing interest toward service ecosystems has been developed for the last ten years, especially referring to the two main areas of knowledge of *Decision Making* and *Ecosystems Management*. The U.S. (170) and China (84) represent the higher number of institutions, collaborating in the 40,31% of all the selected articles, the last ones coming from 59 different journals from diversified fields, such as economy (mainly ecological economics), and marketing.

This review contributes to fill the existing literary gap providing the theoretical background for future studies about the value co-creation in service ecosystems. Nevertheless, some limitations should be acknowledged. Firstly, data collection was limited to peer-reviewed articles present in Business Source Premiere, limiting the number of papers considered in our sample. We aim, for the future, to expand data collection including articles collected in Scopus and WoS.

Secondly, analytical frameworks are missing. Although intentionally neglected, the lack of thematic analysis limits the contribution provided by our paper.

Further research will attempt to expand our results, thus improving both the knowledge and the understanding of service ecosystem and their dynamics. Due to the relevance of relationships, sharing experiences and individuals' perception, we expected that the ecosystems perspective can be applied to hypercompetitive sectors such as tourism, whose offering is essentially based on the exploitation of contextual aspects and in which visitors' experiences represent a recent trend (Barile et al., 2017; Prebensen and Foss, 2011; Binkhorst and Den Dekker, 2009). Despite this, very few works are actually available about service ecosystem in tourism and hospitality industry (e.g., Baccarani and Cassia, 2017; Barile et al., 2017), thus representing a literary gap to fill in the future.

Depending on this consideration, our work proposes to evaluate the evolution of the research field offering a conceptualization of the key subjects, suggesting also a path for theoretical advance in some un-explored industries, as tourism and hospitality are.

References

- Baccarani, C., & Cassia, F. (2017). Evaluating the outcomes of service ecosystems: The interplay between ecosystem well-being and customer well-being. *The TQM Journal*, 29(6), 834-846.
- Barile, S., & Saviano, M. (2014). Resource integration and value co-creation in cultural heritage management. In *Handbook of Research on Management of Cultural Products: E-Relationship Marketing and Accessibility Perspectives* (pp. 58-82). IGI Global.
- Barile, S., Lusch, R., Reynoso, J., Saviano, M., & Spohrer, J. (2016). Systems, networks, and ecosystems in service research. *Journal of Service Management*, 27(4), 652-674.
- Barile, S., Saviano, M., Iandolo, F., & Caputo, F. (2017). La dinamica della sostenibilità tra vortici e correnti: un modello a Tripla Elica. *Atti del Convegno Nazionale dell'Accademia Italiana di Economia Aziendale 2015*.
- Binkhorst, E., & Den Dekker, T. (2009). Agenda for co-creation tourism experience research. *Journal of Hospitality Marketing & Management*, 18(2-3), 311-327.
- Canestrino, R., Ćwiklicki, M., Di Nauta, P., & Magliocca, P. (2019). Creating social value through entrepreneurship: the social business model of La Paranza. *Kybernetes*.
- Denyer, D., & Tranfield, D. (2009). Producing a systematic review. *The Sage handbook of organizational research methods*, 671-689.
- Dobrica, L. (2018). Considerations on Modeling Service Ecosystems. In *Conference proceedings of «eLearning and Software for Education» (eLSE) (Vol. 2, No. 14, pp. 302-308)*. Editura Universității Naționale de Apărare „Carol I”.
- Fisher, B., Turner, R. K., & Morling, P. (2009). Defining and classifying ecosystem services for decision making. *Ecological economics*, 68(3), 643-653.
- Garrick, D., Siebentritt, M. A., Aylward, B., Bauer, C. J., & Purkey, A. (2009). Water markets and freshwater ecosystem services: Policy reform and implementation in the Columbia and Murray-Darling Basins. *Ecological Economics*, 69(2), 366-379.
- Geneletti, D. (2015). A conceptual approach to promote the integration of ecosystem services in strategic environmental assessment. *Journal of Environmental Assessment Policy and Management*, 17(04), 1550035.
- Grönroos, C. (2011). Value co-creation in service logic: A critical analysis. *Marketing theory*, 11(3), 279-301.
- Heinonen, K., Strandvik, T., & Voima, P. (2013). Customer dominant value formation in service. *European business review*, 25(2), 104-123.

- Heinonen, K., Strandvik, T., Mickelsson, K. J., Edvardsson, B., Sundström, E., & Andersson, P. (2010). A customer-dominant logic of service. *Journal of Service management*, 21(4), 531-548.
- Isaacs, R., Tuell, J., Fiedler, A., Gardiner, M., & Landis, D. (2009). Maximizing arthropod-mediated ecosystem services in agricultural landscapes: the role of native plants. *Frontiers in Ecology and the Environment*, 7(4), 196-203.
- Jia, F.; Jiang, Y. (2018), Sustainable Global Sourcing: A Systematic Literature Review and Bibliometric Analysis. *Sustainability* 10, 595
- Knutson B., Beck J., Him S., Cha J. (2006), "Identifying the dimensions of the experience construct", *Journal of Hospitality and Leisure Marketing*, vol. 15, n. 3, pp. 31-47.
- Lusch, R. F., Vargo, S. L., & O'Brien, M. (2007). Competing through service: Insights from service-dominant logic. *Journal of retailing*, 83(1), 5-18.
- Lusch, R. F., Vargo, S. L., & Tanniru, M. (2010). Service, value networks and learning. *Journal of the academy of marketing science*, 38(1), 19-31.
- Merli, R.; Preziosi, M.; Acampora, (2018) A. How do scholars approach the circular economy? A systematic literature review. *J. Clean. Prod.* 178, 703–722.
- Meynhardt, T., Chandler, J. D., & Strathoff, P. (2016). Systemic principles of value co-creation: Synergetics of value and service ecosystems. *Journal of Business Research*, 69(8), 2981-2989.
- Orzes, G.; Moretto, A.M.; Ebrahimpour, M.; Sartor, M.; Moro, M.; Rossi, M. (2018), United Nations Global Compact: Literature review and theory-based research agenda. *Journal of Cleaner Production*, 177, 633–654
- Prebensen, N. K., & Foss, L. (2011). Coping and co-creating in tourist experiences. *International Journal of Tourism Research*, 13(1), 54-67.
- Rey-Martí, A., Ribeiro-Soriano, D., & Palacios-Marqués, D. (2016). A bibliometric analysis of social entrepreneurship. *Journal of Business Research*, 69(5), 1651-1655.
- Snyder, H., Witell, L., Gustafsson, A., Fombelle, P., & Kristensson, P. (2016). Identifying categories of service innovation: A review and synthesis of the literature. *Journal of Business Research*, 69(7), 2401-2408.
- Spohrer, J., Vargo, S. L., Caswell, N., & Maglio, P. P. (2008, January). The service system is the basic abstraction of service science. In *Proceedings of the 41st Annual Hawaii International Conference on System Sciences (HICSS 2008)* (pp. 104-104). IEEE.
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14(3), 207–222
- Troisi, O., Sirianni, C. A., Monda, A., & Grimaldi, M. (2017). ICTS and engagement platforms in resource integration: threat or opportunity for value co-creation?. *Esperienze d'Impresa*.
- Vargo, S. L., & Akaka, M. A. (2012). Value cocreation and service systems (re) formation: A service ecosystems view. *Service Science*, 4(3), 207-217.
- Vargo, S. L., & Lusch, R. F. (2004). The four service marketing myths: remnants of a goods-based, manufacturing model. *Journal of service research*, 6(4), 324-335.
- Vargo, S. L., & Lusch, R. F. (2008a). Service-dominant logic: continuing the evolution. *Journal of the Academy of marketing Science*, 36(1), 1-10.
- Vargo, S. L., & Lusch, R. F. (2008b). From goods to service (s): Divergences and convergences of logics. *Industrial marketing management*, 37(3), 254-259.
- Vargo, S. L., & Lusch, R. F. (2011). It's all B2B... and beyond: Toward a systems perspective of the market. *Industrial marketing management*, 40(2), 181-187.
- Vargo, S. L., & Lusch, R. F. (2016). Institutions and axioms: an extension and update of service-dominant logic. *Journal of the Academy of marketing Science*, 44(1), 5-23.

- Vargo, S.L. and Akaka, M.A. (2009), "Service-dominant logic as a foundation for service science: clarifications", *Service Science*, Vol. 1 No. 1, pp. 32-41.
- Vigolo, V., Sallaku, R., & Testa, F. (2018). Drivers and Barriers to Clean Cooking: A Systematic Literature Review from a Consumer Behavior Perspective. *Sustainability*, 10(11), 4322.
- Yi, Y., & Gong, T. (2013). Customer value co-creation behavior: Scale development and validation. *Journal of Business Research*, 66(9), 1279-1284.

Knowledge Transfer, Innovation and University Engagement: a Study on the “Federico II” San Giovanni Hub (SGH)

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Abstract

The present research aims at defining the scope of an emerging phenomenon occurring in a peripheral suburb in the East area of the city of Naples (Italy), characterised by the settlement of a knowledge intensive Hub involving innovation, technology and knowledge transfer processes. The main subject of the study is the San Giovanni a Teduccio “Federico II” University Hub, a university campus and research centre named the San Giovanni Hub (“SGH”) or simply the “Hub”. Our work addresses the issue of innovation led by a knowledge-intensive context in a peripheral urban area. Such insight should enrich the specific focus on the competences of a university in terms of technology and knowledge transfer.

The theoretical focus of the study is forged around the “Civic University” (Goddard, 2009) main characteristics, which draw from the transposition of the quadruple helix approach. The rationale underpinning the choice of the university engagement view (Holland, 2001) would help overcoming the vision of the University as “company-like” entity.

The contribution to the theoretical framework resides in assessing the relevance of a knowledge intensive site embedded in a peripheral and less developed urban context in the light of the “Civic University” characterising features. Such insight should enrich the specific focus on the competences of a university in terms of technology and knowledge transfer. The outcomes of the analysis can be used as a valuable tool for both the University governance and managers of local urban institutions to promote or enhance knowledge transfer and entrepreneurial activities in the selected area.

Keywords – Innovation, Knowledge creation, Knowledge transfer, University Engagement

Paper type – Academic Research Paper

1 Introduction

According to the concept of the civic university (Goddard, 2009; Goddard & Vallance 2013; Goddard & Tewdwr-Jones, 2015), universities can be rightfully considered reliable partners with cities, since they acknowledge the linkage to their location as a characterisation of their own identity, notwithstanding the national or international extent of their scope. On their turn, cities are expected to assume further responsibility for the local economy and the social issues implicated in the development process of the communities they are in charge of (Goddard & Tewdwr-Jones, 2015).

Over the past three decades, a relevant bulk of literature has theorised the function and role of universities on urban and regional development (Trippel, Sinozic, & Lawton Smith, 2015; Uyerra, 2010). Within this milieu, “regional innovation systems” (RIS) thinking has emerged as a preeminent conceptual paradigm, by theorising universities as deeply involved in the systemic architecture and practice of innovation. Although subject to debate concerning their very definition and scope (Doloreux & Parto, 2005), RIS approaches emphasise “economic and social interaction between agents, spanning the public and private sectors to engender and diffuse innovation within regions embedded in wider national and global systems” (Asheim, Lawton Smith & Oughton, 2011, p. 878).

Actors representing the demand-side include national governance entities that regulate innovation practice, local and regional governments concerned with territorial economic development, and numerous public and private organisations concerned with high-tech entrepreneurship (Addie, Angrisani & De Falco, 2018).

Conversely, universities and research centres occupy privileged positions as supply-side actors (with varying degrees of efficacy) providing knowledge and research competencies and generating new spin-off firms and tradable outputs (Charles, 2006). The regional functions ascribed to universities in RIS analysis do not depend on their own internal organisation and orientation (as with the “entrepreneurial”, “Mode 2”, or “engaged” university) but rather on contextually-specific relations with other actors and knowledge bases along path dependent growth trajectories (Trippel et al., 2015). Fritsch and Slavtchev (2007) suggest that the efficacy of universities in regional innovation is driven by the quality of research and intensity of interactions with firms, not the size of the institutions involved. This endogenous role is prominently captured in the nonlinear, recursive linkages of “triple helix” university-industry-government relations (Etzkowitz, Ranga, Benner, Guarany, Maculan & Kneller, 2008).

In the light of the theoretical framework presented above, a broad research question will drive the investigation (Braun & Clarke, 2006), in the attempt to answer to the following interrogation:

What are the main patterns and characteristics of the SGH in terms of innovation, knowledge transfer and University engagement?

In order to achieve such purposes, a qualitative analysis has been performed by means of a case study methodology (Yin, 2009) on the San Giovanni Hub where data have been gathered by participant observation, narrative documents and in-depth interviews to the

main stakeholders of the Hub for a total of 25 interviews completed for the empirical investigation.

2 Theoretical framework

Triple helix analyses draw attention to new behavioural trends in which individuals and organizations within helices can assume roles beyond those traditionally ascribed to them. Cross-institutional relationships promote the bundling of resources to support technology transfer, firm formation, and the development of capital-intensive infrastructures. Also, they produce a transformative impact on the university itself; engendering the construction of hybridised structures to integrate teaching, research, and commercialisation activities, with entrepreneurial claims (Audretsch, 2014). Deepening interest in commercialising academic enterprise has fed into a policy paradigm whereby universities are expected to stimulate economic development via knowledge transfer to co-located industries (or catalysing the creation of new-Co). With the implementation of policies pushing investments in innovation by academic and governmental institutions, universities' direct actions (spin-offs, technology parks, etc.) and indirect impacts (increased network thickness, enhanced absorptive capacity, etc.) contribute to the development of localised knowledge spill-over cultures (Lendel, 2010), eventually extending their territorial influence (Benneworth & Hospers, 2007). As RISs reach maturity, it is often the indirect benefits – including mobilising the university as a hub for recruiting, training, and retaining regional human capital – that are of greatest importance for regional development (Berggren & Dahlstrand, 2009).

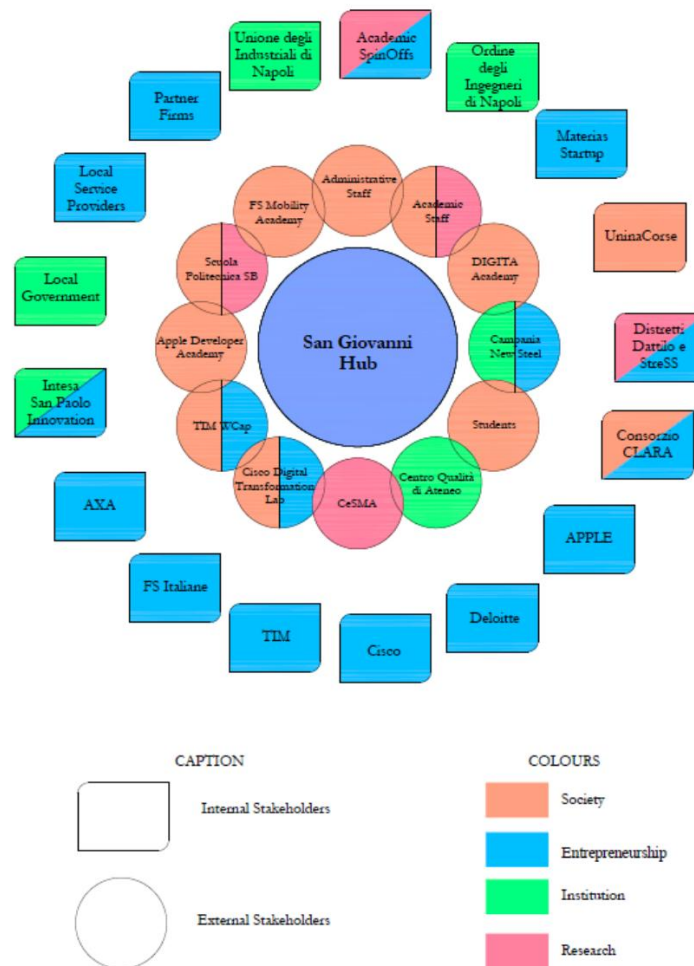
One of the pivotal themes dealt with in the present research concerns the issue of knowledge spillovers (Audretsch & Keilbach, 2007) and proximity (Caragliu & Nijkamp, 2012, 2015), together with the Ba and Co- creation (Nonaka & Konno, 1998; Nonaka, Toyama & Konno, 2000; Huhtelin & Nenonen, 2015) view to explain the way in which space can convey knowledge. The previous matters involve the absorptive and desorptive capacity of actors in technology transfer processes that can affect regional innovation systems (Cohen & Levinthal, 1990; Zahara & George, 2002; Dell'Anno & Del Giudice, 2015). A reference to the main innovation systems (Freeman, 1991, 1995; Edquist, 2005) and the milieu innovateur literature (Maillat, 1991, 1995, 1998; Acs, 2002) will be necessarily provided, also in the light of policy mix approach on strategic policy choices (Borrás & Edquist, 2013). Furthermore, a shared approach concerning the triple helix interaction among university, government and industry and its evolutions will be analysed (Leydesdorff & Etzkowitz, 1998, Etzkowitz & Leydersdorff, 1999; Etzkowitz 2002, Etzkowitz et al. 2008; Carayannis & Campbell, 2014; Leydersdorff, 2012), in order to connect them to the university third mission (Holland, 2001; Molas-Gallart, Castro-Martínez, 2007; Schofield, 2013; Audretsch, 2014) and the service university concept (Goddard, 2009; Goddard & Vallance 2013; Goddard & Tewdwr-Jones, 2015). Finally, a linkage with the service innovation main propositions (Vargo & Akaka, 2012) will be explained to provide a new interpretation of the innovation trends occurring in the selected area.

3 Research design

3.1 The SGH Ecosystem

The preliminary definition of the ecosystem of the SGH has been a challenging task involving a complex analysis on the Stakeholder Map of the subjects interacting with the Hub itself. Being the latter an evolving system, the Stakeholders' list is continuously changing and enriching according to the agreements and connection stimulated by the activities animating the Hub.

Our research shows the actual configuration of the main stakeholders populating the SGH ecosystem, described in figure 3.1 below.



Source: Authors' elaboration

Figure 3.1: Stakeholder Map of the SGH

3.1 The Case study of the SGH

The study has adopted an explorative qualitative inquiry based on a case study methodology to form a new understanding of a previously unstudied phenomenon (Myers, 2013).

The perspective chosen for this study enabled a comprehensive investigation of the SGH as it is perceived and experienced within its context.

For the objective of the investigation, in-depth interviews were undertaken and official documents were analysed to gain exploratory insight into the emergence of the SGH phenomenon and its perceived effects in terms of value creation and knowledge transfer for the area in which the Hub is embedded.

The participants were selected using a purposive sampling technique to provide wide variability and representation of the study context of the Hub (Patton, 1990). Triangulation in the data (Yin, 2009; Patton, 1990) was achieved by examining multiple sources of data (i.e., participant observation, interviews, surveys and documents), and by consulting informants at multiple levels, to either the managerial and academic staff of the Federico II University.

The interview sample included main representatives considered to be the key stakeholders of the Hub, selected according to the more or less formalised partnership with the Federico II University. The information about the stakeholders' assortment has been gathered thanks to the extremely helpful consultation with the SGH key informants. The variety of selection in the stakeholders has sought to ensure capturing perspectives from the academic, entrepreneurial, research and policy-making levels. The sample also included students attending the Apple Developer Academy and the DIGITA academy in partnership with Deloitte Digital to which a questionnaire has been administered with to purpose of gathering the perspective of what the study has considered to be a "selected" category of students.

In total, 25 interviews were conducted, which generated about 24 hours of interview data. Respondent details and their corresponding codes are shown in tables 3.1 and 3.2, below.

Table 3.1: Interviews Grid of the Key Informant Sample

Institution	Position	Stakeholders Taxonomy
Federico II University	Full Professor and CeSMA Director	<ul style="list-style-type: none"> • <i>Research</i> • <i>Entrepreneurship</i> • <i>Institution</i> • <i>Society</i> <p>or varying combinations of them.</p>
Kelyon	CEO	
Materias	PhD	
CeSMA, Federico II University	Administrative staff	
AXA Matrix	Director/Division manager	
Federico II University	Full Professor, DIGITA Director	
Unione Industriali Napoli	Former President	
Federico II University, of Campania New Steel Incubator (CNS)	Full Professor, former CNS President	

Materias	CEO	
CeSMA, S. Giovanni Hub	Manager	
Campania New Steel	Consultant	
Federico II University	Administrative staff	
Federico II University	Full Professor, Apple Academy Director	
Intesa S. Paolo Banco di Napoli	Innovation Specialist	
Regione Campania	Regional Councillor for Start Up, Innovation and Internationalisation,	
Deloitte	Manager	
Federico II University	Rector and Full Professor	
CISCO	Manager	
Federico II University	Research/ PNI (<i>Innovation National Prize</i>) Manager	
Naples Municipality/Federico II University	Municipal Councillor for Urbanisation	
Federico II University	Researcher/ Megaride Spin Off CEO	
Federico II University	Full Professor and Unina Corse President	
Federico II University/Apple Developer Academy	Associate Professor/ Apple Academy manager	
Gematica/ Consorzio CLARA	CEO of Gematica / Managing Director of CLARA	
Unione degli Industriali di Napoli	President	

Table 3.2: Interviews grid Description of participants and their corresponding codes

#	Code	Participant Description	Stakeholder	Length
1	Uni-Academic-01	Full Professor/Research Centre Director	Research	25'
2	Ent-01	CEO and owner of a firm	Entrepreneurship	58'
3	Ent-02	PhD and Consultant for a start-up firm	Entrepreneurship	65'
4	Uni-Administrative-01	Administrative staff	Institution	53'
5	Ent-03	Division Manager of a Corp	Entrepreneurship	120'
6	Uni-Academic-02/Society-01	Full Professor/Director of an Academy	Research/Society	60'

7	Inst-01	Former President of an Entrepreneurs Association	Institution	130'
8	Uni-Academic-03/Ent-03	Full Professor/Formal President of an incubator	Research/Entrepreneurship	52'
9	Ent-04	CEO	Entrepreneurship	30'
10	Uni-Administrative-02	Security Manager	Institution	30'
11	Ent-05	Consultant	Entrepreneurship	50'
12	Uni-Administrative-03	Administrative staff	Institution	38'
13	Uni-Academic-04/Society-03	Full Professor/Director of an Academy	Research/Society	26'
14	Inst-02	Innovation Specialist for a Financial Institution	Institution	58'
15	Gov-01	Director of Division in a Government Institution	Institution	45'
16	Ent-06	Manager	Entrepreneurship (Consulting)	70'
17	Uni-Academic-05/Society-04	Rector and Full Professor	Research/Society	32'
18	Ent-07	Manager	Entrepreneurship	70'
19	Uni-Academic-06/Society-05	Research/PNI (<i>National Innovation Prize</i>) Manager	Research/Society	68'
20	Gov-02	Director of Division of the City council Institution	Institution	90'
21	Uni-Academic-07/Ent-08	Researcher/Spin-Off CEO	Research/Entrepreneurship	65'
22	Uni-Academic-08/Society-06	Full Professor and Unina Corse President	Research/Society	55'
23	Uni-Academic-09/Society-07	Associate Professor/Apple Academy manager	Research/Society	62'
24	Ent-09/Society-08	CEO/Managing Director	Entrepreneurship/Society	58'
25	Inst-03	President of an Entrepreneurs Association	Institution	65'
Total time allocated to the in-depth interviews			Tot. Minutes	1475'
			Tot. Hours	24,6'

No follow-up interviews were necessary on the contrary, most interviewees spontaneously provided several adjunctive information on the historical, political and institutional background of the Hub. Some of them have been recorded during the interviews, some others are off the record information of which memos and written notes have been taken with the consent of the respondent.

Whilst the in-depth interviews were developed according to a pre-defined scheme to make sure that similar issues are covered to allow analytical comparability (Corbetta,

2003), there was flexibility to explore new issues that emerged during the interviews, data analysis and interpretation process (Creswell, 2003; Patton, 1990, King, 2004).

Since all the interviewees are Italian, the interviews were conducted in Italian, in order to yield rich information and minimise distortion. The interviews were recorded and transcribed verbatim to preserve the precision of the data. Translation of the narratives into English was only completed after interpreting the data to attain precise meanings. In the phase dedicated to the organisation of the gathered data, coded have been attributed to each respondent, following the division in four main categories of stakeholders, or varying combinations of them, namely:

- Research
- Entrepreneurship
- Institution
- Society

The transcripts of the 25 in-depth interviews, performed through a semi-structured set of questions, have been analysed by means of a thematic analysis,” which works particularly well when the aim is to compare the perspectives of different groups of staff within a specific context” (King, 2004, 257).

Table 3.3: Thematic areas for the in-depth interviews

Thematic areas	Definition/Relevance for the study	Open-ended Questions set
1. Knowledge and related mechanisms of transfer and exchange	<p><i>“Facts, information, skills acquired through experience or education; the theoretical or practical understanding of a subject”</i> (The Oxford Dictionary).</p> <p><i>“The knowing, as presence in the intellect of a notion, as already acquired knowledge”</i> (Treccani Encyclopaedia).</p> <p>- The concept of Knowledge dealt with herein is not limited to the learning activity.</p>	<p>- What value would you attribute to the knowledge factor applied to the Polo of S. Giovanni?</p> <p>- Can San Giovanni be labelled a “Knowledge Intensive Hub” (KIH)?</p>
2. Stakeholders	<p><i>Main actors (physical persons, institutions and/or organisations) interacting with the Hub. The definition of internal and external STKH depends on relations with the market or the society</i></p>	<p>- Please observe the STKH Map of S. Giovanni: do you consider the map consistent with the activities and the relations started within the Hub?</p> <p>- Could you explain what is it and in what terms your connection with the Hub unfolds?</p>
3. Technology and Knowledge transfer (TT & KT)	<p><i>Set of activities aimed at bringing new technology or new knowledge from research to the market.</i></p>	<p>- Which TT mechanisms, among those shown in the attached table (table 3.5, below) do you think are or could be applied within the Hub?</p>
4. Third mission	<p><i>Set of activities carried out by the university in addition to those related to teaching.</i></p> <p><i>“Activities concerned with the generation, use, application and exploitation of knowledge and</i></p>	<p>- Do you believe that the SGH is a third mission experience? In what terms and with what characteristics?</p>

	<i>other university capabilities outside academic environments” (Molas- Gallart et al., 2002, ii-iv)</i>	
5. Proximity	<i>Geographical, relational, cultural closeness to the Hub.</i>	- In light of the information provided on the concept of proximity applied in this study, do you think that this concept is relevant for the activities of the <i>Hub</i> ?
6. Space	<i>Value and relevance of the interaction within the Hub spaces.</i>	Express what can be, in your experience, the advantages of being an integral part of the Hub. - Do you think that the physical space in which the Hub is organised is an important element for internal and external dynamics in terms of networking and technology transfer?
7. SWOT Analysis applied to the Hub	<i>Analysis of strengths and weaknesses, threats and opportunities of the Hub.</i>	- What do you think are the main strengths, weaknesses and opportunities of the <i>Hub</i> ?
8. Policy choices	<i>Interventions promoted by the central and local government to define and apply the most effective parameters aimed at encouraging economic growth, in this case in terms of dissemination and marketing of research products.</i>	- What policy choices have guided the establishment and development of the Pole (investment and / or redevelopment)? - Which do you think should be implemented (e.g. if you were a policymaker)?

Regarding the surveys, questionnaires were submitted in English for both sub-samples, i.e. the one attending the Apple Developer Academy and the one attending the Digita (Deloitte Digital Academy in partnership with Federico II University). In fact, as emerged from the personal data collected at the beginning of the surveys, the nationality of all the students belonging to the latter academy is Italian, whilst students attending the former come from different Countries.

Table 3.4: Sample size

Unit of Analysis	Sample Unit
San Giovanni a Teduccio University Hub	Economic/non-economic organisations next to the hub in terms of geographical proximity
	Researchers in the selected research centre
	Economic/non-economic organisations connected to the hub in terms of relational, organisational or cultural proximity (Caragliu & Nijkamp, 2015)
	Supporting/administrative staff
	Apple Developer and DIGITA Academies managing directors
	Local government representatives and further primary Stakeholders
	Apple Developer and DIGITA Academies students

4 Findings

The analysis conducted for our case study identifies themes at the semantic level, depicting what has been said with the purpose of focusing on interpreting and explaining it. The main areas of the interviews have served as categories on which themes have been later detected.

Following a thematic analysis approach (King, 2004; Myers, 2013), data were coded and analysed in a ‘template’, to identify the leading categories, patterns, themes, and relationships (King, 2004). Some initial categories and themes were identified from the literature and have been reviewed and modified in accordance with the collected data (King, 2004). In analysing the transcripts, the aim was to identify elements within the thematic areas object of the interviews able to express the perception of the SGH stakeholders. The coding map for the thematic analysis of the in-depth interviews performed for the empirical investigation of the SGH is illustrated in table 4.1, below.

Table 4.1: Template of the coding map for the thematic analysis of the in-depth interviews performed for the empirical investigation

#	Main categories drawn from the interviews topic headings	Code Level 1	Code Level 2	Code Level 3	Illustrative quotes
1	Value of Knowledge for the Hub				
2	Stakeholders				
3	Technology and Knowledge transfer				
4	Third mission				
5	Proximity				
6	Space				
7	Elements of Strength of the SGH				
8	Elements of Weakness of the SGH				
9	Opportunities for the SGH				
10	Threats/Risks for the SGH				
11	Policy choices				

Recalling the seven dimensions of the “Civic” University, the analysis carried out so far has allowed us to verify the mentioned patterns in the Federico II University SGH. Indeed, the thematic analysis outcomes, together with the results of the surveys performed on the Academy students’ sample have supported the initial assumptions of the study. Thus, the civic university concept applied in the San Giovanni Hub embraces the theoretical aspects described in the literature review on the topic. Table 4.4 below enriches the initial enumerations of the civic university dimensions, by adding the specific linkages with the SGH ecosystem.

Table 4.2: Seven Dimensions of the “Civic University” verified in the Federico II San Giovanni Hub

#	Seven Dimensions of the “Civic University”	Evidences from the “Federico II” University SGH	Themes from which the evidence is drawn	Evidences form the surveys
1	It is actively engaged with the wider world as well as the local community of the place in which it is located.	Local and global dimension of the stakeholders interacting with the Hub.	Knowledge-intensive hub that has bypassed territorial borders.	Both Apple Developer Academy and DIGITA Students define themselves as Stakeholders of the SGH, thus recognising the value of the whole context surrounding their very experience within the Academy.
2	It takes a holistic approach to engagement, seeing it as institution wide activity and not confined to specific individuals or teams.	Engagement approach claimed by the very statute of the Federico II University.	Education and aggregation role; Combination of cultural and relational proximity.	Most of the interviewed students recognise a high value to the social impact of the SGH.
3	It has a strong sense of place – it recognises the extent to which its location helps to form its unique identity as an institution.	Hub open to the local community and embedded with the local social and entrepreneurial context.	Knowledge-intensive hub; Role of knowledge attractor and diffuser; Open and usable space.	Most students agree with the leading propositions of the study, claiming that the SGH is a place where knowledge is created, concentrated and shared beyond its physical borders. Thus, implicitly supporting the knowledge spillover and geographical proximity paradigms described in the theoretical framework.
4	It has a sense of purpose – understanding not just what it is good at, but what it is good for.	Third mission and civic engagement purposes.	Example of Third Mission; Aggregating role.	
5	It is willing to invest in order to have impact beyond the academy.	Partnership with both public (Institutional) and private (Companies) subjects.	Investments in physical space of the surrounding areas.	
6	It is transparent and accountable to its stakeholders and the wider public.	Official annual reviews and three-year University strategic planning.	University and the private sector as the main development drivers for the Hub.	
7	It uses innovative methodologies such as social media and team building in its engagement activities with the world at large.	University – Industry Academies (Apple Developer Academy, DIGITA; FS Mobility Academy, etc.)	Matching professional profiles with companies’ needs; Social impact boosted thanks to dissemination in schools, university and civil society.	Students’ agreement on the capability of both the Apple Academy and DIGITA to improve students’ knowledge.

Source: Authors’ elaboration based on the template reported in Goddard et al. (2016), pp. 10-11

5 Conclusions

The most relevant findings of the study have contributed to add qualitative features and items to the analysis of value creation process occurring in the Hub and addressed to its stakeholders.

The investigation on the role of the “Federico II” University Hub in the peripheral/deprived urban area of San Giovanni a Teduccio has provided a first level understanding of:

- i.* the nature of the Hub in terms of innovation, knowledge and technology transfer, and third mission;
- ii.* the innovation strategy implemented or planned by the university governance and local government institutions according to the “Civic university” purposes; and

The outcomes of the analysis can be used as a valuable tool for both the University governance and managers of local urban institutions to promote or enhance knowledge transfer and entrepreneurial activities in the selected area.

The contribution to the theoretical framework resides in assessing the relevance of a knowledge intensive site embedded in a peripheral and less developed urban context in the light of the “Civic University” characterising features. Such insight should enrich the specific focus on the competences of a university in terms of technology and knowledge transfer.

References

- Acs, Z.J. (2002). *Innovation and the growth of cities*. Cheltenham, UK: Edward Elgar.
- Addie, J-P.D., Angrisani, M. & De Falco, S. (2018). “University-led innovation in and for peripheral urban areas: new approaches in Naples, Italy and Newark, NJ, US”. *European Planning Studies*, 26 (6), 1181-1201.
- Asheim, B., Lawton Smith, H., & Oughton, C. (2011). Regional innovation systems: Theory, empirics and policy. *Regional Studies*, 45 (7), 875–891.
- Audretsch D.B., Keilbach M. (2007). The theory of knowledge spillover Entrepreneurship. *Journal of Management Studies*, 44 (7), 1242-1254.
- Audretsch, D.B. (2014). From the entrepreneurial university to the university for the entrepreneurial society. *Journal of Technology Transfer*, 39(3), 313-321.
- Barney, J.B., (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17 (1), 99-120.
- Benneworth, P. & Hospers, G. (2007). The new economic geography of old industrial regions: Universities as global/local pipelines. *Environment and Planning C*, 25 (6), 779–802.
- Berggren, E. & Dahlstrand, A. L. (2009). Creating an entrepreneurial region: Two waves of academic spin-offs from Halmstad University. *European Planning Studies*, 17 (8), 1171–1189.
- Borrás, S. & Edquist, C. (2013). The choice of innovation policy instruments. *Technological Forecasting & Social Change* 80, 1513–1522.
- Caragliu, A. & Nijkamp P. (2015). Space and knowledge spillovers in European regions: the impact of different forms of proximity on spatial knowledge diffusion. *Journal of Economic Geography*, 16 (3), 749–774.

- Caragliu, A., Nijkamp, P. (2012). The impact of regional absorptive capacity on spatial knowledge spillovers. *Applied Economics*, 44, 1363–1374.
- Carayannis, E. G. & Campbell, D.F.J. (2014). Developed democracies versus emerging autocracies: arts, democracy, and innovation in Quadruple Helix innovation systems. *Journal of Innovation and Entrepreneurship*, 3 (12), 1-23.
- Charles, D. (2006). Universities as key knowledge infrastructures in regional innovation systems. *Innovation. The European Journal of Social Science Research*, 19 (1), 117–130.
- Cohen, W.M & Levinthal D.A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35 (1), Special Issue: Technology, Organizations, and Innovation, 128-152.
- Davenport, T.H. & Prusak, L., (1998). *Working knowledge: How organizations manage what they know*. Boston: Harvard Business School Press.
- Dell’Anno, D. & Del Giudice, M. (2015). Absorptive and desorptive capacity of actors within university-industry relations: does technology transfer matter?, *Journal of Innovation and Entrepreneurship*, 4 (13), 1-20.
- Doloreux, D. & Parto, S. (2005). Regional innovation systems: Current discourse and unresolved issues. *Technology in Society*, 27(2), 133-153.
- Edquist, C. (2005). Systems of innovation: perspectives and challenges. in: J. Fagerberg, D. Mowery, R. Nelson (Eds.), *Handbook of Innovation*, Oxford: Oxford University Press: (Oxford) 2005, ch 7, pp. 182-206.
- Etzkowitz, H., (2002). Incubation of Incubators: Innovation as a Triple Helix of University–Industry–Government Networks, *Science and Public Policy* 29 (2), 115–128.
- Etzkowitz, H., & Leydesdorff, L. (1999). The Future Location of Research and Technology Transfer. *Journal of Technology Transfer* 24, 111–123.
- Etzkowitz, H., Ranga, M., Benner, M., Guarany, L., Maculan, A.M. & Kneller, R. (2008). Pathways to the entrepreneurial university: towards a global convergence" *Science and Public Policy*, 35(9), November 2008, pages 681-695.
- Freeman, C. (1991). Networks of Innovators: a Synthesis of Research Issues. *Research Policy* 20, 499–514.
- Freeman, C. (1995). The National System of Innovation in Historical Perspective. *Cambridge Journal of Economics* 19, 5–24.
- Fritsch, M., & Slavtchev, V. (2007). Universities and innovation, *Space. Industry and Innovation*, 14(2), 201-218.
- Goddard, J. (2009). *Reinventing the Civic University*. London: NESTA.
- Goddard, J. & Tewdwr-Jones, M. (2015). *City Futures and the Civic University*. New Castle City Futures.
- Goddard, J. & Vallance, P. (2013). *The University and the City*. Abingdon: Routledge.
- Holland, B.A. (2001). Toward a Definition and Characterization of the Engaged University, *Metropolitan Universities*, 2 (3), 20–29.
- Huhtelin, M. & Nenonen, S. (2015). A Co-creation Centre for university–industry collaboration – a framework for concept development. *Procedia Economics and Finance*, 21, 137-145.
- King, N. (2004). Using templates in the thematic analysis of text. In Cassell, C. & Symon, G. (Eds.). *Essential guide to qualitative methods in organizational research*. London, UK: Sage, 256–270.
- Lendel, I. (2010). The impact of research universities on regional economies: The concept of university products. *Economic Development Quarterly*, 24 (3), 210–230.
- Leydesdorff, L. (2012). The Triple Helix, Quadruple Helix,..., and an N-Tuple of Helices: Explanatory Models for Analyzing the Knowledge-Based Economy?. *J Knowl Econ*, 3 (25), 25–35.

- Leydesdorff, L. & Etzkowitz, H. (1998). The Triple Helix as a Model for Innovation Studies, *Science and Public Policy*, 25 (3), 195–203.
- Maillat D., Crevoisier O. & Lecoq B. (1994). Innovation, networks and territorial dynamic: A tentative typology. in Johansson, B, Karlsson, C. & Westin, L. (Eds.). *Patterns of a Network Economy*. Berlin: Springer Verlag, 33–52.
- Maillat, D. (1991). The Innovation Process and the Role of the Milieu. In Bergman, E, Maier G. & Tödtling, F. (Eds.). *Regions Reconsidered: Economic Networks, Innovation and Local Development in Industrialized Countries*. London: Mansell, 103 - 117.
- Maillat, D. (1995). Territorial dynamics, innovative milieus and regional policy, *Entrepreneurship and Regional Development*, 4, 1–20.
- Maillat, D. (1998). From the industrial district to the innovative milieu: Contribution to an analysis of territorialised productive organisations. *Recherches Économiques de Louvain/ Louvain Economic Review*, 64 (1), (Space and economics in retrospect), 111-129.
- Marr, B. & Schiuma, G. (2001). Measuring and Managing Intellectual Capital and Knowledge Assets in New Economy Organisations. In Bourne, M. (Ed.). *Handbook of Performance Measurement*. London: Gee.
- Molas-Gallart, J. & Castro-Martínez, E. (2007). Ambiguity and conflict in the development of “Third Mission” indicators. *Research Evaluation*, 16 (4), 321-330.
- Nonaka, I. & Konno, N. (1998). The concept of “Ba”: Building a Foundation for Knowledge Creation. *California Management Review*, 3, 40-54
- Nonaka, I., Toyama, R. & Konno, N. (2000). SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation. *Long Range Planning*, 33, 5-34.
- Schofield, T. (2013). Critical success factors for knowledge transfer collaborations between university and industry. *Journal of Research Administration*, 44 (2), 38-56.
- Trippl, M., Sinozic, T., & Lawton Smith, H. (2015). The role of universities in regional development: Conceptual models and policy institutions in the UK, Sweden and Austria. *European Planning Studies*, 23 (9), 1722-1740.
- Uyarra, E. (2010). Conceptualizing the regional roles of universities, implications and contradictions. *European Planning Studies*, 18(8), 1227–1246.
- Vargo, S.L. & Akaka, M.A. (2012). Value Cocreation and Service Systems (Re)Formation: A Service Ecosystems View. *Service Science*, 4 (3), 207–217.
- Yin, R.K. (2009). *Case Study Research. Design and Methods*. 4th ed., Thousand Oaks, CA: Sage.
- Zahra, S.A. & George, G. (2002). Absorptive Capacity: A Review, Reconceptualization, and Extension, *The Academy of Management Review*, 27 (2), 185-203.

Connection between National Culture and Individual Mindfulness

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Abstract

The goal of this paper is to shed light on the connection between national culture, operationalized using Hofstede's dimensions, and individual mindfulness. We obtain data about individual mindfulness levels from published peer reviewed studies to find correlations between values of individual mindfulness and values of Hofstede's dimensions for a variety of cultures. We found that the dimensions of Individualism and Power distance show a relatively strong correlation, with other dimensions showing weak or no correlation at all. In this way we hope to contribute to knowledge concerning the connection between national culture and individual mindfulness, a topic which remains underexplored and which has caught the attention of mindfulness researchers. Additionally, organizational practice may benefit from the contributions that this paper makes regarding the question of individual mindfulness development, i.e. the suggestions that individuals in some cultures may have an easier time developing mindfulness.

Keywords – Individual mindfulness, National culture, MAAS, Hofstede's dimensions

Paper type – Academic Research Paper

1 Introduction

Organizations constantly strive to increase the productivity and performance of their employees, seeking a source of competitive advantage. In this struggle, individual mindfulness has been suggested as a possible path forward as it helps individuals cope with stressful situations (Samuelson et al., 2007), as well as due to its positive effects on mental health (cf. Keng, Smolenski and Robins, 2011; Donald et al., 2016). Though there is little consensus regarding the exact nature of mindfulness, we take the view of Brown and Ryan (2003), who see mindfulness as a state of mind characterized by high levels of awareness and attention toward what is occurring in the present, both outside of the individual as well as within the individual.

Research of individual mindfulness has also gained traction in connection with knowledge management and knowledge creation through its positive effects on innovative thinking and perspective adoption. However, antecedents of individual

mindfulness and its determinants remain an unexplored territory, despite a large volume of research focused on this topic (Sutcliffe, Vogus and Dane, 2016). These authors highlight many potential research directions, including the effect of national culture on individual mindfulness. Thus, the goal of this paper is to find out whether there is a correlation between individual mindfulness, measured using the Mindful Attention Awareness Scale (MAAS), and national culture, operationalized by Hofstede's culture dimensions framework. We ask the following research question: "Is there a correlation between values of Hofstede's cultural dimensions of countries and individual mindfulness measured in these countries?"

In this way, the paper contributes to mindfulness research by providing first preliminary explorations of the connection of individual mindfulness, revealing deeper questions and implications for scholars in this field. Further implications for managerial practice are discussed later in the paper.

2 Theoretical Background

The roots of mindfulness can be found in Buddhist tradition, where the word "sati", referring to the ability of the mind to be aware of a mental object deeply, fully, and accurately (Buddhadāsa, 1998; Gunaratana, 1993). Buddhists have used meditation exercises to increase their mindfulness. As such, they considered mindfulness to be an ability to concentrate on and pay attention to a known, chosen object, such as breath, without getting distracted. In this way they tried to keep a stable, clear, and relaxed mind (Wallace, 2007). In western literature, the term began receiving serious attention after being introduced by Kabat-Zinn (2003, p.145) as "awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment". However, in this paper, we will approach mindfulness following the definition by Brown and Ryan (2003), who see mindfulness as state of mind characterized by high levels of awareness and attention toward what is occurring in the present, both outside of the individual as well as within the individual.

Multiple methods of mindfulness measurement have been suggested, which differ in the way they operationalize mindfulness, the requirements they put on respondents, and other factors. However, most of these measurement instruments are self-report. This is also true for one of the most used methods of mindfulness measurement, the Mindful Attention Awareness Scale (MAAS), created by Brown and Ryan (2003). The popularity of this method is demonstrated by Medvedev et al. (2016), who state that the number of citations connected with MAAS on Web of Science and Google Scholar was 5028 in 2015, which is almost twice the number of citations connected with the second most cited method, The Five Facet Mindfulness Questionnaire. MAAS consists of 15 questions which are answered on a likert scale. The value of mindfulness is calculated as the mean value of all 15 questions.

Individual mindfulness has been shown to have multiple positive effects, including improved attention, awareness of the body, emotional peace and a view of oneself (Hölzel et al., 2011). Its positive effects on mental health have also been observed by e.g. Keng,

Smonski and Robins (2011) or Donald et al. (2016). Additionally, individual mindfulness helps with taking a non-linear approach to problem-solving, through which it supports creativity and flexibility (Ie et al., 2012), it aids in improving attention (Hales and Chakravorty, 2016), task performance (Dane, 2011) and productivity (Altizer, 2017). Due to its effects on knowledge creation, individual mindfulness also found a place in knowledge management. It was found that individuals who process information mindfully are more likely to apply the collected information in innovative ways and in original contexts (Langer, 1989), and take into account different perspectives (Langer, Janis and Wolfer, 1975). As such, individual mindfulness supports innovation and knowledge creation.

Individual mindfulness, knowledge and behavioural ability stand as inputs into the Cultural Intelligence model (Thomas, 2006). Cultural intelligence provides an organization with the ability to facilitate communication and management between people from various cultural backgrounds (Earley, 2002; Earley and Ang, 2003), which may lead to better knowledge transfer and innovation. Since mindfulness plays a central role in the model (Thomas, 2006), it also seems central to management of knowledge within an organization. As such, it is beneficial to know how individual mindfulness comes about and influences it. Despite a large amount of research focused on the topic of antecedents of individual mindfulness (see Sutcliffe, Vogus and Dane (2016) for a review), questions still remain unanswered. It is still unclear how, or whether, national culture influences individual mindfulness. Additionally, multinational corporations which strive to increase the individual mindfulness of their members may benefit from this paper when making decisions regarding the locations of new bases in culturally diverse countries. As such, this paper strives to contribute to filling this research gap.

3 Method

Using a traditional literature review, we obtain data about individual mindfulness in 18 different countries around the globe. The literature search began by searching the Web of Science database using the following algorithm:

((TS=((Mindful) AND ((MAAS) OR (Mindful* NEAR attention NEAR awareness NEAR scale)) AND (Assess* OR measure* OR Test* OR survey*)))) AND LANGUAGE: (English) AND DOCUMENT TYPES: (Article).*

The search took place in 2018. We decided on the relevance of literature found based on several criteria. First, we included empirical studies of individual mindfulness which measured mindfulness using MAAS. This criterion was introduced in order to avoid the problem values of mindfulness diverging due to different measurement methods. MAAS was specifically chosen due to its popularity, which maximized the chances of finding sufficient literature. Second, the study had to state which country the measurement took place in and disclose the actual values of mindfulness measured using MAAS. We included only published peer reviewed articles in the English language. Using this method

of search, we identified 18 research papers that were used as the source of our data. This means that for each country, we only obtained one value of individual mindfulness, as we use the results of a single paper for each country to determine the value of individual mindfulness. The study is further limited by the nature of the papers found, specifically by the composition of the researched sample, which were in some cases quite small or unrepresentative, consisting disproportionately of mental patients or students. As such, the results of this paper are hardly representative themselves, and should be taken as preliminary explorations rather than hard conclusive evidence. The process of literature search, filtering and selection can be found in Figure 1.

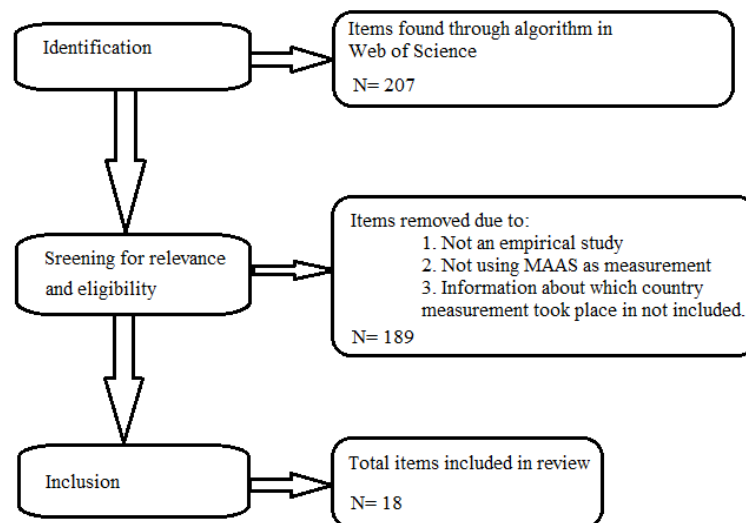


Figure 6: Literature search and selection process

We obtained values of Hofstede's cultural dimensions for individual countries on the Hofstede Insights website. Hofstede's cultural framework consists of 7 dimensions, Power Distance, Individualism, Masculinity, Uncertainty Avoidance, Long-term Orientation and Indulgence. All of these dimensions are bipolar, measured by indices, the value of which can range from 0 to 100 (Hofstede, Hofstede and Minkov, 2010). Although the framework has received criticism regarding its validity, it is still used to classify and operationalize national cultures (cf. Kąkol et al., 2018; Benaida, 2018; Laitinen and Suvas, 2016; Kedmenec and Strašek, 2017, Huang and Crotts, 2019). Hofstede's framework is primarily criticized due to it using nations as a unit, despite nations not being necessarily homogenous. Minkov and Hofstede (2014) addressed this criticism by demonstrating that culture is shared at the group level.

After we obtained values of individual mindfulness and Hofstede's cultural dimensions for individual countries, we used the Pearson Correlation Coefficient to calculate the correlation between individual mindfulness and indices of cultural dimensions.

4 Findings

Values of mindfulness of individual countries can be seen in Table 1, with cultural dimension indices being shown in Table 2. Data were obtained for countries in Europe, North America, South America and Asia, which are culturally quite different. Indeed, values of cultural dimension indices diverge between the countries. However, the means of all dimensions are limited to a rather thin interval between 49.89 and 59.94. The correlation coefficients calculated from values in Table 1 and Table 2 can be seen in Table 3.

Table 11: Average value of individual mindfulness reported in literature. Source: Authors based on data in cited literature.

State	Individual Mindfulness
Netherlands	4,41 (de Bruin et al., 2011)
Spain	4,28 (Gil et al., 2018)
China	3,89 (Zhuang et al., 2017)
France	3,87 (Antoine et al., 2018)
India	3,08 (Dhandra and Park, 2018)
Australia	4,42 (Mak et al., 2018)
USA	4,35 (Osman et al., 2016)
Italy	4,86 (Veneziani and Voci, 2015)
Argentina	3,89 (Montes et al., 2014)
England	4,03 (McCracken et al., 2007)
Canada	3,91 (Garland et al., 2013)
Germany	4,57 (Mothes et al., 2014)
Taiwan	4,10 (Boekel and Hsieh, 2018)
Ireland	4,29 (Murphy and Murphy, 2018)
Norway	4,05 (Østerås, et al., 2017)
Slovenia	3,78 (Cikajlo et al., 2017)
Bangladesh	3,69 (Islam and Siddique, 2016)
Brazil	3,66 (Kozasa et al., 2015)

Table 12: Values of Hofstede's Cultural Dimensions Indices per country. Source: www.hofstede-insights.com

State	Hofstede's cultural dimension indices					
	Power Distance	Individualism	Masculinity	Uncertainty Avoidance	Long-term Orientation	Indulgence
Netherlands	38	80	14	53	67	68
Spain	57	51	42	86	48	44
China	80	20	66	30	87	24
France	68	71	43	86	63	48
India	77	48	56	40	51	26
Australia	36	90	61	51	21	71
USA	40	91	62	46	26	68
Italy	50	76	70	75	61	30
Argentina	46	49	56	86	20	62
England	35	89	66	35	51	69
Canada	39	80	52	48	36	68
Germany	25	67	66	65	83	40
Taiwan	58	17	45	69	93	49
Ireland	28	70	68	35	24	65

Norway	31	69	8	50	35	55
Slovenia	71	27	19	88	49	48
Bangladesh	80	20	55	60	47	20
Brazil	69	38	49	76	44	59

Table 13: Correlation Coefficients between Individual Mindfulness and Cultural dimension indices

	Correlation
Mindfulness/Power Distance	-0.6551
Mindfulness/Individualism	0.5078
Mindfulness/Masculinity	0.1526
Mindfulness/Uncertainty Avoidance	0.0657
Mindfulness/Long-term Orientation	0.0704
Mindfulness/Indulgence	0.2646

The correlation between mindfulness and Power Distance can be considered strong (Evans, 1995), as it reaches the value of $r = -0.655$, suggesting an inverse relationship. In other words, high Power Distance in a culture is correlated with low average individual mindfulness. This can also be seen in Figure 2.

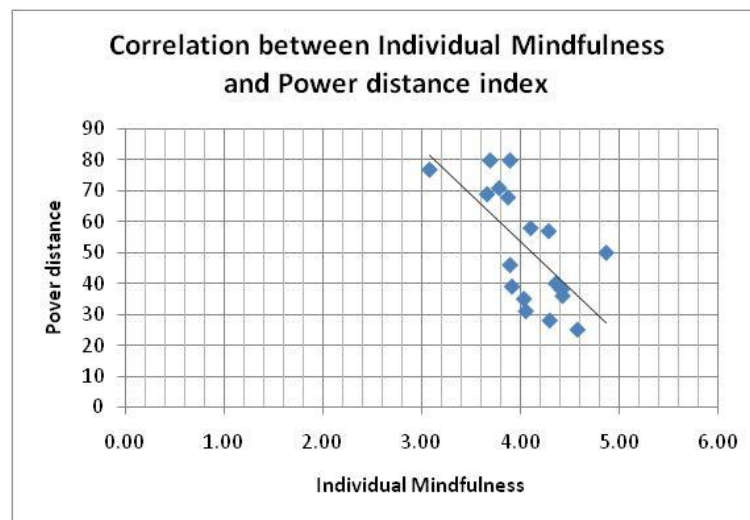


Figure 7: Correlation between Individual Mindfulness and Power distance index

Despite the low number of observations, the graph in Figure 2 does display an inverse relationship.

The correlation between Individual mindfulness and Individualism is $r = 0.508$, moderate. The value is positive, suggesting that an increase in Individualism is correlated

with an increase in Individual Mindfulness. The correlation between Individual Mindfulness and Individualism is displayed in Figure 3.

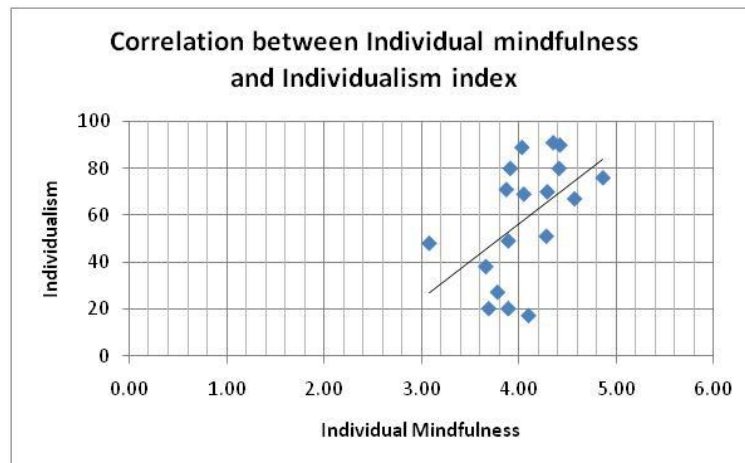


Figure 8: Correlation between Individual Mindfulness and Individualism index

The graph in Figure 3 displays a shape of observations that can be expected from a moderate correlation. The other indices of cultural dimensions are only weakly correlated with individual mindfulness, or not at all, suggesting that there is no relationship between these dimensions and individual mindfulness.

Although dimensions of Individualism and Uncertainty avoidance are of almost the same mean value, the correlations between Individual Mindfulness and Individualism and between Individual Mindfulness and Uncertainty avoidance are very different. This may be caused by differences in variance of the values of the two cultural dimension indices.

5 Discussion

We looked for correlation between national culture and values of individual mindfulness. Our findings reveal a strong negative correlation between the Power distance dimension of culture and individual mindfulness. This suggests that individuals in countries of high Power Distance are on average more mindful. The cause of this correlation is debatable. In cultures with high power distance, individuals have less power to make decisions, potentially reducing the need to be mindful.

Our findings further show a moderate positive correlation between Individualism and Individual mindfulness. This is consistent with the concept of mindfulness itself, being a greater awareness of the self. Individuals who devote more attention and energy to their own goals and themselves than to the goals of a group seem to achieve greater mindfulness.

However, correlation between two phenomena does not necessarily imply a causal link between them. It is possible that the correlation found in this research is a result of the rather small sample of literature used. However, this points to a different problem, that

being a lack of mindfulness research that even considers national culture as a potential factor worth taking into account. We found a lack of studies which would talk about the national culture of participants. With the current unclear link between national culture and individual mindfulness, this may lead to potential loss of information in resulting data. If national culture and individual mindfulness are indeed connected, as the results of this research suggest, then mindfulness researchers should begin observing national culture of participants in their research.

Because this research reports no correlation, not only can it not be interpreted as suggesting a causal relationship, but also does not speak in any way about the direction of the relationship between national culture and mindfulness. In other words, it does not suggest that a decrease in Individual Mindfulness is caused by an increase in Power Distance, or vice-versa. This research is further limited by the data obtained from the papers included in our sample, which was not always based on a representative sample of respondents.

On the other hand, this research found only weak or no correlation between individual mindfulness and five Hofstede's dimensions of culture, Masculinity ($r = 0.1526$), Uncertainty avoidance ($r = 0.0657$), Long-term orientation (0.0704), or Indulgence ($r = 0.2646$). This suggests that there is indeed no causal or any other relationship between these dimensions of national culture and individual mindfulness. In other words, our research suggests that mindfulness scholars do not need to take these dimensions of culture into account when designing their research.

The finding that there is no correlation between Individual Mindfulness and Uncertainty avoidance is somewhat surprising. Mindfulness is an integral part of some organizational theories that seek to deal with uncertainty in organizational practice, such as High-Reliability Theory (Weick and Sutcliffe, 2001). This theory suggests that by incorporating several processes in which individual mindfulness plays a pivotal role, organizations may achieve greater success when faced with an uncertain, ambiguous and high-risk environment. Seeing as uncertainty avoidance describes the tendency to avoid unpredictable and unorthodox behaviour and ideas, some correlation between individual mindfulness and Uncertainty avoidance may be expected. However, no such correlation was found. This may be again caused by the limitations of this research.

Our findings suggest that organizations which seek to improve knowledge transfer through improved communication should consider including members from cultures low in power distance and high in individualism, as these dimensions are correlated with individual mindfulness. This is in connection with the Cultural Intelligence model (Thomas, 2006), which suggests that individual mindfulness is integral to successful communication, and thus knowledge flows, in organizations. Improving individual mindfulness within an organization may not only improve knowledge transfer, creativity (Ie et al., 2012) and innovative behaviour (Langer, 1989), but also mental health (Byron et al., 2015) and task performance (Dane, 2011).

6 Conclusions

The goal of this paper was to find out whether there is a correlation between Individual Mindfulness, measured using MAAS, and Hofstede's dimensions of culture. We found strong negative correlation between Individual Mindfulness and Power Distance, moderate correlation between Individual Mindfulness and Individualism, and weak or no correlation between individual mindfulness and the other dimensions of culture. The results suggest that national culture may be a relevant factor to take into account when doing mindfulness research. This paper further reveals how little attention is put on national culture of mindfulness research subjects. In organizational practice, the research contributes by suggesting a possible link between national culture and knowledge creation and transfer, offering a perspective in which individuals from cultures low on power distance and high on individualism may be more mindful and thus more likely to share and create knowledge. Future research may follow up on this paper with empirical research which would measure the mindfulness of a representative sample of respondents in various cultures and look for causal relationships between national culture and Individual Mindfulness as opposed to merely correlations. This would further contribute to answering the question whether national culture has any impact on individual mindfulness, which despite this research remains open.

References

- Antoine, P., Dauvier, B., Andreotti, E. and Congard, A., (2018) "Individual differences in the effects of a positive psychology intervention: Applied psychology", *Personality and Individual Differences*, Vol. 122, pp. 140-147.
- Altizer, C., (2017) "Mindfulness: performance, wellness or fad?", *Strategic HR Review*, Vol. 16, No. 1, pp.24-31.
- Benaida, M., (2018) "Cross-Cultural Web Design and Education: A Comparison Between Arab Universities and US Universities Based on Hofstede Cultural Dimensions", *International Journal of Computer Science and Network Security*, Vol. 18, No. 10, pp. 91-99.
- Boekel, W. and Hsieh, S. (2018) "Cross-sectional white matter microstructure differences in age and trait mindfulness", *PloS one*, Vol. 13, No. 1.
- Brown, K.W. and Ryan, R.M., (2003) "The Benefits of Being Present: Mindfulness and Its Role in Psychological Well-Being", *Journal of Personality and Social Psychology*, Vol. 84, No. 4, pp. 822-848.
- Buddhadāsa, B., (1988). *Mindfulness with breathing: A manual for serious beginners*, Wisdom Publications, Boston.
- Byron, G., Ziedonis, D. M., McGrath, C., Frazier, J. A. and Fulwiler, C., (2015) "Implementation of mindfulness training for mental health staff: Organizational context and stakeholder perspectives", *Mindfulness*, Vol. 6, No. 4, pp. 861-872.
- Cikajlo, I., Staba, U. C., Vrhovac, S., Larkin, F. and Roddy, M., (2017) "A cloud-based virtual reality app for a Novel telemindfulness service: rationale, design and feasibility evaluation", *JMIR research protocols* 6, No. 6, e108.
- Dane, E., (2011) "Paying Attention to Mindfulness and Its Effects on Task Performance in the Workplace", *Journal of Management*, Vol. 37, No. 4, pp. 997-1018.

- De Bruin, E. I., Zijlstra, B. J., van de Weijer-Bergsma, E. and Bögels, S. M., (2011) "The mindful attention awareness scale for adolescents (MAAS-A): Psychometric properties in a Dutch sample", *Mindfulness*, Vol. 2, No. 3, pp. 201-211.
- Dhandra, T. K. and Park, H. J., (2018) "Mindfulness and gender differences in ethical beliefs", *Social Responsibility Journal*, Vol. 14, No. 2, pp. 274-286.
- Donald, J.N., Atkins, P.W.B., Parker, P.D., Christie, A.M. and Ryan, R.M., (2016) "Daily stress and the benefits of mindfulness: Examining the daily and longitudinal relations between present-moment awareness and stress responses", *Journal of Research and Personality*, Vol. 65, pp. 30-37.
- Earley, P. C., (2002) "Redefining interactions across cultures and organizations: Moving forward with cultural intelligence", *Research in organizational behavior*, Vol. 24, pp. 271-299.
- Earley, P. C. and Ang, S., (2003) *Cultural intelligence: Individual interactions across cultures*, Stanford University Press, Stanford, CA.
- Evans, J.D., (1995) *Straightforward Statistics for the Behavioral Sciences*, Brooks/Cole Pub Co.
- Garland, S. N., Tamagawa, R., Todd, S. C., Speca, M. and Carlson, L. E., (2013) "Increased mindfulness is related to improved stress and mood following participation in a mindfulness-based stress reduction program in individuals with cancer", *Integrative Cancer Therapies*, Vol. 12, No. 1, pp. 31-40.
- Gil, M. N., Marco, C. E., Montero-Marín, J., Zafra, J. M., Shonin, E. and Campayo, J. G., (2018) "Efficacy of neurofeedback on the increase of mindfulness-related capacities in healthy individuals: a controlled trial", *Mindfulness*, Vol. 9, No. 1, pp. 303-311.
- Gunaratana, H., (1993) *Mindfulness in plain English*, Wisdom Publications, Boston.
- Hales, S.C. and Chakravorty, S.S., (2016) "Creating high reliability organizations using mindfulness", *Journal of Business Research*, Vol. 69, No. 8, pp. 2873-2881.
- Hofstede, G., Hofstede, G.J. and Minkov, M., (2010) *Cultures and Organizations: Software of the mind* (third edition), McGraw Hill.
- Hölzel, B. K., Lazar, S. W., Gard, T., Schuman-Olivier, Z., Vago, D. R. and Ott, U., (2011) "How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective", *Perspectives on psychological science*, Vol. 6, No. 6, pp. 537-559.
- Huang, S. S., and Crotts, J., (2019) "Relationships between Hofstede's cultural dimensions and tourist satisfaction: A cross-country cross-sample examination", *Tourism Management*, Vol. 72, pp. 232-241.
- Ie, A., Haller, C.S., Langer, E.J. and Courvoisier, D.S., (2012) "Mindful multitasking: The relationship between mindful flexibility and media multitasking", *Computers in Human Behavior*, Vol. 58, No. 4, pp. 1526-1532.
- Islam, M. A. and Siddique, S., (2016) "Validation of the Bangla Mindful Attention Awareness Scale", *Asian journal of psychiatry*, Vol. 24, pp. 10-16.
- Kabat-Zinn, J., (2003) "Mindfulness-based interventions in context: past, present, and future", *Clinical Psychology: Science and Practice*, Vol. 10, No. 2, pp. 144-156.
- Kąkol, U., Kisilowski, M., Kunikowski, G., and Uklańska, A., (2018) "Adaptation of civil planning and crisis management practices based on Hofstede's cultural dimensions model", *Management Research and Practice*, Vol. 10, No. 4, pp. 62-75.
- Kedmenec, I. and Strašek, S., (2017) "Are some cultures more favourable for social entrepreneurship than others?", *Economic research-Ekonomska istraživanja*, Vol. 30, No. 1, pp. 1461-1476.
- Keng, S.L., Smoski, M.J. and Robins, C.J., (2011) "Effects of mindfulness on psychological health: A review of empirical studies", *Clinical psychology review*, Vol. 31, No. 6, pp. 1041-1056.
- Kozasa, E. H., Lacerda, S. S., Menezes, C., Wallace, B. A., Radvany, J., Mello, L. E. and Sato, J. R., (2015) "Effects of a 9-day Shamatha Buddhist meditation retreat on attention,

- mindfulness and self-compassion in participants with a broad range of meditation experience”, *Mindfulness*, Vol. 6, No. 6, pp. 1235-1241.
- Laitinen, E.K. and Suvas, A., (2016) “Financial distress prediction in an international context: Moderating effects of Hofstede’s original cultural dimensions”, *Journal of Behavioral and Experimental Finance*, Vol. 9, pp. 98-118.
- Langer, E.J., (1989) *Mindfulness*, Perseus Publishing, Cambridge, MA.
- Langer, E.J., Janis, I. and Wolfer, J., (1975) “Reduction of Psychological Stress in Surgical Patients”, *Journal of Experimental Psychology*, Vol. 11, pp. 155-165.
- Mak, C., Whittingham, K., Cunningham, R. and Boyd, R. N., (2018) “Effect of mindfulness yoga programme MiYoga on attention, behaviour, and physical outcomes in cerebral palsy: a randomized controlled trial”, *Developmental Medicine & Child Neurology*, Vol. 60, No. 9, pp. 922-932.
- McCracken, L. M., Gauntlett-Gilbert, J. and Vowles, K. E., (2007) “The role of mindfulness in a contextual cognitive-behavioral analysis of chronic pain-related suffering and disability”, *Pain*, Vol. 131, No. 1-2, pp. 63-69.
- Medvedev, O. N., Siegert, R. J., Feng, X. J., Billington, D. R., Jang, J. Y. and Krägeloh, C. U., (2016) “Measuring trait mindfulness: How to improve the precision of the Mindful Attention Awareness Scale using a Rasch model”, *Mindfulness*, Vol. 7, No. 2, pp. 384-395.
- Minkov, M., and Hofstede, G., (2014) “Clustering of 316 European regions on measures of values: do Europe’s countries have national cultures?”, *Cross-Cultural Research*, Vol. 48, No. 2, pp. 144-176.
- Montes, S. A., Ledesma, R. D., García, N. M. and Poó, F. M., (2014) “The mindful attention awareness scale (MAAS) in an argentine population”, *Measurement and Evaluation in Counseling and Development*, Vol. 47, No. 1, pp. 43-51.
- Mothes, H., Klaperski, S., Seelig, H., Schmidt, S. and Fuchs, R. (2014) “Regular aerobic exercise increases dispositional mindfulness in men: a randomized controlled trial”, *Mental Health and Physical Activity*, Vol. 7, No. 2, pp. 111-119.
- Murphy, L. and Murphy, G., (2018) “Time to drive: Present vs. future orientation and self-reported driving behaviour”, *Transportation research part F: traffic psychology and behaviour*, Vol. 56, pp. 1-13.
- Osman, A., Lamis, D. A., Bagge, C. L., Freedenthal, S. and Barnes, S. M., (2016) “The mindful attention awareness scale: further examination of dimensionality, reliability, and concurrent validity estimates”, *Journal of personality assessment*, Vol. 98, No. 2, pp. 189-199.
- Østerås, B., Sigmundsson, H. and Haga, M. (2017) “Physical Fitness Levels Do Not Affect Stress Levels in a Sample of Norwegian Adolescents”, *Frontiers in psychology*, Vol. 8, 2176.
- Samuelson, M., Carmody, J., Kabat-Zinn, J. and Bratt, M.A., (2007) “Mindfulness-based stress reduction in Massachusetts correctional facilities”, *The Prison Journal*, Vol. 87, No.2, pp. 254-268.
- Sutcliffe, K.M., Vogus, T.J. and Dane, E., (2016) “Mindfulness in Organizations: A cross-level review”, *Annual Review of Organizational Psychology and Organizational Behavior*, Vol. 3, pp. 55-81.
- Thomas, D. C., (2006) “Domain and development of cultural intelligence: The importance of mindfulness”, *Group & Organization Management*, Vol. 31, No. 1, pp. 78-99.
- Veneziani, C. A. and Voci, A. (2015) “The Italian adaptation of the Mindful Awareness Attention Scale and its relation with individual differences and quality of life indexes”, *Mindfulness*, Vol. 6, No. 2, pp. 373-381.
- Wallace, B. A., (2007) *Genuine happiness: meditation as the path to fulfillment*, Wiley, Hoboken.
- Weick, K.E. and Sutcliffe, K.M., (2001) *Managing the Unexpected: Assuring High Performance in an Age of Complexity*, Jossey-Bass, San Francisco, CA.

Zhuang, K., Bi, M., Li, Y., Xia, Y., Guo, X., Chen, Q., Du, X., Wang, K., Wei, D., Yin, H. and Qiu, J., (2017) "A distinction between two instruments measuring dispositional mindfulness and the correlations between those measurements and the neuroanatomical structure", Scientific reports, Vol., 7, No. 1, pp. 1-9.

A Service Design Experiment in the Municipality of Turin to Overcome Organisational Silos

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Abstract

In light of fiscal austerity and mounting pressure to meet new and emerging social needs, governments across Europe are finding the need to experiment with new methods and approaches to serving citizens. An intermediary, supporting infrastructure is growing around the need to increase the innovation capacity of public sector organizations. This can be seen in the rise of public innovation labs, internal innovation teams/labs and consulting services directed specifically at public innovation. These intermediaries often employ approaches, methods and tools coming from the design field, most often grouped under 'design thinking'. Considering the complex nature of the social problems and the complexity of the socio-technical systems in which they are embedded, design processes must include a wide range of actors in order to gather the necessary knowledge to properly frame and solve the problem. Design processes in these settings often take on a participatory nature, providing a collaborative, and more democratic, approach to problem resolution.

In order to understand better how design is helping governments increase their innovation capacity, a 4-month experimentation, under the SIC H2020 project, was conducted with the Municipality of Turin. The objective was to help them design a new service and in the process overcome organizational barriers to innovation, of which include a highly, siloed organizational structure. While the process confirmed some of the initial hypotheses regarding the potential of co-design in contributing to organizational transformation through the translation of new knowledge, three critical points emerged from the experimentation which provide useful insight for future research and experimentation.

Keywords – codesign, experiential learning, organizational change, public innovation, service design.

Paper type –Practical Paper

1 Introduction

Governments across Europe are facing new challenges, emerging from the changing socio-technical paradigm characterizing the welfare needs of society today, but that is also prompting rapid changes in other sectors. The shift is seen in social needs of a different nature that embody the weaknesses of current social structures and the fragility and vulnerability of certain social groups. These *wicked* (Buchanan, 1992; Eggers & Muoio, 2015; Kolko, 2012) problems can be seen in issues like migration, the long-term unemployed, rising numbers of youth not in education, employment or training (NEET), urban decay in cities and demographic changes including an increasing ageing population accompanied by diminishing fertility rates. The social problems are also accompanied with problems regarding access and awareness, as well as appropriateness of the existing services. These issues owe in part to technological advances which have heightened expectations around service structures and delivery, while also opening up new avenues to address these problems.

In response to the turbulent and fast changing environment in which governments, and not only, operate today, new patterns of production and consumption are arising, characterized by a collaborative nature. This was highlighted by the 2016 World Economic Forum in Davos, that placed the phenomenon under the realm of the fourth industrial revolution, which is distinguished not only by technological innovations but also by their capacity to enhance communication between actors and thereby fuel more collaborative socio-economic models. These new models have heralded a “co-“ paradigm that recognizes strength in collaboration between actors, acknowledging the value held in each as resources and knowledgeable agents in the resolution of challenges and in the production of value. This acknowledgement of the value of external actors as knowledge agents and partners in the production of value is not unique to the public sector but has rather established itself in the private sector which has seen, in parallel development with the technological advances in the 1980s and 90s, the rise of new organizational forms, of which include the network organization and the learning organization (Daft & Lewin, 1993; Senge, 1990). These new forms, in contrast to vertically integrated organizations, work on horizontal relationships of collaboration between different organizations who work to fulfill a shared objective. The value of harnessing the collective knowledge and resources of the entire ecosystem of actors around a specific purpose – social or economic in nature – has empowered new approaches that are re-formulating: (1) how knowledge is created and shared; and (2) the relationship between actors who together work towards transforming the organization through the translation of ideas.

The co-paradigm is changing how governments and citizens interact, leading to the co-responsibility of each actor for the welfare needs of communities (Rizzo et al., 2017). Many governments have started to experiment with new approaches and methods through innovation labs that are either housed inside the organization, span across agencies or are external to the organization and left outside government. Many of these approaches and methods are rooted in design, and specifically service design, as most innovation demands of public sector organizations are service-based. An intermediary, support

system of professionals and service structures is thus growing around public sector innovation, acting as mediating devices between the “on the ground” realities of the social service delivery system and the policies guiding its implementation. This system has exacerbated a gap between the ideation of services and their implementation that is rooted in a long-standing policy of the public sector to commission services to other actors, thereby effectively cutting the learning loop and knowledge feedback systems. In other words, while horizontal subsidiarity is a social value for welfare systems, it requires real collaboration and active participation between actors and by *all* actors.

By gathering and involving actors from the service ecosystem, including citizens and users, in the service design, we posit that co-design processes are valuable towards the management and translation of new knowledge that contribute to the transformation of organizations. The experimentation done with the Municipality of Turin, which we will discuss below, confirmed two interconnected organisational challenges: 1) how to achieve a holistic approach to service delivery; and 2) how to overcome internal resistance and barriers connected with the current organisational culture and structure.

2 Theoretical Framework

2.1 Knowledge Management

The production of knowledge and its management has been deeply covered by literature, especially as the value of knowledge has become more and more a lever of competitive advantage with the emergence of the knowledge economy. Nonaka (1991, 1994) was one of the leaders, asserting the importance of externalizing and combining tacit and explicit knowledge, popularized in his spiral of organizational knowledge creation. From this model, the concept of ‘knowledge as an object’ took form based on the idea that knowledge management systems could externalize tacit knowledge for organizational learning and benefit (Cohendet et al., 1999; Crossan et al., 1999). Walsham (2005), however, notes that these interpretations contradict Polanyi’s (1966) definition of tacit and explicit knowledge which are at the base of Nonaka’s model. The problem, he states, rests on the fact that “the meaning of any objective ‘knowledge’ will always remain the subjective product of the person in whose mind this is constituted, always relationally defined, and therefore [not easily transferrable] to others in a form which may be operationalized to the benefit of the organization” (Thompson & Walsham, 2004, p. 726).

Thompson and Walsham (2004) highlight the importance of context in knowledge processes: “the relationally situated ingredients through which knowing occurs” (p. 735.). Theories regarding the practices of knowing and learning (Blackler, 1995; Blackler et al., 2000) have fueled the emergence of concepts like ‘communities of practice’ (Lave and Wenger 1991; Wenger 1998) or knowledge communities (Barrett et al 2004), which have been found (Anand et al., 2002) to be effective in bringing people together – whether from different organizations, different departments within the same or even across

boundaries – to learn and share knowledge. Markus et al. (2000) similarly demonstrated their efficacy in collaborating in artifact development.

Communities of practice are built around the idea that knowing and doing come hand in hand and occur in situated contexts of practice (Lave & Wenger, 1991). In other words, in contexts in which there is room for repeated interaction. Thus while learning is individual, it happens in relation to others. Tsoukas (2003), in fact, states that: “Tacit knowing cannot be ‘captured’, ‘translated’, or ‘converted’, but only displayed and manifested in what we do. New knowledge comes about not when the tacit becomes explicit, but when our skilled performance is punctuated in new ways through social interaction.” (p.410). This focus on the importance of communication and interaction in learning and the generation of new knowledge is also supported by Kaneko and Imai (1987) who note the special quality of networks to interpret new information which in turn fuel new linkages. Compared to hierarchical organizational forms, information flowing through a network is freer and more open to interpretation, allowing for new meaning and thereby providing a context for learning by doing (Powell, 1990, p. 325).

2.2 Design Thinking and Experiential Learning

Design thinking has gained a lot of attention from practitioners and scholars alike in the last decade for its attributed ability to tackle complex, ‘wicked’ problems. Despite its recent fame, the concept can be traced back to the late 1970s in Bruce Archer’s statement: “there exists a designerly way of thinking and communicating that is both different from scientific and scholarly ways of thinking and communicating, and as powerful as scientific and scholarly methods of enquiry when applied to its own kinds of problems” (Archer, 1979). The systematized process of design thinking has only recently emerged as an innovation formula to help businesses (Brown, 2009) adopt a designerly way of thinking (Cross, 1982) and doing and to push knowledge forward through stages leading to breakthrough innovations and competitive advantage (Martin, 2009). Beyond the business context, it has also taken hold of innovation spaces that span across the sectors with varying objectives, including social ones, as seen in its uptake in social innovation development (Brown & Wyatt, 2010). Design thinking is also heavily used by intermediaries – innovation labs, consultancies and internal innovation teams – to introduce design skills into public sector organizations and help guide innovation processes that also seek to enable cross-agency collaboration (Tönurist et al. 2017). These processes however often encounter difficulties in achieving their goal of embedding an experimental culture in public sector organizations or in co-designing better services from a user-centered perspective, as these practices conflict with the long established organizational practices and cognitive patterns that shape the organizational culture of the public sector, which runs in stark contrast with those found in the assembled design teams (Bason 2010; Tönurist et al. 2017; Elsbach & Stigliani 2018). This speaks to the low absorptive capacity (Cohen and Levinthal, 1990) of these organizations and their need for transformation, which in short, calls for knowledge creation and learning.

Most innovation projects with and within the public sector can be considered small-scale experiments. As such, they can be interpreted not only as a means of providing

better services but also as vehicles for deeper transformation through the iterative cycles of analysis and synthesis of the design process (Owen, 1998). These innovation experiments can thus be considered as learning processes (Owen, 2007; Beckman & Barry, 2007), that can lead to organizational transformation (Rizzo et al., 2017). Overlapping the design process with Kolb's (1984) experiential learning model, based on its four iterative steps: experiencing, reflecting, thinking and acting, creates an interesting design-based learning framework (Beckman & Barry, 2007; Rizzo et al., 2017) for reflective learning.

2.3 Co-Design

In a recent paper, Rizzo et al. (2017), point out that when design thinking is applied to societal challenges it takes on complex, participatory processes, engaging a vast number of actors and stakeholders, which extend the nature of participation to include: "1) the [relationship] between the context of the problem to be addressed and the design of the network that will co-produce the solution; and 2) the [experimentation] of different configurations of that network until [...] a robust partnership is individualised and established [into an] institutional form" (p. 130). These configurations, if designed well, have the knowledge resources needed to frame the problem, not only from the perspective of the user but also of other actors involved in the production of the service (and also consumption, even in secondary forms – e.g. caregivers, family members, etc.). Regarding the second point and as will be evidenced in the findings from the case study, finding the right configuration and institutionalizing the interaction is essential towards successfully implementing the new service in the long run and is one of the larger challenges of the translation of these experiments from "nice insights" to applicable knowledge.

Co-design, defined as "the creativity of designers and people not trained in design working together in the design development process" (Sanders & Stappers, 2008), thus represents a powerful method for creating change in government. By including all actors in the design and development of products and services, it threatens existing power structures (ibidem, p. 9) by dismissing and going beyond the 'expert' mindset. In fact, while user-centered design was widespread in the 1990s in consumer product development, it fails to address the complexity of 21st century problems which requires a shift towards a more egalitarian view on idea sharing and knowledge holding, viewing future users as experts and active co-designers rather than passive participants.

Building on the theoretical framework discussed above, we will explore the building of a new service for the Municipality of Turin, to understand how co-design is able to translate new knowledge and contribute to organizational change through: (1) the engagement of a network of actors; and (2) the translation of knowledge through the design process.

3 Methodology

3.1 Method

This research used a descriptive case study approach, supported by a review of literature, to analyze the co-design process of a new service which integrated services, traditionally coming from different departments. The case study method was chosen as a research frame particularly appropriate for examining a contemporary phenomenon within its real-life context during its evolution, when boundaries are blurred and not so clearly defined (Yin, 2014, p. 13). The authors adopted a qualitative approach with the aim of exploring a real-life, contemporary bounded system (a case) over time, through a detailed and in-depth data collection involving several sources of information (Creswell, 2013, p. 97).

This qualitative approach is useful for answering “how” and “why” questions (Yin, 2009). In this research, the question examined was: “how can design increase the innovation capacity of public sector organizations?”. It is important to acknowledge the limited capacity of a single-entity case study to provide generalizable lessons. The results instead are qualitative and allow for detailed insight and lessons useful for inferring or explaining other similar and parallel happenings (King et al., 1994). Therefore, in order to protect the reliability and validity of the study, it is essential for diverse perspectives to be represented and grounding the research findings in theory and other relevant comparative data (Yin, 2009).

3.2 Data Collection

The primary sources of data for this work were first-hand observations made through action research conducted by the authors, as well as other project reports made available by consortium partners through deliverables and tasks completed under the framework of the SIC H2020 project (GA No. 693883).

4 Case Description

Turin is the third largest Italian city, well known in the world as the hometown of FIAT automobiles. The crisis of the automotive sector that started, in 2007, however, led to the delocalisation of production and to a relevant increase in the level of unemployment. Under these premises, the Municipality prioritized the development of internal capacities to design and deliver innovative services that respond to the needs of citizens affected by the crisis. Most of these services, however, call for an integrated approach, requiring the Municipality to first promote a smoother cooperation among departments, with the aim of overcoming organisational silos. Similar to most Italian Public Administrations, the Municipality of Turin is divided into administrative and institutional structures. The administrative side is further divided into eight offices to service the eight districts, each with its own social service office. These offices are in turn further divided into service specific divisions, creating hierarchical layers of nested silos.

These departments then operate according to an organizational logic that benefits their own division, putting organizational needs first rather than those of the user (who is often in contact with several departments to wholly satisfy their needs). The organizational structure and logic with which it operates thus impedes holistic reasoning and planning of problem resolution and social service provision at the macro-level (e.g. understanding and addressing citywide social needs and allocating resources accordingly) and at the micro-level (e.g. the specific needs of citizens).

Even though, Turin is receiving widespread attention for its experimentation with collaborative models of innovation, as seen in its social innovation program – Torino Social Innovation – the high level of bureaucracy and the strong organizational culture characterizing its infrastructure, disincentivizes civil servants to take part in experimentation and organisational innovation, which is seen as an ‘extra’ activity. Understanding how to foster communication between departments and enable reflective processes around the user of their services was pivotal towards the improvement not only of the quality of social services but also their efficacy.

The design of the new services was conducted with the support of design researchers from the Politecnico di Milano within the SIC H2020 project, who saw this as an opportunity to introduce new knowledge and foster cross-agency and cross-sector cooperation, through a service co-design process to develop innovative solutions. The challenge was to combine departments dedicated to employment, social housing, education, and support to disadvantaged families, to design an integrated service, which supports citizens and families at risk of losing their home, by making them economically active. The experimentation allowed 20 employees from different divisions of the Municipality of Turin to take part for 4 months (December 2016 - March 2017) in a service co-design loop, structured in four phases that overlap an experiential learning loop (Owen, 2007; Beckman & Barry, 2007): i) analysis of the problem; ii) problem reframing and envisioning of new solutions; iii) service co-design; and iv) prototyping/experimenting.

The main outcome of the experimentation was a new, integrated service called “TO-HOME”, in which employees from the housing, employment and social care departments could collaborate and work together on social service delivery with increased awareness of the needs and perspectives of their users. The aim of the service is to create a “one-stop-shop” for vulnerable groups at risk of eviction by integrating the knowledge and experience of different departments tackling different facets of the same problem, often starting with the loss of employment. The new service allows for new relationships and collaborations to emerge within the Municipality (between employees from different departments) and with external actors coming from the third sector, civil society or the private sector, who are also involved in the same space. This allows for a new network of actors from across agencies and sectors to form and build experience and knowledge around the problem.

5 Critical Issues and Reflections

The analysis of the experimentation, conducted through the case study methodology, shed light on a few critical issues connected with the embedding of service design knowledge and processes in the culture of a public organisation. The first issue of which is the difficulty of the employees to assume the point of view of the end users as an alternative perspective from which to analyse the current services and design new ones. In our perspective, the deep knowledge of the existing procedures and constraints acted as a barrier, which made the participants very adept at identifying organisational or systemic constraints (e.g. budget and other required resources, service governance, legal framework, etc.), but at the same time quite unable to find ways of spotting alternative solutions by adopting a more user-centric attitude.

A second issue that clearly emerged, whose solution was indeed one of the objectives of the experimentation, is the employees' difficulty in overcoming internal resistance to change and barriers bound to the current organisational structure, based on a divisional model that harks back to the idea of creating efficiency through specialisation. This model is actually quite typical not only in public administrations, but also in all those situations where efficiency and the exploitation of existing resources tend to prevail over exploration and the creation of new knowledge within the organisation (March, 1991). In this respect, introducing service co-design processes has been a way to foster organisational transformation (Sangiorgi, 2011), combining the exploitation of internal knowledge and vertical competences with cross-sectoral cooperation. In our view, this strongly confirms the idea that the co-design approach is not only a matter of introducing a user-centred perspective, but also a wider human-centred one, which recognises the importance of employees as resources to be valorised in service design (Deserti & Rizzo, 2011).

A third issue faced during the experimentation is the difficulty of the employees to reconnect the design of the new service with its real implementation. In particular, during the design of the service blueprint we observed that the participants were unable to come up with effective solutions to four main problems, which could ultimately affect the delivery of the new service:

- how to individualise the competences of the operators that should deliver the new service;
- how to make the service visible and how to communicate it to the end users;
- how to obtain the availability of enough houses to accommodate fragile families; and
- how to engage the users of the services in co-production mechanisms.

A coherent explanation of the difficulty to bridge ideation and implementation of new services could be linked with the policy of outsourcing service implementation and delivery to intermediaries. Extensive externalisation of the delivery of services may actually prevent an organisation from learning from the interaction with users, and better designing new services.

6 Conclusions

Despite the issues mentioned above, the co-design process did see positive developments beyond the creation of the new integrated service. The process allowed for new relationships to be formed and an awareness to be created around the responsibilities and tasks of other departments. The frequent interaction over the four-month period of time also allowed for repetitive interactions, fostering a collaborative spirit around the project. However, if these innovative projects want to go beyond experimentation and create organizational change, the issues explored above must be addressed. These problems are in fact symptoms of a wider cultural problem that hinders innovation in the public sector and is a product of current patterns of operation.

While co-design offers potential opportunities for breaking down these barriers by introducing civil servants to new tools and methods, more work needs to be done to connect the different actors of the service network, particularly the users. Joint collaboration of citizens in service design in both the planning and production could lead to more citizen-centered services. This confirms what is found in literature regarding designing ‘with’ rather than ‘for’ citizens (Junginger, 2014) and is what was missing in the Turin experimentation. Lastly, moving beyond design thinking as an independent process and focusing also on the system of knowledge, competences and skills needed to develop services, embedding a culture of design (Deserti & Rizzo, 2014) in the network of actors could offer more promise in transforming public sector organizations and instilling a culture of experimentation. Further research and experimentation should be done in this direction.

References

- Anand, V., Glick, W.H., & Manz, C.C. (2002). Thriving on the knowledge of outsiders: Tapping organizational social capital. *Academy of Management Executive*, 16(1), 87-101.
- Archer, B. (1979). Design as a Discipline. *Design Studies*, 1(1), 17-20.
- Barrett, M., Cappleman, S., Shoib, G. & Walsham, G. (2004). Learning in knowledge communities: Managing technology and context. *European Management Journal*, 22(1), 1-11.
- Bason, C. (2010). *Leading public sector innovation: Co-creating for a better society*. Policy Press.
- Beckman, S.L. & Barry, M. (2007). Innovation as a Learning Process: Embedding Design Thinking. *California Management Review*, 50(1), 25-56.
- Blackler, F. (1995). Knowledge, knowledge work and organizations: an overview and interpretation. *Organization Studies*, 16(6), 1021-46.
- Blackler, F., Crump, N. & McDonald, S. (2000). Organizing processes in complex activity networks. *Organization*, 7(2), 277-300.
- Brown, T. (2009). *Change by Design*. New York: HarperCollins.
- Brown, T. & Wyatt, J. (2010). Design Thinking for Social Innovation, *Stanford Social Innovation Review*, Winter, 2010.
- Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues*, (8)2, 5-21.
- Creswell, J.W. (2013) *Qualitative Inquiry & Research Design: Choosing Among Five Approaches*. Third Edition. Thousand Oaks, CA: Sage.

- Cohen, W. M. & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128-152.
- Cohendet, P., Kern, F., Mehmanpazir, B. & Munier, F. (1999). Knowledge co-ordination, competence creation and integrated networks in globalised firms. *Cambridge Journal of Economics*, 3, 225-41.
- Cross, N. (1982). Designery Ways of Knowing. *Design Studies*, 3(4), 221-27.
- Crossan, M., Lane, H. & White, R. (1999). An organizational learning framework: from intuition to institution. *Academy of Management Review*, 24(3), 522-37.
- Daft, R. & Lewin, A. (1993). Where are the Theories for the "New" Organizational Forms? An Editorial Essay. *Organization Science*, (4)4, i-vi.
- Deserti, A. & Rizzo, F. (2011). *Co-designing with Companies*. Paper presented at the IASDR 2011 Conference, Delft.
- Deserti, A. & Rizzo, F. (2014). Design and Organizational Change in the Public Sector. *Design Management Journal*, 9(1), 85-97.
- Deserti, A. & Rizzo, F. (2015). Design and Organizational Change in the Public Sector. *Design Management Institute Journal*, (9)1, 85-97. <https://doi.org/10.1111/dmj.12013>
- Eggers, W., & Muoio, A. (2015). Wicked Opportunities. In Deloitte (Ed.). *Business Ecosystems Come of Age* (pp. 31-37). Deloitte University Press.
- Elsbach, K. D., & Stigliani, I. (2018). Design Thinking and Organizational Culture: A Review and Framework for Future Research. *Journal of Management*, 44(6), 2274-2306.
- Junginger, S. (2014). *Design Legacies: Why service designers are not able to embed design in the organization*. 164-172.
- Kaneko, I., & Imai, K. (1987). A network view of the firm. Paper presented at 1st Hitotsubashi-Stanford conference.
- King, G., Keohane, R.O., & Verba, S. (1994). *Designing Social Inquiry: Scientific Inference in Qualitative Research*. Princeton: University Press.
- Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs: Prentice Hall.
- Kolko, J. (2012). *Wicked Problems: Problems Worth Solving*. Austin: Austin Center for Design.
- Lave, J. & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- March, J. G. (1991). Exploration and Exploitation in Organizational Learning. *Organization Science*, 2(1), 71-87.
- Markus, M.L., Manville, B. & Agres, C.E. (2000). What makes a virtual organization work? *Sloan Management Review*, (Fall), 13-26.
- Martin, R. L. (2009). *The Design of Business: Why design thinking is the next competitive advantage*. Boston: Harvard Business Press.
- Nonaka, I. (1991). The knowledge creating company. *Harvard Business Review*, (Nov-Dec), 96-104.
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14-37.
- Owen, C. (1998). Design Research: Building the Knowledge Base. *Design Studies*, 19(1), 9-20.
- Owen, C. (2007). Design Thinking: Notes on its Nature and Use. *Design Research Quarterly*, 3(1), 16-27.
- Polanyi, M. (1966). *The tacit dimension*. London, UK: Routledge & Kegan Paul.
- Powell, W. (1990). Neither Market nor Hierarchy: Network Forms of Organization. *Organizational Behavior*, (12), 295-336.

- Rizzo, F., Deserti, A. & Cobanli, O. (2017). Introducing Design Thinking in Social Innovation and in the Public Sector: A Design-Based Learning Framework. *European Public & Social Innovation Review*, (2)1, 127-143.
- Sanders, E. B.-N. & Stappers, P.J. (2008). Co-creation and the new landscapes of design. *CoDesign*, (4)1, 5-18.
- Sangiorgi, D. (2011). Transformative services and transformation design. *International Journal of Design*, 5(2), 29-40.
- Senge P. M. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Doubleday Currency.
- Tönurist, P., Kattel, R., & Lember, V. (2017). Innovation labs in the public sector: what they are and what they do?. *Public Management Review*, 19(10), 1455-1479.
- Thompson, M. & Walsham, G. (2004). Placing knowledge management in context. *Journal of Management Studies*, 41(5), pp. 725-747.
- Tsoukas, H. (2003). Do we really understand tacit knowledge? In M. Easterby-Smith & M.A. Lyles (Eds.), *The Blackwell handbook of organizational learning and knowledge management* (pp. 410-427). Oxford, UK: Blackwell Publishing.
- Walsham, G. (2005). Knowledge Management Systems: Representation and Communication in Context. *Systems, Signs & Actions*, (1)1, 6-18.
- Wenger, E. (1998). *Communities of practice: Learning, meaning and identity*. Cambridge University Press, Cambridge, UK.
- Yin, R.K. (2009.) *Case Study Research: Design and Methods* (4th ed.). Thousand Oaks, CA: Sage Publications.

Knowledge as a Commons: the Contribution of Higher Education

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Abstract

Technology transfer is one of the three dimensions of the university's third mission, described as a process that allows an effective exchange of knowledge from the producer to the user. Indeed, while at the beginning of their existence universities were not concerned with social and economic issues, today they are completely involved in the development of society.

In this sense, Italian higher education institutions are now exploiting several instruments, in order to better connect themselves to their internal and external stakeholders, as well as to contribute to the common good.

The aim of this paper is to assess if and how this trend is part of the strategic planning process of each institution and of the national university system as a whole. To do so, this paper will analyze the mission statements disclosed by the 97 Italian universities, in order to individuate what values they communicate, as well as to evaluate their interest in transferring research results for social development.

The findings suggest that in about one-third of the institutions analyzed, this "new" role seems to be their primary task and it's regarded as a means to better address the traditional missions of teaching and research. This is especially true for state universities, while non-state universities appears to be more focused only on teaching activities.

Future research will aim at identifying whether there is a correspondence between what is officially declared and the actual engagement of the institutions to the development and enhancement of the common good.

Keywords – University, Knowledge, Technology Transfer, Social Development.

Paper type – Academic Research Paper

1 Introduction

In a time when higher education institutions, previously perceived as “ivory towers” (Etzkowitz, 1998), are called to share the results of their research with the society, knowledge transfer can represent one of the activities or instruments through which universities can contribute to social and economic development. Indeed, even if universities are commonly accepted as generators of knowledge, they have changed their role over the past years and now they appear more engaged and connected with the society.

In this sense, knowledge transfer is one of the three dimensions of the universities’ third mission, seen as an exchange of knowledge between academia and other actors, both public and private, in order to provide solutions to societal issues. It also represents an opportunity for universities, that start to open themselves to community and to perceive the results of their research as “marketable products” (Power and McDougall, 2005). According to Clark (1998), higher education institutions start to act in an “entrepreneurial” way and to appear more business-like, by adopting a strategic behavior and by building connections with the external environment (society, institutions, the economy). Thus, the third mission underlines universities’ ability to connect themselves with their external environment, to understand social needs and expectations, and to offer appropriate answers, in a continuous interchange. A third mission that, along with teaching and research, seems to summarize this new and wider role for universities.

In this context, where higher education institutions struggle for competitiveness and international visibility, strategic planning becomes crucial. Mission statements represent the starting point in this process, by summarizing the universities’ identity and the objectives that they want to achieve. In this sense, Drucker (1973) sees a mission statement as a vital document for every kind of organization (included universities), that can be used by every institution in order to distinguish itself from competitors. Commonly, a university’s mission statement is based on the three basic university’s functions, but there are several factors that can influence the content of these official declarations, represented by the influence and the expectations of governments and markets, or the historical and cultural background of the specific institution.

Based on these premises, this paper answers the following research questions: do Italian higher education institutions disclose their mission statements? Does their content reflect the new role of universities in knowledge transfer and sharing?

This work is structured as follows. In Section 2, an extended literature review on knowledge transfer and strategic planning in higher education institutions is provided. In Section 3, the methodology adopted in examining results is described. Findings are reported in Section 4. Finally, Section 5 is dedicated to Conclusions.

2 A wider role for universities: a literature review

In a context where education is perceived as one of the solution to many of today's problems, universities, with the results of their activities, are able to influence the economic wellbeing and the innovative potential of society.

In this sense, knowledge transfer is seen as the activity that allows an effective exchange of knowledge from the producer to the user (Wellsandt and Thoben, 2016). In the academic literature, this topic has been studied from different points of view. Gibson and Rogers (1994) focus on the process of "technology transfer", explained as the application of information (in the form of a technological innovation) into use, without considering its relationship dimension. On the other side, according to Feller *et al.* (1987), research and technology transfer represents a set of interactive relationships, able to connect basic or disciplinary research, applied research, development, diffusion, adaptation, and dissemination, by converging into an overall technology delivery system. Levin (1993) considers technology transfer as a socio-technical learning and development process, by adding a social dimension to the definition. Power and McDougall (2005) show the marketable aspects of technology transfer, seen as that process through which the new technologies introduced by universities start to be commercialized. Finally, Gibbons *et al.* (1994) explain an innovative way to intend the knowledge exchange, represented by a transition from "Mode 1" to "Mode 2": from a traditional science with no immediate outcomes for society (Mode 1), knowledge production would be represented by a system open to those who use such science (Mode 2). So, while teaching and research allow to preserve, create, apply, and disseminate knowledge, knowledge transfer belongs to the new role of university and refers to its transfer and application to the community (UNESCO Workshop, 2007).

In a knowledge-based society, universities are called to become more "entrepreneurial", to act as a natural incubator in order to transform ideas into social and economic entrepreneurial initiatives (Kirby *et al.*, 2011). They have re-conceptualized their role and now appear as important institutional actors in order to generate new value in a regional or national context (Mowery and Sampat, 2005). This is in line with the Triple Helix Model, introduced by Etzkowitz and Leydesdorff (1995), that recognizes a primary and innovative role of universities in a knowledge-based society.

Thus, the role of universities has evolved over time and Uyarra (2010) identifies five different models to explain this evolution. At the beginning, universities were seen as playing a "knowledge factory" role (Youtihe and Shapire, 2008), able to transform research inputs into social and economic outputs. Then, around the 1980s, universities were called to look for new opportunities in order to face reductions in public funds and support their research; in this sense, linkages with corporations became very important for both, the academic and the economic system (Géiger and Sà, 2008). The model of "entrepreneurial university" (Etzkowitz, 2000; Clark, 2001; Siegel *et al.*, 2007), instead, underlines the institutionalization of technology transfer in universities. Then, other and more recent approaches emphasize the role of universities in networks with firms and other kinds of organizations (Braczyk *et al.*, 1998; Koschatzky and Sternberg, 2000;

Asheim and Coenen, 2005). The impact generated by universities in a specific context would depend on their abilities to mobilize stakeholders for innovation; in this sense, they would play a wider role, that goes beyond the simple capitalization and dissemination of knowledge (Gunasekara, 2006).

Finally, in order to describe the new and more adaptive role for universities, Chatterton and Goddard (2000) use the term “engaged university”, by analyzing their official declarations. According to them, an engaged university declares, in its mission, a specific interest in the regional context, with the aim of building coalitions with state and non-state actors. The adaptation would refer to the university’s ability of considering regional needs and providing a response; thus, higher education institutions would contribute to the social, cultural and environmental development. There are several barriers to the effectiveness of this university engagement, that could be represented by inadequate funding and incentives to research, or the limited capacity of other actors to get involved with higher education (Gunasekara, 2006). In several cases, limitations could regard also the characteristics of universities, such as their age (modern universities are more focused on the social and economic development), their location (newer institutions are more geographically dispersed), and the type and the degree of collaboration (Boucher *et al.*, 2003; Kitagawa, 2004; May and Perry, 2006). In this sense, by considering their mission statements and discourses, universities show different approaches to knowledge transfer, linked to their different levels of interest in contributing to the social and economic development. Indeed, several universities seem fully committed to this new role, others look at this as a complementary part of their mission and others as a small additional activity, separated from their core mission.

When education started to be considered as a public good (Nedbalova *et al.*, 2014), higher education institutions start to develop a strategy, in order to enhance the entrepreneurial mindset and to expand interactions with key stakeholders. In a globalized society, knowledge, research, and innovation are considered the most important resources and universities have to adopt several business practices (Gibbs and Murphy, 2009) and to define the guidelines to follow. In this sense, a mission statement represents an organization’s key document, in which the organization identifies its business objectives, its values, its long term objectives, the essential business activities, and the features in order to be distinguished from its competitors (Drucker, 1963).

The definition of a mission statement represents a widespread practice also for universities, especially in the United States, while its introduction in European higher education institutions has produced less systematic results.

Historically, universities were expected to serve three different missions: teaching, scientific research and a sort of “public service”, the transmission of culture, in order to foster the development of society (Perkins, 1972; Scott, 2006; Montesinos *et al.*, 2008).

Different authors have explored the content of universities’ mission statements, by identifying declarations about their status and market position, their intention or their leadership style (Mackay *et al.*, 1995; Davies and Glaister, 1996). Connell and Galasinski (1998), instead, aim to understand how universities’ statements could represent a paradigm change in their intentions, by adopting a more “business-like” perspective.

The impact exercised by the government and the market could influence the content of mission statements (James and Huisman, 2009), but also the history (Davies and Glaister, 1996; Kuenssberg 2011; Ozdem, 2011; Kosmutzky and Krucken, 2015; Oertel and Soll, 2017; Seeber *et al.*, 2017) and its cultural background (Efe and Ozer, 2015) could influence the essence of universities' activities.

In Germany there are several and notable studies focused on the content of universities official declarations (Hladchenko, 2013; Kosmutzky and Krucken, 2015; Jungblut and Jungblut, 2017). Less studies on this topic have been done about the Irish context (Lillisa and Lynch, 2014), the Ukrainian one (Hladchenko, 2016), and the Spanish one (Palomeras Montero *et al.*, 2012). In Italy the only studies about the university's mission content are from Giusepponi and Tavoletti (2015).

3 Methodology

As previously mentioned, the aim of this work is, first of all, to analyze the extent to which Italian higher education institutions declare in their official documents their mission statements; then, to examine their content; finally, to investigate whether mission statements include considerations on the "new" role of universities with regards to knowledge transfer and sharing.

To do so, the research was focused on the Italian university system, which comprises 97 higher education institutions. Among these, 67 are state universities and 30 are non-state universities. The term "non-state" does not mean "private": indeed, among the 30 non-state universities, 8 do not belong to the State but to other public entities, while the other 22 are effectively "private". Among the non-state institutions, 3 are characterized by a religious orientation, while 11 are online universities.

Data collection on universities' mission statements was realized between January and March 2019, mainly from the institution's strategic plan or statute, but also from the official website. For most institutions, the mission is included in a specific section of the strategic plan, while in a few cases the mission statement is not disclosed in any document.

Mission statements are used to show the reason for the university's existence, by answering to questions such as "Who are we?"; "What we do?"; and "Why are we here?". Several authors have studied the content of these statements by following different qualitative approaches. The first were Mackay, Scott and Smitt (1995), who combined a discourse analysis approach (Faucault, 1982) with a document-based case studies method (Yin, 2003), in order to examine the 101 official declarations of the German universities. Lillisa and Lynch (2014) adopted a documentary analysis approach, based on the strategic plans and the institutional review reports, combined with interviews with senior managers in charge with strategic planning, in order to define the current situation about strategic planning in the Irish education system. With regards to the Italian context, Giusepponi and Tavoletti (2015) studied the strategic orientation of higher education institutions by conducting interviews.

It was decided to adopt the same approach used by Arias-Coello *et al.* (2018), who performed a documentary analysis with specific reference to the Spanish context, based on the following steps. Firstly, the research aims to individuate the major purposes included in mission statements (teaching, research and third mission) and focus on the specific messages related to the knowledge transfer dimension. At the end, findings will be interpreted through a qualitative method.

4 Preliminary Findings

In the sample, composed of 97 institutions, 21 do not disclose a specific and official mission statement. Their intentions and objectives emerge from what they are used to sharing through their strategic plans, their websites or other means of communication, such as the statute, interviews or the declaration of a vision statement. In particular, we can note that 8 Italian universities share their intentions through their strategic plans, without mentioning the word “mission”; they are all state universities, except one. Then, another 5 universities use their statutes in order to communicate what we consider as their mission (all of them are state universities); only 4 universities identify their activities by exploiting their websites and they are all non-state universities. Only one university (non-state) discloses its mission through a declaration of its Dean, reported in the website; in only one university we cannot find, neither directly nor indirectly, any reference to its strategic orientation in terms of mission. Another university does not declare anything, but every department shows its specific mission in its website; another non-state university discloses its objectives in the performance plan; finally, only another university reports its mission in the vision statement.

All the mission statements can be compared on the basis of their different length and the scope declared. The shortest declaration counts only five words, while the longest one is about 423 words.

As previously mentioned, the main scope pursued by the Italian institutions are represented by teaching, research and third mission, with some universities declaring their engagement in all the three “tasks”, while others appearing more focused on only one or two of them. Out of all the 97, 25 universities declare to pursue all the three missions. The most of them are state universities, only 4 are non-state universities.

For 33 institutions, instead, the third mission is considered as the priority role that any university has to play in the society. Almost all of the institutions in this category are characterized by being state universities, with only 2 non-state universities. The engagement in third mission, for 17 of them, is declined in conducting technology/knowledge transfer activities; their aim is to contribute to the social and economic development by sharing the results of their research and this is also written in their mission statements. The other ones are focused on the third mission, without directly referring to the knowledge transfer, but in a wider manner: they want to offer help to society by “fostering the social wellbeing”, or the “civil and economic development”, by “playing as a social operator”, by “building linkages with the external environment”, by

considering teaching and research as “means in order to achieve a knowledge-based society”.

10 universities, according to the tradition, continue to consider teaching as their first and principal mission; 6 of them are non-state universities and this leads to the consideration that there could be a correlation between the public nature of university and its interest in social and economic progress. Some of them underline their effort in order to ensure lifelong learning and distance learning experiences for their students, by exploiting new technology devices. One of them is focused on a specific target, by offering lifelong learning experiences only to teachers.

Then, there is one institutions that bases its mission on teaching, but, at the same time, shows its interest in technology transfer activities (patents, start-ups, and spin-offs). Another 3 universities, instead, present themselves as online universities, they are all non-state universities, with the aim of facilitating the access to education for their students.

14 are the institutions that declare their engagement in the two missions of teaching and research, without including third mission references in their official statements. Out of them, 7 are non-state universities and 1 is engaged in providing postgraduate education.

3 institutions exploit their missions in order to identify and present themselves, by introducing their nature and their history or the values through which they intend to operate.

Only 2 universities declare a pursuit of an international vocation in carrying out their activities of teaching, research, and integration with community.

The Catholic University inserts “religious messages” in its mission: Christianity is shown as a means to solve societal issues. There is another one university that distinguishes itself from the competitors by focusing its efforts on teaching and research activities, even if only in the sports field. Finally, there are other two universities with a peculiar mission: one of them, characterized as a state university, declares its engagement in teaching, research and building linkages with external actors, with a specific interest in wellbeing, for citizens and for the ecosystem; the last one, instead, is a higher education school and declares, through its mission, an attention to the international PhD students and to the social and economic development.

5 Conclusions

In a context where higher education institutions are commonly accepted as playing a teaching role, they have been called to take into account of other two missions, represented by the research activity and a sort of engagement in society, known as the third mission (Uyarra, 2010).

According to this new third mission perspective, universities, traditionally concerned with addressing the results of their research only to an élite of people, started to perceive their activities as being useful for the society, capable of providing solutions to common issues and fostering economic and social growth. In this sense, knowledge creation is not enough, but universities have to transfer and share this new knowledge. In several cases

they also started to commercialize their “outputs”, by operating in an “entrepreneurial” way (Etzkowitz, 2000; Clark, 2001; Siegel *et al.*, 2007). In order to cope with these new challenges, higher education institutions need a strategic orientation, by defining and communicating their mission statements.

After an extended literature review on knowledge transfer and the adoption of strategy in higher education, the aim of this study was to conduct a documentary analysis on the content of the Italian universities’ official mission declarations, in relation to understand the role they played in the society, by individuating their actual interest in knowledge transfer.

The analysis was not easy, as the aim was to retrace all the Italian universities’ declarations in terms of mission, but also to exploit several sources: some of them communicate their intentions and objectives in their strategic plans (not necessary in a specific section identified as “mission”), others in their statutes or performance plans, while others prefer to exploit their official websites. Two of them, instead, had decided not to communicate anything about their activities.

On the basis of available information, the research findings suggest that about the 33% of the Italian universities considers third mission as the primary task to assume: it seems more important than teaching and research, considered as a means to realize it. In particular, in the sample of 97 institutions, results showed that 17 universities were engaged in knowledge transfer activities, by directly sharing this interest in their mission declarations.

The Italian higher education system is characterized by the presence of state and non-state universities: the research can conclude that the public nature of the institution suggests a deeper interest in third mission (in all its manifestations), while non-state universities result more focused only on teaching activities. The practical implication of this work concerns the importance of stimulating a new conception of knowledge, seen as a powerful good, a commons, for social development.

Limitations concern the preliminary work, based on what is disclosed by Italian higher education institutions. It requires further research, aimed at verifying a correspondence between what universities are used to communicate and how they actually operate in the society. In this sense, the engagement in third mission could be exploited by higher education institutions only to improve their visibility and their position in international rankings. In terms of future perspectives, the aim will be to identify best practices in order to ensure first a significant correlation between universities declarations and their activities, then an effective contribution (in terms of knowledge transfer) for social, cultural and economic development.

References

- Arias-Coello, A., Simon-Martin, J., Sanchez-Molero, J.L.G. (2018), “Mission statements in Spanish universities”, *Studies in Higher Education*.
- Asheim, B.T., Coenen, L., (2005), “Knowledge bases and regional innovation systems: Comparing Nordic clusters”, *Research Policy*, 34, 8: 1173-1190.

- Boucher, G., Conway, C., Van Der Meer, E., (2003), "Tiers of engagement by universities in their region's development", *Regional Studies*, 37, 9: 887-897.
- Braczyk, H. J., Cooke, P.N., Heidenreich, M., (1998), *Regional Innovation Systems: The Role of Governance in a Globalized World*, London, Routledge.
- Chatterton, P., Goddard, J., (2000), "The response of higher education institutions to regional needs", *European Journal of Education*, 35, 4: 475-496.
- Clark, B., (2001), "The entrepreneurial university: New foundations for collegiality, autonomy, and achievement", *Higher Education Management*, 13, 2: 9-24.
- Clark, B.R., (1998), "The Entrepreneurial University: Demand and Response", *Tertiary Education and Management*.
- Connell, I., Galasinski, D., (1998), "Academic Mission Statements: An Exercise in Negotiation: *Discourse & Society*, 9,4_ 457-479.
- Davies, S.W., Glaister, K.W., (1996), "Spurs to Higher Things? Mission Statements of UK Universities", *Higher Education Quarterly*, 50,4: 261-294.
- Drucker, P.F., (1973), *Management: Task, Responsibilities, Practices*, New York.
- Efe, I., Ozer, O., (2015), "A Corpus-Based Discourse Analysis of the Vision and Mission Statements of Universities in Turkey", *Higher Education Research & Development*, 34, 6: 1110-1122.
- Etzkowitz, H., (2000), "The future of the university and the university of the future: Evolution of ivory tower to entrepreneurial paradigm", *Research Policy*, 29, 2: 313-330.
- Etzkowitz, H., Leydesdorff, L., (1995), "The Triple Helix –university-industry-government relations: a laboratory for knowledge-based economic development", *EEAST Review*.
- Feller, I., Madden, P., Kaltreider, L., Moore, D., Sims, L., (1987), "The new agricultural and technology transfer policy agenda", *Research Policy*.
- Foucault, M., (1982), "The Archaeology of Knowledge", New York, Pantheon Books.
- Geiger, R. L., Sà, C.M., (2008), *Tapping the Riches of Science: Universities and the Promise of Economic Growth*, Cambridge, Harvard University Press.
- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., Trow, M., (1994), *The New Production of Knowledge*, Sage.
- Gibbs, P., Murphy, P., (2009), "Implementation of ethical higher education marketing", *Tertiary Education and Management*, 15, 4: 341-354.
- Gibson, D. Rogers, E., (1994), *R&D collaboration on trial: the microelectronics and computer technology consortium*, Harvard Business School Press.
- Giusepponi, K., Tavoletti, E., (2015), "Vision and Mission Statements in Italian Universities: Results of an Empirical Investigation on Strategic Orientation", *Journal of the Knowledge Economy*.
- Goldfarb, J., (1998), *Civility and subversion: The intellectual in democratic society*, Cambridge University Press, New York.
- Guerrero, M., Urbano, D., Cunningham, J., Organ, D., (2012), "Entrepreneurial universities in two European regions: a case study comparison", Springer Science +Business Media New York.
- Gunasekara, C., (2006), "The generative and developmental roles of universities in regional innovation systems", *Science and Public Policy*, 33, 2: 137-150.
- Hladchenko, M., (2013), "Mission Statements – A Component of the Strategic Management of University (on the Example of German Universities)", *New Educational Review*, 31, 1: 229-240.
- Hladchenko, M., (2016), "The Organizational Identity Ukrainian Universities as Claimed Through their Mission Statements", *Tertiary Education and Management*, 22, 4: 376-389.

- Jungblut, J., Jungblut, M., (2017), "All Different? All Equal? Differentiation of Universities's Mission Statements and Excellence Initiatives in Germany", *Science and Public Policy*, 44, 4: 535-545.
- Kerr, C., (1963), *The uses of the university*, Harvard University Press.
- Kirby, D.A., Guerrero, M., Urbano, D., (2011), "The theoretical and empirical side of entrepreneurial universities: An institutional approach", *Canadian Journal of Administrative Science*.
- Kitagawa, F., (2004), "Universities and regional advantage: Higher education and innovation policies in English regions", *European Planning Studies*, 12, 6: 835-852.
- Koschatzky, K., Sternberg, R., (2000), *R&D cooperation in innovation systems – some lessons from the European Regional Innovation Survey (ERIS)*, *European Planning Studies*, 8, 4: 487-501.
- Kosmutzky, A., Krucken, G., (2015), "Sameness and Difference: Analyzing Institutional and Organizational Specificities of Universities Through Mission Statements", *International Studies of Management and Organization*, 45, 2: 137-149.
- Levin (1993), "Technology transfer as a learning and developmental process: an analysis of Norwegian programmes on technology transfer", *Technovation*.
- Lillisa, D., Lynch, M., (2014), "New Challenges for Strategy Development in Irish Higher Education Institutions", *Higher Education Policy*, 27, 2: 279-300.
- Mackay, L., Scott, P., Smith, D., (1995), "Restructured and Differentiated? Institutional Responses to the Changing Environment of UK Higher Education", *Higher Education Management*, 7, 2: 193-203.
- May, T., Perry, B., (2006), "Cities, knowledge and universities: Transformations in the image of the intangible", *Social epistemology*, 20, 3: 259-282.
- Montesinos, P., Carot, J., Martinez, J., Mora, F., (2008), "Third Mission Ranking for World Class Universities: Beyond Teaching and Research", *Higher Education in Europe*, 33, 2/3: 259-271.
- Mowery, D., Sampat, B.N., (2005), "Universities in national innovation systems", in D.C.M. Jan Fagerberg & R.R. Nelson (Eds) *The Oxford Handbook of Innovation* (Oxford University Press).
- Nedbalova, E., Greenacre, L., Shulz, J., (2014), "UK higher education viewed through the marketization and marketing lenses", *Journal of Marketing for Higher Education*, 24, 2:178-195.
- Oertel, S., Soll, M., (2017), "Universities Between Traditional Forces and Modern Demands: the Role of Imprinting on the Missions of German Universities", *Higher Education*, 73: 1-18.
- Onyx, J., (2008), "University-Community Engagement: What does it mean?", *Partnerships/Community*.
- Ozdem, G., (2011), "An Analysis of the Mission and Vision Statements on the Strategic Plans of Higher Education Institutions", *Educational Sciences: Theory and Practice*, 11, 4: 1887-1894.
- Palomeras Montero, D., Aracil, A., Castro Martinez, E., (2012), "Misiones actuales de las universidades publicas: una perspectiva sociologica", *Arbor: Ciencia, Pensamiento y Cultura*, 188, 753: 171-192.
- Perkins, J.A., (1972), "Organization and Functions of the University", *The Journal of Higher Education*, 43, 9: 679-691.
- Power J.B., McDougall, P., (2005), "Policy orientation effects on performance with licensing to start-ups and small companies", *Research Policy*.
- Pucciarelli, F., Kaplan, A., (2016), "Competition and strategy in higher education: Managing complexity and uncertainty", *Business Horizons*, 59: 311-320.

- Scott, M., Barberio, V., Huisman, J., Mampaey, J., (2017), "Factors Affecting the Content of Universities' Mission Statement: an Analysis of the United Kingdom Higher Education System", *Studies in Higher Education*.
- Seeber, M., Barberio, V., Huisman, J., Mampaey, J., (2017), "Factors Affecting the Content of Universities' Mission Statements: an Analysis of the United Kingdom Higher Education System", *Studies in Higher Education*.
- Siegel, D.S., Wright, M., Lockett, A., (2007), "The rise of entrepreneurial activity at universities: Organizational and societal implications", *Industrial and Corporate Change*, 16, 4: 489-504.
- Uyarra, E., (2010), "Conceptualizing the Regional roles of Universities, Implications and contradictions", *European Planning Studies*.
- Wellsandt, S., Thoben, K.D., (2016), "Approach to describe knowledge sharing between producer and user", *Science Direct*.
- Yin, R.K., (2003), "Case study Research, Design and Methods", Thousand Oaks, Sage.
- Youthie, J., Shapira, P., (2008), "Building an innovation hub: A case study of the transformation of university roles in regional technological and economic development", *Research Policy*, 37, 8: 1188-1204.

Access to Healthcare as a New Commons: Telemedicine as a Strategy for Providing Value-Based Healthcare Services in Rural Areas

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Abstract

Commons is a general term that refers to a resource shared by a group of people. Over the years scholars have identified two generations of commons. The first generation of commons was about sharing of physical things; the second one is about intangible commons pool resources such as science and culture. These generally can be recognized as "rights" (Hess 2008). Among the various New Commons sectors there is medical and health. In the perspective of guaranteeing the right of Health, the "Access to Healthcare" could be considered as a New Commons provided by worldwide National Healthcare Systems (NHS).

However, healthcare sector is characterised by plenty of stakeholders with myriad, often, conflicting goals. The value-based approach (Porte, 2010) attempts to introduce a new universal language in healthcare management around the value for the patient that reconcile all stakeholders' interest. The goal of this approach is to improve the outcome and increase the number of treatments. This aim is very difficult to be enriched for rural residents; when patients live in remote areas, providing them with valuable medical care can be considered a hard challenge for the NHS, which has to be addressed also by the employment of new healthcare strategies and technologies.

Defined as "a new healthcare delivery process provided when patient and professional are not physically in the same place" (Italian Ministry of Health, 2014), telemedicine could be seen as an answer to this challenge.

Accordingly, this study aims at discovering if telemedicine employment can be effectively considered as a successful strategy to improve healthcare in location far from specialized hospital, enhancing the New Commons "Access to care".

A statistical-based narrative review of the literature was conducted in the field of telemedicine, with the aim to understand which experiences of telemedicine applications have got successful results as support of healthcare delivering in rural locations.

With regards to rural and remote areas, several Authors recognized telemedicine-based strategies as a method to facilitate the access to healthcare in different medical disciplines. In particular, many studies highlight that telemedicine improves patient care by increasing the capacity of the rural clinician to manage patient locally, minimising time away to support networks and reducing unnecessary transfers. Telemedicine could also be considered a cost-effective method whose outcomes remain similar (if not better) in quality to "staffed" services, whose infrastructural costs could be easily paid-back.

Keywords – Commons, Access to Healthcare, Telemedicine, Value-based Healthcare, Rural Areas.

Paper type – Academic Research Paper

1 Introduction

Commons are recognized as the cultural and natural resources accessible to all members of society. From physical and social dimensions, categories of commons have expanded to immaterial objects such as knowledge, intellectual property and software, namely New Commons (NC) (Hess 2008), which generally can be recognized as "rights".

In this perspective, guaranteeing the right of "Access to Healthcare to the population could be considered as a NC provided by worldwide National Healthcare Systems (NHS), "In any field, improving performance and accountability depends on having a shared goal that unites the interest and activities of all stakeholders" (Porter 2010, p. 2477); coherently, the rise of New Public Governance emphasizes the relevance of service processes toward the achievement of ever better outcomes, based on the improvement of inter-organisational relationships and the governance of processes (Osborne, 2006). Therefore, public sector has been affected by a higher necessity to identify innovative managerial and operational models aimed at public Value Creation.

In Healthcare, value is defined as the health outcome achieved per dollar spent. The measure of value encompasses all services and activities that contribute to determine the capability to meet patients' needs; however, this is still often unmeasured and misunderstood. Thus, there is an ever-higher need for healthcare strategies that could support not only the provision of the service but also the assessment of its value around the patient.

The value created for patients is usually measured for group of people with similar needs (medical condition, epidemiology, comorbidity). Therefore, what happens when patients share the geographical condition of living in a rural area? Delivering valuable healthcare in rural areas (du Toit, 2017, Moffat and Eley, 2010) is one of the higher challenges of NHS, and to get this goal, a possible strategy is the employment of

telemedicine infrastructure. Telemedicine is defined as "a new healthcare delivery process provided when patient and professional are not physically in the same place" (Italian Ministry of Health 2014). Based on ICT infrastructure, "it brings a safe biomedical data & information transmission in the form of texts, sounds, images, or other forms necessary for prevention, diagnosis, treatment and follow-up of patients" (Italian Ministry of Health 2014).

Starting from these preconditions, the challenge of this paper is to understand how telemedicine approaches enhance the New Commons of "Access to Healthcare" in rural areas, in coherence with the creation of Value in Health principals.

To achieve its purpose, this paper follows this outline: after this brief introduction, the second section reports a background addressed to the issues of commons, new commons, and their relationship with telemedicine in the lens of value-based healthcare principles; the third section explains the methodology used in this study. The fourth presents findings of the inquiry. The last section discusses results obtained and provides some consideration about the employment of telemedicine as an effective strategy for enhancing access to healthcare in remote locations.

2 Background

Commons is a general term that refers to a resource shared by a group of people. In a common, the resource could be both small and serve a tiny group and it can be community-level or it can extend to international and global level (Hess, Ostrom 2007).

Accordingly, commons are recognized as the cultural and natural resources accessible to all members of society. Held in common and not owned privately, these resources could be managed for individual and collective benefit from groups of people (communities, user groups) (Ostrom 1999, Basu et al. 2017). Commons analysts have found it suitable to distinguish between a common as a resource or resource system and a commons as a property-rights regime (Hess Ostrom 2007) In particular, over the years scholars have identified two generations of commons. The first generation of commons was about sharing of physical things as natural resources (e.g. forester, fisheries, grazing pastures etc.). The second generation is about intangible commons pool resources such as science and culture. Particularly due to a second generation of commons studies the categories of commons have extended to immaterial object such as knowledge, intellectual property and software, namely New Commons (NC) (Hess 2008). These generally can be recognized as "rights". For these reasons, analysing the new commons it is more difficult because it means analysing commons based on intangible 'ideas' rather than commons of tangible 'things' (first generation of commons) (Allen et al 2016). However, the "new commons" alternative is interesting both because of its distributional implications and because of its potential for raising the rate of innovation and value creation. Moreover, the new commons pay specific attention to the right to "distribute" than the right to "exclude". However, the previous commons shared property rights and they do not create a problem of overuse (Evans 2005). There are many different ways that new commons evolve or come into being. Some of them evolve from new technologies that have enabled the capture of previously uncapturable public goods, such as the

Internet, genetic data, outer space, deep seas, and the electromagnetic spectrum (Hesse 2008). Hesse (2008) identified the various new commons sectors, sub-sectors, and representative collective-action communities involved in new commons. One of these sectors is medical and health. In this field, referring to commons and to the right to distribution means referring to the access to healthcare that is the right to access to all medical services and sanitation. Access to health care should be universal, guaranteed for all on an equitable basis.

Healthcare should be affordable and comprehensive for everyone, and physically accessible where and when needed. Accordingly, if the new commons are related to the right of distribution and not to the right of exclusion, improve access to healthcare means improve a new common. Therefore, in the perspective of guaranteeing the right of Health to the population by worldwide National Healthcare Systems (NHS), the “Access to Healthcare” could be considered as a New Commons.

In order to manage complexity of healthcare field, a deep analysis of stakeholder involvement within the different processes performed is requested. This sector, indeed, is characterised by plenty of stakeholders with countless and often conflicting goals. In particular, as underlined by Porter in 2010, the lack of clarity about shared goals was the main reason of slowing down the performance improvement process in healthcare; moreover, the constant growth of the population's health needs has requested a more “patient-oriented” healthcare management. Hence, both for public and private healthcare providers, the traditional approach focused on staff needs over users’ needs becomes no longer acceptable (Fulop et al. 2003).

Value based healthcare represents an advancement of the Total Quality Management (TQM). This is aimed to enhance performance by increasing the quality of services (Deming, 1994). In order to face limitations for patients about choice and access to care (Porter and Teisberg, 2004) caused by financial restrictions, value-based healthcare principles were introduced by Porter and Teisberg in 2006 in United States. Authors’ goal was to introduce an “universal language” for healthcare management, designed around the value for the patient.

Starting from previous theories (Porter, 1991; Porter, 1997), value-based logic has involved an intellectual change: shifting from a healthcare based on volume and intensity of services, to a “patient-centric” healthcare based on value created for the consumer of services. This logic has a two fold aim: improving the outcome and increasing the number of treatments. However, to be practically feasible, this approach implicates a radical modification of the traditional paradigm of healthcare: moving from a vertical “organizational-centric” approach in treating diseases, to a horizontal one tailored on the patient expectations. Thus, this implicates that management should move the attention on process of cares rather than on operational structure.

Therefore, distinguished by similar primary care needs (Kaplan and Porter, 2011), the patient population becomes the unit of analysis of healthcare policy. For the managerial assignments, this implicates the necessity to analyse the omni-comprehensive cycle of cares (Porter, 2010), rather than an individual phase, clinical episode, or single technology for treating diseases.

Accordingly, in the lens of this logic, the concept of Value in Health encompasses all the following variables:

- access to services,
- profitability,
- quality,
- cost,
- safety,
- patient-centeredness,
- patient-satisfaction.

Thus, the achievement of a high value for patients should be the purpose that drives the delivery of healthcare services. Patients, payers, providers, and suppliers can all benefit if the value improve while the economic sustainability of the healthcare system increases (Porter, 2010). Consequently, the achievement of this goal could be considered as the most effective way to gather the interests of all stakeholders involved.

In particular, the Value in Health equation can be expressed as the ratio between outcomes and costs: *outcomes* are multidimensional and related to specific-condition; *cost* refers to the total amount of resource employed for the full cycle of care for the patient's medical condition (and not for the mere individual service). Very often, cost reduction regardless of the outcomes obtained is dangerous and self-defeating; it could lead to false "savings" by limiting effective care for patients (Porter 2010). Accordingly, to reduce cost, the best approach is often to "spend on more service to reduce the need for others" (Porter 2010).

Healthcare delivery in rural and remote areas implicates a choice among two alternative strategies:

- 1) "moving" patients to hospital;
- 2) "moving" hospital to patients.

It is clear that this kind of choice is valid only for those "soft" healthcare services (e.g: diagnosis, monitoring, follow-up, specialized medical consultation, etc), but often the second strategy (patient-centric) is the most effective, also thanks to the availability of new technologies which foster new operational approaches.

Telemedicine is "the use of information and communication technology to provide health care services to individuals who are some distance from the health care provider" (Roine et al, 2001). Many experiences of telemedicine employment have shown improvement of outcomes for patients together with cost containment (Burri et al. 2011; Calò et al. 2013; Hasan and Paul, 2011). One of the major advantages of telemedicine over conventional care is the potential for increased access to medical care for population that experience at level of isolation (eg. prisoner, person working at sea or in war zone) (Norton et al, 1997). Accordingly, many Authors have demonstrated the positive impact of telemedicine strategies in healthcare delivery in remote areas, both for early diagnosis and follow-up. Moffat and Eley, in 2010, have provided literature background with evidences about four areas of benefit of telehealth service for Australian population who live in remote location: i) patients and family, ii) medical provider, iii) participating hospital, iv) society. In particular, this study emphasized that telemedicine strategy could

have a positive impact on two on-going issues: the poorer health status of rural areas, and crisis in the rural health force. In accordance with these endpoints, Du Tuit et al (2017) have showed that a HUB-SPOKES model to delivery healthcare in remote areas is cost-effective. Authors underlined, by a literature review, that the design of healthcare policy based on a clear separation of tasks between high specialized healthcare centre (HUB) and rural clinics (SPOKE), interconnected by telemedicine infrastructures, has excellent impact on the management of rural and remote emergency departments.

Therefore, on the basis of these examples, this study aims at discover if telemedicine employment can be effectively considered as a successful strategy to improve healthcare in location far from specialized hospital, enhancing the New Commons “Access to care”.

3 Methodology

A literature review was conducted in the field of telemedicine in order to understand how this approach improve access to healthcare in rural areas creating value for the patients. Scopus was the database used for conducting the research. The keywords used for the whole inquire are contained in the following table 1.

Table 1 Table 1. Keywords used for the enquiry.

1st Keyword		2nd Keyword
<i>“e-health”</i> or <i>“ehealth”</i> or <i>“telecare”</i> or <i>“telemedicine”</i> or <i>“telehealth”</i> or <i>“telemonitoring”</i> or <i>“telepractice”</i> or <i>“telenursing”</i>	AND	<i>“rural areas”</i> or <i>“rural communities”</i> or <i>“rural population”</i>

Source: Authors’ illustration

Keywords contained in the same column are alternative within them. Papers that containing at least one keyword belonging to each column within title and/or abstract and/or keywords was considered relevant for this study. Other search criteria used to define the selection of papers are the following:

- Language: were selected only studies published in English;
- Document type: were considered only peer-reviewed articles. The other categories of study from Scopus as Conference papers, editorials, book chapters, articles in press, conference proceedings and letters were excluded.

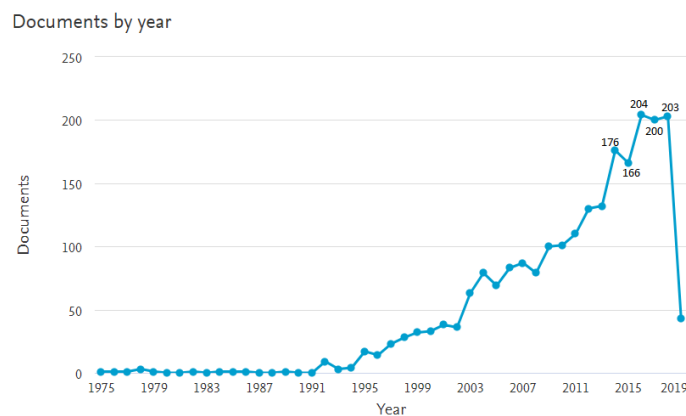
All articles published from 1976 to March 2019 were considered. After the selection of data set a descriptive analysis of final sample was conducted. In particular, there have

been analysed the following dimensions: i) papers/years; ii) journals; iii) countries; iv) research areas.

Moreover, another dataset was defined composed by the twenty most cited papers of the previous sample; then from the application of the snowballing technique, four articles were added. On all these studies, was conducted a conceptual analyses of the papers.

4 Results

At the beginning of the process, 2263 papers were identified; then, by following the search criteria the final sample is composed of 1624 studies. In particular, 1402 are article and 222 literature reviews. The following figure (figure 1) shows the number of Paper per Year, there is a growing interest in the last ten years.



Source: Authors' elaboration from Scopus

Figure 1: Document by years

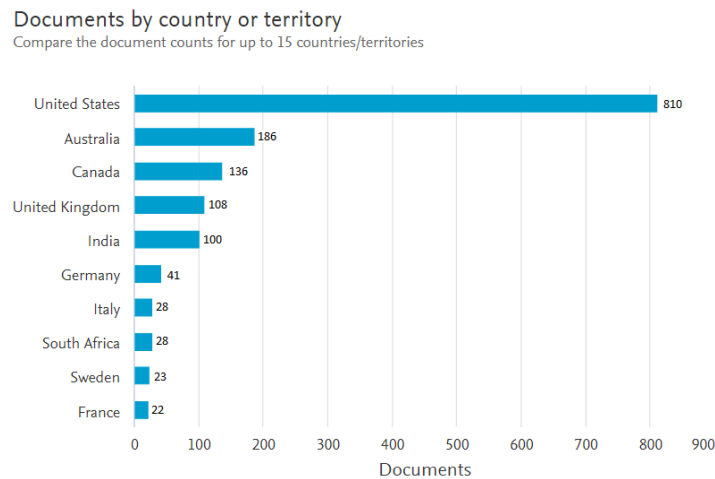
The journal that contained the most studies is Telemedicine and E Health Journal. The figure 2 shows the most relevant journal.

Australian Journal Of Rural Health	13	Telemedicine And E Health	125
Psychiatric Services	12	Journal Of Telemedicine And Telecare	108
Telemedicine Journal	12	Telemedicine Journal And E Health	42
Plos One	11	Journal Of Medical Internet Research	27
Stroke	11	Journal Of Rural Health	25
Internal Medicine Journal	10	Rural And Remote Health	25
International Journal Of Telemedicine And Applications	10	International Journal Of Medical Informatics	18
Journal Of Medical Systems	10	BMC Health Services Research	16
International Journal Of	9		

Source: Authors' elaboration from Scopus

Figure 2: Most productive journal

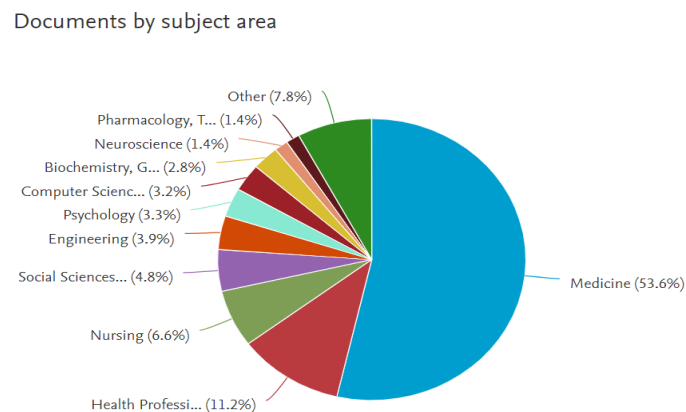
The most productive Countries are shown in Figure 3, the majority of articles are set in United States.



Source: Authors' elaboration from Scopus

Figure 3: Documents by country

Several subject areas are involved. The following figure (figure 4) represents the documents divided by subject area involved.



Source: Authors' elaboration from Scopus

Figure 4: Documents by subject area

After reading of the twenty most cited papers four papers were excluded as they were not considered consistent with the research question of this work. In table 2 all documents considered relevant have been reported. Number of citations lists them. The timeline of papers selected for conceptual analysis is very huge; they are published from 1992 (Preston et al.) to 2017 (du Toit et al.).

Table 2: Most cited papers

PAPER	DISCIPLINE	COUNTRY	TOPIC
1. Wotton et al.	Dermatology	United Kingdom	<i>Comparison of real time telermatology with outpatient dermatology.</i>
2. Audeberg et al.	Neurology	Germany	<i>The effects of a stroke network (implemented in rural areas) with telemedical support in Germany on quality of care.</i>
3. Burdea G.	Rehabilitation	USA	<i>Review the benefits brought by virtual reality-enhanced and virtual reality based rehabilitation to groups of patients.</i>
4. Korenke et al.	Psychiatry	USA	<i>Determine whether centralized telephone based care management coupled with automated symptom monitoring can improve depression and pain in patient with cancer in rural and urban areas</i>
5. Morland et al.	Psychiatry	USA	<i>Demonstrate the non-inferiority of telemedicine modality compared to traditional in person service for rural combat veterans with posttraumatic stress disorder.</i>
6. Wang et al.	Neurology	USA	<i>The use of remote evaluation for acute ischemic stroke and the comparison between values of bedside and remote evaluators.</i>
7. Ricketts T.C.	Health policy	USA	<i>The characteristic of rural health care system in America.</i>
8. Wade et al.	Economics	Australia	<i>The economic evaluation of synchronous or real-time video communication in telehealth delivery.</i>
9. Hess et al.	Neurology	USA	<i>The development of stroke network to bringing guide line driven stroke care to rural, unserved areas.</i>
10. Griffiths et al.	Psychiatry	Australia	<i>Discuss the potential utility of internet-based depression information and automated therapy programs in rural regions.</i>
11. Arora et al.	Health policy	USA	<i>The use of Extension for Community Healthcare Outcomes model to deliver complex speciality medical care in rural areas.</i>
12. Wiborg et al.	Neurology	Germany	<i>The opportunity to improve stroke care in rural areas by using a conventional videoconference system.</i>
13. Soresen et al.	Cardiology	Denmakr	<i>Evaluate the impact of pre-hospital diagnosis on time from emergency medical services in cohort of patients with STEMI.</i>
14. Kleindorfer et al.	Neurology	USA	<i>Describe the US geographic distribution of hospital using rt-PA for acute ischemic stroke.</i>
15. Preston et al.	Health policy	USA	<i>Cost of telemedicine and the improvement of health care in rural areas using telemedicine.</i>
16. Moffatt et al.	Health policy	Australia	<i>Identify the report benefits attributed to telehealth for people living and professional working in rural and remote areas of Australia,</i>

Source: Author's illustration

The four papers obtained from the application of the snowballing technique are in Table 3.

Table 3: Papers from snowballing technique

PAPERS	DISCIPLINE	COUNTRY	TOPIC
1. du Toit et al.	Emergency care	Australia	<i>Identify how telehealth has been used to assist in the management of non-critical presentations in rural and remote emergency departments and the outcomes.</i>
2. Kyle et al.	Emergency care	Australia	<i>Examine the utility of telehealth in assisting the decision-making process of aeromedical coordinators.</i>
3. Mathews et al.	Emergency care	Australia	<i>The effect of telemedicine compared with traditional telephone conversation when evaluating patients for aeromedical retrieval.</i>
4. Muller et al.	Emergency care	USA	<i>Identify tele-emergency models and outcomes.</i>

Source: Author's illustration

4 Discussion and conclusion

The analysis of the sample by the publication year discloses an even-higher interest about the topic from 2009 until now. The increasing number of studies might be caused by the scientific advancement and the subsequent increasing of new technologies availability. The three most relevant journals are in the field of telemedicine. Probably this is due to the complexity and the extent of the topic or for the specific target of audience. The most productive Country is the USA, followed by Australia and Canada.

The interest of these countries might be due to their land morphology. Regarding the extent of subject areas involved it is very heterogeneous due to different fields of studies that telemedicine embraces for his delivery (e.g. medical, social science, engineering etc.).

However, economic aspects of telemedicine in rural areas are still understudied. The analysis of subjects covered by the sample highlighted a prevalence of neurological and emergency disciplines: telemedicine allows a fast exchange of information that can be critical in emergencies and neurological emergencies like a stroke.

Regarding the condition of rural residences, distance to healthcare provider was recognized as a significant barrier to healthcare access in the U.S. in the 19th century (Guiagliardo 2004). Accordingly, the people who live in remote areas are more disadvantaged to get the healthcare they need. Rural residents often experience what Hess (2005) calls "rural penalty". Indeed, in his study, about a rural telestroke network, he stressed the condition of urban and suburban hospitals that are lacking for acute stroke care (Hess 2005). As solution to this problem of access to healthcare for rural residents, Ricketts identified telemedicine. This has been described as the single most important tool aimed at flattening the difference in available resources between rural and urban areas (Ricketts 2000). Several Authors, in different medical disciplines, recognized telemedicine strategies as a tool to facilitate the access to healthcare, especially in rural and remote areas. For example, Griffiths (2007) observed their function in delivery of

mental health assistance; in this case, telehealth represented an efficient alternative for the delivery of help for depression in rural regions and for exceeding of a strong culture of self-reliance of rural residents. Burdea (2003) identified teleconsultation as a provider of expertise from specialist centre such as university hospital in rehabilitation program. In this case, telemedicine allows the access to a better care and improve the outcome. This also happens in neurology field; all Authors underlined how telehealth improves stroke care in rural areas and bring stroke expertise to rural community hospitals (Wiborg 2003; Wang 2003; Kleindorfer 2009). In accordance, the same results came from the literature reviews analysed (Moffatt 2010; Wade 2010). In particular, the Authors stated that telemedicine is utilised in order to improve accessibility or timeliness of service delivery and it may contribute to decreasing the urban–rural health disparities.

Moreover, based on "hub and spokes" model (Mueller 2014), telemedicine improves patient care by increasing the capacity of the rural clinician to manage patient locally, minimising time away to support networks and reducing unnecessary retrievals (Matheus 2008, Kyle 2012).

Fore sure this contribution has some limitations related with the methodology, which restrict generalization of its findings. First of all, the review of the literature is not systematic, but narrative on statistical basis. Second, results on which we based our discussions come from a limited sample made by the 16 most cited papers on Scopus Database, together with 4 paper arisen by the "snowballing" technique. To make reliable our findings probably we should enlarge the sample of papers included in the literature review, also by considering others Database, such as Ebsco – Business Source Complete and Web of Science.

Notwithstanding these limitations, the study shows that telemedicine can significantly improve healthcare provision of both emergency and non-emergency department in rural and remote areas. In this sense, the contribution fosters the debate about the role of information technology and new organisation models in healthcare service providing in remote locations.

In particular, we can surely affirm that telemedicine allows for simplified access to specialist consultation via one port of call (or transmission): this provides remote diagnosis and, when required, it might assist in managing patients locally, by also reducing unnecessary transfers. It can be considered a cost-effective method whose outcomes remain similar (if not better) in quality to "staffed" services, whose infrastructural costs could be easily paid-back. These endpoints completely coherent with the value-based healthcare principles. In fact, "telemedicine-based" healthcare takes into consideration "real-life" patients' needs and not only those clinical.

This contributes to create higher value for patient on the whole process of cares, from patient first engagement with the Healthcare System to patient follow-up after cares (Porter, 2010).

Finally, answering to the research question, we can surely conclude that telemedicine approaches enhance the New Commons of "Access to Healthcare" in rural and remote areas, guaranteeing also more affordable, fair and reliable levels of cares.

References

- Arora, S., Kalishman, S., Thornton, K., Dion, D., Murata, G., Deming, P., Parish, B., Brown, J., Komaromy, M., Colleran, K., Bankhurst, A., Katzman, J., Harkins, M., Curet, L., Cosgrove, E. Pak, W., (2010) "Expanding access to hepatitis C virus treatment - Extension for Community Healthcare Outcomes (ECHO) project: Disruptive innovation in specialty care", *Hepatology*, Vol. 52, No. 3, pp. 1124-1133.
- Audebert, H.J., Schenkel, J., Heuschmann, P.U., Bogdahn, U., Haberl, R.L., (2006) "Effects of the implementation of a telemedical stroke network: the Telemedic Pilot Project for Integrative Stroke Care (TEMPiS) in Bavaria, Germany", *Lancet Neurology*, Vol. 5, No. 9, pp. 742-748.
- Basu, S., Jongerden, J., and Ruivenkamp, G., (2017), "Development of the drought tolerant variety Sahbhagi Dhan: exploring the concepts commons and community building", *International Journal of the Commons*, Vol.11, No 1, pp. 144.
- Burdea, G.C., (2003) "Virtual Rehabilitation - Benefits and Challenges", *Methods of Information in Medicine*, Vol 42, No 5, pp. 519-523.
- Burri, H., Heidbuchel, H., Jung, W., Brugada, P., (2011). "Remote monitoring: a cost or an investment", *Europace*, Vol. 13, pp. 1144–1148.
- Calò, L., Gargaro, A., De Ruvo, E., Palozzi, G., Sciarra, L., Rebecchi, M., ... Chirico, A., (2013) "Economic impact of remote monitoring on ordinary follow-up of implantable cardioverter defibrillators as compared with conventional in- hospital visits. A single-center prospective and randomized study", *Journal of Interventional Cardiac Electrophysiology*, Vol. 37, No 1, pp. 69-78.
- Darcy W.E. Allen, Jason Potts, (2016) "How innovation commons contribute to discovering and developing new technologies", *International Journal of the Commons*, Vol 10, No 2, pp. 1035–1054.
- Deming WE, (1994) *The New Economics: For Industry, Government, Education*, MIT Center for Advanced Engineering Study, 2nd ed, Cambridge, MA.
- Du Toit, M., Malau-Aduli, B., Vangaveti, V., Sabesan, S., Ray, R. A., (2017) "Use of telehealth in the management of non-critical emergencies in rural or remote emergency departments: a systematic review", *Journal of telemedicine and telecare*, Vol 25, No. 1, pp. 3-16.
- Evans, Peter, (2005) "The New Commons vs. The Second Enclosure Movement: Comments on an Emerging Agenda for Development Research", *Studies in Comparative International Development*, Vol. 40, No 2, pp. 85-94.
- Fulop, N., Allen, P., Clarke, A., Black, N., (2003) "From Health Technology Assessment to Research on the Organisation and Delivery of Health Services: Addressing the Balance", *Health Policy*, Vol. 63, No 2, pp. 155-165.
- Griffiths, K.M., Christensen, H., (2007) "Internet-based mental health programs: A powerful tool in the rural medical kit", *Australian Journal of Rural Health*, Vol. 15, No (2), pp. 81-87.
- Guagliardo Mark F, (2004) "Spatial accessibility of primary care: concepts, methods and challenges", *International Journal of Health Geographics*, Vol 3, No 1, pp. 3.
- Hasan A., Paul V., (2011) "Telemonitoring in chronic heart failure", *European Heart Journal*, Vol. 5, No 32, pp. 1457-1464.
- Hess, C., (2008) "Mapping the new commons", *SSRN Electronic Journal*.
- Hess, C., Ostrom, E., (2007) *Understanding Knowledge as a Commons: From Theory to Practice*, Cambridge MA: MIT Press, Cambridge.
- Hess, D.C., Wang, S., Hamilton, W., Lee, S., Pardue, C., Waller, J.L., Gross, H., Nichols, F., Hall, C., Adams, R.J., (2005) "REACH: Clinical feasibility of a rural telestroke network", *Stroke*, Vol. 36, No 9, pp. 2018-2020.

- Italian Ministry of Health, (2014) “Telemedicina – Linee di indirizzo nazionali”, http://www.salute.gov.it/imgs/C_17_pubblicazioni_2129_allegato.pdf, last accessed September 28, 2018.
- Kaplan, R. S., and Porter, M.E., (2011) “How to Solve the Cost Crisis in Healthcare”, *Harvard Business Review*, Vol. 89, No. 9, pp. 46-64.
- Kleindorfer, D., Xu, Y., Moomaw, C.J., Khatri, P., Adeoye, O., Hornung, R., (2009) “US geographic distribution of rt-PA utilization by hospital for acute ischemic stroke”, *Stroke*, Vol. 40, No. 11, pp. 3580-3584.
- Kroenke, K., Theobald, D., Wu, J., Norton, K., Morrison, G., Carpenter, J., Tu, W., (2010) “Effect of telecare management on pain and depression in patients with cancer: A randomized trial”, *JAMA - Journal of the American Medical Association*, Vol. 304, No. 2, pp. 163-171.
- Kyle E, Aitken P, Elcock M, Barneveld, M., (2012) “Use of telehealth for patients referred to a retrieval service: Timing, destination, mode of transport, escort level and patient care”, *Journal of Telemedicine and Telecare*, Vol. 18, pp. 147–150.
- Mathews KA, Elcock MS and Furyk JS., (2008) “The use of telemedicine to aid in assessing patients prior to aeromedical retrieval to a tertiary referral centre”, *Journal of Telemedicine and Telecare*, Vol. 14, pp. 309–314.
- Moffatt, J.J., Eley, D.S., (2010) “The reported benefits of telehealth for rural Australians”, *Australian Health Review*, Vol. 34, No. 3, pp. 276-281.
- Morland, L.A., Greene, C.J., Rosen, C.S., Foy, D., Reilly, P., Shore, J., He, Q., Frueh, B.C., (2010), “Telemedicine for anger management therapy in a rural population of combat veterans with posttraumatic stress disorder: A randomized noninferiority trial”, *Journal of Clinical Psychiatry*, Vol. 71, No 7, pp. 855-863.
- Mueller KJ, Potter AJ, MacKinney AC, Ward, M. M., (2014) “Lessons from tele-emergency: Improving care quality and health outcomes by expanding support for rural care systems” *Health Affairs*, Vol. 33, pp. 228–234.
- Norton SA, Burdick AE, Phillips CM, Berman B., (1997) “Teledermatology and underserved populations”, *Arch Dermatol*, Vol. 133, No. 2, pp. 197- 200.
- Osborne, S.P., (2006) “The New Public Governance?”, *Public Management Review*, Vol. 8, pp. 377–387.
- Ostrom, E., Burger J., Field C.B., Norgaard R.B., Policansky D., (1999) “Revisiting the Commons: Local Lessons, Global Challenges”, *Science*, Vol. 284, No. 5412, pp. 278-82.
- Porter M.E., (2010) “What Is Value in Health Care?”, *The New England Journal of Medicine*, Vol. 363, No. 26, pp. 2477-2481.
- Porter ME, (1991) “Towards a dynamic theory of strategy: special issue”, *Strategic Management journal*, Vol. 12, No. 51, pp. 95-117.
- Porter ME, (1997) “Competitive strategy”, *Measuring Business Excellence*, Vol. 1, No. 2, pp. 12-17.
- Porter ME and Teisberg EO, (2004) *Redefining Competition in Health Care*, Harvard Business School Press, Boston.
- Porter ME, Teisberg EO, (2006) *Redefining Health Care: Creating Value-based Competition on Results*, Harvard Business School Press, Boston.
- Preston, J., Brown, F.W., Hartley, B., (1992) “Using telemedicine to improve health care in distant areas”, *Hospital and Community Psychiatry*, Vol. 43, No. 1, pp. 25-32.
- Ricketts, T.C., (2000) “The changing nature of rural health care”, *Annual Review of Public Health*, Vol. 21, pp. 639-657.
- Roine, R., Ohinmaa, A., Hailey, D., (2001) “Assessing telemedicine: a systematic review of the literature”, *CMAJ: Canadian Medical Association Journal*, Vol. 165, No. 6, pp. 765-71.
- Sørensen, J.T., Terkelsen, C.J., Nørgaard, B.L., Trautner, S., Hansen, T.M., Bøtker, H.E., Lassen, J.F., Andersen, H.R., (2011) “Urban and rural implementation of pre-hospital diagnosis and

- direct referral for primary percutaneous coronary intervention in patients with acute ST-elevation myocardial infarction”, *European Heart Journal*, Vol. 32, No. 4, pp. 430-436.
- Wade, V.A., Karnon, J., Elshaug, A.G., Hiller, J.E., (2010) “A systematic review of economic analyses of telehealth services using real time video communication”, *BMC Health Services Research*, Vol. 10, No. 1, pp. 233.
- Wang, S., Lee, S.B., Pardue, C., Ramsingh, D., Waller, J., Gross, H., Nichols 3rd., F.T., Hess, D.C., Adams, R.J., (2003) “Remote evaluation of acute ischemic stroke: reliability of National Institutes of Health Stroke Scale via telestroke”, *Stroke: a journal of cerebral circulation*, Vol. 34, No 10, pp. 188-191.
- Wiborg, A., Widder, B., (2003) “Teleneurology to Improve Stroke Care in Rural Areas the Telemedicine in Stroke in Swabia (TESS) Project”, *Stroke*, Vol. 34, No 12, pp. 2951-2957.
- Wootton, R., Loane, M.A., Bloomer, S.E., Corbett, R., Eedy, D.J., Hicks, N., Lotery, H.E., Mathews, C., Paisley, J., Steele, K., (2000) “Multicentre randomised control trial comparing real time teledermatology with conventional outpatient dermatological care: Societal cost-benefit analysis”, *British Medical Journal*, Vol. 320, No 7244, pp. 1252-1256.

Enhancing Knowledge Sharing in Public Libraries: Can Gamification Help?

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Abstract

Based on the definition of knowledge as commons, the aim of the paper is to investigate the impact of nudges and considerations stemming from behavioural economics on the promotion and enhancement of commons. Commons are described as goods (material and immaterial) belonging to specific community or to humanity as a whole, and we believe that an approach based on nudging individuals toward desired behaviours may be more effective than top-down policy actions that may be perceived as excessive. In order to answer our research question, we will analyse a case study regarding the network of public libraries in Rome, called Biblioteche di Roma (BdR). BdR launched its online platform in 2009, but it was never able to create a strong connection with offline activities, and contributions by readers (such as comments and ratings) remained very low. In 2018, BdR introduced a gamification section in its website, with the goal of increasing users' interactions and book circulation. We will present and analyse data resulting from the use of gamification, both at city level and within different neighbourhoods. Finally, we will provide suggestions for introducing additional nudges in BdR's gamification strategy, and will make considerations regarding policy implications and paths for future research.

Keywords – Knowledge; Commons; Gamification; Public Sector

Paper type – Academic Research Paper

1 Introduction

The purpose of this paper is to analyse the possibilities for enhanced knowledge sharing in public spaces, and especially public libraries, by using gamification. The field of commons has evolved from the consideration of common pool resources, which were mostly natural ones, to new commons, that are immaterial objects such as knowledge, the Internet and music, to name a few, whose borders are unclear and which raise interesting issues regarding their governance and the identification of those entitled to participate to it. Building on the perspective of knowledge as commons (Hess, 2008), the paper presents a case study regarding a broad network of public libraries in a major Italian city, where a gamification strategy was implemented. The objective of the strategy is to encourage readers, users and citizens to increase their interaction with the library network, especially by borrowing books and by leaving comments on the network's website to encourage others to read and watch films, as well as to provide feedback regarding their appreciation of borrowed books. At the same time, participating in gamification operations is completely free of charge for users, which makes it clear that the strategy is aimed at enhancing knowledge circulation within the network, with the expectation to broaden it to a greater number of citizens/users. The paper will analyse the situation in terms of borrowed books and movies, as well as participation to library activities, before the introduction of gamification, and will then present the impact of strategy implementation by providing data on the increase of activities that it caused. Such evidence will be analysed on the basis of the theoretical framework of behavioural economics and nudging. One relevant aspect of the paper is the direct participation in the project by one of the authors, who collaborates with the team in charge of the gamification strategy and thus has access to first-hand data and information.

In order to answer our research question, the paper is organised as follows. First, we build the theoretical framework of the paper by reviewing the literature on commons, starting from common pool resources toward the new commons. The second pillar of our theoretical framework is built on behavioural economics, more precisely on the concept of nudging. Thirdly, we present the methodology, which is qualitative, and explain data collection and analysis strategies. Fourth, the case study is described and analysed on the basis of the theoretical framework on commons. The final section includes concluding observations and remarks, as well as research limitations and possible paths for future studies. This methodology highlights the relevance of adopting a commons-based perspective in the public sector, and of implementing creative strategies to enhance participation and commons (in this case, knowledge) circulation. The paper is original as it presents a new, ongoing case study, whose preliminary results are described, and which can benefit from feedback and discussion by the academic community. Moreover, one of the authors directly participated in data monitoring with the gamification team in public libraries, thus providing access to first-hand data. The outcome of the application of this work is represented by the possibility to design innovative strategies which enhance citizens' participation and engagement with commons, especially in the cultural and

creative sector; we believe this paper provides interesting insight on how public policy-making could be adjusted to promote culture-based commons.

2 Theoretical framework

As we mentioned in Section 1, the theoretical framework of the paper is built on two pillars, the first being the concept of commons and new commons, and the second being the theory of behavioural economics and nudging.

2.1 The commons

We believe it is possible to define knowledge as a commons, and the objective of this section is to trace the path behind our statement.

The field of commons is quite complex and varied, with numerous authors providing contributions from different disciplinary backgrounds. One relevant aspect is the absence of a single, shared definition of what “the commons” are. The first contributions by Ostrom and Ostrom (1977) focused on common-pool resources, i.e. local commons for which usage rights are regulated, such as lakes, fisheries and woods. The main issues regarding common-pool resources concern their management: it is important to identify those who have the right to make decisions on how to use the resource (usually, it is the community that owns them, as in Ostrom, 1990), and establish clear rules to avoid excessive appropriation (Patnaik *et al.*, 2017; Dietz *et al.*, 2003). Several authors have studied institutional arrangements for managing common-pool resources (Agarwal, 2001; Gibson *et al.*, 2000; Berkes, 2006), the most relevant being Ostrom *et al.*’s Institutional Analysis and Development Framework (1994). In 2007, Hess and Ostrom defined eight principles for self-managing communal resources, mainly based on the necessity of setting clear rules, boundaries and sanctions, and on the idea that community members should have a say in defining such aspects. Since the 1990s, studies on commons have started to look further than common-pool resources, resulting in the identification of a new category, the “new commons” (Hess, 2008), such as the Internet, knowledge and digital libraries, just to mention a few examples. They are defined as “various types of shared resources that have recently been recognised as commons” (Hess, 2008), and they take into account a large number of interests and issues, such as concerns regarding globalisation and the increasing privatisation of public goods. This shift influences management systems: today multilevel governance defined as “institutional arrangements that facilitate the co-production, mediation, translation and negotiation of information and knowledge within and across levels” has become a key concept in managing the commons (Ruiz-Ballesteros and Gual, 2012; Brondizio *et al.*, 2009).

Based on the evolution of the field from material, communal resources to immaterial and global ones, we believe it is possible to define knowledge as a (new) commons, whose protection and enhancement requires the cooperation of a large network of stakeholders.

2.2 From behavioural economics to nudges and gamification

This section builds the theoretical framework of behavioural economics, a topic that has been receiving increasing attention in the last years, and then moves to analyse in detail the practice of nudging and the instrument of gamification, which are the basis of the paper.

The field of behavioural economics is complex, so we will present a selection of concepts that will be useful for framing the research conducted for the paper. First of all, the idea of bounded rationality (Simon, 1955) indicates that when an individual makes decisions his/her rationality is limited by a number of factors, such as the amount of information, the available time and mental structures. Consequently, the decision-maker will aim at achieving a satisfying outcome, rather than the best possible one. Kahneman (2011) tried to explain bounded rationality by building the dual-system theory, according to which the human mind is formed by two cognitive systems, the first being automatic and intuitive, and the second being more reflexive and analytic. The first system is subject to cognitive biases, especially when decisions require that we process large amounts of information that has to be simplified. The author suggests paying attention to mental schemes underlying decisions and not being too quick in following one's impressions.

Another relevant element in behavioural economics is time, especially for what concerns changes in individual preferences: according to theory, individuals tend to prefer present events than future ones (e.g. receiving 100€ today or 110€ in a month).

Finally, behavioural economics does not see the individual decision-maker as rational and isolated: on the other hand, he/she is included in a social context which influences the outcome of individual decisions, for example by the tacit enforcement of social norms. Moreover, others' opinions are strongly linked to emotional aspects that, too, have an influence when making decisions. Thus, behavioural economics paints a complex, multi-faceted picture of individuals and their decision-making processes, where many factors have to be taken into account.

A key concept within the field of behavioural economics is that of nudge, i.e. "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be cheap and easy to avoid." (Thaler and Sunstein, 2008). According to Hausman and Welch (2010), nudges can be used when errors occur in the decision-making process, and their role is to exploit such errors.

Nudges can aim at reducing cognitive biases (a process known as "debiasing") by allowing individuals to acknowledge the mental schemes they employ in decision-making that can lead them to unsatisfying outcomes. Nudges can also be used to modify the choice architecture, i.e. how the choice is presented to the decision-maker, in order to encourage individuals toward the "better" choice.

Sunstein (2014) identifies the ten most important nudges:

- Default rules, such as the automatic enrolment in programs such as wellness or education, where it is always possible to opt out but the default option presented is to opt in;

- Simplification, i.e. the idea of providing clear and intuitive information in order to reduce complexity in decision-making;
- Social norms, i.e. stressing what others would do in the decision-making situation;
- Increases in ease and convenience, i.e. making the “best” decision outcome easier to choose;
- Disclosure, which brings all elements of the decision-making process out in the open;
- Warnings, such as graphic images on cigarettes packaging, which can contribute to increase awareness regarding a specific issue;
- Pre-commitment strategies, that help people to keep up with particularly complex commitments (such as giving up smoking);
- Reminders, for example notifications that remind people of their appointments in case they are too busy;
- “Eliciting implementation intentions”, i.e. asking questions about future intentions can sometimes be enough to trigger the desired behaviour;
- “Informing people of the nature and consequences of their past choices”, i.e. reminding individuals of the results of decisions they made in the past, so that they can avoid making similar mistakes in present and future decisions.

The specific object of this paper is gamification, defined as “the use of game design elements in non-game contexts” (Deterding *et al.*, 2011) and it is built to apply the features of games, in terms of individual stimulation, to non-ludic situations. Gamification is used to solve actual problems, not virtual ones (as they would be in a computer game), which are not connected to the game itself. It builds on the idea that in real life people can experience frustration and stress, while they do not when playing games: according to Chou (2016), gamification is the employment of fun and rewarding aspects of games to real-life situations, such as productive or organisational activities.

Gamification can help to “nudge behaviour to be healthier, work better together and achieve goals, all the while having more fun” (Oberprieler, 2017). Thus, it can be considered as an element of nudging, a way to achieve the nudging effect toward the desired result by working on the choice structure.

According to Wu (2011), both gamification and nudges can influence human behaviour, but each works at a different level: the former focuses on motivation, the latter on abilities and triggers. Nudges make context analysis and choices easier, while gamification has an impact on motivation and stimulates the individual’s skills: without a combination of these three elements, long-term behavioural changes cannot occur.

3 Methodology

The research methodology employed in the paper is based on a case study analysis, which allows us to make considerations regarding possible ways to enhance knowledge sharing and to govern the new commons. The case study describes the experience of the network of public libraries in Rome (Italy), called Biblioteche di Roma (from now on,

BdR), with gamification, and the impact that this had on knowledge circulation. Data were collected first-hand by one of the authors, who cooperated with the ICT department of BdR that was in charge of promoting and monitoring the gamification strategy. Data analysis allowed us to evaluate the impact of gamification on the system of BdR, and we were able to suggest additional steps (presented in the concluding section) on the basis of the theoretical framework on behavioural economics and nudges.

We selected BdR to be the object of our case study as it is the largest network of public libraries in the country, and it presents interesting conditions such as a very large pool of possible users (all those who live in Rome and its surroundings) combined with a relatively limited amount of financial resources (which decreased by 10% in the last five years) and of materials available for lending. Moreover, one of the authors cooperated directly with the ICT department of BdR and was thus able to have first-hand access to data regarding the gamification project.

4 Gamification and knowledge sharing in public libraries: a case study

The objective of this case study is to assess whether the introduction of elements from the field of behavioural economics, such as nudges, can represent an innovative way of enhancing knowledge circulation in the public sector.

BdR is a network of 44 public libraries and research centres in Rome, with a very large pool of possible users (more than 3 million citizens) and around 1 million books, DVDs and e-books for lending. In 2017, BdR had 34.000 registered users and lent more than 800.000 books and other materials. The network is financed by the public administration, and its funds decreased by 10% from 2012 to 2017: this forced BdR to adapt parts of its strategies and come up with innovative technologies in order to provide a high-quality service with limited resources. This is the context where the gamification strategy was launched as a low-cost tool to promote borrowing operations and, consequently, knowledge circulation and sharing.

First we will explain how the gamification strategy is organised, and then we will analyse and discuss data by using the D.R.I.V.E. framework and the nudge classification matrix, which were introduced in Section 2.2.

4.1 The gamification strategy

In early 2018 the ICT department of BdR launched its gamification strategy, to be included in the website and in the mobile app. The objective of the project is to promote knowledge circulation by encouraging library users to behave positively, e.g. by returning borrowed books on time and by interacting on the online platforms (website and applications) by providing feedbacks, writing comments and rating books.

The gamification is based on increasing levels of achievement, that can be reached by accumulating points. The points system is linked to actions carried out by users, such as subscribing to the library network, borrowing books and bringing them back within the required timeframe, downloading the mobile app, posting comments and ratings for books and movies. It is also possible to lose points when returning a book late, or when

comments are disrespectful or “useless” to the website: this mechanism aims at ensuring that users’ actions are thought out and meaningful, rather than just ways to collect points. Points can be accumulated throughout each calendar year, and if the highest level is reached it is possible to obtain a free library card (whose cost is usually 10€).

It is possible to speak of gamification as game aspects are used in a non-ludic context with the objective of influencing behaviours by working on how choices are made.

4.2 Data analysis and discussion

We will now apply frameworks and tools from the behavioural economics field to the BdR gamification strategy in order to interpret and analyse it. In this section we will analyse the project using two frameworks, first the D.R.I.V.E. method and secondly the nudge classification matrix. Thirdly, we will present and discuss quantitative data resulting from the project.

The D.R.I.V.E. approach can be used in order to frame BdR’s strategy in behavioural terms by splitting it into the following steps:

- Define: this is the step where behavioural goals are defined. In the case of BdR, behavioural objectives included the decrease of delays in returning borrowed books and materials, the increase of user engagement inside and outside libraries, and the increase of online interactions and activities.
- Review: the aforementioned goals were defined on the basis of unsatisfactory data for the time period from 2009 to 2017. One example is the amount of comments submitted to the website and application: in the 2009-2017 period, they were 1.693, quite low considering that at least 3.000 users had registered to the website by 2017.
- Identify: in this stage it is important to indicate the target behaviour and how it differs from the present one. According to Hansen (2016), behavioural interventions should be contextual, intuitive and measurable and they should leave target individuals enough freedom of choice. Thus, BdR identified gamification as the most adequate intervention tool to promote users’ desired behaviour.
- Validate: when the intervention is being carried out, it is necessary to evaluate its outcome and to implement corrective measures when needed. In the case of BdR, three months after the launch of the project, in March 2018, the amount of comment since the beginning of the year was higher than the total number of comments from 2009 to 2017. This was a positive indication that the strategy was correct. On the other hand, many users were asking questions regarding the existence of rewards for their participation in the game, which led BdR to introduce the possibility of winning a yearly library pass when reaching the final level.
- Execute: this is the final step, after the implementation of the strategy and corrective measures. In the BdR case, results were successfully attained.

It is also possible to use the nudge classification matrix to analyse the case of BdR. Its gamification strategy mainly aims at stimulating the automatic system and cold affects,

thus influencing users' routine. BdR's gamification employs emotions linked to fun, achievement and rewards in order to encourage users to play and eventually to change their routines, for example by acquiring the habit of returning books on time and posting comments online.

For what concerns data analysis, BdR provided yearly data from 2009 to 2018 regarding comments and ratings uploaded to the website, new subscriptions and return times for borrowed books.

The gamification initiative was very successful in terms of comments, as indicated in Table 1: in 2018, 3.239 comments were posted, more than double the amount during the 8 years before. However, this result over a 9-year period may be influenced by the widespread diffusion of mobile phones and digital technology. The difference between 2017 and 2018, on the other hand, is striking, with an increase in comments close to 1000%, which clearly shows the effectiveness of the gamification strategy in reaching this goal.

Table 1: Comments per year

Year	Submitted comments	Refused comments	% refused
2009	51	0	0%
2010	60	0	0%
2011	107	0	0%
2012	130	2	1,54%
2013	177	6	3,39%
2014	217	2	0,92%
2015	375	3	0,80%
2016	242	2	0,83%
2017	334	2	0,60%
2018	3.239	177	5,46%

Source: Own elaboration

The information regarding comments that are refused because of being inappropriate is particularly interesting: the risk of using a gamification approach is to attract users whose passion is playing more than reading, which would have determined high amounts of comments posted in the hope of obtaining points without paying attention to their content. The introduction of a significant penalty for posting inappropriate comments has allowed to reduce the risk of such behaviour occurring.

The mobile application of BdR was launched in 2012, and so far was downloaded 15.000 times, 4.500 of which in 2018 alone, which represents a relevant increase with respect to previous years.

For what concerns rating submitted by users, 7.488 were submitted throughout 2018, and the final amount is 10% higher than forecast in May 2018.

In 2018, 544.925 books, DVDs and e-books were borrowed, 73,8% of which were returned on time: this is an area where additional work could be done to obtain further improvement; in the concluding section, we will indicate possible solutions that could be adopted to increase timely book returns.

Data are available for the first 4 months of 2018 regarding the age of new subscribers to BdR, and they show a decrease of almost 5 years on average (30 years old vs 25 years

old, and less). This could be linked to the positive impact of gamification on younger users, who are attracted by the possibility to play and earn points to win a free library card. On the other hand, data regarding borrowings indicate that users taking books are around 38-43 years old with no significant change from 2017 to 2018: it is possible that younger new subscribers limit their engagement with BdR to commenting and rating books, but are not really interested in borrowing them.

It was also possible to analyse the geographical location of comments submitted in 2018, and many of them were posted from areas close to universities. This finding confirms the relationship between public libraries and students, who may also be more interested than adults in the chance of obtaining a free library pass, and creates new opportunities for collaboration between BdR and public universities in Rome with the objective of increasing knowledge circulation.

5 Conclusions

The gamification strategy implemented by BdR can be considered successful, given the results of the previous section. In its first year, the adoption of gamification allowed to obtain a massive increase in submitted comments (close to 1.000%) and contributed to the engagement of younger users.

We believe that the implementation of a gamification strategy contributed to enhancing knowledge circulation and sharing in public libraries in Rome, thus providing a positive answer to our research question. At the same time, based on the theoretical framework of behavioural economics and nudges, it is possible to make a series of considerations regarding possible improvements to the strategy. First of all, the assignment of points is not clearly specified anywhere: this would be an easy improvement that could add greater clarity to the whole strategy. Secondly, by exploiting planning fallacies, it is possible to reduce return times for borrowed books by including a nudge in the online lending procedure. When the user selects the book he/she wants to borrow, a pop-up window could appear, asking the estimated time that will be necessary to read and return it and providing several pre-determined choices ranging from 10 days to 30 days (maximum borrowing duration). The user should be nudged to choose middle options such as 15 and 20 days (based on the middle option bias), and if he/she manages to return the book within the selected timeframe he/she could gain a small amount of bonus points. Since this is a nudge, users would not be forced to select any option, and there would be no penalties if they take longer than expected to return the book.

For what concerns research limitation, although results are encouraging they refer to a specific case study. On the other hand, the case of BdR can serve as a best practice in the field of public libraries, since it refers to a very large urban area, with many potential users and high complexity. Public libraries in smaller municipalities may find it easier to engage their users and increase their interactions by using a gamification strategy, thanks the possibility of creating stronger online-offline connections by organising cultural events. Thus, we believe that interesting insight can be gained from the analysis of the BdR case, namely in terms of public policy implications. For certain services public

administrations could consider adding gamification elements to their strategies, especially when users are required to be involved and to interact with the service provider. By employing game-like tools in a non-game environment it is possible to obtain changes in users' routines, which could benefit the administration in terms of a smoother service provision.

Finally, future research should focus on following further development and results of gamification in BdR, and keep track of similar strategies adopted in other contexts in order to define guidelines and strategies that can be easily replicated.

References

- Agarwal, B. (2001). Participatory exclusions, community forestry, and gender: an analysis for South Asia and a conceptual framework. *World Development*, 29(10), 1623-1648.
- Berkes, F. (2006). From community-based resource management to complex systems: the scale issue and marine commons. *Ecology and Society*, 11(1), 45.
- Brondizio, E.S., Ostrom, E., Young, O.R. (2009). Connectivity and the governance of multilevel social-ecological systems: the role of social capital. *Annual Review of Environmental Resources*, 34, 253-278.
- Chou, Y. (2016). *Actionable gamification. Beyond points, badges and leaderboards*. Victoria: Leanpub.
- Deterding, S., Khaled, R., Nacke, L.E., Dixon, D. (2011). *Gamification: toward a definition*. CHI Gamification Workshop Proceedings.
- Dietz, T., Ostrom, E., Stern, P.C. (2003). The struggle to govern the commons. *Science*, 302(5652), 1907-1912.
- Gibson, C.C., McKean, M.A., Ostrom, E. (2000). *People and forests: communities, institutions, and governance*. Cambridge, MA: MIT Press.
- Hansen, P.G. (2016). The definition of nudge and libertarian paternalism: does the hand fit the glove? *European Journal of Risk Regulation*, 7(1), 155-174.
- Hausman, D.M., Welch, B. (2010). Debate: to nudge or not to nudge. *The Journal of Political Philosophy*, 18(1), 123-136.
- Hess, C. (2008). Mapping the new commons. Presented at "Governing shared resources: connecting local experience to global challenges", the 12th Biennial Conference of the International Association for the Study of the Commons, University of Gloucestershire, Cheltenham, England.
- Kahneman, D. (2011). *Thinking, fast and slow*. London: Allen Lane.
- Oberprieler, K. (2017). Gamification is key to nudging collective behaviour. Retrieved at <https://www.youtube.com/watch?v=R6F0CuzEu0A>
- Ostrom, E. (1990). *Governing the commons: the evolution of institutions for collective action*. Cambridge: Cambridge University Press.
- Ostrom, E., Gardner, R., Walker, J.M. (1994). *Rules, games and common-pool resources*. Ann Arbor: University of Michigan Press.
- Ostrom, E. (2013). Institutional diversity of commons. In S. Levin (ed.), *Encyclopedia of biodiversity*. Volume I. Oxford: Elsevier.
- Ostrom, V., Ostrom, E. (1977). Public goods and public choices. In E.S. Savas (ed.), *Alternatives for delivering public services: toward improved performance*. Boulder: Westview.

- Patnaik, A., Ruivenkamp, G., Jongerden, J. (2017). Marginalized community, space of commons and autonomy: the case of the Deccan Development Society in South India. *Journal of Rural Studies*, 53, 173-181.
- Ruiz-Ballesteros, E., Gual, M.A. (2012). The emergence of new commons: community and multi-level governance in the Ecuadorian coast. *Human Ecology*, 40(6), 847-862.
- Simon, H.A. (1955). A behavioural model of rational choice. *The Quarterly Journal of Economics*, 69(1), 99-118.
- Sunstein, C.R. (2014). Nudging: a very short guide. *Journal of Consumer Policy*, 37(583).
- Thaler, R.H., Sunstein, C.R. (2008). *Nudge: improving decisions about health, wealth and happiness*. New Haven: Yale University Press.
- Wu, M. (2011). *Gamification 101: the psychology of motivation*. Lithium Community.

Social Innovations and Conflict: the case of the Santa Maria della Pietà – Rome

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Abstract

Social innovation, as an element of modification of a pre-existing status quo, does not necessarily find an easy life in the production of new services, products and solutions able to solve questions and problems of a community.

The experience of the long iter for the redevelopment of the formerly psychiatric hospital “Santa Maria della Pietà”, in Rome, is a clear example.

Since 2004 the self-management popular experimentation of Pavilion 31 (the “Ex Lavanderia - former Laundry of the mental hospital”) has started, in a place that since the mid-70s had already been converted from the administration of the asylum into an open space for cultural and social production and use.

The economic and cultural relevance of the asset, the length of the dispute, the repeated and contradictory positions taken by the different institutions involved (municipality, region, province, LHU - local health unit), the various attempts made by the involved community and the experimentation initiated by the Ass. Ex Lavanderia in Pavilion 31 make this conflict a paradigmatic case, even if not unique of its kind.

The research aims to evaluate to what extent the uncertainty due to a conflictual context may have influenced the social innovation impact.

Keywords – social innovation, commons, goods of civic use.

Paper type – Practical Paper

1 Social innovation and common goods

Towards the end of the 1980s, Anthony Giddens introduces the concept of “social innovation” into his text “The third way”, envisaging a model according to which it is necessary to reduce the centralized action of the government and to promote the development of the free citizens' initiative joining together to find alternative solutions to social needs. Every social innovation action can be read as the ability of citizens to organize and produce solutions for recognized problems, with the consequence that a change in social relations is a condition and effect of social innovation itself (Maiolini 2015).

The paragraph four of the Article n.118 of the Italian Constitution, by stating that “State, Regions, Metropolitan Cities, Provinces and Municipalities encourage the autonomous initiative of the citizens, individual and associated, for carrying out activities of general interest, based on the principle of subsidiarity”, introduces a new perspective in the relations between citizens and the Public Administration, sanctioning the principle of subsidiarity in a horizontal sense: a privileged power of action is granted to citizens, individual or association, for carrying out activities of general interest. It is the legitimization of the citizen's disinterested right to take care of public affairs (Arena 2006), building new forms of relationship between the various actors involved. On this basis, the debate on *shared administration* was triggered, and in particular on the horizontal relationship between administration and citizens “in such a way that they leave the passive role of administrated to become co-administrators” (Arena 1997, p. 29). The need for new forms of relationship between public authorities has been defined as “corporate citizenship” (Donati 2000), which cannot be traced back only to the formal form of participatory or procedural citizenship, but must aim, according to the opinion of the Council of State, “to be understood in its immediately relational dimension” (Opinion Council n.1440/2003).

A characteristic feature of the *shared administration model* is certainly that inherent to the management of “common goods”, in particular those goods that have become common in urban areas and in relation to certain fundamental rights and needs (Rodotà 2015). Maurizio Zanardi, speaking about the “Ex Asilo Filangieri”, as a common good, affirms that “the good is not a ‘thing’ but a practice. It is not something that already exists, something to regain possession of, but above all a collective action to be invented. An act that does not pre-exist its appearance. Around the *good as a thing*, inevitably, appropriately dynamics are unleashed: everyone try to tear off a part, a fragment, of the good. The good-thing is ‘torn apart’ to be divided between groups, particular interests, existing powers. The *good as a practice* is, on the contrary, inappropriate and indivisible, because, as long as the practice is at work, it coincides with the autonomy and the set of gestures of those who exercise it. To be clear, if there is a common good, is not the Ex Asilo Filangieri building, which can be badly used, but the practice that invents it as a place for good encounters”.

2 Social innovation, mental hospitals and Law 180/1978

The social innovation, that characterizes the struggles for the management of public goods, has one fundamental characteristic: attention to practice. A practice that we can track back in the social dynamics put in place by the movement for the closure of mental asylums in Italy in the 1970s. The possibility of an inclusive and at the same time democratic management, where nothing is sanctioned before the relationship between people, it was at the base of the first assemblies of the movement, that after a long culture battle lead to the closure of asylums (Basaglia 1998).

3 The transformation of the former places into common goods: the case of the Santa Maria della Pietà and the Ex Lavanderia

In the experiences of reusing abandoned places, public or private buildings, the notions and the practices of *common goods* and *participatory democracy* are now in the process of merging up, giving life to the “immense non-city, anonymous and disordered” (Berdini 2014, page 138). Abandoned spaces have become real incubators of civic activism, in defence from degradation and privatization, have become places for a new generation of social mobilization. The case study presented here concerns the pavilion used as laundry in the former mental hospital Santa Maria della Pietà in Rome, called since the mid-1970s “Ex Lavanderia”.

The Santa Maria della Pietà, built between 1909 and 1913, was the largest psychiatric hospital in Europe: over 30 pavilions on 27 hectares of land, in an agricultural area of 130 hectares. Its closure was completed at the end of 1998, already preceded, however, by a series of cultural and social initiatives open to citizenship since the mid-1970s.

In 1995, while the local institutions started a process of re-valorisation, also favoured by the Law n.833 of 1978, 40 associations (national and local level, psychiatric, environmental, urban and cultural associations) gave birth to the network “La Città Ideale” and in 1997 promoted the project “La Città Ideale”. In 2003, the network collected the signatures for a resolution of popular initiative aimed at the acquisition the complex by the Municipality and, in 2004, against the project of transformation of the Ex Lavanderia into a health service (nursing school), it occupied the pavilion to maintain its socio-cultural function.

From 2004 until 2016, the successive administrations neither have completed any urban planning relating to the complex nor activated forms of participation for its development. In 2016, the Region, with a Regional Executive’s Resolution, sanctioned its return to health functions, entrusting the entire estate to the LHU of competence. What initially appeared to be a temporary occupation has turned into a permanent action, demonstrating the demand for places of sociality from the territory and the city.

The Ex Lavanderia therefore proposes itself as an open and inclusive space, where the activities carried out “are not selected on the basis of the contents, as happens for example in the artistic direction, but on the sustainability of the projects based on criteria of self-

organization and exchange of time” (Micciarelli 2017, pag.148). In fact, the association provides spaces for artistic, recreational, cultural and educational proposals.

The research in progress, whose first results are illustrated here, starts from the reconstruction of the history of this experience. The intent is to explore the dimension of action and social innovation in the suspension/conflict, which the activists of the Ex Lavanderia have been living for years, and how this condition has influenced, and is influencing, their participatory, creative, social experience. For this reason it was decided to use a non-directive approach in the interviews conducted with the activists, so that they filled our cognitive questions with their own experience. Two interview tracks were articulated, one for the representatives of the laboratories and projects and one for the members of the Association's board. The first explored the personal history of activism, the relationship with the territorial framework, the relationships with other referents of projects and with the Association, the positive and negative peculiarities identified in carrying out a project in a context like this. The second explored the personal history in the Association, the relationship between association and the environment, exploring how much one's commitment could be considered an instance of the territory, the internal organization, the relationship with the institutions, the voluntary status, the collaboration with similar realities. In both cases it was then asked if operate in a former asylum provoke any emotional feeling. The interviews were conducted in tandem, with a leading and a shadow researcher (Tusini, 2006), the material obtained does not coincide with the results of the research, that is not a self-evidence to show (cfr. Martire, 2012) and this is why the text contains only excerpts, faithful to the language used, to support advanced reasoning.

The activities currently present in the Ex Lavanderia are divided between laboratories and projects. The workshops include: papier-mâché, Yoga course, Peruvian and popular dance course, meditation, integrated movement, Brazilian percussion. Among the projects: Tatawelo cafeteria (as a reception area, presentation of the activities of the Ex Lavanderia and promotion of fair trade projects), popular bicycle workshop, public theater and the recovery of the old Park for Children of the Municipality with “Le Belle Lavanderine” (beautiful sinks). It also houses the venue of the “Banca del Tempo” of the XIVth Municipality. Almost every week a cultural initiative is proposed (exhibition, concert, event) and a children's party is hosted - organized by the same families. All the activities are free.

4 Planning and conflict

From the reconstruction provided by the White Book on the Santa Maria della Pietà, it emerges that over the years the institutions involved in the process of reusing and enhancing the complex have succeeded in carrying out, in succession, mutually contradictory actions, often incomplete or inadequate, leaving, to every step, a more tangled and difficult situation.

A representative of the Association Executive Board:

The only functions that have increased in the Santa Maria della Pietà are health services. The ASL with the approval of the Region, occupies pavilions in an area like this one, that is surrounded by hospitals and clinics. This is the district of Rome with more "health services". Politics does not imagine the city in 20 years, this is the problem. I imagine that for this neighborhood the Santa Maria could be a resource that goes far beyond its sanitization, but politics does not understand it and wants to continue with the process of sanitization, it is what happening, one pavilion at a time, just read the story of the ASL in here since 2004.

It is different what it happens on the front of "civic" planning. The associative form has undergone changes over the years, the participants have changed or have changed themselves, there was the difficulty of having always adequate tools to intervene in the processes, but the clarity of the objectives does not seem to have disappeared within the Ex Lavanderia. The various successive local administrations have tried to bring this experience back into the category of "occupations of social centers", but its different and specific nature clearly emerges: the association inherits the lead of the *La Citta Ideale* Coordination, which promotes in 2013 a second popular initiative resolution (given the failure to discuss the first, then Del. Comune n.40/2015) and a proposal for a regional law for the planning and inter-institutional and participatory management of the complex (2014); in addition, it participates in the activities of the Urban Center of the Municipality. In the meantime continuing to act, with the support of a wide network, even if disarticulated, to demonstrate the possibility of using the Ex Lavanderia for what had been considered its function since 2000, a place of sociality and culture.

Represented Theatre laboratory:

It is easier to capture the cultural ferment of a city like Rome from the Ex Lavanderia than from the Theatre of Rome. The problem is what can be the prejudices, what may be the institutional closure, but really it moves me everything that happens here at the Ex Lavanderia from the milonga, to the theatre, to the activities for children, everything brings back to the role that should have the culture in a society. Surely the biggest disadvantage is the one with institutions, they don't have a vision. The institution does not understand that a place like the Ex Lavanderia should be a wealth to be exploited.

This would probably not have been possible without two conditions: *i*) a broad acceptance of Basaglia's approach to mental and social distress (Basaglia 1998) and of the processes and methodologies for its overcoming in the context of civil society *ii*) and an urbanistic vision centred on the development of places that could reconstruct the social fabric swept away by too large processes of economization.

Representative of the Cafeteria:

It makes me think that we are in the former asylum in Rome... in the sense that from this space comes a different response from what it was. Producing a different thought from what this place has been it's positive. The institutions think that they are a bit like providence, that they are able to govern disorder, they think they will arrive and fix things. Here at the Ex Lavanderia happens the opposite, here we are

doing politics in a horizontal way, there is initiative and freedom to be able to do. It is the idea of a small community that can be governed without a leader, we are all equal.

5 Participatory planning and conflict resolution

Theoretically the city of Rome has adopted a specific Regulation since 2006 for citizen participation in urban planning choices and also determined instruments such as the Popular Initiative Decisions. In reality there is no guarantee to protect the citizens' efforts: as for the Resolution for the acquisition of Santa Maria della Pietà in 2003 the Capitolina assembly can simply decide never to arrive at an evaluation of the proposals. Even in the presence of rules and instruments of participation the administration decides to take into account the bottom up process only when an analysis of the pros and cons suggests an utility. Still talking about participatory planning and about the popular initiative bill presented to the Region, on the participatory planning of reuse and ignored, a representative of the board states:

Since we made our law proposal, three years have passed and no one has ever taken up this. We have collected 12,000 signatures in 6 months... In my opinion there is no conflict with the institutions, there is a "no listening", there is indifference, I repeat we have made a law proposal and nothing. At least tell me "no" and reject it but they didn't even take this responsibility. The truth is that politics not only does not want dissent but not even proposals, or consultation. I believe that there is no way in Rome to have a relationship with institutions because on the other side there is no form of reception, nothing. There is really an inability to understand, I think that doing an health district is more "economical".

What emerges is not so much a clear conflict with the institutions as an absolute indifference to realities, like the Ex Lavanderia, which are bearers of possible alternative solutions.

Representative of the bicycle workshop:

Over the years there have been several administrations and not that much has changed between them. We have always found resistance.

Representative of the Cafeteria:

The institutions do not speak to you and this don't talk to you is a form to govern you. We do not have a relationship with institutions. There is a lot of indifference.. I believe there is a lot of ignorance. They have no idea of the concept of the common good that the Ex Lavanderia represents.

Participatory planning should be a circular process in the relationship between the needs of citizens and the system of interventions and services at the territorial level, a space for participation and shared responsibility for the various actors involved (Giachi, 2015). Consequently, the decision-making process should take place in terms of the

inclusiveness of all stakeholders, taking into account the non-reducible domain and pluralism of interests, objectives and points of view (Fetterman and Wandersman, 2007), of the exchange between procedural and tacit knowledge, and non-shared that become explicit, conscious, circulating (Castelfranchi, 1985; McAllister and Walsh, 2004). This process promotes and does not hide phenomena of conflict between the subjects, overcoming the logic of the Nimby syndrome (Bobbio 2004). Giving vent to the conflict through the inclusiveness of a participatory planning demonstrates that: “the conflict is not a pathology, but a sign of health: if not feared and suffered as a complication, but recognized as a source of problems that politics can face, it becomes an opportunity for knowledge and a necessary opportunity for government, for dialectical confrontation” (Bassetti, 2004, p. 17). In the absence of a clear process, the conflict here is expressed in two different ways. The first way is the “veiled” conflict, where the episodes, such as the cutting of light by the LSC to the Ex Lavanderia, symbolize a threat that inevitably influences who operates within the structure. No coincidence that this important episode was reported by all the interviewees, without a specific question being asked about this event.

Representative of the Association Executive:

The idea of conflict is well represented by the fact that the LSC has taken away the light, and now we use a generator. Not directly, but more or less veiled attempts to send us away have been made on several occasions. Veiled not even so much, they gave us three causes and we lost one. They don't attack us on the merits of what we do, because on that they would lose, how can they attack you because you do “theater”? They attack us on the fact that they consider us illegitimate, that we don't pay you the light, they don't attack us on what we are giving to the neighborhood.

Representative of the bicycle workshop:

When they turned off the light, we thought they would send us away, but it didn't happen. When it happened there were acts of solidarity on the part of the territory, we received economic offers to buy the generator.

The other way in which the conflict manifests itself is represented by the difficulty of planning in the medium-long term. The undeclared weight, but somehow present, of the possibility of an eviction ends up influencing the activities that are carried out.

Represented in the theatre laboratory:

Specifically for the Lavanderia, the closure of the institutions makes it difficult to plan.

To the specific question about *the future of the Ex Lavanderia in three years* the answers were the following:

Representative of the bicycle workshop:

I am optimistic by nature but at the moment we are struggling. They can evict us at any moment, they don't do it because they know that we do useful things for the territory, we do beautiful things. Let's say that now

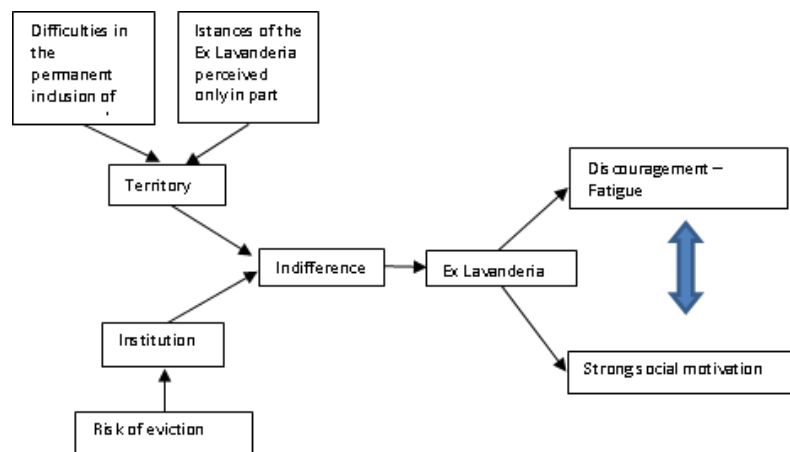
in particular we need something that gives us a new boost, a new energy because two years ago they turned the light off (...) a series of things that happened sucked our energy out.

Represented in the theatre laboratory:

I do not know. We need to understand the institutions, after 14 years I believe it is difficult to put a point also at institutional level. There are no people who take responsibility at the institutional level (...) I can't make a forecast, of course if there were intelligent minds betting on the Ex Lavanderia, this place could become an international model of relationship with the territory, of cultural growth, however, to find these people.

6 Partial conclusions

The following graph tries to summarize a first conclusion to which the research came. From what emerged, the conflict manifests itself in terms of indifference on the part of the institutions. However, this phenomenon also seems to invest a theme on which the activists of the Ex Lavanderia have often returned: the relationship with the local territorial community. In particular, the difficulty of activating the citizenship of the neighbourhood towards the Ex Lavanderia as a common good.



Representative of the Board:

The difficulty of relating to the territory also arises because we are all volunteers. We are here at the Ex Lavanderia, we carry on this battle, when we do not work, mainly in the evening and on Saturdays and Sundays. The difficulties we encounter in the territory, are not only of the territory that does not listen to us, but it is also our responsibility.

Representative of the Cafeteria:

We have difficulty communicating with the territory. Over the years I had thought it was our inability, then as time went on I began to think that it is not

entirely our fault. I also believe that there is the influence of being in the former asylum of Rome. The Santa Maria remains as a great fief, a closed space.

Representative of the bicycle workshop:

It is difficult to involve people in the initiatives we do (...) we would like people to be more active. Here are young families and perhaps we should build our activities starting from this user. For example, when there is theater for children there are often many families (...) in general, initiatives involving children work. We usually distribute flyers to let people know about our activities, but this is the time when we are most active. Otherwise, people discover the Ex Lavanderia accidentally when they visit the park.

Even if there is no permanent response from the neighborhood, at least in the terms that the Ex Lavanderia activists would like, it should be remembered that the initiatives and laboratories are proposals coming from the local territory and the city, which however require internal management. This "temporary" participation generates processes that result mainly in the lack of a replacement in the organizational nucleus of the Ex Lavanderia and in the inevitable tiredness, which is amplified by being all volunteers without income, or almost, within the structure.

Representative of the Board:

We could not make a breach. Perhaps because we don't offer "fashionable" activities for a 20-year-old boy. (...) Then there is the theme of volunteering, as there is no income at the base of the activities you do, you end up doing them when you can.

Representative of the bicycle workshop:

Finding new volunteers... we've been the same for a very long time. Some volunteers come occasionally, but after a period of time, they go away. Everyone recognizes that this place is potentially fantastic, but they remain for a short time or remain only in words. As a Ex Lavanderia we have often asked ourselves why there is no replay. Now we are looking for new partners, associations that give us a hand both in terms of organization of events, and of ideas to make the participation of the territory more active.

Represented in the theatre laboratory:

Another difficulty is the age group which is difficult to get involved. I mean young people. Although this place is open to new ideas, the only age range that offers us activity is always quite old, never young. My explanation comes from my experience in schools: in young people the ability to associate is lacking. Politics is missing now, a young man now has no awareness that he can count for anything.

It should however be emphasized that the relationship with the environment is effectively contradictory: although it is difficult the one with the closest citizenship, it is not lacking with the city of Rome, which uses the Ex Lavanderia both as a user of its proposals and using the structure itself as a common good.

Represented in the theatre laboratory:

The incredible thing is that often here at the Ex Lavanderia, for the theater, there are people who are not from the area. Where institutions do not provide space to try, a place like the Ex Lavanderia becomes ideal to try. In Rome there are no big opportunities for theatre companies at this time.

Representative of folk dances:

In my laboratory only four people are from this district, the majority come from other areas. I think they knew the lab via the internet. I once had a person who came from Acilia.

In this delicate and precarious balance in which the Ex Lavanderia moves, we can say that the main reason that still holds the activists together, and the very survival of the structure, is a very strong awareness of the importance and value of their activism for the community, as well as the dispute over the area of the District, which is clearly the main reason why problems are faced.

Representative of the Board:

If there were not a strong sense of belonging, ending up arguing with the volunteers who run the Ex Lavanderia each time would be a snap. A sense of belonging that can be translated into the idea of “doing something here, in this territory”.

Representative of the bicycle workshop:

I stayed because I like what I do and I like to make a contribution to this territory because it's like a second home for me. And this is a dead neighborhood. And the fact of doing laboratories, activity, I feel I revive this territory. To make myself useful so that this territory is alive, for this reason I do not give up despite the thousand difficulties.

Representative of the Cafeteria:

The idea of living in another way. Living in the idea of a common good. With the Ex Lavanderia I can think of another way of life. We are here to defend a space that wants to be common.

The intention of research in the near future will be to investigate the reasons why in certain circumstances virtuous circuits have been created between local administrations and citizens in the management of common goods. In the next future, More, we are going to study in deep the local territory, involving all the stakeholders of this process (like also the municipality and the LHU), and comparing this case study with other experiences of management of “common goods”. In fact there are positive examples in this regard, just think of the regulations drawn up by 189 administrations scattered in Italy (es. Naples or Potenza). The intent of all similar realities, is to make public administrations change their sign, which can no longer decide in a exclusive way for goods that belong to the entire community (Ferrajoli 2013).

References

- Allegretti U. (2006) *Verso una nuova forma di democrazia: la democrazia partecipativa*, in *democrazia e diritto*, 3.
- Arena G. (1997) *Introduzione all'amministrazione condivisa*, in *Studi parlamentari e di politica costituzionale*, 117-118.
- Arena G. (2006) *Cittadini attivi*, Laterza, Roma- Bari.
- Basaglia, F. (1998) *L'istituzione negata*, Baldini&Castoldi, Milano.
- Berdini P. (2014) *Città fallite. I grandi comuni italiani e la crisi del welfare urbano*, Donzelli Roma.
- Bobbio N. (2004). *A più voci. Amministrazioni pubbliche, imprese, associazioni e cittadini nei processi decisionali inclusivi*, Edizioni Scientifiche Italiane, Napoli-Roma.
- Caroli M. G. (2015) *L'innovazione sociale: caratteristiche chiave, determinanti e principali manifestazioni empiriche*, in Caroli M. G. (a cura di), *Modelli ed esperienze di innovazione sociale in Italia. Secondo Rapporto sull'innovazione sociale*, ed. Franco Angeli, Milano
- Castelfranchi C. (1985). Problemi teorici, metodologici e politici della valutazione della valutazione dei servizi di salute mentale, in Tansella M. (a cura di), *L'approccio epidemiologico in psichiatria*, Boringhieri, Torino.
- Donati P. (2000) *La cittadinanza societaria*. Laterza, Roma- Bari.
- Ex Asilo Filangeri (2015) *Dichiarazione di uso civico e collettivo urbano*, in <http://www.exasilofilangeri.it/regolamento-duso-civico/>
- Ex Lavanderia Ass. (2017) *Santa Maria della Pietà. Libro Bianco 1996–2016*, autoprodotta, http://www.exlavanderia.it/images/documenti/librobianco/libro_bianco.pdf
- Ferrajoli L. (2013). *La democrazia attraverso i diritti. Il costituzionalismo garantista come modello teorico e come progetto politico*, Laterza, Roma- Bari.
- Fetterman D. M., Wandersman A. (2007). *Empowerment evaluation. Yesterday, today, and tomorrow*, in *American Journal of Evaluation*, 28, 2.
- Giachi L. (2015). *L'intrattenimento nella riabilitazione psichiatrica*, Carocci, Roma.
- Giddens A. (2013). *The third Way: the renewal of social democracy*. John Wiley e Sons.
- Goffman, E. (1968). *Asylums*, Einaudi, Torino.
- Maiolini R. (2015). *Lo stato dell'arte della letteratura sull'innovazione sociale*, in Caroli M. G. (a cura di), *Secondo rapporto sull'innovazione sociale*, Franco Angeli, Milano.
- Mcallister M., Walsh K. (2004). Different voices: reviewing and revisiting the politics of working with consumers in mental health, in *International Journal of mental health nursing*, 13.
- Martire, F. (2012) *Perché una ricerca non standard?* in *Come ci vedono e ci raccontano. Rappresentazioni sociali degli immigrati cinesi a Roma* (a c. di Pitrone, M.C. Martire, F. Fazzi, G.) edizioni Franco Angeli, 2012
- Micciarelli G. (2017), *Introduzione all'uso civico e collettivo urbano. La gestione diretta dei beni comuni urbani*, in *Munus I*.
- Rodotà S. (2015). *Il diritto di avere diritti*, Laterza, Roma- Bari.
- Saraceno, B. (1995). *La fine dell'intrattenimento*, Etas, Milano.
- Tusini, S. (2006) *La ricerca sociale come relazione. L'intervista nelle scienze sociali*, Franco Angeli, Milano

Knowledge-Based Regional Development: a Methodological Approach to Innovation Network Analysis

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Abstract

Observing the contribution that an approach using the Innovation Networks Analysis involving the Triple Helix spectrum, its contributions to the diffusion of a knowledge-based economy, potentializing regional socioeconomic development, the present study carried out a literature systematic review with the purpose to verify the contributions that Innovation Network Analysis, as a strategic analysis tool, can bring to establish strategic Regional Knowledge-Based Development. At the conclusion of this study, it was verified that Network Analysis and Knowledge-Based Development are emerging themes, with emphasis on scientific production in the last five years, and converge towards a strategic approach to policies and practices at local, regional, national and multinational levels, contributing to the diffusion of a knowledge-based economy, enhancing regional socioeconomic development.

Keywords – Knowledge-based Development, Regional Development, Network Analysis, Innovation Networks, Knowledge Management.

Paper type – Academic Research Paper / Practical Paper

1 Introduction

Much has been said about the opportunities and challenges range facing countries, regions, sectors, institutions and individuals, associated with emergence and diffusion of an 'era', 'society' or 'economy' of knowledge. A new technical-economic pattern emerges based on increasing intensity and complexity of knowledge developed, accompanied by an accelerated incorporation of this knowledge into goods and services produced and marketed. Knowledge-based development is the knowledge resources transformation into local development, providing basis for sustainable development, and as society becomes more and more knowledge-based, development nature changes as activities in knowledge sector are becoming more important.

Studies that synthesize the literature are extensively developed with the purpose of aggregating research evidence to guide new studies that seek to advance scientific knowledge. Evidence-based practice is a rather widespread methodology and consists of scientific evidence use produced by studies developed with methodological rigor to make decisions about conduct in face of problems that professional / scientist is facing. Scientific evidence formation starts from formulation of a question, seeks evidence, which is found, undergoes a critical evaluation and decision making is carried out based on this evidence (PEDROLO, 2009).

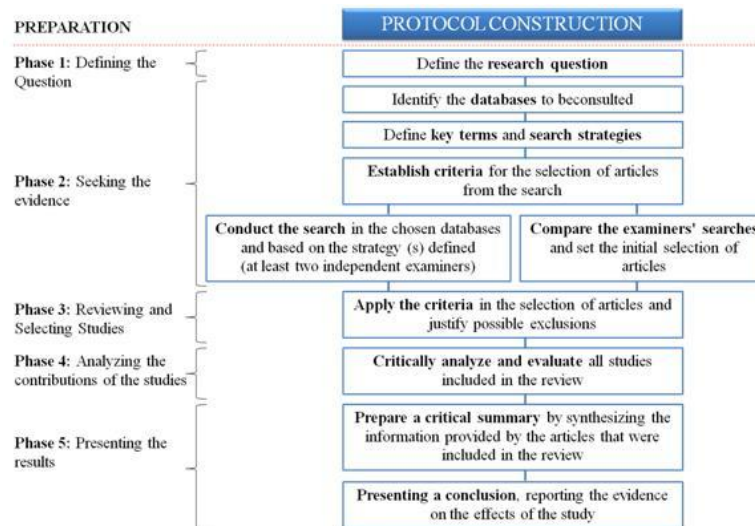
According to Amaral and Silva (2011), "the systematic review results allow us to identify gaps in the theory that can be explored by other researchers but which have not been identified in similar studies due to superficiality and lack of rigor in review bibliographic".

In this way, systematic reviews are designed with the explicitly explaining intention their design in a methodical, explicit and reproducible way. Sampaio and Mancini (2007) point out that this study type is used to guide projects development, indicating new directions for future research and identifying which research methods were used in a given area.

In this sense, this literature systematic review aims to research evidences around the theme: Regional Development based on Knowledge in an approach using Innovation Networks Analysis. Specific objectives are to demonstrate study relevance and its contribution to new studies and to identify knowledge gap already produced about subject, demonstrating study contributions to the science advancement.

2 Systematic Literature Review

A literature systematic review requires a clear question, a search strategy definition, criteria establishment for articles inclusion and exclusion and, above all, a careful analysis of selected literature quality. Sampaio and Mancini (2007) suggest that conducting a systematic review involves work of at least two researchers, who will independently evaluate the methodological quality of each selected article. The scheme used to elaborate the present research follows steps suggested by Sampaio and Mancini (2007), as shown in the steps of Figure 1, with the appropriate adaptations.



Source: Adapted from Sampaio and Mancini (2007).

Figure 1 - Scheme of the Systematic Literature Review process

Before describing the five phases of this systematic review, authors emphasize the importance of elaborating a research protocol, which was elaborated in research preparation phase, since it will guide work during the systematic review entire process.

2.1 Defining the Question

Based on research origin, presented in research contextualization, it was identified as a guiding theme the Regional Development based on Knowledge in an approach using Innovation Networks Analysis. In this sense, the research question was established as follows: How the social interconnections between a local network agents can contribute to the Regional Development based on Knowledge?

2.2 Seeking the evidence

For development this systematic review two databases with significant relevance to search were identified:

- Elsevier BV's Scopus Platform: selected due to its wide breadth and indexed data relevance, considered the largest abstracts and citations database of peer-reviewed international scientific literature, has intelligent tools to monitor, analyze and support the search. With access to 70 million records in the areas of Science, Technology, Medicine, Social Sciences, Arts and Humanities, bringing together 22,800 titles from over 5,000 international publishers, including 2,600 open access journals, 370 trade publications and 420 book series.

- Clarivate Analytics Web of Science platform: a multidisciplinary reference framework integrated with the ISI Web of Knowledge database, which has approximately 12,000 journals and offers tools for citation, reference and index analysis, allowing bibliometric analysis and is also considered one of the larger databases.

Using the protocol built in research and selection phase as databases for research sources search, we define the key terms based on the research question: Knowledge (K), Regional Development (RD), Analysis of Networks (NA) and Innovation (I). In independent searches, the term Economic Development (ED) was also used, which was considered relevant for inclusion.

From this, search strategies were established, when Galvão, Sawada and Trevizan (2004) suggest that, for this stage, the strategy used should be broad, so there was no restriction regarding document type, area geography, language or knowledge area, the search fields were Article Title, Abstract, Keywords in Scopus and using the Topic selector in Web of Science. The chosen time period covers every year, from the first records to current publications. Using search capabilities of both databases, the quotation marks were used to avoid lematizations and to restrict search in determined term, it was necessary, also, use of the boolean operators "AND" to combine terms.

Table 1 shows the total production recorded in selected databases using each key term selected individually and in combination between them.

Table 1: Scientific production resulting from search strategies

Key Terms	Scopus		WoS		TOTAL	
K	1.775.007	76,88%	1.185.416	79,06%	2.960.423	77,74%
RD	15.159	0,66%	9.802	0,65%	24.961	0,66%
ED	82.921	3,59%	53.657	3,58%	136.578	3,59%
NA	85.794	3,72%	28.427	1,90%	114.221	3,00%
I	349.915	15,16%	222.040	14,81%	571.955	15,02%
TOTAL	2.313.640	100%	1.499.432	100%	3.808.138	100%
RD + ED	2.401	10,38%	1.461	8,51%	3.862	9,58%
RD + NA	62	0,27%	43	0,25%	105	0,26%
ED + NA	208	0,90%	138	0,80%	346	0,86%
RD + K	1.269	5,49%	1.186	6,91%	2.455	6,09%
ED + K	5.089	22,01%	3.662	21,33%	8.751	21,72%
RD + I	1.643	7,10%	1.529	8,90%	3.172	7,87%
ED + I	5.234	22,63%	4.352	25,35%	9.586	23,79%
NA + K	5.603	24,23%	3.439	20,03%	9.042	22,44%
NA + I	1.525	6,59%	1.271	7,40%	2.796	6,94%
RD + NA + K	12	0,05%	13	0,08%	25	0,06%
ED + NA + K	31	0,13%	30	0,17%	61	0,15%
RD + NA + I	16	0,07%	15	0,09%	31	0,08%
ED + NA + I	31	0,13%	29	0,17%	60	0,15%
RD+ED+NA + K + I	2	0,01%	3	0,02%	5	0,01%
TOTAL	23.126	100%	17.171	100%	40.297	100%

Source: Prepared by the author from the Scopus and Web of Science databases (2018).

The Table 1 data allow a scientific production analysis, initially showing that the key term Knowledge (K) has a significant emphasis on scientific production, representing 77.74% of registrations, followed by the production in Innovation (I), 15.02 %.

2.3 Reviewing and Selecting Studies

During the initial survey, with extensive search strategies use in databases, it was possible to observe that in combination of terms Regional Development and Network Analysis (RD + NA), as well as Economic Development and Network Analysis (ED + NA), there is a significant reduction in records found, being this determinant to review a search strategy with objective of selecting studies for critical analysis.

It is also worth noting that, by combining the five key terms selected for systematic review (RD, ED, NA, K and I), it was observed that there are few studies, representing that there is a possible gap in scientific knowledge published on these bases, thus, the search strategies in these combinations are determined in order to select all studies relevant to this systematic review.

Table 2 shows the combination of key terms and respective strategies used in studies search.

Table 2: Scientific production resulting from search strategies for review and selection of studies

Key Terms	Search strategy	Scopus	WoS	TOTAL
RD + NA + K	TITLE-ABS-KEY ("Regional Development" AND "Network Analysis" AND Knowledge)	12	13	25
ED + NA + K	TITLE-ABS-KEY ("Economic Development" AND "Network Analysis" AND Knowledge)	31	30	61
RD + NA + I	TITLE-ABS-KEY ("Regional Development" AND "Network Analysis" AND Innovation)	16	15	31
ED + NA + I	TITLE-ABS-KEY ("Economic Development" AND "Network Analysis" AND Innovation)	31	29	60
RD+ED+NA+K+I	TITLE-ABS-KEY ("Regional Development" AND "Economic Development" AND "Network Analysis" AND Innovation AND Knowledge)	2	3	5
TOTAL		92	90	182

Source: Prepared by the author from the Scopus and Web of Science databases (2018).

Once the 182 studies were selected, was made a critical evaluation of the titles and abstracts, obeying the inclusion and exclusion criteria defined in research protocol. When title was not enlightening and the abstract was not retrieved by database, the article was searched in its entirety, so as not to risk leaving important studies out of systematic review. Table 3 shows the studies selected number after a critical evaluation of studies.

Table 3: Scientific production resulting from search strategies for review and selection of studies

Key Terms	Scopus	WoS	TOTAL	Deleted	Repeated	Selected
RD + NA + K	12	13	25	3	2	20
ED + NA + K	31	30	61	21	8	32
RD + NA + I	16	15	31	2	7	22
ED + NA + I	31	29	60	19	8	33
RD+ED+NA+K+ I	2	3	5	0	2	3
TOTAL	92	90	182	45	27	110
DUPLICATIONS						45
RESULT						65

Source: Prepared by the author from the Scopus and Web of Science databases (2018).

About the 182 studies selected for critical analysis, 45 were eliminated, because they did not show adherence to research, 27 replications were identified in both databases and 45 studies were duplicated, that is, they were registered in more than one search using two or more terms resulting in 65 selected studies.

3 Results

3.1 Analyzing the contributions of the studies

According to Galvão, Sawada and Trevizan (2004), the any systematic review usefulness depends largely on quality of the studies included in it. The authors also point out that critical evaluation consists on phase where all selected studies are evaluated with methodological rigor, in order to determine if research results are sufficiently valid to be considered. Table 4 presents synthesized contributions of 65 selected articles.

Table 4 - Contributions from selected studies

Theme	Author(s) / year	Contributions
Management in network configurations	Agranoff and McGuire (1999) Hauck et al. (2015)	Management in network configurations is not based on central authority, suggesting that future research should discuss the skills development needed for network management.
	Sasaki et al. (2011)	Cluster regional policies are recognized as intensive projects to form effective knowledge networks. On other hand, the methodology for evaluating these network structures is still in development.
	Li, Li and Liu (2011)	By analyzing networks structure and interactions between networks, four stages of network evolution are identified: family networks, internal division networks, local innovation networks and global supply networks. Each stage plays a different role in cluster development.
	Schüßler et al. (2013)	Internally governed clusters networks are formed to establish links between representative clusters to share knowledge and pool resources in selected activities; Externally managed cluster networks are formed to systematically develop links and skills across clusters at different levels and are intermediated by a central inter-cluster administrative organization as well as by several leading decentralized organizations.
Innovation, cooperation, collective learning	Mackellar (2006) Eraydin and Fingleton (2006) Steinberg et al. (2010)	The results demonstrate the success of regional development cooperation and highlight the importance of developing and maintaining network relationships for collective learning and knowledge overflow

and regional development	Deas et al. (2013) Evans et al. (2015) Ansell et al. (2017) Im et al. (2017)	
	Yokura et al. (2013) Fromhold-Eisebith and Werker (2013) Meyborg (2013) Wakabayashi and Takai (2016) Snickars and Karlsson (2017)	Academic cooperation has a far greater spatial reach than cooperation with private firms, while the public sector plays an important role in local innovation processes. Universities play a key role as a platform for knowledge in regional economic development.
	Holman (2013)	Ephemeral partnerships are a problem because the knowledge generated by these partnerships can also be seen as ephemeral, increasing fatigue and cynicism among stakeholders. The structure of the network and the ability to collaborate can contribute to the depth of penetration and the longevity of the knowledge created in local partnerships.
Network Connectivity	He and Fallah (2006) Casper (2007) Sonmez (2017)	Mobility of people among their employers contributes to knowledge connectivity in the cluster.
	Van Der Valk (2007)	At the level of the network of collaborations, the research institutes have a central position.
	Fritsch and Kauffeld-Monz (2009) Kustepeli et al. (2013) Dziadkowiec et al (2015) Bauer et al. (2018)	Strong ties are more beneficial to the exchange of knowledge and information than weak ties and the positions of brokers tend to be associated with social returns rather than private benefits. Building Trust is a Key Factor for Collaboration
	Graf and Henning (2009) Schiller and Kiese (2010) Caniëls and Van den Bosch (2011) Yun and Lee (2013) Scoponi et al (2016)	Universities and non-university institutions of public research are key actors as integrators and essential elements of an effective innovation system.
	Krätke (2010) Yun and Lee (2013) Almodovar and Teixeira (2014) Calignano (2014) Makarem (2016) Noguera-Méndez et al. (2016) Lahdelma and Laakso (2016) Huggins and Prokop (2017) Rubio-Mondejar and Garrues-Irurzun (2017) Fang (2018)	Connectivity in a regional knowledge network can contribute positively to the innovation capacity of a region. Applying network theory, we can improve our knowledge of structural differences and their relationship to economic growth and regional development.
	Li et al. (2011)	Traditional production clusters are most affected by emotional connections, family relationships are the dominant channels of business, while supply and demand relationships and mobility of skilled workers are also important paths to network learning, and cooperative relationships are comparatively stable.
	Plum and Hassink (2011)	There are some key differences found in the knowledge network characteristics between knowledge base (science-based) and synthetic (engineering-based) knowledge base.

Global Networking	Eraydin and Fingleton (2006) Xu and McNaughton (2006)	The mobility of inventors between their employers and collective learning contributes to the globalization of companies.
	Varga and Sebestyen (2017)	Innovation in less developed regions tends to rely more on external knowledge to compensate for the underdevelopment of their local knowledge infrastructure.
Knowledge Based Development	Webb (2008) Chilton and Jung (2018) Galaso (2018)	It explores the social capital and knowledge networks of a region, responding to regional development agendas, identifying the need to specifically address the underlying weaknesses (participation, connectivity, and enterprise) in the regions of the city.
	Schiller and Kiese (2010) Fromhold-Eisebith and Werker (2013)	Universities and public research institutes are an important driver of innovation and knowledge-based economic development and their performance is increasingly evaluated based on their impact on regional development.
	Shapiro and Park (2012) Cabanelas et al. (2014) Wanzenbock et al (2015) Sigler and Martinus (2017) Sun and Grimes (2017) Gama et al. (2018)	Policies to encourage research specialization programs help the region become a network hub of knowledge. Public policy must be clearly committed to supporting research as a driving force in regional development.
	Emons (2012)	A better regional R & D activity to stimulate regional economic development
	Vittorio et al. (2013)	Differences in socioeconomic development can be explained by reference to some peculiarities of the knowledge economy.
Social Networking Analysis	Reid et al. (2008)	It uses a social network analysis as a method of analysis, in critique of the spatial delimitation approach, given by the clustered literature, which makes the difference between leaders, and economic development professionals and researchers.
	Russo and Rossi (2009)	Combining the tools of ethnographic research and analysis of social networks, this approach derives from the general characteristics, besides selecting methodologies for the design and evaluation of programs for innovation networks.
	Kratke and Brandt (2009)	The networks analysis of knowledge of a polycentric metropolitan region in different fields of competence produced information about the density of interconnected knowledge in the region, the degree of connectivity between the scientific institutions of the region and the companies in the private and central sector of the network. within the region.
	Brandt et al. (2009) Krebs and Latvia Univ (2013) Zhong (2018)	The analysis of networks as a thematic tool of information for knowledge management, the production of network diagrams and the parameters of network size, density, centrality, cohesion and connectivity of a large sample of actors and connections.
	Krätke (2010) Martinus (2018)	The use of a social network analysis approach can improve knowledge networks in a regional context.
	Lopes et al. (2010)	The use of social network analysis in a perspective of building communities of knowledge and adoption of ICTs.
	Kiminami et al. (2011)	The existence of a network of Small World types is considered to induce a flow of knowledge and information.
	Gopal (2012)	It serves the techniques: conceptual visualizations of trees to find patterns that affect regional development; network analysis to compare and contrast urbanization; The analysis of feelings for various sectors of development that provoke positive and negative reactions.
Social Networking Analysis	Fromhold-Eisebith and Werker (2013)	The social networks analysis and their theoretical basis offers more information on the functions of knowledge transfer of universities.

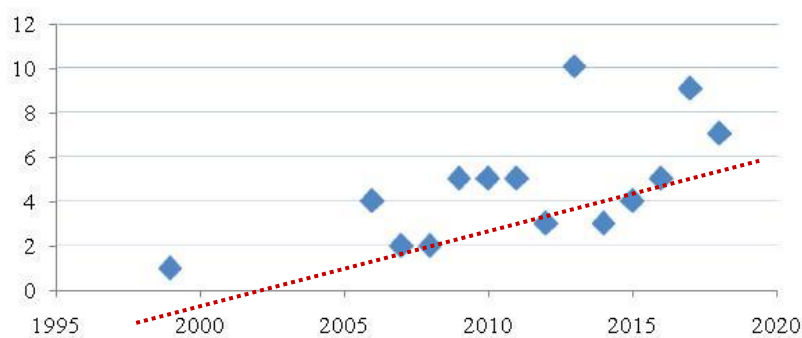
Source: Prepared by the author.

From this point on, the systematic review allows connection between selected scientific productions and research themes, identifying their contributions and raising new questions that allow the advancement in science, corroborating studies relevance that approach development based on knowledge in a approach to social network analysis.

The systematic review allow a synthesis of all studies on the subject, allowing a greater relevant results range to be incorporated, and this systematic review step presents results regarding the selected studies contributions and an advance analysis in scientific knowledge in which new studies are inserted.

3.2 Bibliometric Analysis

The Graph 1 allows a view of the temporal evolution of the studies produced and selected that contribute to the thematic of this study. The trend line shows that the productivity of studies in the subject under analysis shows an increase in the number of publications, suggesting that this is an emerging theme, especially in the last five years.



Source: Prepared by the author (2018).

Graph 1 - Time distribution of scientific production in the theme

According to Guedes and Borschiver (2006) bibliometrics is a set of laws and empirical principles that contribute to the establishment of the theoretical foundations of Information Science. The standard of distribution of bibliometric laws and principles follows the maxim "few with much and very few", known as the Matthew Effect in Science. Lotka's Law, quoted by the authors, considers that some researchers, presumably of more prestige in a certain area of knowledge, produce much and many researchers, presumably of lesser prestige, produce little.

Krätke produced three of the selected studies, two in 2009 in co-authoring with Brandt, one of which was produced only by the two authors and one co-authored by Hahn and Kiese. In 2010 Krätke produced the study Regional Knowledge Networks: A network analysis approach to the interlinking of knowledge resources published in the European Urban and Regional Studies where it employs a stakeholder networks approach for the analysis of knowledge networks in a metropolitan region of Germany to to investigate the structure and properties of regional innovation networks in a detailed and differentiated way, contributing significantly to new research.

Another bibliometric analysis mentioned by Guedes and Borschiver (2006, p.4) concerns Zipf's Laws, which allow estimating the frequencies of occurrence of the words of a given scientific text: "a small group of words occur many times and a large number of words is of small frequency of occurrence".



Figure 2 - Word cloud using the titles of the selected studies in the SLR

Following the ranking of the frequency of occurrence of words in the titles of selected studies appear the words: Regional, Innovation, Knowledge and Development. This represents the importance of considering knowledge-based regional development from the perspective of innovation. However, innovation must conceive of a perspective that transcends organizational aspects, in its process vision, products (goods and services) and marketing, these aspects are now required to be useful for human development. In this line, the ranking of frequency of occurrence of words (Table 5) presents its evidence when the word Social is above the word Economic.

Table 5 - Ranking of frequency of occurrence of words in the titles of selected studies

Ranking	Word	Frequency
1°	Network	61
2°	Analysis	21
3°	Regional	21
4°	Innovation	20
5°	Knowledge	18
6°	Development	16
7°	Social	14
8°	Economic	12
9°	Cluster	12
10°	Research	9

Source: Prepared by the author.

Another aspect to be considered in the evidence of the occurrence of words is the form of organization in Clusters, presenting itself as a significantly representative theme in the surveys between 2006 and 2016, where networking became a tool to increase the competitiveness of companies.

In 2017 and 2018 they begin studies using the network analysis approach that seeks to identify the flow of knowledge and ideas, political-institutional university-company relations and between regions, highlighting the relevance of the morphology of cities in this process of socio- sustainable economic.

4 Discussions

Emphasis is given to the contributions that future studies intend to present for advancement in knowledge-based regional development studies using a network analysis approach. In this new context of transformation of society, development must presuppose factors that move beyond the paradigm focused on economic growth, seeking the broad development of a region, from the perspective of a society based on knowledge.

However, to this end, we must understand factors that contribute to this advance in social and human factors, paying more attention to the improvement of the factors that determine the quality of life, of a more cultural and environmental nature, in which knowledge-based development using a approach to network analysis, allows you to understand the spectrum of values that an organization or a society has.

It is important to highlight that the models of analysis using probabilistic mathematics are no longer sufficient to prospect models of future scenarios. In contrast to deterministic processes, in the context of the Knowledge Age, it is necessary to apply stochastic processes, thus, network analysis seeks to establish a family of random variables representing the evolution of a value system over time.

Knowledge-based Development is the opportunity to pay more attention to the improvement of the factors that determine the quality of life, factors of a more cultural and environmental nature than those of the productive sector. However, this new context requires conditions and environments very different from those required by mass production activities. In order to survive, organizations must become more dynamic, more open and more sensitive to changing demands (changes in technology, the market, etc.)

and this requires more knowledge about all aspects of a production chain, which requires more and more customized solutions, as well as distribution, marketing, financing and flexibility aspects.

In this way, Knowledge Based Development seeks to meet the need to promote accelerated and sustained productivity growth and increase competitiveness through a new development model that privileges the use of knowledge, seeks sustainable development, through social processes of knowledge that values endogeneity, local potential and resources. It is the result of a mosaic of research and practice focused on knowledge that is shaping a multidisciplinary field that promotes decision makers and analysts with new concepts and technological tools that enable the development of appropriate frameworks and policies. Thus, Knowledge Based Development is built using social technologies that utilize the participation and engagement of the three spheres that make up the Triple Helix: Business, University and Government.

Therefore, innovation, understood in its technological, organizational and institutional dimensions, assumes an even more important importance as a strategic variable, since it causes a structural break with the technological standard, changing the status quo, giving rise to new industries, sectors and markets , or even significant reduction of costs and increase of quality in existing products, fundamental for the increase of the productivity and, consequently, of the competitiveness of a region and national.

The complexity of the innovative process requires an interorganizational network interaction, because there are relevant factors in the innovative environment where the organization is inserted and in the innovation management process, there is greater internalization through links with sources of knowledge and cooperation, generating knowledge results. Therefore, a new understanding of managerial and strategic aspects is important, where hierarchical leadership gives way to network leadership. Thus, as studies on innovation and entrepreneurship, Network Analysis also has its roots in several theoretical perspectives, and can be considered an interdisciplinary field of study. There is a rapid development of Network Analysis in recent years, leading to the resurgence of experimental and non-experimental research on the relationship between the centrality and power of social agents. Observing the contribution that an approach using the Analysis of Innovation Networks involving the spectrum of the Triple Propeller, its contributions to the diffusion of a knowledge-based economy, potentializing regional socioeconomic development.

In this sense, it is fundamental to carry out research in the field of relations between agents of an ecosystem of innovation, seeking to establish strategies of regional development based on knowledge.

5 Conclusions

The Systematic Review allowed the search of the indexed studies in the selected databases and, through explicit methods of planning and execution, these were evaluated and selected, presenting significant contributions for future studies. This process is fundamental to search for evidence regarding relevance to research topics, the evolution

and maturity of the studies already produced, as well as to limit the scope of the research, allowing to identify gaps in the theory where it is sought to explore the opportunity of new scientific contributions.

The bibliometric analysis shows that the theme is relevant for its contemporaneity, with a significant growth of studies in the last years, that future studies are added to the recent studies, allowing the scientific advance that the development of a region must understand, besides economic factors, social and human factors, paying more attention to the improvement of the factors that determine the quality of life, of a more cultural and environmental nature, that is, based on knowledge, allowing to understand the spectrum of values with which an organization counts or a society.

Another important factor is a new conception regarding the contributions to regional development from the perspective of innovation, where organizational aspects are transcended in their process design, products (goods and services) and marketing, but it is fundamental that innovation solutions to the quality of life of a society and to human development.

References

- Agranoff, R. and M. McGuire (1999). "Managing in network settings." *Review of Policy Research* 16(1): 18-41.
- Almodovar, J. and A. A. C. Teixeira (2014). "Assessing the Importance of Local Supporting Organizations in the Automotive Industry: A Hybrid Dynamic Framework of Innovation Networks." *European Planning Studies* 22(4): 841-865.
- Ansell, C., et al. (2017). "How learning aggregates: a social network analysis of learning between Swedish municipalities." *Local Government Studies* 43(6): 903-926.
- Bauer, F., et al. (2018). "Innovation in the bioeconomy - dynamics of biorefinery innovation networks." *Technology Analysis & Strategic Management* 30(8): 935-947.
- Brandt, A., et al. (2009). "Metropolitan regions in the knowledge economy: network analysis as a strategic information tool." *Tijdschrift voor Economische en Sociale Geografie* 100(2): 236-249.
- Cabanelas, P., et al. (2014). "Influence of Governance on Regional Research Network Performance." *Revista Espanola De Investigaciones Sociologicas*(148): 3-20.
- Calignano, G. (2014). "Italian organisations within the European nanotechnology network: Presence, dynamics and effects." *Erde* 145(4): 241-259.
- Caniëls, M. C. and H. Van den Bosch (2011). "The role of Higher Education Institutions in building regional innovation systems." *Papers in Regional Science* 90(2): 271-286.
- Casper, S. (2007). "How do technology clusters emerge and become sustainable? Social network formation and inter-firm mobility within the San Diego biotechnology cluster." *Research Policy* 36(4): 438-455.
- Chilton, K. and K. Jung (2018). "The applicability of growth machine theory to the knowledge economy: Social network analysis of Chattanooga's civic infrastructure." *International Journal of Social Economics* 45(4): 582-601.
- Conforto, E. C., Amaral, D. C. and Silva, S. L. da. (2011) Roteiro para revisão bibliográfica sistemática: aplicação no desenvolvimento de produtos e gerenciamento de projetos. N: 8º Congresso brasileiro de gestão de desenvolvimento de produto-CBGDP. Disponível em: <<http://vision.ime.usp.br/~acmt/conforto.pdf>>. Acesso em: 28 set. 2018.

- Deas, I., et al. (2013). "Explicitly permissive? Understanding actor interrelationships in the governance of economic development: The experience of England's Local Enterprise Partnerships." *Local Economy* **28**(7-8): 718-737.
- Dziadkowiec, O., et al. (2015). "A social network analysis of south central Kansas workforce innovations in regional economic development." *Journal of Place Management and Development* **8**(1): 6-22.
- Emons, O. (2012). Innovation and specialization dynamics in the European automotive sector: Comparative analysis of cooperation and application network. *Clusters in Automotive and Information & Communication Technology: Innovation, Multinationalization and Networking Dynamics*: 185-240.
- Eraydin, A. and B. Fingleton (2006). "Network relations and local economic development: Some causes of differentiated network structures and intensities among Turkish industrial firms." *Environment and Planning A* **38**(6): 1171-1186.
- Evans, D., et al. (2015). Network models of entrepreneurial ecosystems in developing economies.
- Fang, J. (2018). "An analysis of the differentiation rules and influencing factors of venture capital in Beijing-Tianjin-Hebei urban agglomeration." *Journal of Geographical Sciences* **28**(4): 514-528.
- Fritsch, M. and M. Kauffeld-Monz (2009). "The impact of network structure on knowledge transfer: An application of social network analysis in the context of regional innovation networks." *Annals of Regional Science* **44**(1): 21-38.
- Fromhold-Eisebith, M. and C. Werker (2013). "Universities' functions in knowledge transfer: a geographical perspective." *Annals of Regional Science* **51**(3): 621-643.
- Galaso, P. (2018). "Network topologies as collective social capital in cities and regions: a critical review of empirical studies." *European Planning Studies* **26**(3): 571-590.
- Galvão, C. M., Sawada, N. O. and Trevizan, M. A. (2004). Revisão sistemática: recurso que proporciona a incorporação das evidências na prática da enfermagem. *Revista Latino Americana de Enfermagem*, v. 12, n. 3, p. 549-56, maio/jun.
- Gama, R., et al. (2018). "Science Policy, R&D and Knowledge in Portugal: an Application of Social Network Analysis." *Journal of the Knowledge Economy* **9**(2): 329-358.
- Gopal, S. (2012). "Global synthesis of Searchlight reports using knowledge discovery and visualization." *Foresight* **14**(6): 468-488.
- Graf, H. and T. Henning (2009). "Public research in regional networks of innovators: A comparative study of Four East German regions." *Regional Studies* **43**(10): 1349-1368.
- Hauck, J., et al. (2015). "Seeing the forest and the trees: Facilitating participatory network planning in environmental governance." *Global Environmental Change* **35**: 400-410.
- He, J. and M. H. Fallah (2006). Dynamics of inventors' network and growth of geographic clusters: Evidence from telecommunications industry in NJ and TX.
- Holman, N. (2013). "Effective strategy implementation: why partnership interconnectivity matters." *Environment and Planning C-Government and Policy* **31**(1): 82-101.
- Huggins, R. and D. Prokop (2017). "Network structure and regional innovation: A study of university-industry ties." *Urban Studies* **54**(4): 931-952.
- Im, E., et al. (2017). "Which Local Self-Governments Seek More Collaboration? Evidence from Interlocal Collaboration for Economic Development in South Korea." *Lex Localis-Journal of Local Self-Government* **15**(2): 175-197.
- Kiminami, L., et al. (2011). "Analysis of network structure of a food sub-cluster: Case study of the health-related industry clustering in niigata prefecture, Japan." *Studies in Regional Science* **41**(4): 1055-1074.
- Krätke, S. (2010). "Regional knowledge networks: A network analysis approach to the interlinking of knowledge resources." *European Urban and Regional Studies* **17**(1): 83-97.

- Kratke, S. and A. Brandt (2009). "Knowledge Networks as a Regional Development Resource: A Network Analysis of the Interlinks between Scientific Institutions and Regional Firms in the Metropolitan region of Hanover, Germany." *European Planning Studies* **17**(1): 43-63.
- Krebs, V. and A. Latvia Univ (2013). Applying Information and Communication Technology To Economic Network Development.
- Kustepeli, Y., et al. (2013). "The innovativeness of the Turkish textile industry within similar knowledge bases across different regional innovation systems." *European Urban and Regional Studies* **20**(2): 227-242.
- Lahdelma, T. and S. Laakso (2016). "Network analysis as a method of evaluating enterprise networks in regional development projects." *Evaluation* **22**(4): 435-450.
- Li, E., et al. (2011). "Relationships and evolving networks of rural manufacturing clusters: A case study in Yucheng County, Henan Province of China." *Chinese Geographical Science* **21**(3): 364-376.
- Lopes, L. C. R., et al. (2010). Fostering social technologies sharing through open knowledge space: A Brazilian case study of knowledge network. **67 LNICST**: 100-108.
- Mackellar, J. (2006). "Conventions, festivals, and tourism: Exploring the network that binds." *Journal of Convention and Event Tourism* **8**(2): 45-56.
- Makarem, N. P. (2016). "Social networks and regional economic development: the Los Angeles and Bay Area metropolitan regions, 1980-2010." *Environment and Planning C-Government and Policy* **34**(1): 91-112.
- Martinus, K. (2018). "Labor Networks Connecting Peripheral Economies to the National Innovation System." *Annals of the American Association of Geographers* **108**(3): 845-863.
- Meyborg, M. (2013). The role of German universities in a system of joint knowledge generation and innovation: A social network analysis of publications and patents with a focus on the spatial dimension.
- Noguera-Méndez, P., et al. (2016). "Interindustrial structure and economic development. An analysis from network and input-output perspectives." *Trimestre Económico* **83**(331): 581-609.
- Pedrolo, E. et al. (2009). A prática baseada em evidências como ferramenta para prática profissional do enfermeiro. *Cogitare Enfermagem*, v. 14, n. 4.
- Plum, O. and R. Hassink (2011). "Comparing knowledge networking in different knowledge bases in Germany." *Papers in Regional Science* **90**(2): 355-371.
- Reid, N., et al. (2008). "Cluster Regions A Social Network Perspective." *Economic Development Quarterly* **22**(4): 345-352.
- Rubio-Mondejar, J. A. and J. Garrues-Irurzun (2017). "A shortage of weak ties: economic backwardness in contemporary Andalusia from a business-network perspective." *Hispania-Revista Espanola De Historia* **77**(257): 793-826.
- Russo, M. and F. Rossi (2009). "Cooperation networks and innovation: A complex systems perspective to the analysis and evaluation of a regional innovation policy programme." *Evaluation* **15**(1): 75-99.
- Sampaio, R. F. and Mancini M. C (2007). Estudos de revisão sistemática: um guia para síntese criteriosa da evidência científica. *Revista brasileira de fisioterapia*, v. 11, n. 1, p. 83-89.. Disponível em: <<http://www.scielo.br/pdf/rbfs/v11n1/12.pdf>>. Acesso em 25 set. 2018.
- Sasaki, H., et al. (2011). Multiple Layered Network Structure of Regional Alliances in Japan: Implication for Regional Cluster Policy.
- Schiller, D. and M. Kiese (2010). "Editorial: Universities and research institutes as engines of regional cluster and economic development." *Berichte zur Deutschen Landeskunde* **84**(2): 105-113.

- Schüßler, E., et al. (2013). "Networks of Clusters: A Governance Perspective." *Industry and Innovation* **20**(4): 357-377.
- Scoponi, L., et al. (2016). "Academic cooperation in latin america for innovation in agribusiness." *Journal of Technology Management and Innovation* **11**(2): 111-120.
- Shapiro, M. A. and H. W. Park (2012). "Regional development in South Korea: accounting for research area in centrality and networks." *Scientometrics* **90**(1): 271-287.
- Sigler, T. J. and K. Martinus (2017). "Extending beyond 'world cities' in World City Network (WCN) research: Urban positionality and economic linkages through the Australia-based corporate network." *Environment and Planning A* **49**(12): 2916-2937.
- Snickars, F. V. and U. Karlsson (2017). "Research infrastructure, networks of science and regional development – the case of oskarshamn." *Region* **4**(3): 119-131.
- Sonmez, Z. (2017). "Inventor mobility and the geography of knowledge flows: Evidence from the US biopharmaceutical industry." *Science and Public Policy* **44**(5): 670-682.
- Steinberg, S. J., et al. (2010). Socio spatial network analysis for rural economic development.
- Sun, Y. T. and S. Grimes (2017). "The actors and relations in evolving networks: The determinants of inter-regional technology transaction in China." *Technological Forecasting and Social Change* **125**: 125-136.
- Van Der Valk, T. (2007). Technology dynamics, network dynamics and partnering. *Nederlandse Geografische Studies*: 1-141.
- Varga, A. and T. Sebestyen (2017). "Does EU Framework Program Participation Affect Regional Innovation? The Differentiating Role of Economic Development." *International Regional Science Review* **40**(4): 405-439.
- Vittorio, C., et al. (2013). The knowledge economy in the eu: a neural network analysis. 7th International Technology, Education and Development Conference. L. G. Chova, A. L. Martinez and I. C. Torres: 6438-6447.
- Wakabayashi, N. and K. Takai (2016). Institutionl Policy and Network Evolution in Industry University Collaborations: Longitudinal Analysis of Joint Patent Networks in a Japanese Biotechnology Cluster during 2000's. Portland International Conference on Management of Engineering and Technology. D. F. Kocaoglu, T. R. Anderson, T. U. Daim et al.: 1186-1194.
- Wanzenbock, I., et al. (2015). "Embeddedness of European Regions in European Union-Funded Research and Development (R&D) Networks: A Spatial Econometric Perspective." *Regional Studies* **49**(10): 1685-1705.
- Webb, C. (2008). "Measuring social capital and knowledge networks." *Journal of Knowledge Management* **12**(5): 65-78.
- Xu, S. X. and R. B. McNaughton (2006). "High-technology cluster evolution: A network analysis of Canada's Technology Triangle." *International Journal of Entrepreneurship and Innovation Management* **6**(6): 591-608.
- Yokura, Y., et al. (2013). "R&D networks and regional innovation: a social network analysis of joint research projects in Japan." *Area* **45**(4): 493-503.
- Yun, S. and J. Lee (2013). "An innovation network analysis of science clusters in South Korea and Taiwan." *Asian Journal of Technology Innovation* **21**(2): 277-289.
- Zhong, Z. (2018). "The evolution of regional collaborative innovation from the complex social networks perspective." *Journal of Advanced Oxidation Technologies* **21**(2).

Today's Business and Entrepreneurship Development: Knowledge Dynamics and Competences of Managers and Entrepreneurs

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Abstract

As was already identified in our previous studies, managers who operate in the modern organizations should apply a new set of abilities to lead the teams (Nikitina and Lapina, 2018; 2019). Policy makers (OECD policy report, 2018) claim that entrepreneurial behaviour of employees urged to adapt to changes. There is no common opinion among researchers about similarities of managerial and entrepreneurial competencies. Some researchers point out that psychological differences between managers and entrepreneurs are insignificant in large organizations (Begley and Boyd, 1987; Sexton and Bowman, 1984; Brockhaus and Horwitz, 1986; Low and MacMillan, 1988). Other researchers report that entrepreneurs manifest more overconfidence contrary to managers (Busenitz and Barney, 1997). Other researchers assume that business owners' competencies are combined from managerial and entrepreneurial (Chandler and Hanks 1994). Recent studies emphasize that entrepreneurs are different from non-entrepreneurs in terms of the competencies they possess (e.g. Huck and McEwen, 1991; Chandler and Jansen, 1992; Minet and Morris, 2000; Baum et al., 2001; Man et al., 2002; Sony and Iman, 2005) and entrepreneurial behaviour needs to manage culture, while the non-entrepreneurial one is oriented towards performance management (Sadler-Smith et al. 2003).

Over the last decades there is a rise in the number of SME companies where people perform entrepreneurial, managerial, and operational functions (Cohen & Musson, 2000). Researchers assume that entrepreneurs have a broader scope of competencies, as they need to play the roles of the manager, owner and entrepreneur (Man, 2001). Researchers have identified a specific group of competencies relevant to development of small businesses (Smith and Morse, 2005). Addressing SME challenges, researchers define finance management, establishing good human relations and planning goals as the most important competencies needed for SME entrepreneurs (Huck and McEwen, 1991), then the list was extended with opportunity recognition, opportunity development, and strategic and decision-making skills (Herron and Robinson, 1993; Man et al., 2002). The findings correspond to the discoveries proposed by Gaile-Sarkane who introduced Semi

Management Theory addressing management functions in small and medium companies (Gaile-Sarkane, 2012).

The purpose of the research was to analyse the relationship between managerial and entrepreneurial competencies, the following hypotheses were used:

H1: Managers and entrepreneurs share the same set of competencies but the importance of the competencies varies for each of the groups.

H2: Managers and entrepreneurs acquire the competencies differently – the first set is gained via education and experience; the other set is developed due to personality and experience.

Keywords – competence, managerial competences, entrepreneurial competence, knowledge management

Paper type: Academic Research Paper

1. Literature Review

Literature review was conducted to respond to the questions whether there is change and development trend in entrepreneurial knowledge, skills sets, and competencies and whether there is a method to train and assess them in the real business environment. For the purpose of the content analysis the authors reviewed academic sources in the EBSCO database for the period from 2015 to 2018. Initially 98 articles were selected according to keywords “entrepreneurial skills”, “entrepreneurial competences”, “entrepreneur + competence”. For analysis the authors chose 70 articles where entrepreneurs were considered as subjects for investigations on entrepreneurial competences, whereas studies where organizations were assumed as subject for research were excluded from the content analysis. As per recommendations for qualitative content analysis developed by P.Mayring (2014), three segmentation rules or units of analysis were defined. The first one is the ‘coding unit’, or the smallest component of material within one category; in the study it is a specific word or phrase. The second one is the ‘context unit’, which defines the largest component in the category, a document page in the case. Finally, the third one is the ‘recording unit’ that “determines which text portions are confronted with one system of categories”, it is an article or document. The authors were interested in the changes appearing during the last three years and discovered that half of the sample were devoted to the role of higher education institutions (HEIs), competence assessment and training methods to develop entrepreneurial competences, while the other part of articles were focused on field research and case studies. The authors identified some correlation between perception about entrepreneurial competences in previous years in comparison to the latest years, as well as linkage to managerial competences. For purpose of this research the authors define the following concepts: competence (plural – competences) is a set of skills, knowledge and attitude or set of competencies (singular – competency) that include also personal behaviour or intent. A summarized output of the first part is represented below in Table 1 and Figure 1.

2. Methodology of Research

As the studies were performed as a part of ERASMUS+ KA2 project, to validate the theoretical detections EntreComp: the Entrepreneurship Framework was set as a benchmark for emerging and demanded skills in the labour market. The geographic scope is primarily Finland, Latvia and the Netherlands. A study on trans-disciplinary entrepreneurship training is considered an intellectual output of the research. Business environment trends in the demand for competences in the labour market and international business environment is one of the focuses for the researchers.

Three focus groups that consisted of 5 start-up entrepreneurs were considered as an identification method to recognize the sets of knowledge, skills and competence for further analysis. The focus group members in Finland, the Netherlands and Latvia conducted brainstorming for competences generation, and then named whether or not the competences corresponded to the ones that are enlisted in the 15 EntreComp model competences. The evaluation of the importance of the existing 15 EntreComp competences and of newly identified competences was required for the first half of the importance/performance analysis – the importance of competences necessary in the transdisciplinary entrepreneurship training methodology for entrepreneurship and management students. During the later phases of the project research the list of competences was analyzed to understand whether the performance of training meets entrepreneurs' perception about the skills importance/demand, hereafter in Table 2 it is possible to see the respondents' assessment divided per country.

Importance-Performance Analysis is a technique which visualizes an area divided into four quadrants based the values of importance and performance of different elements which are calculated in relation to each other on two-dimensional coordinate system. As per authors of the method (Martilla & James, 1977), values of different attributes are provided by respondents' assessment, calculated and represented in the coordinate system where the horizontal axis is considered as performance, and the vertical axis – importance. When conducting focus groups formed from start-up entrepreneurs, the authors asked the respondents in each country to evaluate the competences listed in the EntreComp competences list on the scale from 1 to 4 where 1 is the least important ability. Then the data from all respondents was summarized per country and its weighted values are presented in Table 2 illustrating importance of each competence to SME during its early phases.

3. Entrepreneurial competences

There are many competences, such as initiative taking, creativity, result orientation, capacity for reflection and interpersonal skills, active problem seeking and problem-solving, risk appetite, that are considered by many researchers as typical for entrepreneurs (Baert & Camertijn, 2007; Gibb, 2008; Laevers & Bertrands, 2004; Van den Berghe, 2007; Van der Kuip & Verheul, 2004, Schelfhout et al., 2016). At the same time, as already mentioned above, modern environment and policy makers are interested in

approximation of managerial and entrepreneurial competences. HEIs are concerned with developing not only skills but attitude that shapes the action of the workforce turning towards proactive entrepreneurial behaviour. For example, European Competence Framework (ECF) is used as a base for a self-assessment study to identify entrepreneurial competences acquired in entrepreneurship education courses in Estonian universities. The researchers have evaluated cognitive outcomes of the courses (knowledge about entrepreneurship), then affective outcomes (entrepreneurship-related attitudes,) and skill-based outcomes (entrepreneurial skills). To the last group of competences correspond business planning and modelling organization, project management, marketing, leadership, motivating others, team and individual work, negotiation, risk-taking, lateral thinking, commitment, managing uncertainty, solving problems, creative thinking, resolving conflicts (Kraiger et al., 1993; European Union recommendations, 2006; European Commission, 2007; Fisher et al., 2008; Kyro, 2008; ECOTEC, 2010; European Commission, 2012; Amaeshi, 2017). It was discovered that an overview of an educational program reports positive outcomes of skill-based training, although those students who come from entrepreneurial families demonstrate higher aspiration to education, a study conducted by Mets revealed that earlier orientation of students significantly influences the outcomes of the course (Mets et al., 2017). An interesting fact is that another study reported that entrepreneurial skills, such as creativity, openness to risk-taking, negotiations skills, technical knowledge and skills and marketing, are passed from generation to generation in case of a family SME (Letonja et al., 2016). Another study in the Baltics discovered creativity, communication, organiser and project manager skills, ability to plan and ability to take risk, entrepreneurial ability, and as an opportunity to acquire knowledge as a skillset for start-upers. In contrast to the previous study in the neighbouring country, it was discovered that students in Latvia have less knowledge about entrepreneurship and the demands of the labour market (Bikse et al., 2017). Similar findings were reported by researchers from Poland stating that people tend to see themselves as employees not employers, do not willing to take risks, initiative, or demonstrate creativity (Igielski, 2017). When investigating the need of entrepreneurial competences for managers and leaders another researcher discovered that entrepreneurial competences are more important for those who “need to deal with risks and challenges” (Postuła and Majczyk, 2018). Other researchers agree by pointing out that there are differences in the entrepreneurial competences between the countries depending on economic climate, i.e. passive environment or opportunity scanning (Taipale-Erävala et al, 2014).

Interestingly that a researcher from Finland emphasizes the significant role of social skills, supporting and serving society as a powerful driver to raise a responsible citizen that leads to the appearance of responsible entrepreneurial behaviour (Laalo and Heinonen, 2016). Researchers recognize the importance of network development, i.e. development of transactional and relational competences (Maksimov, 2017). There is a correlation between strong partnership management skills and sales and marketing skills (Khalid, 2015). Similar observations were made in the Netherlands where an empirical study among Master students revealed the influence of social competence and social

capital towards the raise of entrepreneurial ambitions. It was stated that social competence is a cornerstone to a range of opportunities for the entrepreneur forming a social capital for early-stage entrepreneurs (Lans et al., 2015). Dealing in uncertain situations requires a competence of crisis management; application of the competence to the context of entrepreneurial crises, such as resource shortage, dissatisfied clients or incorrect overview of financial perspective of the new venture, demands fostering the entrepreneurial competences of perceiving the critical incidents and coping with them (Heinrichs, 2016). Intriguing findings were reported by a Lithuanian researcher who proposed a technology entrepreneurship development aimed to combine techniques for launching a new business and products as well as exploring opportunities in the field of technical knowledge and science. Hereafter, it is suggested to train engineers in lean start-up methodology, business modelling, intellectual property protection and funding for a start-up in the same way that future managers and entrepreneurs are usually trained (Juceviciene et al., 2015). The author referred to previous studies (Pretorius et al., 2005) where competencies related to business management were set as complementary for an overall entrepreneurial competence. Researchers emphasize the importance of both the entrepreneurial and technical competence as preconditions for innovation and successful launch and further growth of a new SME (Ng et al., 2016). As SMEs usually operate with limited access to resources, the enterprises benefit from professional technical expertise and experience of their owners, e.g. receiving a grant at the beginning of business activities (Stenholm and Renko, 2016). Alike to the previous studies, some researchers are convinced that the abilities to plan and organize work, supervise tasks and manage people are perceived as the most important both for managers and owners of internationalized SMEs (Korsakiene, 2015).

Interestingly, the idea of gaining benefits from academic entrepreneurship, cross-disciplinary studies, entrepreneurial and operational activities is supported by researchers who write about entrepreneurial ecosystem and beneficial location of the clusters where HEIs and start-ups are collocated (Rasmussen 2011, Rao and Mulloth, 2017). Researchers (Bohdziewicz, 2016, Tuononen et al., 2016; Bravo et al., 2017; Sales et al., 2017), who explore entrepreneurial and managerial competences, refer to the concept of Career Anchors by Edgar Schein (Schein, 1985) that describes an individual's personal identity or self-image with many facets including among others technical and functional, general management and entrepreneurial creativity. Researchers found out that when comparing the entrepreneurial orientation with the managerial orientation, there is a big overlapping in the criterion variables to which each is related, hence the main difference between these two dimensions of career orientation is the desire for upward movement within the organization in the managerial orientation in contrast to a dedication for the creation of new products or processes for the entrepreneurial orientation (Bravo et al., 2017).

There are many categorizations for entrepreneurial competences, some researchers (Bird, 2002; Man et al., 2002,) divided them as 1) market exploiting opportunities; 2) interpersonal relationships; 3) conceptual abilities, such as decision-making, understanding of complex situations and innovativeness; 4) organizational skills; 5) strategic skills; 6) belonging and leading. There is another approach proposed by Le Deist

and Winterton (2005) in the context of entrepreneurial educational program development that defines entrepreneurial competence as a sum of 1) knowledge-related cognitive competence; 2) entrepreneurial skills and know-how functional competence; 3) behavioural competence.

According to the EntreComp framework (EntreComp, 2018), 15 entrepreneurial competences are divided into three areas, they are: 1) ideas and opportunities, 2) resources, and 3) into action; the full list of competences, output of content analysis and managerial competences discovered by the authors in the previous studies are compared in Table 1 below.

Table 1 Comparison of Entrepreneur's and Manager's Competences, created by the authors

EntreComp (2018)	Entrepreneurial Competences	Entrepreneurial Competences since 2015	Managerial Competences
Creativity	Creativity, creative and lateral thinking	Creativity and creative thinking	Creativity
Coping with uncertainty, ambiguity and risk	Managing uncertainty	Managing uncertainty	Ability to react and divide risks
Working with others	Team and individual work	Team and individual work	Teamwork
Self-awareness and self-efficacy	Capacity for reflection	Self-awareness	Self-organization
Mobilizing others	Interpersonal skills, incl. conflict resolution and negotiation	People management incl. Communication and Social skills, network development, partnership management, social competence	Ability for collaboration and forming relationship
Motivation and perseverance	Motivating others	Motivating others	n/a
Taking the initiative	Initiative taking	Initiative taking	n/a
Planning and management	Business planning, modelling organization, project management	Business modelling, organizing incl. specialized techniques, e.g. Lean start-up methodology	n/a
Spotting opportunities, Valuing ideas and Vision	Entrepreneurial ability	Entrepreneurial ability	n/a
Learning through experience	n/a	Ability to acquire knowledge	Willingness to learn and Erudition
n/a	Leadership	Leadership	Leadership

It was interesting to identify that three competences that are creativity, managing uncertainty, teamwork, ability for self-awareness and self-organization and strong people management competences are relevant for all researchable groups – for modern managers, entrepreneurs and the entrepreneurial educational standard as well. It is important to note that when describing entrepreneurs in the last three years researchers pay great attention to the investigation of social competence, communication and social skills, network development, and partnership management – that is a mirror image of the manager's collaboration ability and competence to form internal and external relationships.

The next group of the entrepreneurial competences identified by researchers among entrepreneurs in the last decades, including the last three years, and included in the EntreComp framework are the ability for motivating others, ability to take initiative, competence in business planning and management and ability to spot opportunities. A thought-provoking finding is that during the last couple of years, entrepreneurial competences in the field tend to be very specific, for example, a competence in business modelling, organizing incl. specialised techniques such as the lean start-up methodology. The researchers assume the change might be caused by the increasing role of start-ups as a form of SMEs and a rise in the number of business accelerators and incubators.

There are two more peculiar findings: leadership competence, which for many year was considered as an undivided part for leaders and managers, is not included in the EntreComp model, however, the ability to acquire new knowledge, which is demanded for modern entrepreneurs and managers as well as incorporated in the EU Entrepreneurship Competence Framework, is a novelty for academic research appearing recently.

The authors identified that researchers discussed the following entrepreneurial skills before and after 2015, however the competences are not reflected either in EntreComp or in managerial skills: 1) solving problems / dealing with critical incidents; 2) risk appetite and openness to risk taking / risk taking. At the same time, there are entrepreneurial skills that were discussed extensively earlier but have not been very popular in academic discussion during the last three years; they are result orientation and commitment, as well as marketing competence. Instead of it, academics utterly emphasize the significance of a) technical knowledge and skills; b) technology entrepreneurship; c) knowledge on intellectual property protection; d) competence in funding for start-ups. Probably these findings are linked with digital entrepreneurship and the notable role of ICT in the modern environment. Another interesting finding is that the EntreComp framework includes some skills that have not been widely discussed by researchers, they are:

- 1) ethical and sustainable thinking;
- 2) mobilizing resources;
- 3) financial and economic literacy.

Finally, the authors noticed that the ability to analyse and evaluate is obviously related to the managerial skills set only. A graphic representation of the findings is shown in Figure 1 below.

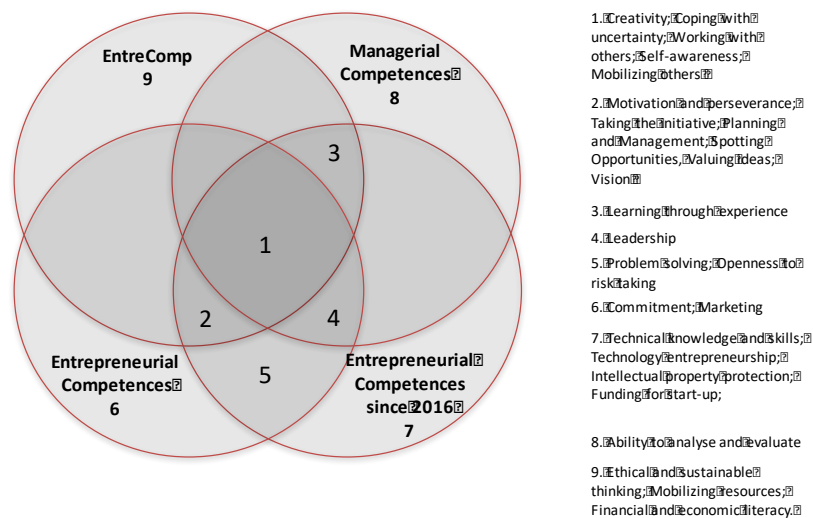


Figure 1 Entrepreneurial and Managerial Competences Model, created by the authors

4. Finding and Results

It was interesting to identify that entrepreneurs in all three countries participating in the research have a unanimous opinion about the motivation and perseverance competence as the most important to launch a business. The ability for spotting opportunities was chosen as the second most important by entrepreneurs in Finland and the Netherlands, while Latvian start-up founders ranked taking the initiative as the second most important for running a business on early stages. The third competence assumed as significant by the business persons was creativity in Finland, vision ability in the Netherlands and coping with uncertainty, ambiguity and risk in Latvia. A similar unanimous consent was demonstrated by the focus group members expressing their opinions about the least important skills for entrepreneurs: ethical and sustainable thinking, financial and economic literacy were chosen as less meaningful in all countries. In addition, the Finnish group pointed out that mobilizing others is not important for start-up companies; it might be explained by usually high motivation of the start-up team. The Dutch group also mentioned that planning and management are not so important for businesses during their early stages; it might be explained by the fact that start-ups usually focus on product development and launch, while tedious business and project planning are characteristic for firms in more mature development phases.

Comparison of the focus groups findings with previous findings of the authors lead to unexpected results, as the skills that were chosen by start-up founders as the least valuable for entrepreneurs are identical to the competences included the EU EntreComp framework but not massively investigated by other researchers from the perspective of entrepreneurial or managerial competences in modern organizations:

- 1) ethical and sustainable thinking;
- 2) mobilizing resources;

3) financial and economic literacy.

Table 2. 15 EntreComp Competences Evaluated by Start-up Entrepreneurs in Finland, the Netherlands and Latvia

EntreComp Competences	FI	NL	LV
Spotting opportunities	16	15	18
Creativity	16	13	16
Vision	8	15	17
Valuing ideas	4	10	18
Ethical and sustainable thinking	0	9,5	14
Self-awareness and self-efficacy	8	14	17
Motivation and perseverance	20	16	20
Mobilizing resources	8	13	18
Financial and economic literacy	0	7	14
Mobilizing others	4	14	17
Taking the initiative	4	14	20
Planning and management	12	8	19
Coping with uncertainty, ambiguity and risk	12	13	20
Working with others	12	10	18
Learning through experience	16	14	18

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References

- Amaeshi, U.F. (2017) “Project Management Capabilities & Competences for Successful Entrepreneurship in Nigeria”, *PM World Journal*. Jan2017, Vol. 6 Issue 1, pp.1-33.
- Baert, H. & Camertijn, C. (2007). *Zelfbeoordeling van Ondernemerscompetenties in een Competentiegericht Ontwikkelingstraject: de ENTRE-Spiegel*. Paper presented at Onderwijs Research Dagen 2007. Groningen, The Netherlands
- Baum, J.R., Locke, E.A., Smith, K.G. (2001) "A multidimensional model of venture growth", *Academy of Management Journal*, Vol.44 No.2, pp. 292-303.
- Begley, T.M., and Boyd, D.P. (1987) “Psychological characteristics associated with performance in entrepreneurial firms and smaller businesses”, *Journal of Business Venturing*, Vol. 2, pp. 79-93.
- Bikse V., Lusena-Ezera I., and Rivza B. (2016) “PERFORMANCE TRENDS IN YOUTH ENTREPRENEUR’S CAPACITY PREREQUISITE FOR THE ENTREPRENEURSHIP DEVELOPMENT OF LATVIA”, *POLISH JOURNAL OF MANAGEMENT STUDIES*, 2016 Vol. 14 No.1, pp. 40-50.
- Bird, B. J. (2002). “Learning entrepreneurship competencies: the self-directed learning approach”, *International Journal of Entrepreneurship Education*, 1 (2), pp. 203- 227.

- Bohdziewicz, P. (2016) "Career Anchors of Representatives of Generation Z: Some Conclusions for Managing the Younger Generation of Employees", *Zarządzanie Zasobami Ludzkimi*, 2016 6 (113), pp. 57-74.
- Brockhaus, R.H., and Horwitz, P.S. (1986) *The psychology of the entrepreneur*. In D.L. Sexton and R.W. Smilor, eds., *The Art and Science of Entrepreneurship*. Cambridge, MA: Ballinger Publishing.
- Busenitz, L.W. and Barney, J.B. (1997) "Difference Between Entrepreneurs and Managers in Large Organizations: Biases and Heuristic in Strategic Decision-Making", *Journal of Business Venturing* Vol. 12, pp. 9-30
- Chandler, G.N. and Jansen, E. (1992) "The founder's self-assessed competence and venture performance" *Journal of Business Venturing*, Vol. 7 No.3, pp. 223–236.
- Chandler, G.N. and Hanks, S.H. (1994) "Founder competence, the environment, and venture performance", *Entrepreneurship Theory and Practice*, Vol.18 No.3, pp. 77–89.
- Cohen, L. and Musson, G. (2000) "Entrepreneurial Identities: Reflections from Two Case Studies", *Organizations*, Vol. 7 No.1, pp. 31-48.
- Developing entrepreneurship competencies, Policy Note to the OECD Ministerial Conference on Small and Medium-sized Enterprises, taking place on 22-23 February 2018 in Mexico.
- EC (2007) *Key Competences for Lifelong Learning: A European Framework*. Luxembourg: Office for Official Publications of the European Communities.
- EC (2012) *Effects and Impact of Entrepreneurship Programmes in Higher Education*. Brussels: European Commission, DG Enterprise & Industry.
- ECOTEC (2010) *Towards Greater Cooperation and Coherence in Entrepreneurship Education*. Birmingham: Ecorys.
- EntreComp into Action. Get Inspired. Make it Happen. A user guide to the European Entrepreneurship Competence Framework. (2018) Luxembourg: Publications Office of the European Union, 2018 Retrieved from <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/entrecomp-action-get-inspired-make-it-happen-user-guide-european-entrepreneurship-competence>
- EU (2006) Recommendation of the European Parliament and the Council of 18 December 2006 on Key Competences for Life- long Learning. Official Journal of the European Union L 394/ 10 of 30.12.2006. Retrieved from <http://ec.europa.eu>
- Eurostat Statistical database. Available from European Commission. Brussels. ISBN 92-894-7909-4. Retrieved from <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home>
- Fisher, S., Graham, M. and Compeau, M. (2008) "Starting from scratch: understanding the learning outcomes of entrepreneurship education", Harrison R and Leitch C (eds) *Entrepreneurial Learning: Conceptual Frameworks and Applications*. New York: Routledge, pp. 313–340.
- Gaile-Sarkane, E. (2012) "Semi Management Theory and Business Sophistication", 16th World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2012), United States of America, Orlando, 17-20th July, 2012; International Institute of Informatics and Systemics, Florida, pp. 25-30.
- Gibb, A.A. (2008) 'Entrepreneurship and Enterprise Education in Schools and Colleges. Insights from UK practice' *International Journal of Entrepreneurship Education*, 6,2 forthcoming Senate Hall Academic Publishing.
- Heinrichs, K. (2016) "Dealing with Critical Incidents in the Postformation Phase: Design and Evaluation of an Entrepreneurship Education Course", *Vocations and Learning*, v9 n3 pp. 257-273.
- Herron, L. and Robinson, R.B. (1993) "A structural model of the effects of entrepreneurial characteristics on venture performance", *Journal of Business Venturing*, Vol. 8 No.3, pp. 281-294.

- Huck, J.F. and McEwen, T. (1991) "Competencies Needed for Small Business Success: Perceptions of Jamaican Entrepreneurs", *Journal of Small Business Management*, Vol. 29 No.4, pp. 90-93.
- Igielski, M. (2017) "MODEL WSPARCIA POSTAW PRZEDSIĘBIORCZYCH ABSOLWENTÓW SZKÓŁ WYŻSZYCH - PROGRAM ROZWOJU KOMPETENCJI", *Research Papers of the Wrocław University of Economics / Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*. 2017, Issue 499, pp.100-108.
- Jesus, B., Seibert, S.E., Kraimer, M.L., Wayne, S. and Liden, R.C. (2015) "Measuring Career Orientations in the Era of the Boundaryless Career", *Journal of Career Assessment* 25(3) November 2015.
- Juceviciene, R., Kazakeviciute, A. and Petraite, M. (2015) "Technology Entrepreneurship Competence as a Result of Experiential Learning: Relationship Between Knowledge, Skills and Abilities", *Proceedings of the European Conference on Innovation & Entrepreneurship* 2015, pp. 330-340.
- Kraiger K, Ford J and Salas E (1993) "Application of cognitive, skill-based and affective theories of learning outcomes to new methods of training evaluation", *Journal of Applied Psychology* 78, pp. 311–328.
- Kyro, P. (2008) A theoretical framework for teaching and learning entrepreneurship. *International Journal of Business and Globalisation* 2(1) pp. 39–55.
- Laalo, H. and Heinonen, J. (2016) "Governing the entrepreneurial mindset: Business students' constructions of entrepreneurial subjectivity", *European Educational Research Journal*, Volume: 15 issue, pp. 696-713.
- Laevers, F., & Bertrands, E. (2004). *Ondernemingszin (h)erkennen*. Leuven: CEGO Publishers.
- Lans, T., Blok, V. BlokJudith T. M., and Gulikers, J.T.M. (2015) "Show me your network and I'll tell you who you are: social competence and social capital of early-stage entrepreneurs", *Entrepreneurship and Regional Development* 27(7-8), pp. 458-473.
- Le Deist, F. D., & Winterton, J. (2005). "What is competence?" *Human Resource Development International*, 8(1), 27–46.
- Letonja, M., Mitja Jerajmitja, M., and Maričmiha, M. (2016) "An Empirical Study of the Relationship between Entrepreneurial Competences and Innovativeness of Successors in Family SMEs", *Organizacija*, Volume 49: Issue 4, pp.225-239.
- Low, M.B., and MacMillan, I.C. (1988) "Entrepreneurship: Past research and future challenges", *Journal of Management*, Vol.14 No.2, pp. 139-161.
- Maksimov, V. (2017) "Entrepreneurial Orientation and the Co-Development of Transactional and Relational Competences", January 2017 Academy of Management Annual Meeting Proceedings 2017(1).
- Man, T.W.Y. (2001) "Entrepreneurial competencies and the performance of small and medium enterprises in the Hong Kong services sector", PhD dissertation, Hong Kong Polytechnic University.
- Man, T.W.Y., Lau, T. and Chan, K.F. (2002). "The competitiveness of small and medium enterprises a conceptualization with focus on entrepreneurial competencies", *Journal of Business Venturing*, Vol.17, pp.123–142.
- Martilla, J. A., & James, J. C. (1977). Importance-performance analysis. *The journal of marketing*, 77-79.
- Mayring, P. (2014). *Qualitative content analysis: theoretical foundation, basic procedures and software solution*. Klagenfurt, 2014. URN: <http://nbn-resolving.de/urn:nbn:de:0168-ss0ar-395173>
- Mets, T., Kozlinska, I., and Raudsaar, M. (2017). "Patterns in Entrepreneurial Competences as Perceived Learning Outcomes of Entrepreneurship Education: the Case of Estonian HEIs", *Industry and Higher Education*, 31 (1), pp. 23–33.

- Minet, S. and Morris, M. (2000). Adaptation as a core entrepreneurial competency: Components, antecedents, and Outcomes. American Marketing Association. Conference Proceedings; 2000; 11, ABI/INFORM Global.
- Nikitina, T. and Lapina I. (2018) ‘The concept of manager: critical analysis and competencies required’, Vilnius Gediminas Technical University 10th International Scientific Conference “Business and Management 2018” Proceedings, Vilnius
- Nikitina, T. and Lapina, I. (2019) “Creating and Managing Knowledge towards Managerial Competence Development in Contemporary Business Environment”, Knowledge Management Research and Practice, DOI 10.1080/14778238.2019.1569487
- Ng, H.S., Kee, D.M.H., and Ramayah, T. (2017) “The role of transformational leadership, entrepreneurial competence and technical competence on enterprise success of owner-managed SMEs”, Journal of General Management, Volume: 42 issue: 1, pp. 23-43.
- Pretorius, M., Nieman, G., and Vuuren, J. (2005). “Critical evaluation of the two models for entrepreneurial education: An improved model through integration”, International Journal of Educational Management, Vol. 19, No. 5, pp. 413–427.
- Postuła, A. and Majczyk, J. (2018) “Managers and Leaders in Need of Entrepreneurial Competences”, Entrepreneurial Business and Economics Review, Vol 6 No 1 (2018): Social Entrepreneurship in the Global Context, pp. 91-103.
- Rao, B. and Mulltoth, B. (2016) “The Role of Universities in Encouraging Growth of Technology-Based New Ventures”, International Journal of Innovation and Technology Management Vol. 14, No. 4 (2016) 1750014.
- Rasmussen, E. (2011) “Understanding academic entrepreneurship: Exploring the emergence of university spin-off ventures using process theories”, International Small Business Journal, October 2011 29(5), pp. 448-471.
- Sadler-Smith, E., Hampson, Y., Chaston, I., and Badger, B. (2003) “Managerial Behaviour, Entrepreneurial Style, and Small Firm Performance”, Journal of Small Business Management, Vol. 41 No.1, pp. 47-67
- Sales, M. L., Xavier Filho, J. L. J., & Damascena, E. O. (2017) «Serviço Público como Expectativa Profissional dos Graduandos em Administração». Revista Pensamento Contemporâneo em Administração, 11(1), pp. 1-16.
- Schein, E.H. (1985). Career Anchors: Discovering Your Real Values. San Diego: University Associates
- Schelfhout, W., Bruggeman, K., and De Maeyer, S. (2016) «Evaluation of entrepreneurial competence through scaled behavioural indicators: validation of an instrument», Studies in educational evaluation. Oxford. 51(2016), pp. 29-41.
- Sexton, D.L., and Bowman, N. (1984) “The effects of pre-existing psychological characteristics on new venture initiations”, Paper presented at the annual meeting of the Academy of Management, Boston, MA.
- Smith, B. and Morse, E. (2005), Entrepreneurial Competencies: Literature Review and Best Practices. Small Business Policy Branch Industry Canada, Ottawa.
- Sony, H. P. and Iman, S. (2005). “Relationship between entrepreneurial learning, entrepreneurial competencies and venture success: empirical study on SMEs”, International Journal of Entrepreneurship and Innovation Management, Vol. 5 No.5/6, pp. 454-468.
- Stenholm, P. and Renko, M. (2016) "Passionate bricoleurs and new venture survival," Journal of Business Venturing, Elsevier, vol. 31(5), pp. 595-611.
- Taipale-Eräväla, K., Lampela, H. and Heilmann, P. (2015) “Survival Skills in SMEs—Continuous Competence Renewing and Opportunity Scanning”, Journal of East-West Business, 21, pp. 1–21.
- Tuononen, T., Lammintakanen, J. and Suominen, A.L. (2016) Career anchors of dentist leaders, Acta Odontologica Scandinavica, 74:6, pp. 487-493.

- Van den Berghe, W. (2007). Ondernemend leren en leren ondernemen. Brussel: Koning Boudewijnstichting.
- Van der Kuip, I., & Verheul, I. (2004). Early development of entrepreneurial qualities: The role of initial education. *Journal of Entrepreneurship Education*, 2(2)
- Vidic, F. (2012). "Vpliv podjetniške in tržne naravnosti ter kreiranja znanja na uspešnost podjetij [The influence of entrepreneurial and market orientation and knowledge creation on the success of companies]", Ljubljana: University of Ljubljana, Faculty of Economics.

Coproduction and Innovation in Knowledge-Intensive Business Services

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Abstract

This paper focuses on coproduction of knowledge-intensive business services (KIBS) and the impact it causes on their innovation activity. Coproduction refers to the customer engagement in one or more stages of the services production process. Although coproduction and value co-creation are close concepts and very often are used interchangeably, significant differences between these concepts exist as the latter covers a wider range of provider-client interaction during consumption and usage stages. While value co-creation is related to the development of the customer experience, coproduction is devoted to the creation of the service offering itself. According to the service-dominant logic, which is the most common framework in this field, customer is always a co-creator of value, while his involvement in coproduction is optional. This paper aims at studying whether those KIBS that involve their customers in coproduction are more innovative. The research model includes a set of innovation drivers like human capital, advertising expenditures, the existence of multiregional branch network and standardization as well as the coproduction measure. This model was empirically tested using a dataset of 441 KIBS enterprises in Russia. The results show that coproduction have a strong positive effect on the implementation of both technological and non-technological innovations in KIBS. It means that innovation-oriented KIBS may benefit from developing coproduction-based strategies. These findings contribute to both innovation management and KIBS studies and provide opportunities for future research in both fields.

Keywords – KIBS, coproduction, client involvement, innovation

Paper type – Academic Research Paper

1 Introduction

The concept of service co-production emerged in the late 1970s to describe close interactions between public services producers and the population as consumers of these services (Lehrer et al., 2012). However, since 2000s this concept has been started to be applied to the exploration of the relationships between private companies and their clients (Vieira et al., 2015). The growth of information availability, globalization and networking

in early 2000s has changed the world significantly and the research focus has shifted from producers to consumers (Vargo & Lusch, 2004). Companies' activities also moved from autonomous actions to those that involve collaborative interactions with their customers (Prahalad & Ramaswamy, 2004).

This inseparability of service production and consumption significantly enhanced the need for service producers to interact with their customers to deliver more valuable solutions (Lehrer et al., 2012). These consumer interactions are especially important for KIBS, i.e. service companies that provide knowledge-based solution at B2B markets, because they are extremely customer-oriented enterprises that develop customized services aiming at serving specific needs of each particular client (Bettencourt et al., 2002). This process requires information about the particular client rather than about the "typical customer" (den Hertog, 2001) and could be obtained only in a collaborative manner.

Despite the growing number of studies in the field of coproduction and value co-creation in a marketing and management literature, most studies cover only B2C markets and focus on customer outcomes like loyalty or satisfaction, while their impact on innovations is still being under-researched (Cui & Wu, 2016; Cabigiosu & Campagnolo, 2018). In addition, most studies in this field are conceptual in their nature and only suggest some hypotheses to be validated, but lack the empirical evidence to support them (Jouny-Rivier & Ngobo, 2016). However, with the growth of the importance of customer inputs coproduction management has become one of the most critical issues (Siahtiri, 2017), especially at emerging markets. This paper tries to fill these gaps and empirically explore the following research question: *how coproduction of KIBS influences innovation activities of these enterprises?*

The paper is structured as follows. Section 2 briefly introduces KIBS topic and presents the results of the bibliometric research. Section 3 relates to the discussion of coproduction concept and its comparison with the concept of value co-creation, following by the Section 4 which is devoted to the discussion of innovation drivers in KIBS. Sections 5 and 6 describe the methodology and the results respectively. The final section discusses the empirical findings and concludes.

2 Knowledge-Intensive Business Services

The concept of KIBS was introduced in the mid 1990s by Miles et al. (1995) who highlighted, that economic activity of a set of some service industries leads to "the creation, accumulation or dissemination of knowledge" (p. 18). Since then the research interest to these industries has grown significantly corresponded to the increase of KIBS contribution to economic growth and development (Miles et al., 2018). In innovation systems KIBS act as both knowledge intermediaries who provide required innovation inputs for their clients and innovators who develop innovative solution themselves (Shearmur & Doloreux, 2018).

Scarso (2015) highlighted that although most papers related to KIBS come from economics, in recent years management and geography scholars have also started to

contribute to KIBS studies. In addition, if earlier Muller & Doloreux (2009) suggested three main dimension for KIBS research (knowledge, innovation, and spatial proximity), Scarso (2015) add an additional “management” dimension which deals with marketing, customer relationships, new service development and human factors. To check whether the research interest in KIBS by management scholars still exists in this paper a keyword co-occurrence analysis was conducted¹. Final keyword co-occurrence network presented at figure 1 covers 125 items occurred in the selected papers at least 5 times. More recent used keywords are highlighted in yellow.

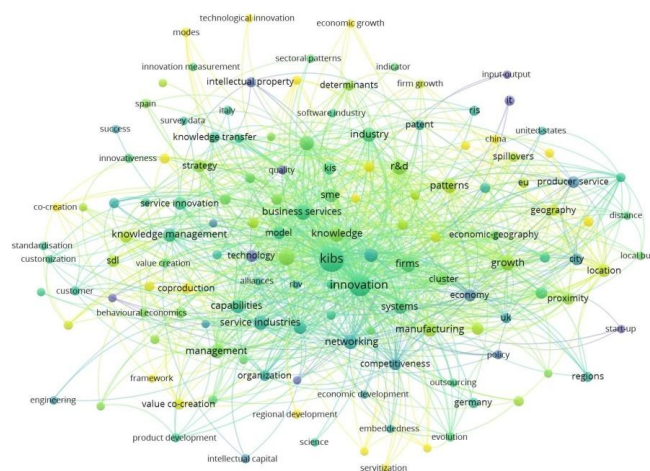


Figure 1. Keyword co-occurrence analysis of KIBS topic in WOS database

The results of the keyword co-occurrence analysis confirm that coproduction is one of the most emerging topics in KIBS literature. It is also usually co-occurred with such topics like customer interaction or value co-creation. It is in line with Lehrer et al. (2012), who highlighted that both terms “coproduction” and “co-creation” are usually used to describe the collaboration between service providers and their clients. However, very often the term “co-creation” is used without making a reference whether it relates to coproduction or to value co-creation (Mustak et al., 2013). These practices creates the ambiguity and make the differences between two concepts fuzzy (Vieira et al., 2015).

¹ The analysis is based on the published studies covered by the Web of Science database. The search query includes the following terms: “knowledge-intensive business services”, knowledge intensive business services” and “KIBS”. The analysis deals with those papers that have at least one these terms in the title or abstract. Papers that include terms like “kinetic inductance bolometers” (KIBs), “ion” or “batteries” (K-ion batteries, KIBs) were excluded. Final dataset consist of 456 publications including journal articles, conference proceedings and book chapters. The analysis of keyword co-occurrence was done using freely available VOSviewer software. Some keywords were merged manually due to the spelling issues.

3 Coproduction and Value Co-creation

Coproduction is usually recognized as one of the main feature of services (Lehrer et al., 2012). Despite the growth of research interest in this area there is still no commonly shared definition of this process. However, some core features may be derived from a wide range of approaches (Lehrer et al., 2012; Aarikka-Stenroos & Jaakkola, 2012; Leclercq et al., 2016; Ranjan & Read, 2016):

- Customers as active participants may be engaged in coproduction of service provider output at any stages of the production process preceding service consumption, including idea generation and design stages, production of related goods, service delivery, etc;
- During coproduction service providers integrates to their production processes some inputs provided by customers including intellectual (knowledge and expertise) and labor resources;
- This joint effort of both service provider and its customer is usually aimed at developing of the more optimal / effective / better quality / service solution;

The basic framework for the research of value co-creation is service-dominant logic. In their initial paper on service-dominant logic Vargo & Lusch (2004) suggested that the customer is always a coproducer of value and marks this statement as one of the fundamental premises of this theory. However, later they replace the term “coproducer” by the term “co-creator”, because coproduction relates to the service development (“making units of output”), while the process of value co-creation also includes service consumption, customer experience and perceptions (Vargo & Lusch, 2008). In their recent study Vargo & Lusch (2016) also paid attention to the importance of making a distinction between co-creation of value and customer engagement in the development of value propositions (service offerings). The comparison of two concepts is presented in Table 1.

Table 1. Comparison of “value co-creation” and “coproduction” concepts

Criteria	Concept	
	Value co-creation	Coproduction
Scope	Covers a wide range of collaborative service provider-customer relationships especially during service consumption and usage stages	Restricted to the service production and include only purposeful interactions and resource (including knowledge) sharing between service provider and its customer
Result	Value benefits for all the participants realized via interactions	Service offering (value proposition) as providers’ output that can be exchanged
Frequency	All the customers are always involved in the value co-creation as the services has no value till it is consumed	Not necessarily exist, usually is observed in interactions with experienced customers and lead users

Customer role	Leading role of the customer; Service provider helps to create or co-create his value and experience	Customer is only a contributor, leading role of the service provider
Participants	May be extended to relationships with all members of business ecosystem	Dyadic relationships between service provider and its customer
Type of value	Value-in-use	Value-in-exchange

Source: Developed by the author based on Vieira et al. (2015), Kohtamäki & Rajala (2016), Leclercq et al. (2016), Mustak et al. (2016), Mustak (2017).

Coproduction may be considered as a sub-process of value co-creation (Kohtamäki & Rajala, 2016). In addition, Leclercq et al. (2016) argued that coproduction of the service offering may lead not only to the co-creation of value, but also to the co-destruction of value. In turn, coproduction as being optional is often considered as an important process that facilitates the development of new innovative services (Greer & Lei, 2012). Miles (2008) also argued that innovative KIBS are more dependent on customer inputs than their counterparts from other industries which makes coproduction to be important innovation driver. Thus, the research hypothesis is as follows:

Research hypothesis: Coproduction is positively related to innovation activities in KIBS.

4 Innovation Drivers in KIBS

In this paper the model suggested in Chichkanov et al. (2019) is used as a baseline framework. This model covers four main innovation drivers found to be crucial in previous KIBS-related literature: human capital, access to the wider knowledge base, advertising expenditures and standardization. As the baseline model follows Gonzalez-Blanco et al. (2019) and treat both product and process innovations as a single group of technological ones, this paper also adopt this approach and additionally treat marketing and organizational innovations as a single group of “soft” or non-technological ones.

Human capital is usually considered as key production factor in KIBS as the nature of their activities is based on the tacit professional knowledge and expertise embedded in their employees (Schrike et al., 2012). In addition, most business processes in KIBS are those of the human nature, so these firms usually spend more on human resource training and development than manufacturing enterprises (Gotsch et al., 2011). Moreover, it was empirically shown that those companies that employ more qualified workforce are also better prepared to solving different issues related to innovation barriers (D’Este et al., 2014). Human capital may also be a measure of the absorptive capacity (Duchek, 2013).

According to Grandinetti (2018), absorptive capacity is important for KIBS as they are usually involved in both A- and C-networks. The latter refers to KIBS relationships with their customers, while the former is related to any other KIBS connections with competitors, research universities, etc. During their relationships with clients KIBS may either coproduce knowledge or just transfer knowledge they previously absorbed. In that case, A-networks become crucial as they provide KIBS an access to new external

knowledge that may be acquired, assimilated, transformed and applied. In that case, a multiregional branch network provides an opportunity to have an access to a wider knowledge base. In turn, this diversified knowledge base may enhance the innovation activity of KIBS by ensuring the availability of required knowledge inputs (Chichkanov et al., 2019).

In line with a “Schmooklerian” view of demand-driven innovation, the lack of demand significantly reduces the innovation activity (D’Este et al., 2012). The lack of demand is one of the biggest challenges for KIBS, especially at immature emerging markets (Lingyun et al., 2011). In developed countries KIBS also usually invest a lot in marketing and advertising to promote their innovative solutions (Asikainen, 2015). Moreover, advertising and marketing is often considered by services enterprises as an effective tool for protecting their innovations (Djellal & Gallouj, 2001).

Service solutions developed by KIBS are usually considered as highly customized and it is also described as one of the main sources of KIBS competitive advantage (Campagnolo & Cabigiosu, 2015). Bettiol et al. (2015) created an alternative taxonomy of KIBS including industrialized (provide mainly standardized solutions), bespoke (enterprises with a highly customized output) and combinatory (develop both standardized and customized solutions) KIBS and found combinatory KIBS to be the most successful in terms of revenue. Standardization may cause both positive and negative effects for innovation activities. More customized solutions are usually better suited to customer needs, while more standardized solutions are transferable from one customer to another (Cabigiosu & Campagnolo, 2018).

5 Methodology

5.1 Research Model

The research model includes four innovation drivers (expenditures on the development of the human capital, advertising expenditures, multiregional branch network and standardization) found to be significant in Chichkanov et al. (2019). In addition, coproduction measure taken from Doroshenko et al. (2013) is used. This measure reflects the average level of customer engagement in service production process and is based on the 10-grade scale where 1 refers to the lowest customer engagement (restricted by the terms of reference from the official contract) and 10 refers to the highest customer participation (collaborative activities during the whole project). Two alternative measures are dummy variables for those KIBS companies who reported that they apply the knowledge learned from or developed during the interaction with the one customer to the service development for other customers often or sometimes respectively. Descriptions for all used variables are presented in Appendix A. The final research model is as follows:

$$\log\left(\frac{P_i}{(1-P_i)}\right) = \alpha + (\beta_1 \dots \beta_4) * Innovation\ Drivers + (\gamma_1 \dots \gamma_3) * Coproduction + (\lambda_1 \dots \lambda_5) * Controls + \varepsilon_i$$

where $\log(\frac{p_i}{1-p_i})$ is the logarithm of the ratio of the probability that KIBS enterprise implements an innovation to the probability, that it does not; Innovation Drivers is a set of innovation drivers; Coproduction is a set of coproduction measures; Controls is a set of control variables, α is a constant; β, γ, λ are regression coefficients; ε is an error term.

5.2 Data

This paper uses the data from the database of the HSE ISSEK project “Monitoring of Knowledge-Intensive Business Services in Russia”. The dataset was collected in 2015 in 14 major Russian cities during two-stage sampling procedure ensuring the representativeness of the sample in terms of the geographical distribution, industry and size. After excluding observations with missing data the final dataset consists of 441 KIBS enterprises. The data was collected through structured interviews either with the owner of the KIBS company or a key-position employee like CEO.

6 Empirical Results

The results of model estimation for both technological and non-technological innovations are presented in tables 2. The results for the baseline model are presented in columns 1 and 3, while columns 2 and 4 presents the results for those models that include an additional coproduction variable. All the models are based on the robust standard errors to cope with heteroscedasticity issue. VIF values show that multicollinearity issue does not affect the results. The goodness of fit for all models is verified by Hosmer-Lemeshow statistics.

Table 2. The results of model testing for technological (1-2) and non-technological (3-4) innovations (marginal effects)

	(1)	(2)	(3)	(4)
Share of HR development expenditures	0.0167*** (0.00447)	0.0159*** (0.00449)	0.00502 (0.00438)	0.00375 (0.00449)
Share of advertising expenditures	0.00849* (0.00435)	0.00834* (0.00438)	0.00984** (0.00427)	0.00959** (0.00424)
Branches	0.257*** (0.0595)	0.249*** (0.0590)	0.128** (0.0562)	0.116** (0.0558)
Standardization	0.166*** (0.0643)	0.155** (0.0634)	0.0916 (0.0736)	0.0741 (0.0732)
Standardization ²	-0.0231*** (0.00670)	-0.0214*** (0.00665)	-0.0133* (0.00776)	-0.0108 (0.00775)
Coproduction		0.0141* (0.00725)		0.0173** (0.00867)
Moscow	-0.0765* (0.0457)	-0.0820* (0.0455)	0.00319 (0.0526)	0.00182 (0.0518)
T-KIBS	0.182***	0.179***	-0.159**	-0.164**

	(0.0594)	(0.0595)	(0.0658)	(0.0654)
C-KIBS	0.110** (0.0474)	0.119** (0.0472)	-0.0348 (0.0528)	-0.0247 (0.0529)
Age	-0.00992 (0.0329)	-0.0119 (0.0332)	-0.00679 (0.0365)	-0.0120 (0.0364)
Size	-0.0337 (0.0442)	-0.0357 (0.0450)	-0.00685 (0.0470)	-0.00545 (0.0464)

The results support the positive impact of coproduction on innovation activities in KIBS in terms of the implementation of both technological and non-technological innovations. The relationships between other innovation drivers and implementation of innovation in KIBS are in line with the baseline framework (Chichkanov et al., 2019). Thus, advertising expenditures and multiregional branch network were found to be significant drivers of both technological and non-technological innovations, while the positive impact of HR expenditures is observed only for technological ones. In addition, the relationship between standardization and technological innovations is non-linear and describes by the inverted U-shaped curve. Finally, two alternative coproduction measures are used to check the robustness of the results. The impact of coproduction on innovation activities remains positive and significant, while all other effects were also found to be stable across the specifications.

5 Discussion and Conclusions

The results support the positive view of coproduction as a mechanism that may contribute to the growth of the innovation activity of KIBS. KIBS may improve their innovation activity either by more intensive engagement of their customers into the production of services or by more frequent coproduction of knowledge. From the practical point of view these findings suggest that the development of coproduction-based strategies may help KIBS not only to improve their service offerings, but also to become more innovative.

More tight relationships with their customers help KIBS providers to enhance their innovation activity, which is in line with Greer & Lei (2012). Jouny-Rivier & Ngobo (2016) argued that developing these relationships or networks is determine the success of KIBS innovation projects as they help to integrate KIBS professional expertise and client industry-specific information. The development of KIBS also requires a lot of non-codified tacit knowledge which in turn requires deeper collaboration with the customer (Kohtamaki & Rajala, 2016).

In addition, those companies that report frequent or even occasional usage of knowledge coproduced with their customers or learned from them during the interaction also tend to implement more both technological and non-technological innovations. It is in line with den Hertog (2010) who argued that tacit knowledge developed or transferred during KIBS provider-customers interaction may enhance innovation activity not only in client firm, but also in KIBS. According to Ryzhkova (2015), these insightful customer

knowledge and expertise helps companies to discover additional opportunities at the market. In that case, KIBS often follow the market-pull approach and develop their innovative solutions in line with market insights they obtain during customer interactions (Camapagnolo & Cabigiosu, 2015).

One of the main problems is studying coproduction is its measurement. Most existing studies in this field are theoretical, while others are based on a limited amount of case studies or in-depth interviews that makes it difficult to create an appropriate tool to measure the phenomenon of coproduction (Skarzauskaite, 2013). The measures used in this paper also have some limitations and future studies will benefit by overcoming these issues.

The first used measure of coproduction is focused only on the average intensity of customer involvement and neglects some important characteristics of this process. On the one hand, the level of coproduction intensity may vary across different project stages. On the other hand, this level may also vary across different customer segments due to the client characteristics. In addition, the used measure does not focus on the duration of coproduction (Ryzhkova, 2015) and its quality. A new more sophisticated measure of coproduction intensity that covers these different contexts will be very useful for coproduction studies.

The alternative measures of coproduction look at the frequency of knowledge coproduction. Although knowledge is the most crucial production factor of KIBS by their nature, some other customer resources (labor or managerial implications) may also be exchanged during coproduction, which means additional measures that covers other types of coproduction content are required (Ryzhkova, 2015).

Finally, this study explores the link between coproduction and the implementation of technological and non-technological innovation, but it does study the commercial success of these innovations or other outcomes. In addition, comparative studies that cover different countries or longitudinal researches may also contribute to the understanding of the impact of coproduction on innovation activity in KIBS.

References

- Aarikka-Stenroos, L., Jaakkola, E. (2012), "Value co-creation in knowledge intensive business services: A dyadic perspective on the joint problem solving process", *Industrial Marketing Management*, Vol. 41, No. 1, pp. 15–26.
- Asikainen, A. (2015) "Innovation modes and strategies in knowledge intensive business services", *Service Business*, Vol. 9, Iss. 1, pp. 77–95.
- Bettencourt, L., Ostrom, A., Brown, S., Roundtree, R. (2002) "Client co-production in knowledge-intensive business services", *California Management Review*, Vol. 44, Iss. 4, pp. 100–128.
- Bettiol, M., Di Maria, E., Grandinetti, R. (2015) "Service customisation and standardisation in combinatory knowledge-intensive business services", *International Journal of Knowledge-Based Development*, Vol. 6, Iss. 3, pp. 241–260.
- Cabigiosu, A., Campagnolo, D. (2018) "Innovation and growth in KIBS: the role of clients' collaboration and service customisation", *Industry and Innovation*, Vol. 26, Iss. 5, pp. 592–618.

- Campagnolo, D., Cabigiosu, A. (2015) "Innovation, Service Types, and Performance in Knowledge Intensive Business Services" In R. Agarwal, W. Selen, G. Roos, R. Green (Eds.), *The Handbook of Service Innovation* (pp. 109-121). London: Springer.
- Chichkanov, N., Miles, I. D., Belousova, V. (2019) "Drivers for innovation in KIBS: evidence from Russia", *Service Industries Journal*, pp. 1-23 (in print).
- D'Este, P., Iammarino, S., Savona, M., von Tunzelmann, N. (2012) "What hampers innovation? Revealed barriers versus deterring barriers", *Research Policy*, Vol. 41, Iss. 2, pp. 482–488.
- D'Este, P., Rentocchini, F., Vega-Jurado, J. (2014) "The role of human capital in lowering the barriers to engaging in innovation: evidence from the Spanish innovation survey", *Industry and Innovation*, Vol. 21, Iss. 1, pp. 1–19.
- den Hertog, P. (2001) "Knowledge Intensive Business as Co-producers of Innovation", *International Journal of Innovation Management*, Vol. 4, Iss. 4, pp. 491–528.
- Djellal, F., Gallouj, F. (2001) "Patterns of innovation organisation in service firms: postal survey results and theoretical models", *Science and Public Policy*, Vol. 28, Iss. 1, pp. 57–67.
- Doroshenko, M., Miles, I., Vinogradov, D. (2013) "Knowledge intensive business services as generators of innovations", HSE WP BRP Science, Technology and Innovation no 12, Moscow: NRU Higher School of Economics.
- Duchek, S. (2013) "Capturing absorptive capacity: a critical review and future prospects", *Schmalenbach Business Review*, Vol. 65, Iss. 3, pp. 312-329.
- González-Blanco, J., Coca-Pérez, J., Guisado-González, M. (2019) "Relations between technological and non-technological innovations in the service sector", *The Service Industries Journal*, Vol. 39, Iss. 2, pp. 134-153.
- Gotsch, M., Hipp, C., Gallego, J., Rubalcaba, L. (2011) "Sectoral Innovation Watch: Knowledge Intensive Services Sector", *Europe INNOVA Sectoral Innovation Watch*, for DG Enterprise and Industry, European Commission.
- Grandinetti, R. (2018) "The KIBS paradox and structural holes", *Knowledge Management Research & Practice*, Vol. 16, Iss. 2, pp. 161-172.
- Greer, C.R., Lei, D. (2012) "Collaborative Innovation with Customers: A Review of the Literature and Suggestions for Future Research", *International Journal of Management Reviews*, Vol. 14, Iss.1, pp. 63–84.
- Kohtamäki, M., Rajala, R. (2016) "Theory and practice of value co-creation in B2B systems", *Industrial Marketing Management*, Vol. 56, pp. 4–13.
- Leclercq, T., Hammedi, W., Poncin, I. (2016) "Ten years of value cocreation: An integrative review", *Recherche et Applications En Marketing*, Vol. 31, No. 3, pp. 26–60.
- Lehrer, M., Ordanini, A., DeFillippi, R., Miozzo, M. (2012) "Challenging the orthodoxy of value co-creation theory: A contingent view of co-production in design-intensive business services", *European Management Journal*, Vol. 30 No. 6, pp. 499–509.
- Lingyun, W., Muhos, M., Kess, P. (2011) "Motivations, Modes and Challenges of KIBS in the Internationalisation to China", *Journal of modern accounting and auditing*, Vol. 7, Iss. 6, pp. 588-600.
- Miles, I., Belousova, V., Chichkanov, N. (2018) "Knowledge intensive business services: ambiguities and continuities", *Foresight*, Vol. 20, Iss. 1, pp. 1-26.
- Miles, I., Kastrinos, N., Flanagan, K., Bilderbeek, R., den Hertog, P., Huitink, R., Bouman, M. (1995) "Knowledge-Intensive Business Services: Users, Carriers and Sources of Innovation", *European Innovation Monitoring Service*, Publication no. 15. Luxembourg.
- Muller, E., Doloreux, D. (2009) "What we should know about knowledge-intensive business services", *Technology in Society*, Vol. 31, Iss. 1, pp. 64–72.
- Mustak, M. (2017), "Customer participation in knowledge intensive business services: Perceived value outcomes from a dyadic perspective", *Industrial Marketing Management*, Vol. 78, pp. 76–87.

- Mustak, M., Jaakkola, E., Halinen, A. (2013) "Customer participation and value creation: A systematic review and research implications", *Managing Service Quality*, Vol. 23, No. 4, pp. 341–359.
- Mustak, M., Jaakkola, E., Halinen, A., Kaartemo, V. (2016) "Customer participation management: Developing a comprehensive framework and a research agenda", *Journal of Service Management*, Vol. 27, Iss. 3, pp.250-275.
- Prahalad, C., Ramaswamy, V. (2004) "Co-creation experiences: The next practice in value creation", *Journal of Interactive Marketing*, Vol. 18, Iss. 3, pp. 5–14.
- Ranjan, K., Read, S. (2016) "Value co-creation: concept and measurement", *Journal of the Academy of Marketing Science*, Vol. 44, No. 3, pp. 290–315.
- Scarso, E. (2015) "What do we know about KIBS? Results of a systematic literature review", In *Proceedings of IFKAD 2015*, edited by Spender J., Schiuma G., Albino V. pp. 1159-1172.
- Schricke, E., Zenker, A., Stahlecker, T. (2012) "Knowledge-Intensive (Business) Services in Europe", Luxembourg: Publications Office of the European Union.
- Shearmur, R., Doloreux, D. (2018) "KIBS as both innovators and knowledge intermediaries in the innovation process: Intermediation as a contingent role". *Papers in Regional Science*, Vol. 98, Iss. 1, pp. 191-209.
- Vargo, S., Lusch, R (2004) "Evolving to a New Dominant Logic for Marketing", *Journal of Marketing*, Vol. 68 No. 1, pp. 1–17.
- Vargo, S., Lusch, R. (2008) "Service-dominant logic: continuing the evolution." *Journal of the Academy of marketing Science*, Vol. 36, Iss. 1, pp. 1-10.
- Vargo, S., Lusch, R. (2016) "Institutions and axioms: an extension and update of service-dominant logic", *Journal of the Academy of marketing Science*, Vol. 44, Iss. 1, pp. 5-23.
- Vieira, L. V., Silva Filho, A. I., Reis, M. C. A. (2015) "Innovation in Public Services: A descriptive analysis of award-winning innovative experiences in Brazil". In: *Proceedings of XXIV Annual RESER Conference. 25th International Conference of RESER*, Copenhagen.
- Cui, A., Wu, F. (2016) "Utilizing Customer Knowledge in Innovation: Antecedents and Impact of Customer Involvement on New Product Performance", *Journal of the Academy of Marketing Science*, Vol. 44, Iss. 4, pp. 516–38.
- den Hertog, P. (2010) "A Systemic Approach: Knowledge Intensive Business Services as Co-Producers of Innovation." In *Managing Service Innovation: Firm-Level Dynamic Capabilities and Policy Options*, edited by Pim den Hertog, Utrecht.
- Jouny-Rivier, E., Ngobo. P. (2016) "Drivers of Companies' Willingness to Co-Create B2B Services", *Recherche et Applications En Marketing*, Vol. 31, Iss. 3, pp. 61–87.
- Miles, I. (2008) "Patterns of Innovation in Service Industries", *IBM Systems Journal*, Vol. 47, Iss. 1, pp. 115–28.
- Ryzhkova, N. (2015) "Does Online Collaboration with Customers Drive Innovation Performance?" *Journal of Service Theory and Practice*, Vol. 25, Iss. 3, pp. 327–47.
- Siahtiri, V. (2017) "Does Cooperating with Customers Support the Financial Performance of Business-to-Business Professional Service Firms?" *Journal of Service Theory and Practice*, Vol. 27, Iss. 3, pp. 547–68.
- Skaržauskaitė, M. (2013) "Measuring and Managing Value Co-Creation Process: Overview of Existing Theoretical Models." *Social Technologies*, Vol. 3, Iss. 1, pp. 115–29.

Appendix A. Descriptive statistics of used variables

	Description	Min	Max	Mean	St. dev.
Technological Innovation	1 if company implemented technological innovation (including innovative products and services) in the 1 st half of 2015, 0 otherwise	0	1	0.64	0.48
Non-technological innovation	1 if company implemented non-technological innovation (marketing and/or organisational) in the 1 st half of 2015, 0 otherwise	0	1	0.41	0.49
Share of HR development expenditures	Share of expenditures on recruiting and training in total expenditures of the company in the 1 st half of 2015	0	25	4.98	5.76
Share of advertising expenditures	Share of expenditures on advertising in total expenditures of the company in the 1 st half of 2015	0	40	6.73	5.59
Branches	1 if in the 1 st half of 2015 the company have branches in other regions, 0 otherwise	0	1	0.27	0.44
Standardisation	7 categories: 1 if the share of standardised services in 2014 was less than 10%, 2 for 10-20%, 3 for 21-40%, 4 for 41-60%, 5 for 61- 80%, 6 for 81-90%, 7 if the share of standardised services exceeded 90%	1	7	5.34	1.55
Standardisation ²	Square of the standardisation variable (for non-linearity testing)	1	49	30.96	14.77
Coproduction	Company's self-assessment of the average level of customer engagement in service production process from 1 (the lowest customer engagement) to 10 (the highest customer engagement).	1	10	5.93	2.80
High knowledge coproduction	1 if the company often apply the knowledge learned from or developed during the interaction with the one customer to the service development for other customers, 0 otherwise	0	1	0.08	0.27
Medium knowledge coproduction	1 if the company sometimes apply the knowledge learned from or developed during the interaction with the one customer to the service development for other customers, 0 otherwise	0	1	0.22	0.41
Control variables					
Moscow	1 if the company is located in Moscow, 0 otherwise	0	1	0.31	0.46
T-KIBS	1 if the company belongs to information technology or engineering industries, 0 otherwise	0	1	0.18	0.39
C-KIBS	1 if the company belongs to advertising, information-communication consulting or web, design and digital services industries, 0 otherwise	0	1	0.32	0.47
Size	1 for small enterprises (7-50 employees), 2 for medium-sized enterprises (51-249 employees) and 3 for large enterprises (more than 250 employees)	1	3	1.36	0.57
Age	Natural logarithm of the company age	0	4.17	2.14	0.69

In Search of Knowledge Ecosystems for Underdeveloped Countries: a Practical Case in Oncology and Complex Disease in Bolivia

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Abstract

This paper outlines a practical case of innovation for all in developing countries. Research focuses on innovation to support complex diseases patients. Key innovation success factors are information technologies, especially social networks; and human capital as a community of good practices (SANTI). By selecting a professional group with related knowledge in healthcare in three countries: Spain, USA, and Bolivia. Paper focuses on how to establish SANTI, with few resources and fast response, to support real cases cancer and complex patients. Research outlines a model with support of design science research, qualitative investigations and 5 cases of study with patients in Bolivia and one in Spain.

Results point to vital role of human capital and information technologies. Successful innovation relies on creating an appropriate community; strategy and values contribute positively to results.

Scholars avoid wicked problems as a hot topic in literature. Wicked problem as cancer has been avoided from an inclusive community committed to innovation with quick response to patients in developing countries. This study shows how a community of practices is capable of supporting complex patients and how it responds efficiently and fast. Innovation is possible with support of information technologies, especially social networks. Human/social process is enhanced by strategy and coach or mentor leadership. SANTI grows and evolves by open and honest communication and permission to experiment and fail. This model promotes personal health management through self-management and self-care of disease. SANTI provides resources not accessible for patients and facilitates access them through crowdfunding.

SANTI as mini-ecosystem of knowledge offers positive results in society progress, open innovation, encourage innovation of new models in health care and digital transformation. Research describes how to grow from a mini-ecosystem to provide strategic, solutions based on knowledge and how they can positively impact growth, well-being, and innovation for all. Finally, SANTI transforms the impact of current social and economic changes and challenges on positive effects on growth and well-being in chronic patients with exclusion risk. Simplicity of model makes it easily scalable to ensure growth and improve the quality life for patients in developing countries.

Keywords – Innovation for all, knowledge ecosystems, personal health management, intellectual capital management, digital healthcare transformation.

Paper type – Practical Paper

1 Introduction

The knowledge revolution brings new business models and growth to regions and cities, but it also creates new barriers, especially to groups that have no access to new technologies and specialized services and these differences become more evident in developing countries. Complex issues, such as cancer treatment, include not only medication treatment but also the follow-up in the quality of life of these patients who were already outpatients, they find a solution through advances in research and technology in the first world. However, this does not happen in developing countries as it is the case of Bolivia. In this country, there are 16 oncologists to address all cases of cancer occurring in the country, and this is due to the lack of specialized resources, the lack of training and access to scientific progress. This research aims to respond to this issue practically through knowledge ecosystems to contribute to the development of society through the elevation of health and welfare in real cases of cancer. To be able to achieve results in the short term and low cost, the research relies on the use of information technologies and in human capital, which are the primary sources to overcome the barriers of developing countries.

Another cornerstone is the creation of communities in practices and management through a coach. The research relies on the personal supervision of health from a comprehensive point of view, with the support of a vision from the intellectual capital and in the line of the concept of health proposed by the World Health Organization.

The model promotes personal health management through self-management and self-care of the disease (related to symptoms, complications and long period side effects), so the community of good practices provides resources that are not accessible to the patient and facilitates access to them through crowdfunding.

2 Theoretical background

2.1 Knowledge Ecosystem

Knowledge ecosystem is an approach to knowledge management which claims to foster the dynamic evolution of knowledge interactions between entities to improve decision-making and innovation through enhanced evolutionary networks of collaboration (Clarysse *et al.*, 2014). Concept popularity due to it frames the decisions we make affecting nature in terms of the value of life to people and makes those values more visible.

2.2 Growth and shape a sustainable future

Large clusters, cities, and metropolitan concentrate the regional development (Fagerberg and Verspagen, 2006). Regions differ each other depending on how fast is the process and the availability of resources to grow. The differences between areas make the availability of resources and services different from one region to another.

Similarly, innovation tends to cluster in specific sectors or areas, which grow faster and often require structural changes. However, sometimes there are significant differences between one industry to another. Thus, to solve complex situations, there is a need to establish links between sectors and innovation is a real solution for that.

Innovation ecosystem refers to a dynamic, interactive network that breeds innovation. It was born with industry and business clusters (Porter, 1998; Estrin, 2009) and in the Triple Helix approach to regional development and national innovation systems (Smith and Leydesdorff, 2000). In practice, the term can refer to local hubs, global networks, or technology platforms (Moore, 2006).

When ecosystems are studied frequently the goal is to emphasize on local and regional ecosystems and their development. The ecosystem approach emphasizes the position and roles of local and public actors in developing innovation activity. The ecosystem metaphor also enriches the systems model with value and culture. (Nambisan and Baron, 2013)

The continual realignment of synergistic relationships of people, knowledge, and resources for both incremental and transformational value co-creation characterizes the transformation of an ecosystem. Through links, value co-creation networks evolve from mutually beneficial relationships between people, companies, and investment organizations.

(Estrin, 2009) defines an innovation ecosystem; in her view, the innovation ecosystem is made up of communities of people with various types of expertise and skill sets. Sustainable development has economic, environmental, and social dimensions (Quinn, Doorley and Paquette, 1990). It is the emerging concept of "sustainable innovation."

Undoubtedly innovation has a crucial role in solving significant challenges such as water scarcity, climate, recycling, energy consumption (Kao, 2007). This approach could be successful for the creation of new products and services as part of the initiatives of the innovation network, but it seems different in the case of wicked problems (see Rittel & Webber, 1984) In complex issues the solution requires extensive cooperation and many actors. Wicked problems need more time for results, but when managed successfully, the solutions provide a means to tap into a significant, long-term innovation potential

In recent decades, wicked problems have been a hot topic with scholars and practitioners from different disciplines (Weber & Kahneman, 2008). In knowledge revolution organizations, companies, non-governmental organizations, and citizens are all interested in creating solutions to wicked problems. It seems that more efficient identification of issues and more collaborative approaches to building solutions are needed. Similarly, innovations are often produced through co-creation among diverse individuals and groups, not by institutions alone.

Problem solvers often possess conflicting views of the problem, of solution methods, and the legitimacy of possible solutions (Wexler, 2009). Ideation and discussions should take place in shared arenas, where organizations together with opinion leaders and other central figures guide the innovation processes and meaning creation (Luoma-aho & Vos, 2010). Inclusive innovation policy starts from the principle that all people should have the

opportunity to develop their skills and look for creative solutions to the challenges they see as necessary.

2.3 Community of practices

Communities of Practice is a term referred to how people naturally work together. It acknowledges and celebrates the power of informal communities of peers, their creativity and resourcefulness in solving problems, and inventing better, more natural ways to meet their commitments. They are peers in the execution of 'real work. What holds them together is a shared sense of purpose and a real need to know what each other knows.

A community of practice is a group of people who are informally bound to one another by exposure to a standard class of problem.

Communities of Practice Deliver their Value Proposition by developing and spreading better practices faster; connecting "islands of knowledge" into self-organizing, knowledge sharing networks of professional communities.

2.4 Building a successful team

Human capital, specifically talent, is the differential factor in organizations. Talented professional has knowledge and skills that will allow him to achieve the expected results; commitment to the project of the organization; and action. However, the most important thing is knowing how to play as a team (Bolet, 2000). The culture of an organization comprises a dynamic set of values, ideas, habits and traditions shared by the people who are part of an organization that regulates their performance. The change of culture and the elements that must be motivated and counteracted while seeking a culture oriented towards knowledge (Minsal Pérez and Pérez Rodríguez, 2007).

Talent has three main components: competence, commitment and action. Commitment is essential to achieve results. Without commitment the creation of wealth is not possible. Being fundamental to achieve results. Therefore, it is key to detect the talent that is convenient to our organizations, understand the social and economic factors that have made talent a strategic priority and measure the impact of talent management on business results(Jericó Rodríguez, 1996).

A team works if there is trust among its members. Trust is the new currency of our interdependent and collaborative world. At the same time, it is the most critical component of a successful leader and an organization (Covey and Merrill, 2006).

2.5 Supporting a wicked problem as cancer from patient centred care

It is given the name Cancer to a group of related diseases. Body cells lose cell division control and begin creating malign tissue, with the time this tissue starts to spread, and it depends on how much time that reaches more and more muscles. Physiological functions are affected by this process, and because of it the body starts working in a way it should not When the cancer is not progressing anymore, and scan tests show the disease in a stable state, clinicians consider that the condition is under control.

Nowadays there is a large group of people suffering from this disease a part of them despite having cancer under control do not have a successful cure or eliminated the entire illness and have to live their whole life with it or a long time (What Is Cancer?, 2017).

Cancer can affect a person physically, emotionally, and mentally, it can interfere with daily activities, and some degree of depression and anxiety is common in people who are coping with cancer every day. Because of, people with the disease need patient centered-care which focuses not only on relief of physical and emotional symptoms related to illness.

2.6 Intellectual capital approach for health

According to Gratton et al. there are three types of resources which make up own individual human capital (Gratton, L., & Ghoshal, 2003). Different elements of human capital are highly interrelated. Individual's sustainable competitive advantage is built from the relation of social capital elements; the combination of these elements, feedback loops, and connectivity bring individual benefit (Enache and Martí, 2007).

As well as intellectual capital refers to fundamental individual attributes highly interrelated, World Health Organization (WHO), recently proposed a basic definition of health as "a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity." This definition suggests a holistic view of health, and it proposes a state broader than the absence of disease. More recent studies stand health is a state of both: wellness and illness. Thus, people without diagnosed disease can be ill (e.g., chronic pain sufferers). Even in the context of illness, it is possible to assist patients to achieve an optimal state of wellness through enhancements essential constituents of well-being (nutrition, exercise, sleep and rest) (Ekdahl, Andersson and Friedrichsen, 2010).

Due to the similarities in personal capital management with health management, researchers propose personal health management from the intellectual capital perspective (Hurtado Illanes and María Viedma Martí, 2018)

2.7 Specialization and accessibility of medical resources in developing countries

Bolivia only has seven machines for cancer treatments: two linear accelerators, one in a private center and the other in the Caja Petrolera; and five cobalt pumps, whose technology dates back more than 50 years and which are used in the public system and social security. According to data from the Pan American Health Organization (PAHO), in the country, there is, on average, one unit of tele-radio therapy (equipment to treat cancer with ionizing radiation) for every two million inhabitants. In addition to five radiotherapy centers, 11 oncologists, therapists, and five medical physicists. In Bolivia, there are 10,027,254 inhabitants. Making comparisons with a neighboring country, in Argentina, there are six teams for every two million people; in addition to 80 centers, 176 specialists and 98 physical doctors (Razón, 2015)

Delayed reaction to cancer affects especially women. This situation makes the health problem more expensive in this country. It is due to recent and slow handling of own information capable of orienting prevention policies and timely attention. Cancer in Bolivia is an evil that has not stopped growing and has improved especially women. Latest news systematized 2012 indicates there were 17,170 cases every year. In 2013, Pan American Health Organization estimated 6,936 people had died in the country due to cancer.

A health law from the patient perspective, is trend in world and perhaps key for medicine in Bolivia to incorporate into therapy concepts such as proper treatment, adequate time for people care, right to second medical opinion and clinical information opening of patient himself. Lack of economic resources make this model long time term; meanwhile every day some cases require urgent attention and country does not have enough funds to attend them.

In Bolivia community automatically links cancer patient with short term death and there is nothing else can be done leaving the person in a state of abandonment waiting for a final outcome. It happens because of ignorance.

3 Methodology

Theoretical development of this framework is based on Dubin's theory building model because the phenomenon under study is unstructured and requires a thorough understanding (Dubin, 1978). The case study enables the in-depth exploration of new phenomena and the identification of patterns among cases in response to how and why (Yin, 2013; Greenberg *et al.*, 2017). This approach is typically used to study and understand complex and dynamic processes on service innovation (Adams, G. R., & Schvaneveldt, 1985; Ian Stuart, 1998).

Research questions this project tries to find out are 'Complex patients in under developing countries could self-management and self-care disease with support of a community of practices?'. 'How ecosystem improves quality of life and dignity of patients, their families and their environment, achieving the postulate to live well, die with dignity'. The goal is to promote personal health management through self-management and self-care of disease. Because of lack of professionals in the area, patients need support of a community to reach this goal.

To gain more insight into the process, it has been invited complex patients to participate in case studies. There have been selected patients with different types of cancer and stages of this disease and also cases of complex diseases patients. The methodology was empirically tested by reflexive cycles proposed by Andriessen *et al.* (Andriessen, 2004). Moreover, qualitative research methods such as interviews with specialists, professionals of the community of practices and patients were useful to address a variety of evidence.

Practical methodology follows a learning by doing process through a knowledge-action ecosystem laboratory. Knowledge ecosystem has built as a community of practices, known as SANTI.

3.1 Building model

The practical methodology follows learning by doing the process. First step was the strategy formulation of SANTI. The strategy has built as a series of planned actions that help make decisions and achieve the best possible results. Those planned actions are directly related with factors to improve health (Hurtado and Viedma, 2017), The main goal of SANTI was to promote personal health management through self-management

and self-care of the disease. Patients need support of a community to achieving SANTI goal on developing countries. They also need fluent communication with members to request resources not available for them. Patients in exclusion risk need an accompaniment social network with resources to motivate emotionally, integrate patient and transmit strength to disease.

In contrast to developed countries, it is necessary to find resources compromised with patients especially in cases of exclusion risk. In this the way, patient with community help is capable of self-care and take decisions about its health process.

SANTI strategy was based on developing effective services and resources for a healthy lifestyle and coaching patients to find a personal strategy formulation to improve health

The second step was to build SANTI by inviting professional with residence in researched countries. They have been selected people matching predefined conditions. It was relevant to ensure professionals understand the strategy, mission and goals of SANTI as well as a compromise to work according to that.

The last step was to search for resources for SANTI. The premise was to explore people and resources known by SANTI members according to the following conditions: 1. Low cost. 2. Accessible easily. 3. According to values of SANTI. 4. The motivation for help with patients. 5. Identification with the mission of SANTI. 6. Compromise. Members collaborated with this step searching resources through social networks on its contact networks. Then members contacted and invited by itself collaborators to participate in SANTI.

Social networks are a critical resource to identify people who reside in areas close to patients. Thus, members can attend physically and personally to provide support to the patient accordingly needs. In this way members are capable of searching about medical specialists, take care services, diffusion and organize crowdfunding activities when are necessary. The leader must be compromised and identified with the strategy and mission of SANTI. He also is the coach of patients, introducing them to community and motivate SANTI members to include the patient as part of a big family. Leadership is a key resource for the success of the model. SANTI grows and evolves by open and honest communication and permission to experiment and fail.

There are permanent knowledge transfers between members and between community and patients. According to design science research, the model is reviewed continuously to attend needs and suggestions shared by members and patients. Internet is a critical resource, especially social networks. The communication is online for all members 24 hours, because of time differences in members countries.

It doesn't follow a capitalist model but a collaborative one. Members offer help following their values and not in search of their benefit.

4 Results

In complex medical cases, the specialization and accessibility of resources, as well as the response time, are vital to the patient's recovery. SANTI as support of complex patients in Bolivia has following results:

1. SANTI makes it possible to arrive in a timely way to resources either in the developing countries as in the developed countries in which the members reside in an agile and timely manner thanks to information technologies, especially social networks.

2. Community members living in developed countries share their know-how with the community by helping to address the situation effectively.

3. Integrate patients to the community brings other elements to the patient that are not necessarily conventional medical resources, such as how to transmit a healthy lifestyle model through changes in food, provide emotional support and motivation through the social network and a sense of belonging to a community of support to confront the disease.

4. The leader knows the model and shares it with the members of SANTI and with the patients so that together they motivate the patient to find their own model of health through changes in your lifestyle

5. Trust as a community value makes information flow and the community is perfected through the innovation that members propose.

6. The patient's emotional state is a key factor in their recovery, through the community the patient goes from feeling excluded from society to be the protagonist of a group that also contributes, in which he knows other cases and can take distance from the disease situation.

7. As new technologies allow the patient to be able to participate in the community regardless of their geographical location; SANTI is an ideal model to be able to participate and self-care at home.

4.2 Sample

To analyze SANTI services results with patients, (table xxx) describes the five cases of study.

	Nationality and sex	Age	Comments
Health and social situation	Bolivian Male	27	Osteosarcoma in the hip. Chemotherapy treatment. Orphan of father and mother. He died during the study due to nutritional conditions.
Actions			Social support to the family with information about disease and possibilities of treatment. Diffusion of family crowdfunding actions, emotional support to patient and family, nutritional suggestions, contact to health specialists. Support during the grieving process.
Patient and caregiver comments			Patient lived the process with better quality life, motivated and gratefully to the community. He participated at home with photos, audios, and videos by chat. He was happy to meet new friends around the world. Family values positively support during sickness and process. They feel grateful to SANTI members and

Health and social situation	Bolivian Female	38	continue giving support to new cases in the group. Osteosarcoma in hand and spine. She lives alone and doesn't have enough economic resources for private treatment, and social security can't support her. Chemotherapy treatment.
Actions Patient and caregiver comments			SANTI support with crowdfunding actions, emotional support to the patient, nutritional suggestions. Resident members in nearby areas assisted physically and personally with the purchase and delivery tasks according to needs. She values the help of SANTI to prepare her treatment with chemotherapy through healthy nutrition. She has also been able to contact foundations through the group. It is almost impossible to face cancer without insurance, without fixed income, and even worse being alone, thanks to SANTI it has been possible. Convalescence after chemotherapy is also hard for her. SANTI continues to offer psycho-emotional and nutritionist support since the effects are unpredictable in their duration.
Health and social situation Actions Patient and caregiver comments	Bolivian Female	40	Encephalitis in the study. Unknown causes, possibly rare autoimmune sick. On intensive care during research. Emotional support to the caregiver. SANTI through its support networks actively seeks contact with medical specialists, official media to support family crowdfunding initiatives. The caregiver, although he doesn't personally know SANTI members, has felt supported and motivated by emotional messages received. He appreciates sincerity and honesty in SANTI. He also values the leader role. He values positively: usefulness, frequency, fluid communication and group interest in patient evolution. He feels strengthened by group proximity and spirit of overcoming received. He values new friends found in SANTI to rely on and to continue the caregiver process.
Health and social situation Actions Patient and caregiver comments			Colon cancer. Chemotherapy treatment and surgery Emotional support to the patient and nutritional suggestions. Tumor has reduced enough for surgery. The patient values the information regarding a healthy and adequate diet. It has helped him be prepared for treatment. He found new ways to meditate and positive messages also helped him to face disease with optimism.
Health and social situation	Spanish Female	35	Brain cancer. Chemotherapy treatment.
Actions Patient and caregiver comments			Emotional support to the patient and nutritional suggestions. Patient feels better and more optimism respect disease. Tumor has reduced considerably. She supports treatment with nutritional changes.

5 Conclusions

Scholars researched wicked problems as a hot topic in literature. In complex issues, the solution requires extensive cooperation and many actors. Wicked problems need more time for results. Cancer as a wicked problem has been researched with real patients in Bolivia through an inclusive community committed to innovation with quick response to patients in developing countries.

SANTI as mini-ecosystem of knowledge offers positive results in society progress, open innovation, encourage innovation of new models in health care and digital transformation. Simplicity of model makes knowledge ecosystem easily scalable to ensure growth and improve the quality of life for patients in developing countries.

Cancer affects the emotional health of the person who suffers, the family of the patient and the community that surrounds it. A diagnosis of cancer can have a considerable impact on the majority of patients, families, and caregivers. The feelings of depression, anxiety and fear are very common and are normal responses to this experience that changes the life, but that are amplified by the feeling of isolation and loneliness.

Oncology patients require multi-disciplinary interventions for an extended period especially cancer survivors or complex patients. A compromised community is fundamental to support the patient on lifestyle

changes to reach states of well-being.

The most common fears that arise in these people are related to unknowledge of disease, death and economic support to pay treatment. These cancer fears are based on stories, rumors or wrong information

It usually helps to have good information to deal with fears and concerns. Most people have less fear when they know about their reality. They feel less anxiety and know what to expect.

Learning about your cancer and understanding what you can do to be an active participant in your care allows for a better lifestyle and improves the conditions you are facing

People who are well informed of their disease and treatment are more likely to follow their treatment plans and recover from cancer more quickly than those who are not.

When a person is told that their illness is terminal and that the treatment is no longer curative, but palliative, it needs great psychological, social and spiritual support, but resources are not always available to go to therapy centers, or pay for food services, expert care, and nutrition, or, as in the case of Bolivia, you cannot access these because of the lack of professionals in the area, the creation of a participatory ecosystem like the one described in the study is the opportunity to improve the conditions of people and their families by providing a simple tool to have control, information and general strategies based on the evidence and the experience of the members of this group.

The resulting social impact is promising, the low cost of implementing these strategies, the widespread use of tools such as WhatsApp or Facebook, allow based on the three postulates of "competence, commitment, and action", they allow to eliminate

distances, They transcend knowledge and allow the patient and their environment to feel part of a "something" environment that offers hope and that reducing stress will definitely improve their life strategy, feeling in control of a situation, their situation, aspect that is not possible today yet.

So definitely helping to cope with the burden of the disease by evading educational and social economic, cultural barriers in order to achieve what everything human requires: "feel part of a community even if the end is near."

References

- Andriessen, D. (2004) "IC valuation and measurement: classifying the state of the art," *Journal of Intellectual Capital*. Emerald Group Publishing Limited, 5(2), pp. 230–242. doi: 10.1108/14691930410533669.
- Bolet, P. H. (2000) "La gestión del talento," 2000, pp. 228–234.
- Clarysse, B. *et al.* (2014) "Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems," *Research Policy*. North-Holland, 43(7), pp. 1164–1176. doi: 10.1016/J.RESPOL.2014.04.014.
- Covey, S. M. R. and Merrill, R. R. (2006) *The speed of trust: the one thing that changes everything*. Available at: <https://books.google.es/books?hl=es&lr=&id=nQZnDwAAQBAJ&oi=fnd&pg=PA1&dq=speed+of+trust+covey&ots=rAICAmIuPj&sig=4hMC5iPyRhkkEuro0vpsjwo4GXA#v=onepage&q=speed+of+trust+covey&f=false> (Accessed: April 24, 2019).
- Dubin, R. (1978) "Theory development." New York: Free Press.
- Ekdahl, A. W., Andersson, L. and Friedrichsen, M. (2010) "'They do what they think is the best for me.' Frail elderly patients' preferences for participation in their care during hospitalization," *Patient Education and Counseling*, 80(2), pp. 233–240. doi: 10.1016/j.pec.2009.10.026.
- Enache, M. and Martí, J. M. V. (2007) "Achieving professional excellence in the era of the boundaryless careers," *Proceedings of the European Conference on Knowledge Management, ECKM*, pp. 291–300.
- Estrin, J. (2009) *Closing the innovation gap: reigniting the spark of creativity in a global economy*.
- Fagerberg, J. and Verspagen, B. (2006) "Innovation studies-an emerging discipline (or what)? A study of the global network of innovation scholars," *Science And Technology*. doi: 10.1007/s10750-008-9654-z.
- Gratton, L., & Ghoshal, S. (2003) "Managing Personal Human Capital:: New Ethos for the 'Volunteer' Employee," *European Management Journal*, 21(1), pp. 1–10.
- Greenberg, A. J. *et al.* (2017) "Access to Electronic Personal Health Records Among Patients With Multiple Chronic Conditions: A Secondary Data Analysis," *Journal of Medical Internet Research*, 19(6), p. e188. doi: 10.2196/jmir.7417.
- Hurtado Illanes, M. and María Viedma Martí, J. (2018) *In Search of a Framework for Personal Healthcare Management in Oncology*. Available at: <https://search.proquest.com/openview/e80416aab3e693b8f0adf6c5cdf8c61f/1?pq-origsite=gscholar&cbl=1796412> (Accessed: April 27, 2019).
- Jericó Rodríguez, P. (1996) *Training & development digest, Training & development digest, ISSN 1137-2230, N.º. 71, 2008, págs. 34-39*. Griker & Asociados. Available at: <https://dialnet.unirioja.es/servlet/articulo?codigo=2685267> (Accessed: April 24, 2019).
- Minsal Pérez, D. and Pérez Rodríguez, Y. (2007) "Hacia una nueva cultura organizacional: la cultura del conocimiento," *ACIMED*. 2000, Editorial Ciencias Médicas, 16(3), pp. 0–0. Available at: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1024-

- 94352007000900008&lng=es&nrm=iso&tlng=es (Accessed: April 24, 2019).
- Moore, J. F. (2006) "Business Ecosystems and the View from the Firm," *The Antitrust Bulletin*. SAGE PublicationsSage CA: Los Angeles, CA, 51(1), pp. 31–75. doi: 10.1177/0003603X0605100103.
- Nambisan, S. and Baron, R. A. (2013) "Entrepreneurship in Innovation Ecosystems: Entrepreneurs' Self-Regulatory Processes and Their Implications for New Venture Success," *Entrepreneurship Theory and Practice*. SAGE PublicationsSage CA: Los Angeles, CA, 37(5), pp. 1071–1097. doi: 10.1111/j.1540-6520.2012.00519.x.
- Porter, B. Y. M. E. (1998) "Clusters and the new competition," *Harvard Business Review*, 76(6), pp. 77–90.
- Quinn, J. B., Doorley, T. L. and Paquette, P. C. (1990) "Beyond products: services-based strategy.," *Harvard business review*, 68(2), pp. 58–60, 64–6, 68. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/10106517> (Accessed: July 20, 2017).
- Razón, L. (2015) *La Razón (Bolivia) | Bolivia solo tiene 7 equipos para tratamientos contra el cáncer*. Available at: https://m.la-razon.com/sociedad/Bolivia-solo-equipos-tratamientos-cancer_0_2331366892.html (Accessed: April 24, 2019).
- Smith, H. L. and Leydesdorff, L. (2000) *The Triple Helix in the context of global change: dynamics and challenges*. Available at: <http://www.leydesdorff.net> (Accessed: April 25, 2019).
- What Is Cancer?* (2017). Available at: <https://www.cancer.org/cancer/cancer-basics/what-is-cancer.html> (Accessed: July 29, 2017).
- Yin, R. K. (2013) *Case study research: Design and methods*. Sage publications.

Regional Intellectual Capital and Regional Development: a New Approach to Target the Resources that Matter

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Abstract

The purpose of this paper is to suggest a new approach of regional intellectual capital (further RIC) identification leading to competitive regional development. In order to make RIC management decisions leading to competitive growth, it has to be identified and its relevance for particular development purpose must be defined first. Therefore, this paper aims to reason a new RIC identification approach that takes into account strategic perspective. Suggested RIC identification approach is based on the theoretical analysis of scientific literature. According to suggested approach targeting regional intellectual resources that matter requires integration of four underpinning theories: IC theory, regional competitiveness theory, resource-based management theory and strategic management theory. Integration of these theories enriches RIC identification with strategic aspect and makes it more target-oriented. Based on the theory of regional competitiveness RIC separation into public and private dimensions is required within RIC identification process. It enables more precise distribution of responsibilities among stakeholders and makes RIC management more coordinated.

Keywords – regional intellectual capital, regional development, regional competitiveness

Paper type – Academic Research Paper

1 Introduction

Regional intellectual capital (further RIC) which is defined as hidden value of individuals, organizations, institutions and communities within region is believed to be the foundation for regional wealth and potential growth in future (Edvinsson & Stenfelt, 1999; Bontis, 2004; Lin and Edvinsson, 2008; Schiuma et al. 2008; Lin and Edvinsson,

2010). Ståhle et. al. (2015) proves that 45 % of world's GDP is generated by intellectual capital. Countries like Sweden, Finland, Denmark or Israel are recognised worldwide as the countries whose economic growth is mostly related to aspects of intellectual resources (Edvinsson, 2013). The need to understand the fundamentals of RIC becomes strong since such knowledge may bring wealth to a region or country.

Regional dimension nowadays becomes increasingly important because even in the same country, a certain level of differentiation may be observed. Some regions lag while others thrive. The European Commission has already noticed this fluctuation and has initiated monitoring of regional innovativeness and competitiveness to shape particular regional policy making, which would lead to the catching up of lagging regions and improvement of overall national competitiveness (European Union, 2017). In addition, the organizational level is explored much more thoroughly and answers to sustainable competitive advantage may be captured from the past research (Guthrie, 2001; Zickgraf, 2009; Roos et. al., 2005). Therefore, in this paper, a focus on the regional dimension is more relevant than the national or organizational.

The need to focus towards policy making has emerged which requires understanding what intangible resources are important in particular situation and why. Identification of RIC becomes a problem since region's development objectives and context differ. Orientation to practice has become a strong requirement for new methods since theoretical measurements have not been adopted in policy making. RIC importance and relevance has to be demonstrated with the purpose to reach policy makers attention. Therefore, this paper aims to suggest a new RIC identification approach leading to justifiable argumentation why some intangible resources are important for regional development. The ideas of regional competitiveness, strategic management and resources based management theories are implemented in the new approach since the lack of strategic aspect is addressed.

The results of this paper contribute to intellectual capital theory providing better understanding on RIC concept and its role in regional development. Such understanding is valuable further developing RIC management strategies focused towards regional development.

The paper is organised as follows. Section 2 provides theoretical background. Section 3 explains a suggested new approach to RIC identification. Section 4 follows with conclusions and provides future research recommendations.

2 Theoretical background

RIC definition is broad and complex leaving a lot of freedom to interpret RIC in different perspectives. Käpylä (2012) points that such indeterminacy leads to exclusion of certain knowledge like ethics, culture, history etc. from measurement indexes and results only in easily measurable indicators that may not fully reflect RIC. Some researchers who have introduced national benchmarking indexes highlight that supply of indicators is limited and a fraction of intellectual capital at national or regional level is left unmeasured (Bontis, 2004; Weziak, 2007). Usually at national level benchmarking is applied for

diagnostic purpose (Bontis, 2004; Andriessen and Stam, 2005; Weziak, 2007; Lin and Edvinsson, 2008; Lin and Edvinsson, 2011). However, relevancy of the information provided by benchmarking methods is questionable (Salonius and Lönnqvist, 2012). Therefore, in order to achieve competitive regional development, there is a need to find a way to capture relevant information and define appropriate RIC interpretation.

Issue of uniqueness of intangible resources is additional concern. Uniqueness and contextual situation is significantly stressed at organizational level by Chaminade and Johanson (2003) and Angel and Ortiz (2009). However, Schiuma et al. (2007), Kujansivu (2008), Lönnqvist et al. (2009) accept this to be true at regional level as well. Certain researches emphasize that intangible resources are unique for particular country or region and uniqueness has to be taken into account evaluating RIC (Käpylä, 2012; Yigitcanlar and Lönnqvist, 2013; Malhotra, 2003; Schneider, 2007; Käpylä, et. al., 2012). Käpylä, et al. (2012) points that regional development objectives differ in addition to regional context. Hence, RIC measurement methods should address this problem and provide a way to take uniqueness into account.

The outcome of RIC and its measurement purpose is also a question. Wealth, prosperity and economic growth are usually named as outcomes of substantial and well-developed RIC. Such viewpoint has led to researches demonstrating RIC relation to GDP. However, GDP has become a questionable indicator of prosperity and even economic development. Henderson (2008) reveals that society defines regional wellbeing beyond GDP. Delgado et al. (2012) claims that many policy makers consider competitiveness as the most important factor of regional economic policy. Definitions of regional competitiveness disclose a necessity to focus more on conditions and environment empowering economic growth rather than the final result which is demonstrated by GDP. Therefore, a demand for a new shift of RIC measurements can be observed.

Regional intellectual capital approach can be seen as more target oriented perspective which takes into consideration regional development objectives and demonstrates better orientation to practice (Viedma Martí, 2006; Medina et al., 2007; Schiuma et al., 2008; Lerro and Schiuma, 2009; Yigitcanlar and Lönnqvist, 2013; Lönnqvist et al., 2014; Kohl et al., 2015). Regional competitiveness becomes a major focus of this approach (Rodriguez and Viedma Martí, 2006; Medina et al., 2007; Lerro and Schiuma, 2009). Categorisation of regional intellectual capital becomes based on desired outcome or aspiration, for instance: sustainable development (Medina, et al., 2007), vision, core activities and capabilities (Rodriguez and Viedma Martí, 2006), social value (Lönnqvist, et al., 2014), development strategy goals (Lerro and Schiuma, 2009) (see Table 1). Kozak (2011) develops a framework for regional intellectual capital management in respect to specific strategic objectives. However, the framework is not approved yet. Nevertheless, orientation to regional objectives, competitiveness as well as intellectual capital interpretation and evaluation taking into consideration region's contextual situation is welcome in practice.

Table 14. Regional intellectual capital approaches (edited by authors).

Authors	Regional Development Goal	Intellectual Capital Dimensions
Rodriguez and Viedma Martí (2006)	Sustainable economic development	Institutions and governance Societal framework Social capital Technology Regional human capital
Medina et al. (2007)	Sustainability	Training and development Public administration Social capital Environmental capital Tourism capital Economic activity
Lerro and Schiuma (2009)	Competitive development	Human capital Structural capital Relational capital
Lönnqvist et al. (2014)	Social wellbeing	No dimensions excluded. Used indicators: Diversity of the region: Manifold knowledge Educations Universities Vitality that universities and the youth bring Very good regional image Capability for renewal Strong and varied competence of regional actors Good—open and trusting-relational actors Congenial atmosphere: willingness to seek consensus and reconciliation Eagerness for future-oriented development
Yigitcanlar et al. (2014)	Knowledge-based development	Human and social capital Environment Institutional capital Economy
Kohl et al. (2015)	Regional development	Human capital Structural capital Relational capital

It can be concluded that a new approach of RIC identification should address issues of concept indeterminacy, uniqueness, development objectives, competitiveness and relevancy of information. The next section is aimed to explain how a suggested new approach is influenced by these factors.

3 A new approach to RIC identification

Researchers (Edvinsson & Stenfelt, 1999; Malhotra, 2003; Bontis, 2004; Stam & Andriessen, 2009; Käpylä *et al.*, 2012) usually define RIC as all intangible resources available to a region including knowledge and erudition of society itself, private and public institutions' intangible resources as well as personal human knowledge. But such definition, even though reflects the true meaning of RIC, has limited value for RIC identification concerning regional development. RIC identification reveals the most important intangible resources for competitive regional growth and enables to manage them. However, management itself is inseparable from a managing body. Broad RIC

definition includes intangible resources that may be managed by different bodies: private and public institutions' intangible resources are managed respectively by private sector and public sector; personal human knowledge is managed by person himself; knowledge and erudition of society is a result of successful management of different bodies. Käpylä *et al.* (2012) research may be provided as an example of an attempt to identify RIC managing bodies in respect to RIC location: the private sector (i.e. the business sector of companies), the public sector, the third sector (i.e. civic society) and the fourth sector (i.e. family, relatives and friends). However, analysing the structure of RIC measurement approaches, it can be noticed that various indicators are included (from different RIC locations as described by Käpylä *et al.* (2012)) and there is no clarity who is responsible for the value of particular indicator. Therefore, it is difficult to create RIC management strategy based on such indexes since it is not known who is responsible for a particular resource. In order to reach competitive regional development through management of RIC, RIC identification must be carried out keeping in mind a managing body. Thus, links between resources and managing bodies have to be defined first.

Researches focused on RIC, its measurement and management usually discuss policy making perspective and dedicate findings to policy makers (Bontis, 2004; Schneider, 2007; Käpylä *et al.*, 2012; Saloniemi & Lönnqvist, 2012; Stähle, Stähle, & Lin, 2015). Such orientation towards policy making leads to understanding that managing bodies of RIC lie within a public sector. Public sector may be defined as a sector composed of all levels of government providing various governmental services and is controlled exceptionally by a state (Wegrich 2016). Further, only that part of RIC which is managed by public sector is worth investigation in respect to region's development since findings are addressed to policy makers. Private sector that can be defined as a sector controlled by individuals or group of individuals (usually business organizations) (WebFinance 2016) contain intellectual capital that cannot be directly controlled by a state. Therefore, there is no point to include intellectual capital of private sector into researches focused on RIC since it cannot be managed by public sector. Getting back to Käpylä *et al.* (2012), RIC located in civic society, family, relatives and friends or as indicated by the author third and forth sector, should be excluded from RIC identification additionally since these resources are not controlled directly by public sector as well. To conclude, RIC identification means an identification of intangible resources that are controlled by public sector and contributes to competitive regional development.

RIC managed by public sector can be structured into three typical categories of intellectual capital: human, structural and relational. Human capital is defined as publicly available human resources that include graduates, available labour force, public administrators and their competences, high skilled talents and available scientists, etc. Structural capital is defined as public intangible infrastructure including legal environment, regulations, institutional infrastructure and its efficiency, knowledge sharing networks between institutions, etc. Relational capital is defined as various relations between public sector and private sector as well as relations between institutions within a public sector. It should be emphasized that all these resources (human, structural and relational) must create value in respect to regional development in order to be considered

as capital. Within this study, RIC is defined as a composition of publicly available human, structural and relational resources that are controlled by public sector and contribute to regional growth.

A new approach to RIC identification is discussed further. Suggested solution is based on ideas of regional competitiveness, resources-based management and strategic management theories in order to provide valuable information for policy making and formation of regional development strategy. From regional competitiveness theory, public sector shapes the environment that private sector acts in (Porter, 1990). That environment empowers private sector and directly influences how successful it is. As long as competitiveness is a key concern, success of private sector is defined as its successful performance in an interregional market which demonstrates competitive advantage in respect to other market participants. Overall regional competitiveness is defined by Porter (1990) as a total success of all country's private organizations in an interregional market. Therefore, RIC identification should be based on viewpoint of private sector which actually creates a competitive advantage and defines overall regional competitiveness and leads to regional development. RIC relation to regional development is illustrated in Fig 1.



Figure 9. RIC relation to regional development.

In order to identify intangible resources that are relevant or matter the most, particular regional development objectives as well as regional context must be defined. Resources-based management theory, introduced by Wernerfelt (1995) and integrated into strategic management theory by Grant (1991), suggests that objectives indicate resources that are required to reach desired outcome. Strategic management theory suggests that particular regional context reflects specific situation, strengths and weaknesses that are inherent and must be taken into account considering development objectives. Therefore, identification of RIC is inseparable from objectives and current contextual situation.

Consequently, RIC identification focused on competitive regional development requires: (1) evaluate RIC from a viewpoint of private sector which creates competitive advantage; and (2) determine specific development objectives concerning regional competitiveness and investigate contextual situation. RIC identification factors are depicted in Fig 2.

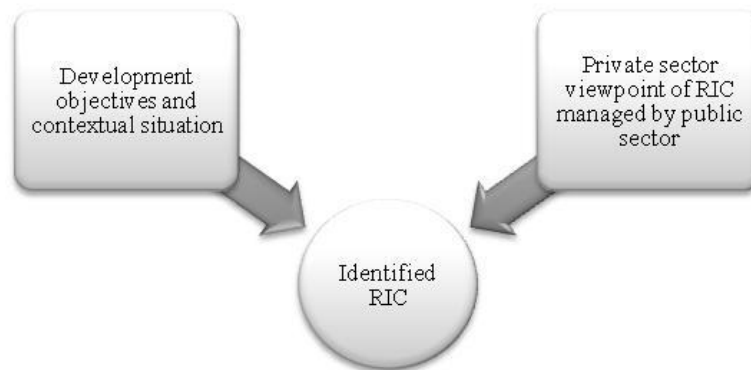


Figure 10. Factors of RIC identification.

It has to be highlighted that development objectives concerned in this case should be specific and allow determination of public sector institutions responsible for its execution (managing body of RIC has to be clear). In addition, objectives have to contribute to regional competitiveness. Investigation of contextual situation should lead to identification of RIC elements that are present and important in current situation. RIC importance from a viewpoint of private sector can be obtained through various empirical researches that allow private sector representatives to evaluate RIC according to their business performance. According to Barney (1991), RIC identification process should be continuous as long as development objectives, contextual situation and private sector performance change throughout time and competitive advantage created by RIC is achieved just for a certain period of time.

4 Conclusions

RIC acts as a foundation for every intangible infrastructure, ecosystem, shapes the environment and determines the future success of particular initiatives. Lack of understanding of RIC prevents from strategically oriented decisions concerning RIC management and leads to performance of initiatives that do not correspond to real problems. This consequently results in money and effort wasting just because the fundamentals behind the numbers are not perceived. Therefore, RIC theory should follow the direction leading to practically oriented researches willing to reveal the fundamentals behind RIC indicators.

Conducted study demonstrates how new suggested approach for RIC identification may provide different perspective on observed problems. Suggested approach brings those problems into holistic picture and enables versatile evaluation and interpretation on relations between the problems and intangible resources that created them. This evaluation performed in the context of particular strategic goal allows better evaluation and prediction of effectiveness of public initiatives. Even though complexity becomes an issue in this case an appropriate methodological approach may solve it.

Suggested RIC identification logic could be implemented in various public organisations, but for better effectiveness and objectivity it should be performed by third party. As long as this approach investigates public RIC and challenges government and other public organisations' activity, evaluation doubtfully could be objectively performed by organisations themselves. At least supervision is needed. Private sector point of view towards public sector can be concluded to be valuable and such approach should be further maintained.

The greatest issue of suggested approach is complexity. RIC identification requires evaluation of many variables that can equally influence the final estimation. Even though the approach allows gathering versatile information, it is not easy to make sense out of it. Interpretation of results requires understanding how various components interact and there is still a lack of such kind of knowledge. Methodological implementation is also a concern. Suggested approach favours qualitative research design, however it is difficult to generalise the findings. Combined research design could provide even better insights and more rigorous results.

For future research it is recommended to specify methodological solution for implementation of suggested identification approach that would work best and determine how this logic could be applied in decision making process. Valuable information which can be provided by suggested approach should be determined and decided how it should serve for decision making.

References

- Andriessen, D.G. & Stam, C.D., 2005. Intellectual capital of the European Union. McMaster World Congress on the Management of Intellectual Capital and Innovation, pp.1–24.
- Barney, J., 1991. Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), pp.99–120.
- Bontis, N. 2004. National Intellectual Capital Index: A United Nations initiative for the Arab region, *Journal of Intellectual Capital* 5(1): 13 – 39.
- Chaminade, C. & Johanson, U., 2003. Can guidelines for intellectual capital management and reporting be considered without addressing cultural differences? *Journal of Intellectual Capital*, 4(4), pp.528–542.
- Delgado, M. et al., 2012. *The determinants of national competitiveness*, Cambridge.
- Edvinsson, L., 2013. IC 21 : reflections from 21 years of IC practice and theory. *Journal of Intellectual Capital*, 14(1), pp.163–172.
- Edvinsson, L. & Stenfelt, C., 1999. *Journal of Human Resource Costing & Accounting*. *Journal of Human Resource Costing & Accounting*, 4(1), pp.21–33.
- European Union, 2017. *Regional Innovation Scoreboard 2017; European Innovation Scoreboards (EIS) Project for the European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs; European Union: Brussels, Belgium.*
- Grant, R.M., 1991. Resources-based theory of competitive advantage: implications for strategy formulation. *California Management Review*, pp.114–135.
- Guthrie, J., 2001. The management, measurement and the reporting of intellectual capital. *Journal of Intellectual Capital*, 2, 27–41.
- Henderson, H., 2008. Worldwide support found for measuring true wealth of nations. *Foresight*, 10(2), pp.67–69.

- Yigitcanlar, T. & Lönnqvist, A., 2013. Benchmarking knowledge-based urban development performance: Results from the international comparison of Helsinki. *Cities*, 31, pp.357–369.
- Yigitcanlar, T., Lönnqvist, A. & Saloniemi, H., 2014. Analysis of a city-region from the knowledge perspective: Tampere, Finland. *Vine*, 44(3), pp.445–466.
- Käpylä, J., 2012. Towards a critical societal knowledge management. *Journal of Intellectual Capital*, 13(3), pp.288–304.
- Käpylä, J., Kujansivu, P. & Lönnqvist, A., 2012. National intellectual capital performance: A strategic approach. *Journal of Intellectual Capital*, 13(3), pp.343–362.
- Kohl, H. et al., 2015. Intellectual Capital Statements as a Driver for Regional Development. *Proceedings of the European Conference on Intellectual Capital*, pp.189–198.
- Kozak, M., 2011. Strategic approach to intellectual capital development in regions, *International Journal of Learning and Intellectual Capital*, 8(1), pp. 76–93.
- Kujansivu, P., 2008. *Intellectual Capital Management—Understanding Why Finnish Companies Do Not Apply Intellectual Capital Management Models*, Tampere: Tampere University of Technology, Publication 747.
- Lerro, A. & Schiuma, G., 2009. Knowledge-based dynamics of regional development: the case of Basilicata region. *Journal of Knowledge Management*, 13(5), pp.287–300.
- Lin, C.Y.Y. & Edvinsson, L., 2010. National intellectual capital: A comparison of 40 countries. *National Intellectual Capital: A Comparison of 40 Countries*, pp.1–392.
- Lin, C.Y.-Y. & Edvinsson, L., 2008. National intellectual capital: comparison of the Nordic countries. *Journal of Intellectual Capital*, 9(4), pp.525–545.
- Lin, C.Y.Y. & Edvinsson, L. 2011. *National Intellectual Capital, A Comparison of 40 Countries*. New York: Springer.
- Lönnqvist, A., Kianto, A. & Sillanpää, V., 2009. Using intellectual capital management for facilitating organizational change, *Journal of Intellectual Capital*, 10(4), pp. 559–572.
- Lönnqvist, A. et al., 2014. Knowledge That Matters : Identifying Regional Knowledge Assets of the Tampere Region Knowledge That Matters : Identifying Regional Knowledge Assets of the Tampere Region. *European Planning Studies*, 22(10), pp.2011–2029.
- Malhotra, Y., 2003. *Measuring knowledge assets of a nation: Knowledge systems for development*, New York.
- McCann, P. & Ortega-Argilés, R., 2014. Smart specialisation in European regions: issues of strategy, institutions and implementation. *European Journal of Innovation Management*, 17(4), pp.409–427.
- Medina, A.J.S., Gonzalez, A.M. & Falcon, J.M.G., 2007. Intellectual capital and sustainable development on islands: An application to the case of Gran Canaria. *Regional Studies*, 41(4), pp.473–487.
- Ortiz, M.A.A., 2009. Analysis and valuation of intellectual capital according to its context. *Journal of Intellectual Capital*, 10(3), pp.451–482.
- Pasher, E. & Shachar, S. 2005. The intellectual capital of state of Israel. In Bounfour, A.; Edvinsson, L. (Ed.) *Intellectual Capital for Communities. Nations, Regions and Cities*, MA: 139-150. Burlington: Elsevier Butterworth-Heinemann.
- Porter, M.E., 1990. The Competitive Advantage of Nations. *Harvard Business Review*, 68, pp.73–93.
- Porter, M.E., 2008. *On Competition*. Updated and Expanded Edition, Harvard Business School Press, Oxford.
- Rodriguez, B.M. & Viedma Martí, J.M., 2006. The region's intellectual capital benchmarking system: Enabling economic growth through evaluation. *Journal of Knowledge Management*, 10(5), pp.41–54.

- Roos, G., 2014. Regional Economic Renewal Through Structured Intellectual Capital Development. *Proceedings of the International Conference on Intellectual Capital, Knowledge Management & Organizational Learning*, pp.337–346.
- Roos, G.; Pike, S.; Ferntröm, L., 2005. *Managing Intellectual Capital in Practice*; Elsevier: Oxford, UK.
- Salonius, H. & Lönnqvist, A., 2012. Exploring the policy relevance of national intellectual capital information. *Journal of Intellectual Capital*, 13(3), pp.331–342.
- Schiuma, G., Lerro, A. & Carlucci, D., 2007. The Knoware Tree and the Regional Intellectual Capital Index: An assessment within Italy. *Journal of Intellectual Capital*, 9(2), pp.283–300.
- Schneider, U., 2007. The Austrian National Knowledge Report. *Journal of Knowledge Management*, 11, pp.129–140.
- Ståhle, P., Ståhle, S. & Lin, C.Y.Y., 2015. Intangibles and national economic wealth - a new perspective on how they are linked. *Journal of Intellectual Capital*, 16(1), pp.20–57.
- Stam, C. & Andriessen, D., 2009. Intellectual Capital of the European Union 2008: Measuring the Lisbon Strategy for Growth and Jobs. *Journal of Knowledge Management*, 7(4), pp.489–500.
- Viedma Marti, J.M., 2006. ICBS – Intellectual Capital Benchmarking System, *Journal of Intellectual Capital*, Vol. 2 Iss 2 pp. 148 - 165.
- WebFinance, 2016. Private sector. *BusinessDictionary.com*. Available at: <http://www.businessdictionary.com/definition/private-sector.html>.
- Wegrich, K., 2016. Public sector. *Encyclopedia BRITANICA*. Available at: <https://www.britanRiCa.com/topic/public-sector>.
- Wernerfelt, B., 1995. The Resource-based View of the Firm: Ten Years After. *Strategic Management Journal*, 16, pp.171–174.
- Weziak, D., 2007. Measurement of national intellectual capital: application to EU countries. *IRISS Working Paper Series*, 13(November), pp.1–42.
- Zickgraf, S., 2009. *Intellectual Capital Statement—Made in Europe (InCaS)*; DG Research under the EU 6th Framework Programme; Confédération Européenne Des Associations De Petites Et Moyennes Entreprises: Brussels, Belgium.

The Arts of Cultural Ecosystem and International Fair for Global Value Creation - a Case Study of Art Revolution Taipei

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Abstract

The international art fairs enhance the cultural exchanges among different countries, not just stimulating developments of the art industry but also substantially benefiting both the host country and participating parties, as well as serving the purpose of transactions. Therefore, the art market oriented by galleries has been transforming into the economic model surrounding art expositions. It's a major issue for to explore how to have impacts on the cultural exchanges among countries by operating and developing art expositions. This study is focused on the globally renowned Art Revolution Taipei (A.R.T.), to explore from the systems thinking perspective on how the organizer of A.R.T. imbues the value concept of putting artist-centered value and front; how to create jointly a valuable business model with artists from different countries and visitors. The relevant managerial implications and suggestions will be discussed.

Keywords – art exposition、systems thinking、culture ecosystem、value creation.

Paper type – Academic Research Paper

1 Introduction

The 21st century is the era of knowledge economy; in the fierce competition in politic, economic, social and cultural relationship among countries has led to an assimilated trend for the global culture. Developments in arts are rooted in daily life, and closely related to politic and economic factors with subtle interactions. The globalization of the art market has led to a surging number of art expositions, which has increased to more than 60 of them from 10 during this decade; art expositions become an important platform for showcasing artworks from artists.

Art expositions is one of the most common model to demonstrate the standard of a country's arts and culture. The principal purpose of an exhibition is to provide an exhibition venue with educational values to the public; it may exhibit the means at man's

disposal for meeting the needs of civilization, or demonstrate the progress achieved in one or more branches of human endeavour, or show prospects for the future. (Art.1 of Convention Relating to International Exhibitions). An art exposition means to hold an event for enhancing industrial and economic developments and culture exchange through exhibiting and transact artworks in huge scale at a certain venue.

The international art expositions also serve the functions of culture promotion and exchange among different countries, not just stimulating developments of the art industry but also substantially benefiting both the host country and participating parties, as well as serving the purpose of transactions.

Art Revolution Taipei (A.R.T.) is a large-scale art event planned and launched by Taiwan International Contemporary Artist Association, a group of like-minded social elites, to promote arts and art itself in Taiwan globally without any governmental subsidy. It promotes the international image of Taiwan and democratization of arts by widely recruiting artists and buyers around the world to gather and contact directly at the A.R.T. platform; it endows a new look to art exposition by putting artists centre and front to make every booth an artist's solo exhibition, instead of following the gallery-oriented convention. The innovative and creative marketing strategies are so eye-catching that the accumulated number since 2011 to 2018 amount to 191,925 visitors; the average percentage of transaction is about 90%. In 2014, the transaction rate even reached up to 93.21%, a new record among international art fairs. In 2018, there were 471 artists from 74 countries to present more than 3,000 pieces of artworks with local features diverse styles . The detailed information of A.R.T are shown in Table 1, Table2 and Table3.

Table 1 The total number of visitors to A.R.T. for 8 editions (2011-2018)

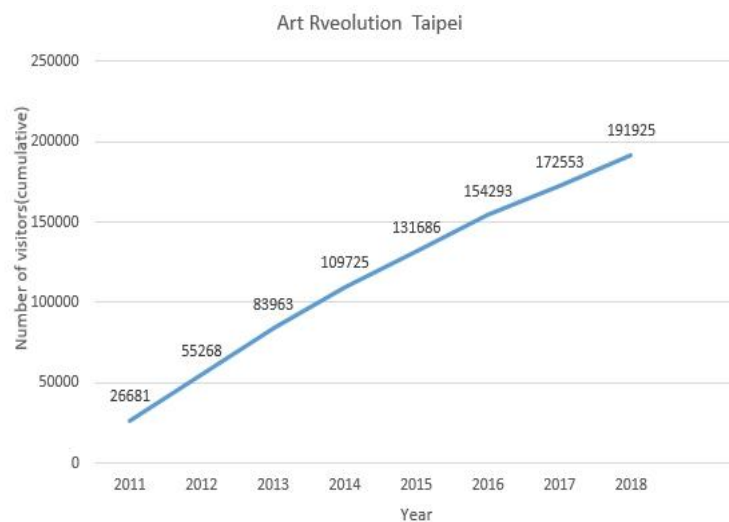


Table 2 The number of participating artists to A.R.T. for 9 editions (2011-2019)

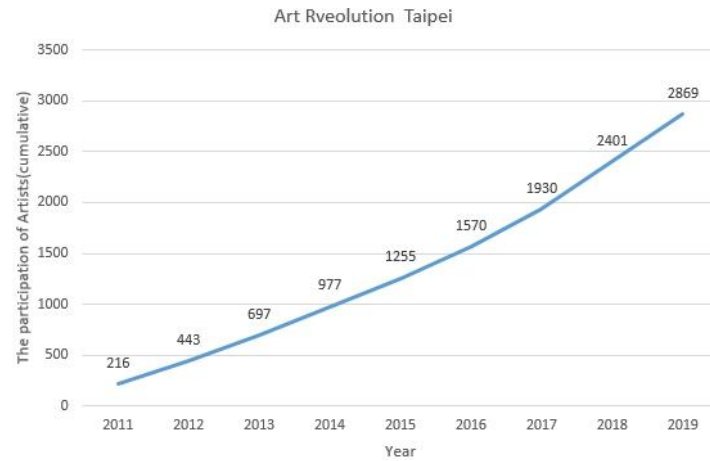
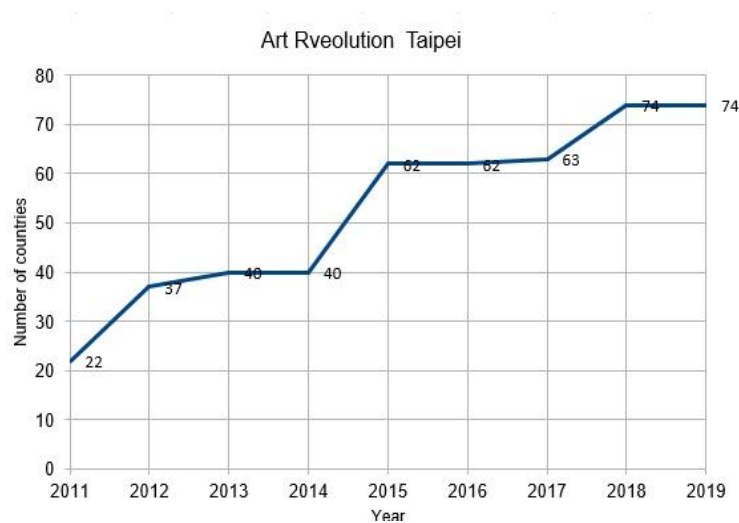


Table 3 The number of participating countries in the A.R.T for each edition. (2011-2019)



Source: Art Revolution Taipei

According to the conceptual framework of cultural ecosystem services (Fish, Church and Winter, 2016), the concept of cultural ecosystem services covers critical elements of hard special environment and soft cultural practice, and offers various opportunities to facilitate effects of cultural ecosystem and to deepen the recognition about the arts & culture, so more and more people would commit themselves to cultural activities and nurture their own tastes on arts and cultures. The cultural values are created under the creation, promotion and circulation of the general cultural ecosystem.

Furthermore, Giovanni Schiuma (2011) pointed out that through arts-based initiatives,

it's possible to create higher value and performance for industries. The case explored for this study, the Art Revolution Taipei (A.R.T.), is an international art platform integrating the cultural ecosystem services with the concepts of values created via arts, encompassing conceptions of art creativity, value concepts of putting artists center and front, artworks from different countries, and marketing strategies collaborated by the executive team, as well as the co-relationship and interactions among sponsors, buyers, artists and the organizer; which makes all stakeholders recognize the values created by Art Revolution Taipei with great feedbacks and self-enhancement through the experiences. In return, the cultural ecosystem services keep on expansion from the positive cycle of value-creations, and raise impacts from the A.R.T.

Peter Senge(2010) articulated the success of an organizational operation model is contributed by s series of complicate interactions among various factors; therefore, it's worthwhile to explore the reciprocal influences among stakeholders from different aspects, such as the Art Director, artist association, buyers, artists, sponsors, AD media. In this study, the perspective of systems thinking is applied to analyze the business model and strategies for Art Revolution Taipei to create values from interactions among participants in the cultural ecosystem, including the organizer, artists and visitors (buyers), hopefully to serve as a reference for other countries to plan and execute art expositions in the future.

2 Business Model

This study explores the business model of Art Revolution Taipei from the perspective of systems thinking, through literatures (Drucker,2005; Heilbrun et al., 2011; Hill et al.,2013; Kim, 1997; Mintzberg, 1977; Osterwalder,2010; Quemini, 2013 ; Sterman, 2016) and interviews with the founder and curator from the organizer, one artist in Taiwan and another one from other country, visitor, and buyers (one in Taiwan and the other one from other country) to collect data; also it attempts to find out critical factors of value creation and their interactive relationships from the main participants in the concept of cultural ecosystem, including the organizer, artists and visitors. The main models are elaborated as follows.

2.1 Values created by the organizer

- A.R.T. focuses on the “artist-centered value” and gain “core value recognition”. The higher “core value recognition,” the more “the management team's overall coherence” is. And then it can get better “overall service quality of the exhibition.” The better “overall service quality of the exhibition” leads to the more “artworks sold.” And then it will increase the “A.R.T. value and benefits, which in turn boost more “international media coverage and word of mouth”. And then it can attract more people attracted to recognize the core value of organizer.
- The casual feedback loop (shown in Figure 1) represents the “reinforcing loop,” and this feedback loop into a virtuous cycle just like snow balls either to get better and better or worse and worse.

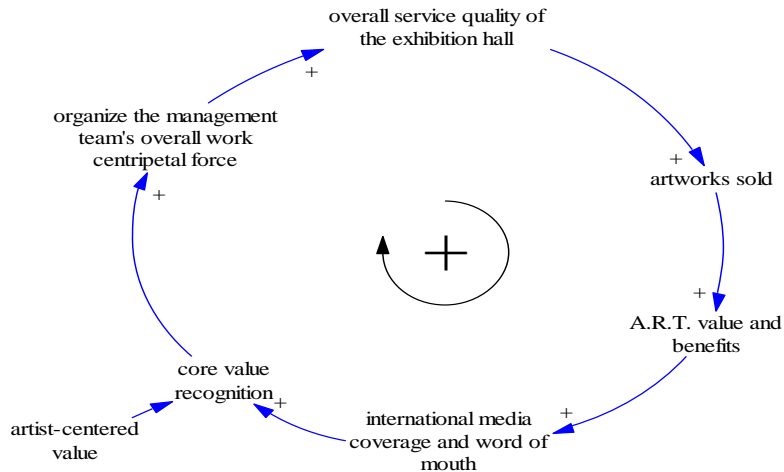


Figure1 The casual feedback loop of value creation by organizer

2.2 Value creation from visitors and buyers

- The casual feedback loop of value creation from visitors and buyers mainly focuses on visitors. Basically, it starts from introducing the core value(artist-centered value), subsequently the acceptance and recognition of the core value increase. From its debut, the A.R.T. has pushed this feedback loop into a virtuous cycle on its own.
- The internal cycle
After the recognition of core value increases, the PR publicity for marketing activities increase accordingly, resulting in more visitors and subsequently more interactive services and communication, which includes explanation from the exhibition staff and artists from different countries; an environment and platform for cultural exchanges for multi-countries thus formed. The cultural exchanges lead to more artworks sold and enhance feeling values for visitors and buyers.
- The A.R.T.'s strategies
The left side on the figure includes "public welfare activities," "Media use," "Strategic Alliance" and other auxiliary measures, to boost the PR publicity, and further to facilitate the internal virtuous cycle. The part of "artworks sold" on the right side is accompanied with "overall service quality of the exhibition hall," which covers the A.R.T.'s key features such as the explanation from the staff, the entire logistics and cash flows. To facilitate the artworks sold efficiently, there's a package of complete logistics and cash flows in place, which impacts the number of artworks sold. The casual feedback loop of value creation for visitors and buyers is shown as Figure2.

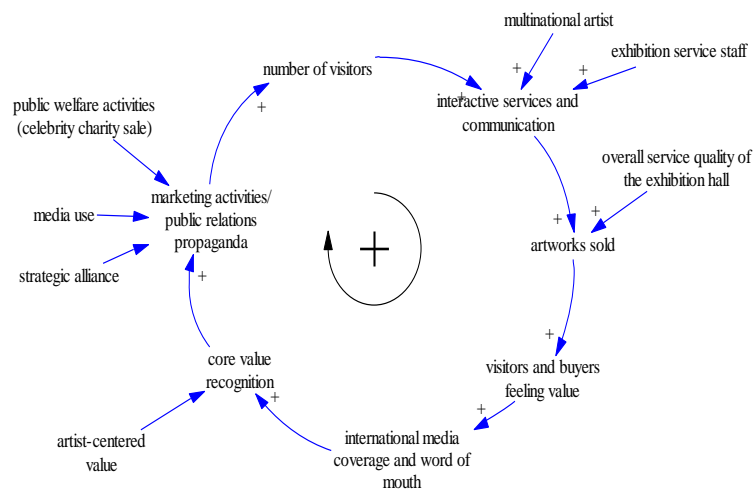


Figure 2 The casual feedback loop of value creation for visitors and buyers

2.3 Value creation for artists

- The casual feedback loop of value creation for artists

The higher core value of “artist-centered value” increases the level of value recognition, which in return attracts more good artists to exhibit their artworks; more artworks form a more healthy competition, which increases the diversity and quality in participants and artworks, then more artworks sold in return, so as the artists’ artist’s income and feeling value. The more international media coverage and reputations facilitates the level of core value recognition, which in return again to attract more excellent artists globally to participate.
- The A.R.T.’s strategies

The main purpose is expediate the virtuous cycle for a better performance, which includes a rigorous screening mechanism to present outstanding artworks to visitors by selecting excellent artists worldwide. Furthermore, in order to establish a stable market with reasonable prices, the external influential factors, such as VIP s system, previews, extended exhibitions and fixed pricing strategies, are used strategically. Please refer to the casual feedback loop of value creation for artists, shown as Figure 3.

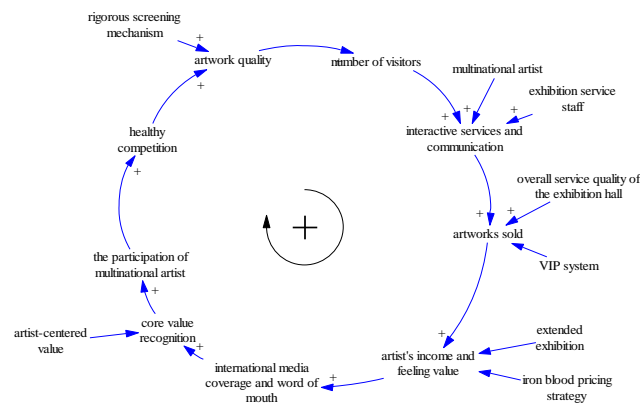


Figure 3 The casual feedback loop of value creation for artists

3 value creation about the business model of an international art exposition

Based on the literature researches, semi-structured interviews, and interviews with the A.R.T. organizer, artists and visitors-buyers, this study analyzes the business model of A.R.T. by system thinking, to construct a casual feedback loop for value creation about the business model of an international art exposition, taking Art Revolution Taipei as a study case. The conclusions we have drawn are as follows.

3.1 Combining the above-mentioned models covering interaction among the organizer, visitor and buyers for value creation

Combining the above-mentioned models covering interaction among the organizer, visitor and buyers for value creation, the general casual feedback loop is constructed shown as Figure 4.

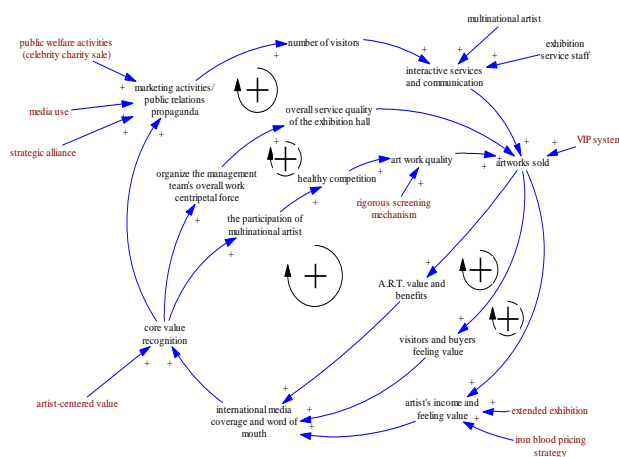


Figure 4 The general casual feedback loop of value creation From A.R.T.

3.2 Sample

In order to analyse this loop consists of three previous figures, to enhance readers' comprehension of a whole picture about the operation of A.R.T. There are many reinforcing loops and marked in red, indicating strategies introduced by A.R.T., in hope of a more smooth operation.

The main strategies include the artist-centered value, strategic alliance, media use, public welfare activities (Hundreds of Celebrities Charity event), rigorous screening mechanism, VIP system, extended exhibition, and iron blood pricing strategy. It aims at creating a win-win-win situation for the organizer, visitors and artists, then go further to establish a reputation by recognizing the core value. This in return reinforces the internal coherence of the executive team, and improve the service quality and performance; in the meantime, the PR marketing campaign could become even more powerful to attract more visitors, who would lead to more interactions with exhibiting artists and staff. Being the operational essence of A.R.T., the whole positive loop would increase the volume of artworks sold, which benefits and adds values to all parties, so as to the entire reputation.

References

- Drucker, P. (2005). *Manage Yourself and Then Your Company: Set an Example*. IEDC ,Books of the Year
- Fish, R., Church, A. and Winter, M.(2016), "Conceptualising cultural ecosystem services: A novel framework for research and critical engagement", *Ecosystem Services*, 21, 208-217.
- Heilbrun, James and Gray(2001).*The Economics of Art and Culture*. Cambridge: Cambridge UniversityPress, 169-174.
- Hill, Charles W. L. and Jones, Gareth R.(2013),*Strategic Management Theory: An Integrated Approach*,.Published on January 30, 2013 by DANIEL GARCIA.
- Kim, Daniel H. (1997), " From Key Success Factors to Key Success Loops" , *The System Thinker*,8:5, Pegasus Communications, P.O. Box 1281, Cambridge, MA, 6-7
- Le Compte, M.D. (2000). *Analyzing Qualitative Data. Theory Into Practice*, 39(3), 146-155.
- Mintzberg, H.: 1977, "Strategy Formulation as an Historical Process", *International Studies of Management and Organization* 7(2), 28–42.
- Osterwalder, A. and Pigneur, Y. (2010), *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. Wiley, Jul 2010.
- Quemin, A. (2013). *INTERNATIONAL CONTEMPORARY ART FAIRS IN A 'GLOBALIZED' ART MARKET*. *European Societies Volume 15*, 2013 - Issue 2
- Schiama, G. (2011), *The Value of Arts for Business*, Cambridge University Press , UK.
- Senge, P. (2010), *The Fifth Discipline: The Art & Practice of The Learning Organization*. Doubleday/Currency, New York:
- Sterman, J. D. (2006). *Learning from evidence in a complex world*. *American Journal of Public Health*, 96(3), 505–514.

A Dynamic Decision Support Model for Entrepreneurial Innovation and Strategic Market Development in the Biotechnology and Healthcare Industries

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Abstract

According to the annual pharmaceutical industry data from Ministry of Interior, Department of statistics and IQVIA Company at 2015 and 2017, Taiwan health care expenditure at 2014 is NTD933 billion (USD31 billion), GDP reaches 6.3% and the sales amount for oncology products reaches NTD4.8 billion (USD160 million). In 2016, total anti-neoplastic market reaches 8.336 billion (USD278 million), which is almost double the market size. In order to response to fast growing anti-neoplastic market, biosimilar new entries and limitation of the NHIA reimbursement, traditional marketing strategy may not fit well in this evolving pharmaceutical industry. Industrial environment change and dynamic strategy should be further considered. System dynamics management is sensitive to environment change and can mimic the result of return on investment, which can predicts a better strategic decision. This research based on system dynamics views, using marketing module of management flight simulator in system dynamic, simulating this business case in real world to produce multiple strategies and its consequences as the suggestion of future business management.

The research shows:

- 1. Use system dynamic to support decision-maker understanding the change of the environment and impact level of critical elements when making a decision*
- 2. Use flight simulator in system dynamic, identified 5-level target customers, tailored marketing strategies for each level, and simulated the result in order to get the best solution*
- 3. Validate system algorithm, external factors and internal resource allocation during simulation process, support decision-maker to understand critical elements, developing tailored strategies, forming concrete target customer structure to ensure business sustainability*

Conclusion: The research implies

- 1. Business management and decision making process*
- 2. Maximize business value and profit*
- 3. Resilience when facing competition*

Keywords Key words: System dynamics; strategy dynamic; dynamic strategy; Pharmaceutical industry

Paper type – Academic Research Paper

1.Introduction

WHO (World Health Organization) announces that cancer is the second leading cause of death in the world, causing 9.6 million deaths in 2018, which accounts for nearly one-sixth of the world's total deaths. The economic impact of cancer is tremendous and is still growing. AHRQ(The Agency for Healthcare Research and Quality) estimated the total cost of treating cancer just in the States itself is about 80.2 billion US dollars in 2015.

The number of new cancer patients and the number of deaths are increasing continuously, and the global anti-cancer drug market has maintained rapid growth in the recent years. According to IQVIA, the global expenditure for anti-cancer drugs has increased from US\$96 billion to US\$133 billion in 2013-2017. In the States, the expenditure for the cancer drug increased from US\$38 billion in 2013 to US\$61 billion in 2017, which accounted for 46% of the global market. IQVIA predicts that the global cancer treatment drug market is expected to reach US\$200 billion in 2022. However, in the pharmaceutical industry, the local laws and regulations are not the same in different countries, and the insurance payment and national policies are different. How to make use of the market research and data analysis to achieve local planning and tailored regional planning so that more patients can get more appropriate treatment.

Facing the huge market opportunities, the oncology drug market is extremely competitive. The top 10 pharmaceutical companies worldwide have about 40% of the research and development product layout is in the field of cancer treatment. Traditionally, it is no longer easy for the pharmaceutical companies to apply the promotional mode to the current environment. There must be more innovations and a quick responsive market, so that enterprises can continue to operate regardless of technological innovation and product innovation.

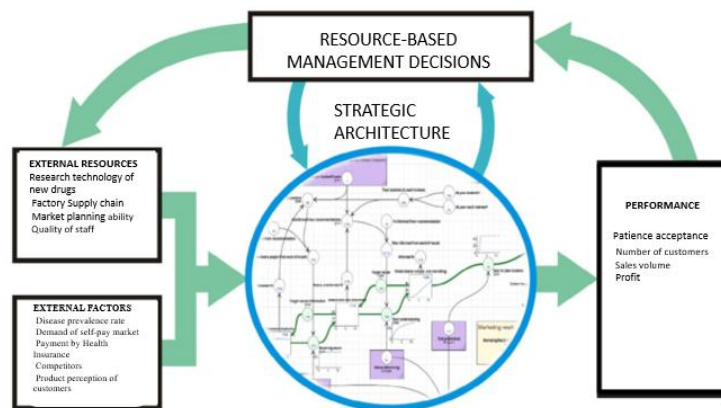
In order for the enterprises to sustain operation, there must be more innovations and possess the capability of responding quickly to the market. Regardless of technological innovation, product innovation, service innovation and business innovation, it can greatly contribute to the development of the enterprise market. Continuous service innovation can meet the needs of the existing customers, and product innovation is able to cater to the needs of customers in the future market, reducing unnecessary delivery of resources can also increase the ROI of the enterprise, process improvement and staff adjustment will also affect the product and business models, at the same time, good results are more supportive to the growth of business and revenue.

In the Yan (2018) research, it is proposed that the framework of SSDSS uses a simulation management model to establish strategic planning combined with external resources and external factors, and helps the company to examine a good decision-making business model through the customer cognitive phase and feedback mechanism.

In this case, the use of the SSDSS framework through the decision-making process, the relevant variables and feedback mechanisms can clearly outline the overall picture and diagnose the problems encountered by the corporate cases and develop relevant strategies to expand the anti-tumor market in Taiwan.

2.Strategic Framework

By importing the interview data under the SDSSS framework, it can be summarized the external resources of the medical industry including the quality of the staff, the rate at which new drugs are developed, the capability of marketing planning, the supply capacity and external factor disease prevalence rate, insurance system, the disease awareness of the customers and if the self-pay market is perfect, will affect the customer's recognition of products and enterprises.

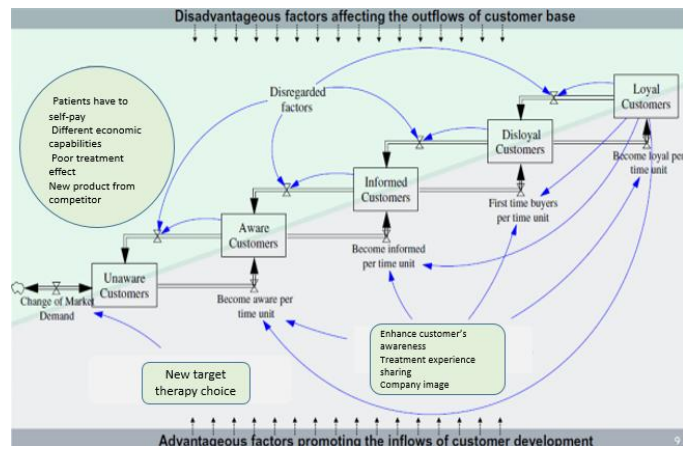


References : M. R. Yan (2018). Improving entrepreneurial knowledge and business innovations by simulation-based strategic decision support system. *KnowledgeManagement Resea Rch & Practice*, 16(1),1-10.

Figure 1-1 SSDSS Decision analysis chart

According to Figure 1-1, the strategic framework illustrates the strategic results and performance, over time, changes in customer perceptions and customer inflows or outflows depend on resources, management decisions, and external factors.

In order to confirm the feasibility of the strategy, it is necessary to assess the awareness of the customers at different stages, and enterprises can apply different marketing strategies according to the different perceptions of the customers. The marketing challenge encountered by the medical industry is how to increase customer's prescription experience to accelerate customer inflows and to reduce the risk of customer outflows. This case uses SSDSS analysis to more effectively apply the method of investing in the development of customer at different stages.



Reference sources : M. R. Yan (2018). Improving entrepreneurial knowledge and business innovations by simulation-based strategic decision support system. *Knowledge Management Research & Practice*, 16(1),1-10.

Figure 1-2 Factors influencing different stages of target customer scalar quantity and flow

The customer development phase can be divided into four phases of resource allocation to maximize resource development at different stages:

(1) Unaware customers Stage of contact marketing

Increase the opportunities for the target customers to be in touch with the product and to establish brand impressions, regardless of product being advertised in the medical news magazine, or display at sponsored booth, or cooperation with the media public relations and so forth, it presents only the image of the brand logo.

(2) Aware customers Stage of experiential marketing

Allow the customers who are aware of the products but are not interested, to experience the product, besides the introduction of the products by sales representatives, invite the customers to participate in the large scale seminars, understanding the benefits of the product in detail and the treatment effect, and transform the impression of the customers' interest in the product

(3) Informed customers Stage of reciprocation marketing

To enable the target customers who have shown interest but have not consumed to become actual non-loyal consumers, invite them to attend small scale medical seminars, and consult the experts any related treatment related questions or doubts, and be invited to participate in any of the clinical trial plan to increase treatment experience and confidence.

(4) Disloyal customers Stage of testimonial marketing

At this stage, the task is to strengthen the continuous return of the customers, so that they will become devoted customers, and through the sharing of the results of large scale treatment experiments by experienced experts and arrange exchange of experience in international exchanges, so that everyone can understand more about the trend of international treatment

3. Introduction of Case Study

Roche Pharmaceuticals was founded in 1986, and the headquarters are located in Basel, Switzerland. It is the biggest biotechnology company in the world. The revenue of Roche Pharmaceuticals is 48.1 Swiss francs. Since the beginning of 21 century, the company is focusing on full development of the anti-tumor drugs. The Taiwan branch was set up in 1967, and there are about 300 employees currently, and the annual revenue is almost 270 million US dollars, which is the third biggest pharmaceutical company in Taiwan, and its anti-tumor drugs accounted for 72% of the company revenue.

The National Health Insurance implemented in Taiwan generally covers a great range of anti-tumor treatments. Because of the rapid increase of patients, many newly listed anti- cancer drugs can only be used at their own expense. For those countries relying on national health insurance, it is a very tough market, so for those managing these drugs must have a clear market research and perception of customers and big data analysis, in order to make helpful strategic planning.

In the enterprise case study, the drug, Avastin , serves as an action machine which cooperates with the chemotherapy to hinder the supply of nutrients to the cancer cells, and it can be used in the treatment of many cancers. The subject of this case study is directed at Avastin newly listed on the market for the treatment of ovarian cancer drugs. The case study is based on Avastin's new treatment of ovarian cancer drugs. Firstly, the SDSS framework is used to support management decisions and the in-depth interviews with medical experts and secondary data simulation of the amount of resources invested in the market, and to achieve changes of the dynamic equilibrium state and affecting results and to improve business performance.

Based on a total of 80 specialists of women's cancer in Taiwan, a sample interview of 30 physicians, the analysis of the target customers are as follows:

Table1. Research Approach and Sample Design

	2018 Avastin in OC survey
Sample size & target audience	n=21 Gynaecologic Oncologists n=9 Medical Oncologists
Methodology	60 minutes face to face interview with semi-structured questionnaire
Sample criteria	Practice within 3~35 years Must have at least 10 OC patients prescribed with systemic chemotherapy in past 1 year Must have at least 1 CC patients prescribed with systemic chemotherapy in past 1 year
Quota	Area - North: Central :South = 5:2:3 Medical center : Regional Hospital = 7:3 OC class - Level A:B:unclassified = 8:17:5

Scale up sample size according to the 5 stages of strategic framework, and classify them as follows:

Stage 1: Definition of unaware: Specialists of women cancer who have not heard of this product. There are about 80 Gynecology specialists in Taiwan, and approximately 20% physicians have not heard of this product.

Stage 2 Definition of Aware: Have not participated in any product presentations and those customers not fully aware of the product information accounts for 18% of the gynecology specialists.

Stage 3: Definition of informed customers: The targeted group have participated in product presentations or seminars and expressed that they have partially understood the product but have not used it before. These account for about 18% of the gynecology specialists.

Stage 4: Definition of disloyal customers: Have used the product and its substitute before, and it accounts for about 13% of the gynecology specialists.

Stage 5: Definition of loyal customers: Good experience of using the product and recommending personal treatment experience to other physicians at the large scale institutes, and this accounts for about 31% of the gynecology specialists.

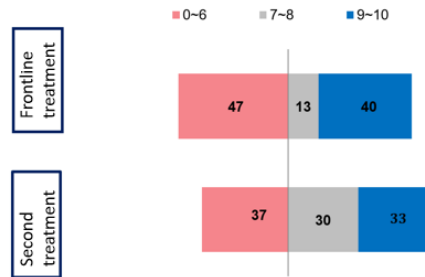
According to the Ministry of Health and Welfare, the prevalence rate of ovarian cancer in Taiwan is as follows:

Table 2 Number of ovarian cancers according to clinical and pathological classification(not including 0 stage)

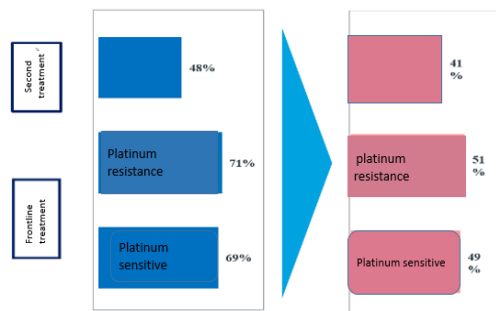
	Pathological stages				
Clinical stages	Stage I	Stage II	Stage III	Stage IV	Total
Stage I	311	19	22	2	354
Stage II	12	39	21	0	72
Stage III	32	18	226	9	285
Stage IV	1	0	7	134	142
Total	356	176	276	145	

Source of information: 2015 Ministry of Health and Welfare Ovarian Cancer Report.

In the case study, according to the client list of the company, the customers who are willing to recommend the patient's willingness to use and the patient's willingness to pay at their personal expense after recommendation are as follows:



Picture 3-5: Statistical ratio of phase target customer willing to recommend to patients
References : IQVIA & Roche company.



Picture: 3-6 Target customer recommendation acceptance ratio
References : IQVIA & Roche company.

3.1 Results of the analysis

Inflows and outflows are constantly alternating at the customer development stage, the scalar quantity and flow will evolve dynamically due to promotional behavior decisions or business models. Therefore, the accumulation of the target customer at the four stages is quite important. Investing resources at the four stages are used to increase the customer's awareness of the disease:

Unaware to Aware: Through large-scale broadcasting such as launching of product, medical magazine media or setting up medical clinic booths, motivate the customers to move towards customers who are recognize the product but show no interest

Aware to informed: Through small scale seminars or product presentations, the unique treatment effects and clinical trial results of the product brand are passed on to the uninterested customers.

Informed to disloyal: At this stage, the main task is to heighten the confidence of treatment and invite these customers to participate in clinical trials, and so forth.

Disloyal to loyal: The marketing task at this stage is to convert customers into product loyalists.

Therefore, the investment resources are more concentrated in strengthening the good experience of the customer and speech giving training program to increase personal influence.

Through the model framework, it can also be seen that the theory of customer development stage of the flow is subjected to dynamic changes due to the patient's self-paying ability or the ability of advisory reception or the effect of treatment is not good and the appearance of new competitors.

4. Conclusions

This case study, through SSDSS, arrives at three crucial factors to promote the business growth, firstly, to confirm changes in the mobility of customers and the five stages market development, how it can utilize the company resources to maximize the efficiency, innovation of the second business model, creates clearly the product awareness, leading customer to recognize the value of the product and increase the market share by using service innovation. Lastly, uses the strategic framework to uncover potential customers and each stage of strategic planning can assist the decision maker clearly see the whole picture and make the right decisions.

Although this study is useful for the market, but there are some restrictions.

For example, there are many factors affecting the revenue, other than the interaction between the variables, the interaction between the employees and customers will also affect the result. This encourages the study in future to continue further discussion and research.

References

Chinese Part

- Meadows, D. H. (2016), Systematic thinking: Overcoming blind spots, facing complexity, The overall thinking of The forest and the trees (translated by Qiu Zhaoliang Press), EcoTrend
- Roche Enterprise, source : <http://www.roche.com.tw/>
- Senge, P. (1995), The Fifth Discipline Fieldbook: Strategies and Tools for Building a Learning Organization, Taipei: Commonwealth Publishing Co., Ltd. (original paper published in 1994)
- Warren, K. (2015), The core principle of strategy dynamics (compiled by Lu Xinke, Yan Minren, Lin Yijun) International Research-Based Pharmaceutical Manufacturers Association, www.irpma.orf.com/ The Taiwan Medical magazine 43(2013),56(2).
- Chao-Chuan Yu (2001), Marketing theory research, Journal of the Far East University,19.
- Song Liangyao(2017), Systems thinking of Service Quality and Managerial Strategies for Long-Term Care Institutions in Taiwan, unpublished Master thesis of Department of Business Administration, School of Business, Chinese Culture University
- Qiu Zhisheng(2015), Marketing Research, Taipei City : Best-Wise
- Chiu Tzu-Chieh(2018), System Dynamics Strategic Modelling for Integrated Marketing of Chain Restaurant – A Cases Study of Ten Ren cha FOR TEA, unpublished Master thesis of

- Department of Business Administration, School of Business, Chinese Culture University.
- American Marketing Association(AMA),www.ama.org/.
- Taiwan Research Institute Research on Social Welfare Policies in Major Countries in Accordance with Population Ageing, (95)060.809.
- Health Promotion Administration (2018),www.mohw.gov.tw/.
- Chen Yinshan(2017), To investigate the Influence of Customer Relationship Management Orientation on Operational Performance, unpublished Master thesis of Department of Business Administration, National Sun Yat-sen University
- Liao Wenquan(2016), An application of The Systems Thinking Approach to Explore the Key Success Loops of a Conglomerate's Diversification Strategy, unpublished Master thesis of Department of Business Administration, National Sun Yat-Sen University

English Part

- American cancer society <https://www.cancer.org/.../targeted-therapy/what-is.html>.
- Bakken, B., Gould, J., & Kim, D. (1992). Experimentation on learning organization: A management flight simulator approach. *European Journal of Operational Research*, 59(1), May.
- Blackston, M. (1992). A brand with an attitude: A suitable case for treatment. *Journal of the Market Research Society*, 34(3), 231-241.
- Brunton, L., Knollman, B., & Chabner, B. A. (2011). *Goodman & gilman's the pharmacological basis of therapeutics*, 12thed. McGraw-Hill.
- Definition of targeted therapy-NCI Dictionary of Cancer Terms. National cancer Institute.www.cancer.org/.
- Forrester, J. W. (1961). *Industrial dynamics*, cambridge, Massachusetts: MIT Press.
- Forrester, J. W. (1971). *World dynamics*, cambridge, Massachusetts: MIT Press.
- Išoraitė, M. (2016). Marketing mix theoretical aspects. *International Journal of Research*, 4(6), 25-37.
- John, W., Sons, Inc., Stern, J. A., & Reve, P. F. (1980). Cognitive Relativism and the Practice of Marketing.
- Matty, S. E., Mayer, M., Coleman, J. E., Reynolds, K. E., & Lee, J. (1996). Customer sales associate retail relationships. *Journal of Retailing*, 72(3), 223-247.
- Menon, A. R., Yao, D. A. (2014). *Elevating repositioning costs: Strategy dynamics and competitive interactions in grand strategy*. Boston: Harvard Business School Press, 14-103.
- NCCN Guidelines® Updates: Targeted Therapy <https://education.nccn.org/node/83373>.
- Perriena, J., & Ricardb, L. (1995). The Meaning of a Marketing Relationship: A Pilot Study. *Article in Industrial Marketing Management*, 24(1), 37-43.
- Richard, R. N. (1993). National innovation systems: A comparative analysis. Columbia University - School of International & Public Affairs (SIPA).
- Sheth, J. N., Gardner, D. M., & Garrett, D. E. (1988). *Marketing theory: Evolution and evaluation*. New York.
- Sterman, J. (2002). System dynamics: Systems thinking and modeling for a complex world. ESD Internal symposium.JJJ
- Stone, M., Woodcock, N., & Wilson, M. (1996). Managing the change from marketing planning to customer relationship management. *Long Range Planning*, 29(5), 675-683.
- The Cost of Innovation in the Pharmaceutical Industry A Review <https://farmaactueel.nl/webcasts/extern/EAHP2014/PDF/Schuhmacher.pdf>.
- Walter, A., Mueller, T. A., & Helfert, G. (1990). *The impact of satisfaction, trust, and relationship value on commitment: Theoretical considerations and empirical results*, University of

Karlsruhe, IBU.

- Wazana, A. (2000). Physicians and the pharmaceutical industry: Is a gift ever just a gift? *JAMA*, 283, 373-380. doi: 10.1001/jama.283.3.373.
- Yan, M. R. (2018). Improving entrepreneurial knowledge and business innovations by simulation-based strategic decision support system. *Knowledge Management Research & Practice*, 16(1), 1-10.
- Stewart BW, Wild CP, editors. World cancer report 2014. Lyon: International Agency for Research on Cancer; 2014.

University Growth Strategy with Executive Education and Industry Knowledge Ecosystem Development: A Case Study in China

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Abstract

With the development of knowledge economy and increase of global competition, the role of university is becoming more and more critical in the development of local and national community. Besides the traditional twin missions of teaching and research, nowadays more and more emphasis has been put on the so-called third mission, i.e. social service, which commercialize generated knowledge and intellectual property. Under the New Public Management paradigm, a few performance indicators are set to make university accountable, such as number of students, amount of public and industry funding and number of transferred patents. Furthermore, a lot of rankings are introduced to compare the performance among universities. However, only a few universities meet the expectation of stakeholders. In this study, we conducted a case study in China to

investigate what is the limiting factors behind university development. First, unstructured interview towards faculties is used to investigate the limiting factors and a causal loop diagram is sketched to describe the underlying mechanism. Then a university growth strategy with executive education and industry knowledge ecosystem is proposed to alleviate the constraints and to achieve the full potential of university.

Keywords University Growth Strategy, Limits to Growth, Executive Education, Knowledge Ecosystem, Causal Loop Diagram

Paper type Academic Research Paper

1 Introduction

In the last decades, worldwide governments introduced new university reforms to respond more effectively to the changes of the economic, social and political systems (Lindstrom, 1994; Tierney, 1998; Butera, 2000). With the development of knowledge economy, university become more and more important and closely embedded in the society (Mckelvey et al 2018). Traditionally, universities are expected to create new knowledge and share it, to educate and to train people for the manufacturing and service sectors and the society at large. Compared to the twin missions of teaching and research (Etzkowitz 2004), nowadays more and more emphasis has been put on the third mission, i.e. social service, which commercialize the generated knowledge to support the development of community (Zhang et al 2018).

One of the main indicators to measure university performance is ranking, which is a weighted sum of the performance metrics. Among them, ARWU, The Times, USNews and QS university rankings are the top four. The performance metrics and respective weights of QS and The Times University Ranking can be seen in Table 1. Generally, university is evaluated based on its performance in research, teaching and reputation.

Table 15 Performance indicators and weights in QS and The Times University Ranking

Rankings	Indicators and respective weights
QS	Academic Peer Review (40%); Citations per faculty (20%); Faculty student ratio (20%); Global Employer Review (10%); International Student Ratio (5%); International Faculty Ratio (5%)
The Times	Teaching (30%); Research (30%); Citations (30%); International outlook (7.5%); Industry Income (2.5%)

In both of two rankings, research accounts more than 60% of the ranking. Indeed, among the three missions, research lies in the centre, as university is the centre of great minds and responsible for knowledge creation since it is built in the middle century, without which it cannot play a leading role in higher education. Thus in this paper, we investigate the research part of university and try to propose proper strategy to foster university growth.

2 Literature review

2.1. *University Mission and Performance Measures*

It is difficult to precisely define the universities' role in modern society. Since it is founded in the middle century, university is the centre of great minds, which creates and diffuses knowledge, delivers both knowledge and skilled students to the society. With the booming of knowledge economy and increase of global competition, universities need to reposition themselves and restructure to respond more effectively to the changing social, economic, and political forces.

It is time for universities to redesign mission. As suggested by Lindstrom (1994), this is a time of transition for everyone involved in the production of public service, internal effectiveness and external influence have been the identical standard for all organizations. The author argued that quality is the strategic factor for competition and cooperation in the university world and we need to go back to the fundamental questions, i.e., "What is meant by quality? For whom is quality intended? Who is responsible for quality? Within which areas will quality be followed up? How are quality levels followed up?" Finally Lindstrom concluded that university should engaged staff in quality evaluation and improving all areas of operations continuously. In the book titled "The Responsive University: Restructuring for High Performance", Tierney (1998) advocates reorienting basic working structures and designing more creative organizations and they argue that it is critical to find alternative ways to measure productivity and reconfigure promotion and tenure, along with academic freedom, faculty roles and rewards. Butera (2000) thinks that it is the true challenge facing the universities to contribute substantially to the development of a knowledge economy and the training of knowledge workers. Universities has assets to be successful, but also suffers severe constraints because of legacy systems rooted in organization, personnel rules, and a culture for a past era.

To define and evaluate the performance of universities is the prerequisite to achieve university mission. Sarpong et al (2015) identified three domains of practices (advanced research capabilities and external partnerships, the quantification of scientific knowledge and outputs, and collective entrepreneurship) that constitutively facilitate partnership and in turn the successful transition to a hybrid triple helix model. They also suggested integrating flexible routines and procedures into organizational processes and collaboration architectures, so as to engage productive innovation partnerships. Based on the model of collective intelligence (Boder,2006), Secundo et al (2016) proposed a three dimension framework, i.e., entrepreneurial competence development, technology transfer and innovation, social engagement and regional development, for universities to enhance their intangible resources and endorse the capacity of their "crowd", on which a profitable interaction with the external environment is based.

2.2. *System Dynamics-based University Policy Analysis*

The System dynamics (SD) methodology was found by the pioneering work of Forrester (1961), which aims at investigating complex systems through a cause-and-effect perspective. This preliminary analysis provides the basis to build simulation models oriented to supporting decision makers' learning processes. In fact, through the investigation of simulation results derived from the implementation of desired policies, decision makers can acquire a deeper knowledge on the relationship between the cause-and-effect system structure and the related main variables behaviours over time.

It was first applied in supply chain management. Nowadays, it is widely used in social science, engineering, healthcare, education, with applications in public, private and non-profit organisations (Stermann et al. 2015). The field of study related to university growth strategy, however, is not well investigated.

Richardson and Lamitie (1988) conducted a research on the increased use of school aids in Connecticut. They built a simulation model to support school's decision makers to question their thinking about target state aids, and to envisage alternative policies to effectively deal with the local districts' resistance factors. Galbraith (1998) tried to introduce system dynamics to university management by identifying system archetypes triggered by increasing competition among universities. Barlas and Diker (2000) developed an interactive simulation model named UNIGAME on which the academic aspects of university management are analysed and alternative management strategies can be tested. The use of the simulator may support decisions makers to understand the system as a whole and to make the decision process transparent.

To adapt to different situations and modelling objectives, modellers can look at the system in varied ways. At the institutional level, performance is assessed primarily in relation to the effects produced by decision makers on their own institution. At the inter-institutional level, performance is assessed in relation to the effects produced by decision makers on the wider system, e.g., either a local area or the industry to which they belong (Bianchi, 2016), such as tax contributions, increasing employment, shared knowledge with business partners, etc. Besides, there are three types of models, conceptual model, stock-and-flow model and insight model. Conceptual model depicts the feedback loops explaining system behaviour, with no quantitative data or simulation. Stock-and-flow model is quantitative which implies a level of detail, an accuracy, and an extension of explored system boundaries i.e. usually broader than in a qualitative analysis. Insight or policy-based model is built based on its usefulness to users, rather than how closely it mimics reality of historic time series. Therefore, relatively simple models might be valid, and just as effective as a highly detailed models (Lyneis, 1999; Bianchi, 2016).

2.3 Executive education and knowledge ecosystem

It has long been argued that executive education helps to build learning alliance between business and business schools (Ghoshal et al 1992). The authors proposed that instead of viewing research and teaching as independent or sequentially linked activities, such programs can make them simultaneous outputs from a shared learning experience. The executive education can close the gap between academic research and field knowledge, which will improve the productivity by increasing the relevance of research to industry. Besides, executive education provide extra funding and industry resources for further research.

Starting from its (re)introduction two decades ago by Moore (1996), the ecosystem concept has also been actively discussed in management studies, bridging, for instance, system thinking and evolutionary economics (Valkokari, 2015). Compared with business ecosystem, which focus on customer value creation and with big companies as key players, knowledge ecosystem focus on generation of new knowledge and research institutes such as universities play a central role in the system. Similar as business ecosystem, the value creation of knowledge ecosystem is two-fold: (1) facilitation of the innovation process for individual companies and (2) creation of an innovation community (Borgh et al. 2011).

3 Research method

First, the status quo is investigated by unstructured interview towards a few faculties in the selected university. Then a few limiting factors are identified and a causal loop diagram is drawn to depict the underlying mechanism. Causal loop diagram is a conceptual system dynamics tool which represents a closed loop of cause-effect linkages (causal links) as a diagram which is intended to capture how the variables interrelate (Zhu et al. 1995). Causal loop diagrams identify and label feedback loops to facilitate dynamic reasoning and formal modelling. At last, we compare the causal loop diagram with classical system archetype and a university growth strategy is proposed to achieve the full potential of university.

4 Empirical study

To investigate the development of research in university, Shanghai University of International Business and Economics, is selected as our case. Founded in 1960, the Shanghai University of International Business and Economics (SUIBE) is one of the Chinese specialized universities which is famous for economics and finance. SUIBE offers 30 undergraduate programs, covering five fields of disciplines, i.e. economics, management, literature, law and natural science.

First, an unstructured interview with faculties is conducted to investigate the critical factors that influence the research productivity and limited resources. Based on the interview, we extract cause-and-effect links from the text and develop a causal loop diagram to sketch the mental model (Doyle and Ford 2015) of faculties about research productivity. As Figure 1 shows, there are 4 reinforcing loops and 6 balancing loops, which can be described as below:

- R1 Workforce adjustment (Faculty-Publications-Projects-Desired Workforce-Recruitment-Faculty): when number of faculty increases, publications increase, which enable more projects, more faculties are required, and recruitment is adjusted to close the gap between desired workforce and current faculties.
- R2 Funding support (Research Productivity-Publications-Projects-Funding per Faculty-research productivity): when research productivity increase, publications increases, projects increases, more funding are distributed, higher funding per faculty in turn increase research productivity.
- R3 Work input (Research Productivity-Publications-Projects-Research Workload-Research Productivity): Research productivity is driven by more research workload.
- R4 Attrition Adjustment (Faculty-Attrition Rate-Recruitment-Faculty): when attrition increase, recruitment is also increased to fill the gap, faculty increases.

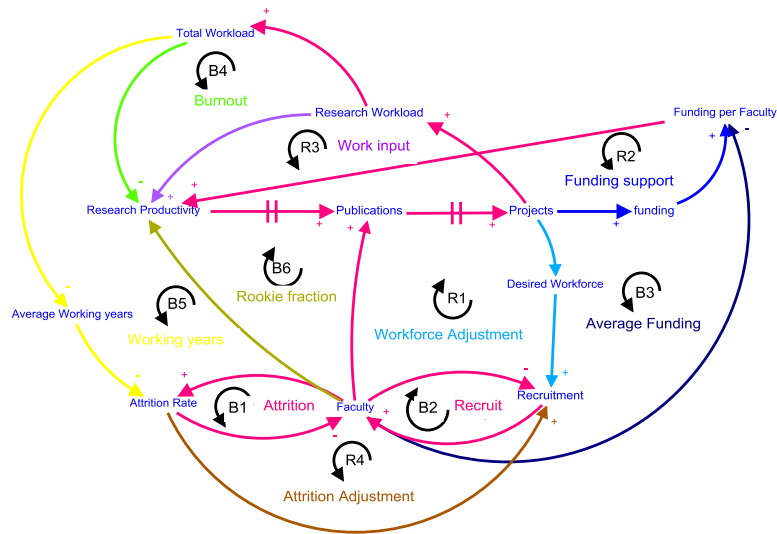


Figure 11 Causal loop diagram of university research

- B1 Attrition (Faculty-Attrition Rate-Faculty): The higher the number of faculties, the higher attrition rate, which limits the growth of faculties.
- B2 Recruitment (Faculty-Recruitment-Faculty): when number of faculties is high, recruitment is decreased, which limit the growth of faculties.
- B3 Average funding (Research Productivity-Publications-Projects-Desired Workforce-Recruitment-Faculty-Funding per Faculty-Research Productivity): Average funding is decreased because of the recruitment of faculty, which decreases research productivity.
- B4 Burnout (Research Productivity-Publications-Projects-Research Workload-Total Workload-Research Productivity): research productivity is decreased because of high total workload.
- B5 Working years (Faculty-Publications-Projects-Research Workload-Total Workload-Average Working Years-Attrition Rate-Faculty) Limit of faculty growth because of shorter average working years, which increases attrition rate.
- B6 Rookie fraction (Research Productivity-Publications-Projects-Desired Workforce-Recruitment-Faculty-Research Productivity): Limit of research productivity because when recruitment help to increase faculty number, the rookie fraction also increase, and in turn research productivity decrease.

There are four limits to growth archetype in the system, as Table 1 and Figure 2 show, for every reinforcing loop driving the development of university, there are one or two balancing loops counteracting the effect. Without the alleviation of balancing loop, it is useless to push the reinforcing loop. For example, the workforce adjustment R1 can increase the number of faculties, but B6 counteracts by increasing rookies fraction which decrease research productivity.

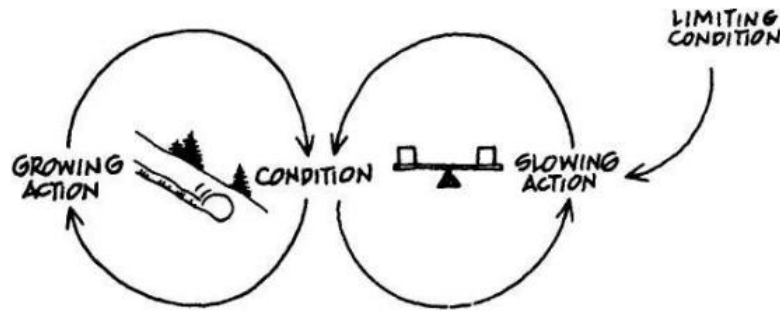


Figure 2 Limits to growth (Senge, 1991)

Table 16 limits to growth archetype of substructure

Substructure	Reinforcing Loops	Balancing Loops
Workforce adjustment	R1	B6
Funding support	R2	B3
Work input	R3	B4, B5
Attrition adjustment	R4	B1, B2

5 Policy analysis

As suggested by Senge (1991), with the limits to growth structure, it is useless to push the reinforcing loop without alleviating the balancing loop, thus possible policies can be addressed to overcome the effect of balancing loops. For example, increase knowledge sharing and career development to help rookies to learn faster to adjust the effect of B6. Thus we propose a university growth strategy with executive education and industry knowledge ecosystem development, which can strengthen the reinforcing loops on one hand, and alleviate the effect of balancing loops on the other hand.

Foster university growth by executive education. Executive education provides professional education and training for experienced managers, especially for senior managers. It has long been argued that executive education helps to build learning alliance between business and business schools (Ghoshal et al 1992). The executive education can close the gap between academic research and field knowledge, which will improve the productivity by increasing the relevance of research to industry. This will in turn strengthen the cooperation between university and industry, which help to attract more funding to support research.

Foster university growth by industry knowledge ecosystem development. Knowledge ecosystem becomes a buzz word recently, in which mutually complementary stake holders form a close network to share knowledge and gain competitive advantages. Based on a unique hand-collected database of 138 innovative start-ups in the region of Flanders, Clarysse et al (2014) analyse the knowledge and business ecosystem and the financial

support network. The authors find that the knowledge ecosystem is well structured and concentrated around a number of central actors while the business ecosystem is almost non-existent at the local level. University is famous for its openness and tolerance, based on which it can naturally be the central actors in the knowledge ecosystem and bridge different stakeholders, i.e. public organizations, private organizations and citizens. This will create tremendous opportunities to commercialize the generated knowledge and contribute to the development of community.

6 Conclusion

In conclusion, university is facing great challenges and it can't deal with the issues alone as there are a few limits to growth structure inside the system. Based on the analysis of system structure and investigation of latest practices, we propose a university growth strategy with executive education and industry knowledge ecosystem development. This strategy will help to strengthen the tie between university and industry and contribute to the achievement of university mission in large.

References

- Barlas, Y., & Diker, V. G. (2000). A dynamic simulation game (UNIGAME) for strategic university management. *Simulation & Gaming*, 31(3), 331-358.
- Bianchi, C. (2016). *Dynamic performance management* (Vol. 1). Berlin: Springer.
- Boder, A. (2006). Collective intelligence: a keystone in knowledge management. *Journal of Knowledge Management*, 10(1), 81-93.
- Van der Borgh, M., Clodt, M., & Romme, A. G. L. (2012). Value creation by knowledge-based ecosystems: evidence from a field study. *R&D Management*, 42(2), 150-169.
- Butera, F. (2000). Adapting the pattern of university organisation to the needs of the knowledge economy. *European Journal of Education*, 35(4), 403-419.
- Clarysse, B. , Wright, M. , Bruneel, J. , & Mahajan, A. . (2014). Creating value in ecosystems: crossing the chasm between knowledge and business ecosystems. *Research Policy*, 43(7), 1164-1176.
- Doyle, J. K., & Ford, D. N. (2015). Mental models concepts for system dynamics research. *System Dynamics Review*, 14(1), 3-29.
- Etzkowitz, H. (2004). Evolution of the entrepreneurial university. *International Journal of Technology & Globalisation*, 1(1), 64.
- Forrester, J. W. (1961). *Industrial dynamics*. 1961. Pegasus Communications, Waltham, MA.
- Galbraith, P. L. (1998). System dynamics and university management. *System Dynamics Review: The Journal of the System Dynamics Society*, 14(1), 69-84.
- Ghoshal, S. , Arnzen, B. , & Brownfield, S. . (1992). A learning allinace between business and business schools: executive education as a platform for partnership. *California Management Review*, 35(1), 50-67.
- Lindstrom, J. (1994). A system for quality improvement in higher education. *European Journal of Engineering Education*, 19(3), 255-261.
- Lyneis, J. M. (1999). System dynamics for business strategy: a phased approach. *System Dynamics Review: The Journal of the System Dynamics Society*, 15(1), 37-70.

- Mckelvey, M., Buenstorf, G., & Broström, A. (2018). The knowledge economy, innovation and the new challenges to universities. *Innovation Management Policy & Practice*, 20(1), 84-86.
- Moore, J. (1996). *The death of competition: Leadership and strategy in the age of business ecosystems* harper collins. New York, NY.
- Richardson, G. P., & Lamitie, R. E. (1989). Improving Connecticut School Aid: A Case Study with Model-Based Policy Analysis. *Journal of Education Finance*, 15(2), 169-188.
- Sarpong, D., AbdRazak, A., Alexander, E., & Meissner, D. (2017). Organizing practices of university, industry and government that facilitate (or impede) the transition to a hybrid triple helix model of innovation. *Technological Forecasting and Social Change*, 123, 142-152.
- Secundo, G., Dumay, J., Schiuma, G., & Passiante, G. (2016). Managing intellectual capital through a collective intelligence approach: an integrated framework for universities. *Journal of Intellectual Capital*, 17(2), 298-319.
- Senge, P. M. (1991). The fifth discipline, the art and practice of the learning organization. *Performance+ Instruction*, 30(5), 37-37.
- Sterman, J., Oliva, R., Linderman, K. W., & Bendoly, E. (2015). System dynamics perspectives and modeling opportunities for research in operations management. *Journal of Operations Management*, 39, 40.
- Tierney, W. G. (1998). *The responsive university: Restructuring for high performance*. The Johns Hopkins University Press, 2715 North Charles St., Baltimore, MD 21218-4319.
- Valkokari, K. (2015). Business, innovation, and knowledge ecosystems: How they differ and how to survive and thrive within them. *Technology Innovation Management Review*, 5(8).
- Zhang Z, Yan H, Qi J and Bivona E. (2018). Framing alternative policies to achieve university mission: a case study of a Chinese regional university in the 36th International System Dynamics Conference, Reykjavík, Iceland, August 6-10
- Zhu, H. And others. 1995. Road Maps Glossary. D-4498, MIT System Dynamics Group Literature Collection. www.systemdynamics.org/mit-sdgroup-literature-collection

Applying Systems Thinking Concepts in the Analysis of Knowledge Sharing on WeChat

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Abstract

This research is intended to theoretically investigate and analyse the characteristics of WeChat and its effect on knowledge sharing through a systems thinking approach. As one of the most popular mobile social application in China, WeChat has social attributes and the functions of multimedia interaction platform and has been gradually used in knowledge management practice. On one hand, comparing with virtual communities of practice, WeChat provides a more open and individual environment which break free the shackles of workplace relations. On the other hand, as a user-operated media and instant messaging software, WeChat has dramatically different structure with academic social network sites, such as ResearchGate and academia.edu and so on. It is found that this new emerging tool could be useful in sharing explicit and tacit knowledge through providing interactive and collaborative technologies. Meanwhile, these user-operated

media are bringing new challenges for knowledge sharing. For example, they provide a high level of convenience for the diffusion of “false knowledge”.

There is still a poverty of literature to understand how and what might be the contributions and effects of WeChat on sharing different knowledge dynamically. Therefore, the purpose of this research is to analyze the effects of social media on knowledge sharing towards a systems thinking approach in order to provide a better understanding of social media users’ knowledge sharing behavior and important practical implications for the scientific and reasonable management of knowledge sharing. By conducting a study of the characteristics of knowledge sharing on WeChat, the subject, object, content, channel, and effect of knowledge sharing were analysed. The results show that WeChat present knowledge sharing opportunity that augment personal and organizational knowledge management in terms of tacit knowledge sharing, explicit knowledge sharing and false knowledge sharing.

Keywords – WeChat; Social media; Knowledge sharing; Systems thinking

Paper type – Academic Research Paper

1 Introduction

Nowadays, social media (SM) has emerged as a valuable platform dependent on advanced information technology for facilitating knowledge sharing (KS) and communication. It becomes an important method for collecting new information, shaping new ideas, and developing new products and insight (Ogink and Dong, 2017; Ransbotham and Kane, 2011). For instance, higher education institutions have also adopted social media as a mean of inspiring learning activities (Balakrishnan and Gan, 2016; Kulakli and Mahony, 2014). The essence of these social medias is knowledge collaboration, which includes a series of activities of sharing, transfer, accumulation, and co-creation of knowledge (Faraj et al., 2011).

Social media platforms incorporate a wide range of online media, including word-of-mouth forums such as Social Networking (SNS) (like Myspace and Facebook), microblogs (like personal blogs or Twitter), pictures or video-sharing applications (like Flickr or YouTube), and collaborative websites like Wikipedia (Kaplan and Haenlein, 2010; Osatuyi, 2013; Yan et al., 2013). These types of social media tools are considered to be prominent and well-established spaces for creating knowledge sharing channels, where people are able to find other individuals with similar interests, and share their thoughts with them (Bilgihan et al., 2016). Therefore, how to facilitate knowledge sharing on social media has become a central research issue. Our study follows this research issue, aiming to fill in the gaps that come from neglecting the support of technological tools on knowledge sharing.

As the emerging social media, WeChat plays an important role in Chinese daily life since it is launched in 2011. The result of a recent research shows that: 97% of their

anticipants used WeChat every day, half of the respondents opened it at least 20 times a day, and 16.01% opened it as much as 40 to 50 times a day. Over half of the respondents stayed on WeChat for at least 1 h each day, while 18.97% used it for more than 3 h (Zhang et al., 2016). WeChat has social attributes and the functions of multimedia interaction platform and has been gradually used in knowledge management practice. For example, the WeChat service number of China Merchants Bank---official WeChat of China Merchants Bank Credit Card Centre has achieved online communication and knowledge transfer between enterprises and customers, and the WeChat subscription number of Harvard Business Review magazine has pushed and shared new knowledge on management to and with users in real time (Zheng et al., 2014). And WeChat Library was found to have many advantages, such as low development cost, automatic cross-platform service, adaptive screen, low acceptance cost, easier promotion, strong user viscosity, strong interactivity and real-time consulting (Wei and Yang, 2015). These successful examples show that WeChat plays a key role of platform in online knowledge dissemination and sharing.

The current studies mostly focus on the research of WeChat users' behaviour (Chen et al, 2018) and its motivations from the aspects of social capital (Zhang and Liu, 2018) and self-efficacy (Wang et al., 2017). There is still a lack of understanding on how social media may facilitate knowledge sharing among its users, how can maximize the benefits, and how to tailor social media platforms for the needs of knowledge sharing. Therefore, to better understanding the phenomenon of knowledge sharing in social media space, this study is intended to make a theoretical link between social media concepts and characteristics with requirements of knowledge creation and sharing to find out probable potential of social media in facilitating knowledge sharing. This research aims to answer the following questions:

- (1) What WeChat activities are used for knowledge sharing?
- (2) What are sources of knowledge sharing on WeChat?
- (3) What are effects of knowledge sharing on WeChat?
- (4) What key challenges are faced when using WeChat for knowledge sharing?

This paper is structured with five sections. Firstly, the background and objects of this research is introduced. Then the introduction of WeChat and the characteristics of WeChat is reviewed. In the third section, the role of WeChat in knowledge sharing is explained based on case study. The forth section describes a systems analysis of the relationship between WeChat and knowledge sharing. Finally, based on the research results, the fifth section presents a discussion of the review, and its conclusion.

2 WeChat and its characteristics

2.1 WeChat

WeChat (WeiXin in Chinese) is a mobile instant text and voice messaging communication service developed by Tencent Holdings Ltd. in China on January 21, 2011. It has developed from a communication tool to a platform that connects people,

service, and business. WeChat has similar features to WhatsApp to generate both text and voice messages. It is a free application program that provides an instant messaging service for intelligent terminals including iPhone, Android, and Windows Phone operating systems. WeChat supports sending text messaging, hold-to-talk voice messaging, one-to-many messaging, photo/video sharing, location sharing, and contact information exchange (Chen, 2015). WeChat is the most widely used social networking service in China and has become an important social media platform for computer-mediated communication. And WeChat is among the top App that contributes to the highest percentage of data consumption. WeChat-driven information consumption reached RMB 209.7 billion WeChat accounted for 34% of the total data traffic of users (2018 WeChat data report). With the advances in Internet connection and the popularity of smart phone, WeChat reached 1.09 billion monthly active users at the end of 2018 and is available in over 200 countries and supports 18 different languages (2018 WeChat data report). Figure 1 shows the main functions of WeChat.
















	Voice Chat		Favourite Messages		Video Call		Shake
	Group Chat		Group Chat QR Code		Sticker Gallery		People Nearby
	Moments		Chat History Backup		Broadcast Messages		Walkie Talkie
	Free Call		Web WeChat		Friend Radar		

Figure 12 Main functions of WeChat (Wei and Yang, 2015)

2.2 The characteristics of WeChat

A wide variety of characteristics and capabilities have been defined for social media in the current research, including user-generated content, peer to peer communication, networking, multimedia oriented, and user friendly (Panahi et al., 2012). As one form of the social media, WeChat's characteristics are accordance with the characteristics of social media. For instance, WeChat is enabling users to store and share multiple content forms such as text, image, audio, video, and other formats in an interactive and easy way. This provides opportunity for users to easily share their own created multi-media files, tag, and comment on them. Meanwhile, like YouTube and Facebook, WeChat allows people to share variety of video and photo files with different subjects. But there's also some unique features that WeChat have. These can be categorized into three features:

Official accounts: There are two official account types on WeChat public platform, including service account and subscription account. The first one appears as friends in the "chat" section of WeChat. It is extremely visible and can only post 4 messages per month. While subscription account can send up to 1 push message per day to their followers and are grouped together in a dedicated folder. They are focused on providing users with

information by supplying media and individuals with a completely new channel for information dissemination and building improved communication and management patterns with patrons. The official account can be registered and run by individual and organization.

Equality: On WeChat, like Facebook and WhatsApp, users can easily establish a chatting room or group by adding members from their friends list. The difference is that it can add any of their friends into a WeChat chatting room without the permission of the members and the one was added. And the new members can also invite and add any friends to this chatting room from their own friends list. All the members in the same community have the equal power, which make the expansion of chatting room easier than before. WeChat group become the main form of network group life. Joining WeChat group is the routine of WeChat users.

Acquaintance network: There are obvious differences between WeChat and online community chat, especially with the so-called posting and follow-up mode, which subverts the traditional form of community life. Unlike the weak relational social networking platform, strong connectivity is the main feature of WeChat, enabling people easily to stay connected with each other in a real-time and in a global base. WeChat have provided an effective channel for social interaction and real time conversations between users in forms of chatting, video/telephone conferencing, etc.

The combination of those features and associated tools have made WeChat good channel for knowledge sharing activities. It helps people get connected, communicate with each other, build relationship, develop trust, and share their knowledge. It supports knowledge creation, distribution, and visibility of knowledge more effectively compared to traditional knowledge management systems.

3 The role of WeChat in knowledge sharing

WeChat is a virtual interactive platform based on interpersonal communication and strong relational interaction. Its media attribute is not so strong as WhatsApp. It pays more attention to pursues a kind of relationship rather than concern. WeChat group users have a higher sense of group identity and trust. The communication and discussion between users are more active and direct, forming a cultural circle with distinct topics. As collecting emotion and trust plays a direct role in inducing tacit knowledge sharing behavior, WeChat group is more recessive than other online social networks. The role of WeChat in knowledge sharing can be analyzed in the following aspects:

1) Accelerate the speed of knowledge sharing

WeChat can speed up the process of dissemination, sharing and transformation of explicit and tacit knowledge. We take the official account of Chinese Public Administration as an example. Table 1 shows the comparison of the reading numbers of the same articles posted by Chinese Public Administration on WeChat and the downloads on CNKI (China National Knowledge Infrastructure) until April 6, 2019. These articles are published in the February issue on the Journal of Chinese Public Administration. The

results indicate that the sharing speed on WeChat is more than ten times the speed on CNKI.

Table 17 Comparison of the knowledge dissemination on WeChat and on CNKI

No.	Title	WeChat	CNKI
1	Public communication, media role, and multiple consensus in social transformation: the experience and legacy of the U.S. progressive movement	642	59
2	The study of the classification system reform of Chinese civil servants from the perspective of institutional logics	1223	105
3	On the status and function of government publishing in the business climate	2028	85

2) Promote the dissemination of tacit knowledge

The role of periodicals and knowledge sharing website like ResearchGate is similar. They only can supply academic knowledge as there's a high requirement for academic rigor. This limits the knowledge sharing on these platforms are mainly explicit knowledge. The dissemination of tacit knowledge which comes from experience sharing is still very scarce. WeChat has created a new platform for informal knowledge sharing among the public. For example, in the official account of Chinese Public Administration Review, there is a special service is experience sharing of learning (Figure 2). This enriches the content of knowledge sharing and improving the dissemination of tacit knowledge.

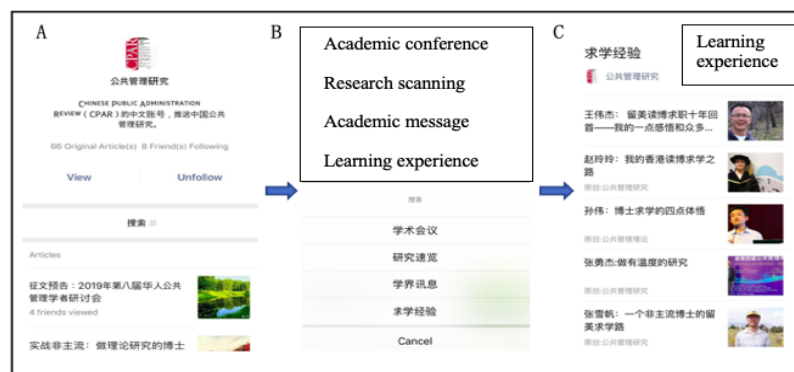


Figure 2 Application flow sheet of 'Chinese Public Administration Review' WeChat official account

3) Improve the effectiveness of knowledge sharing

Comparing with searching knowledge actively, WeChat can support a more easier and time-saving way to receive knowledge. WeChat users can achieve the latest knowledge by subscribing subscription accounts they are interested. And they could also obtain the knowledge shared by their friends and the friends of their friends. The source of knowledge is more widely. In the previous QQ group, only the group owners or authorized administrators have the right to invite new members to join. While each group member of the WeChat group can freely invite new members to join, which gather many

people in a short time. Comparing with other social media platforms, the rapid expansion of weak relationships enables knowledge in WeChat Groups to grow rapidly and increases the possibility of delivering knowledge to their potential recipients.

4) Increase the convenience of knowledge sharing

WeChat makes the access and transfer of knowledge easier. One of the most notable representative application is the usage of WeChat Library. WeChat Library is the mobile service platform developed and customized by a library based on the WeChat platform which realizes mobile service functions by connecting with the library management system, such as digital resource retrieval, OPAC retrieval, e-books and personal library (Wei and Yang, 2016). Since 2012, a lot of libraries for example Tsinghua university, opened their WeChat Library. WeChat Library realizes common mobile services, such as announcements, mobile reading, mobile consulting, recent arrivals, digital resources retrieval and items borrowed. We take Shanghai University of International Business and Economics Library as an example (Figure 3). There are three main services contents in this service account, including micro-services, cloud resource and important news. Under the cloud resource item, users can connect to the services of popular database, discovery of Chinese Periodicals, discovery of Foreign Periodicals and celebrity teacher forum. A detailed interface of discovery of Chinese Periodicals is given in figure 3.



Figure 3 Application flow sheet of 'Shanghai University of International Business and Economics Library' WeChat official account

4 System analysis of the role of WeChat in knowledge sharing

In this part, systems thinking is used to help identify and understand the relationship between WeChat and knowledge sharing from a technique support inspective. Systems thinking is a conceptual framework for problem-solving that considers problems in their entirety (P.M. Senge, 1990). Problem-solving in this research represents illustrating the mechanism of knowledge sharing on WeChat in order to enhance understanding of, and

responsiveness to, the problem. Outcomes from systems thinking depend heavily on how a system is defined because systems thinking examines relationships between the various parts of the system. Boundaries must be set to distinguish what parts of the world are contained inside the system and what parts are considered the environment of the system. The environment of the system will influence problem-solving because it influences the system, but it is not part of the system (Ackoff & Emery, 1972).

According to the definition of Davenport and Prusak's (1998), knowledge sharing includes two parts: knowledge transmission and knowledge absorption. It represents the knowledge exchange between knowledge owners and knowledge reconstructors. This knowledge sharing process can be considered as a system. The people; the knowledge people have, share, and need; the culture for knowledge sharing (or lack thereof); the technical support and the environment for knowledge sharing must all be considered for effective knowledge sharing initiatives. Systems thinking can enhance knowledge sharing through its ability to depict complex, dynamic processes and thus enhance understanding and the ability of knowledge sharing initiatives to respond to the needs of the individual and organizations (Schlange, 1995).

The feedback system of knowledge sharing is described as shown in figure 4. Five major reinforcing feedback loops and one balancing feedback loop and their effects have been identified. R1 represents a reinforcing feedback that shows in such a virtual space, WeChat users can create and display their own knowledges and exchanging their knowledge and views with others easier taking the convenience of a varied functions supported by WeChat. The diverse functions of WeChat give them the possible to quickly establish contacts, cooperate, share their views and unofficially published knowledge with people has the same research interests and fields across geographical and spatial constraints. This process accelerates the speed of tacit knowledge sharing and increase the available amount of knowledge shared on WeChat. Then the effectiveness of knowledge sharing is on the increase as WeChat users could obtain more knowledge and benefit more on WeChat. Therefore, the attractiveness of WeChat will increase and more people will tend to use WeChat as their communication tool than QQ or other social media. More WeChat users contribute to the increasement of demands. Ultimately when the demand of knowledge sharing increases, how to satisfy this demand better will become a driving force for improvement of functions. The same analysis can be applied to R4, which shows the diverse functions of WeChat accelerates the speed of explicit knowledge sharing.

R2 represents a reinforcing feedback that illustrates WeChat provides important opportunity for the dissemination of tacit knowledge. The diverse functions of WeChat, such as the subscription account, enrich the content of knowledge sharing. For example, it breaks down the barriers that academic journals can only provide professional academic knowledge. Nowadays, academic journals can also provide experience sharing through their official account. It can be concluded that WeChat plays an positive important role in exchanging and communicating tacit knowledge.

R3 represents a reinforcing feedback that good social interaction on WeChat has a positive relationship with tacit knowledge sharing. Comparing with social networking sites, such ResearchGate, WeChat has obvious advantages in the terms of interaction

between its users. The active interactions among knowledge owners and knowledge reconstructors is beneficial to tacit knowledge sharing.

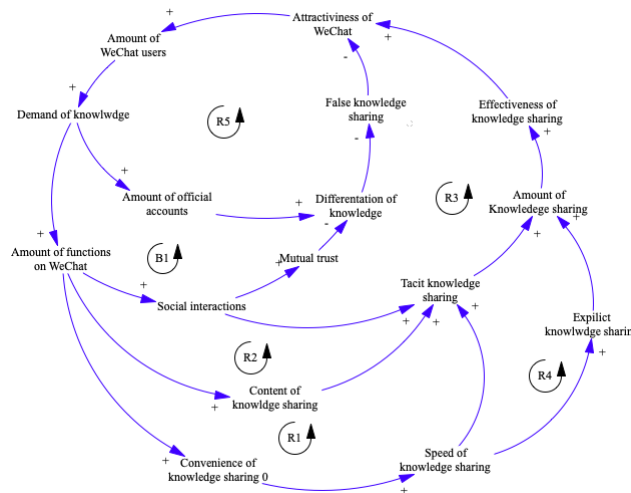


Figure 4 The eco-system of knowledge sharing on WeChat

R5 represents a reinforcing feedback that shows the usage of WeChat official account could reduce the sharing of false knowledge. WeChat official account is more authentic to users since the organization's legal name will be displayed on the information page. The knowledge provided by WeChat official account requires strict evaluation and verification. WeChat official account has strong guidance for the knowledge sharing. Therefore, WeChat users' ability to differentiate false knowledge will increase with the help of WeChat official account.

B1 is a balancing feedback that shows social interactions has positive effects on sharing false knowledge. Active social interactions could enhance the mutual trust between WeChat users, which will decrease the differentiation of knowledge. More users will share the knowledge they received without discerning between the true and the false. WeChat offers facilities for sharing false knowledge.

Based on the aforementioned feedback system, it is recognized that WeChat has the value to be an incentive to reinforce the improvement of knowledge sharing. However, improving the WeChat users' judging abilities of knowledge is one of key challenges that need to be addressed.

5 Conclusion

As an indispensable part consisting in media market, WeChat plays a more and more important role in promoting and facilitating knowledge sharing and innovation. It presents knowledge sharing opportunity that augment personal and organizational knowledge management. Although it is, yet, unable to meet all the needs of knowledge sharing, its

usage in knowledge sharing is certain to undergo further expansions along with the increasing growth of WeChat functions and the new need of the public. For example, the achievement of combining social tools with study tools makes WeChat can meet the need of fragmented learning. Future study for how WeChat augment the motivation antecedents of incentives, values, and competence-based trust will be conducted. For example, the research for studying how WeChat relate to the motivation for knowledge sharing and how WeChat affect the motivation for knowledge sharing are needed.

References

- Ackoff, R. L., and Emery, F. E. (1972). "On Purposeful Systems". London, United Kingdom: Tavistock Publications.
- Balakrishnan, V., and Gan, C. L. (2016). "Students' learning styles and their effects on the use of social media technology for learning". *Telematics and Informatics*, 33(3), 808-821.
- Bhardwaj R. K. (2017) "Academic Social Networking Site: Comparative Analysis of ResearchGate, academia.edu, Mendeley and Zotero", *Information and Learning Science*, 118(5), 298-316.
- Bilgihan, A., Barreda, A., Okumus, F., and Nusair, K. (2016). "Consumer perception of knowledge-sharing in travel-related online social networks". *Tourism Management*, 52, 287-296.
- Chan, C. (2015). "When one app rules them all: The case of WeChat and mobile in China". Recuperado de <http://a16z.com/2015/08/06/wechat-china-mobile-first>.
- Chen Y., Liang C. L., and Cai D.Q. (2018). "Understanding WeChat Users' Behavior of Sharing Social Crisis Information". *International Journal of Human-Computer Interaction*, 34(4), 356-366.
- Davenport, T. H., and Prusak, L. (1998). "Working knowledge: How organizations manage what they know". Harvard Business Press.
- Faraj, S., Jarvenpaa, S. L., and Majchrzak, A. (2011). "Knowledge collaboration in online communities". *Organization science*, 22(5), 1224-1239.
- Kaplan, A. M., and Haenlein, M. (2010). "Users of the world, unite! The challenges and opportunities of Social Media". *Business horizons*, 53(1), 59-68.
- Kulakli, A., and Mahony, S. (2014). "Knowledge creation and sharing with Web 2.0 tools for teaching and learning roles in so-called University 2.0". *Procedia-Social and Behavioural Sciences*, 150, 648-657.
- Lien, C. H., and Cao, Y. (2014). "Examining WeChat users' motivations, trust, attitudes, and positive word-of-mouth: Evidence from China". *Computers in Human Behaviour*, 41, 104-111.
- Ogink, T., and Dong, J. Q. (2017). "Stimulating innovation by user feedback on social media: The case of an online user innovation community". *Technological Forecasting and Social Change*.
- Osatuyi, B. (2013). "Information sharing on social media sites". *Computers in Human Behavior*, 29(6), 2622-2631.
- Panahi S., Waston J., and Partridge H., (2012). "Social Media and Tacit Knowledge Sharing: Developing a Conceptual Model", *Word Academy of Science*, 1095- 1102.
- Ransbotham, S., and Kane, G. C. (2011). "Membership turnover and collaboration success in online communities: Explaining rises and falls from grace in Wikipedia". *Mis Quarterly*, 613-627.
- Schlange, L. E. (1995). "Linking futures research methodologies: an application of systems thinking and metagame analysis to nuclear energy policy issues". *Futures*, 27(8), 823-838.
- Senge, P. M. (1990). "The art and practice of the learning organization".

- Wang Y.F., Jia X.L., and Li D. Q. (2017). "A Study on the Influencing Factors of WeChat Academic Information Sharing Intention". *Library and Information*, (03), 9-18.
- WeChat Impact Report 2018. <https://walkthechat.com/wechat-impact-report-2016/>
- Wei Q., and Yang Y. (2017). "WeChat Library: a new mode of mobile library service", *The Electronic Library*, 35(1), 198-208.
- Yan, Y., Davison, R. M., and Mo, C. (2013). "Employee creativity formation: The roles of knowledge seeking, knowledge contributing and flow experience in Web 2.0 virtual communities". *Computers in Human Behaviour*, 29(5): 1923-1932.
- Zhang S.T., and Liu L. L. (2018). "Influence of social capital on WeChat group users' knowledge sharing willingness". *Science Research Management*, 39(10):108-119.
- Zhang X., Wen D., Liang J., and Lei, J. (2017). "How the public uses social media WeChat to obtain health information in china: a survey study". *BMC Medical Informatics and Decision Making*, 17(2), 66.
- Zheng, Z. L., Zhang, Q. P., & Wang, B. (2014, August). "Research on model of online knowledge sharing for CoPS R&D team based on WeChat platform". In *2014 International Conference on Management Science & Engineering 21th Annual Conference Proceedings*, 891-897. IEEE.

Policy Evaluation of Higher Education Ecosystem and Strategic Knowledge Community in Shanghai

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Abstract

In an economy such as China's with vast territory, where development differences widely exist in higher education, searching for characteristics is an inevitable choice, especially for those regional universities. The success worldwide provides experience for the regional universities to seek differentiated development by relying on the dominant disciplines with special characteristics. Using the systems science theory and ecology conceptual lens in combination with knowledge management approach, it is centring on the regional specialized university ecosystem in Shanghai. After identifying the main actors from the ecosystem theoretical framework, the characteristics and how the ecosystem is enacted are constructed. The final part is policy evaluation and discussion. Policies aim to support the effective integration of sustainable development and foster

performance in the regional higher education ecosystem. Results suggested that evaluation, regulation and funding of policy networks could aid change at higher education ecosystem.

Keywords – Higher Education Ecosystem, Strategic Knowledge Community, Regional University, Public Policy

Paper type – Academic Research Paper

1 Introduction

Regional universities refer to colleges and universities allocated funds by local administrative departments. In the higher education ecosystem in China, the number of regional universities is large, accounting for more than 95% of the total number of colleges and universities, undertaking the task of training talents for the region and serving the local economic and social development. However, compared with the universities affiliated directly to the ministry of education, the overall strength of regional ones is relatively weak, and the development is either insufficient or not fully balanced.

Specialized university is one of the important trends in the development of higher education in the modern world. For example, Babson College in the United States, as a leader in the field of entrepreneurship, has a worldwide recognized expertise in entrepreneurship. Carnegie Mellon University has made remarkable achievements in computer, robotics, software engineering, management information technology and other fields. It has rapidly developed from an ordinary regional university to a world-renowned research university. These high-end specialized universities have taken their expertise to the extreme. The success worldwide provides experience for the regional universities to seek differentiated development by relying on the dominant disciplines with special characteristics, attach importance to talent training based on local or industry, and change the construction orientation of “Go in for grandiose projects “. They will have full opportunities to be embedded in the education ecosystem to improve strengths, avoid weaknesses and win by surprise.

In order to guide the orientation on the diversified development, promote the optimization of the higher education ecosystem structure and resource allocation, it is significantly meaningful to analyze the characteristics of Shanghai regional university ecosystem, deepen the research on the application of ecology in the regional higher education field.

2 Literature review

2.1 University development and challenge

With the development of knowledge economy, universities become more and more important and closely embedded in the society (Mckelvey et al 2018). As a large

developing country, China is now faced with the dilemma of inadequate research and technology transfer capacity of research universities, weak teaching and social service level of teaching-oriented universities (Yao et al 2016). However, in many literatures analyzing the current situation and development of Chinese universities, there is a lack of research on regional specialized universities.

Butera (2000) thinks that it is the true challenge facing the universities to contribute substantially to the development of a knowledge economy and the training of knowledge workers. Besides the traditional twin missions of teaching and research, more recently universities promote and monitor results also achieved in the so-called third mission. This additional activity involves transferring and commercializing generated knowledge by interacting with key-actors of the socio-economic system (e.g., public and private organisations) and contributing to regional and national economic development (Etzkowitz, 2004, Montesinos et al., 2008). In the last twenty years, a general trend of universities adopting stronger entrepreneurship and innovation strategies has emerged giving birth to the entrepreneurial university (Clark, 1996, 1998a, 1998b, 2000; Davies, 1987; Etzkowitz, 1983), which means universities have tried to achieve the third mission. This new model of university is characterized by a more direct role in stimulating local and regional economic growth (Guerrero et al., 2014; Thorp and Goldstein, 2013).

2.2 Higher education ecosystem

An ecosystem is defined as “A biological system composed of all the organisms found in a particular physical environment, interacting with it and each other. Also in extended use: a complex system resembling this” (Oxford English Dictionary, 2017). The higher education ecosystem is an open and nonlinear complex system formed by the interaction of various elements within the higher education system with nature and social environment (Hu et al 2009).

Ecosystem researchers have continuously expanded the boundaries of their analyses (Masaharu et al 2018). Hu et al (2009) believed that it is a new attempt to study and discuss these problems by using ecological methods and principles. In recent years, the research on the ecosystem of higher education has been attached greater importance by scholars. Liu et al (2009) studied the “entrepreneurial ecosystem” advocated by MIT, which combines entrepreneurship activities with entrepreneurship education and can provide reference for the cultivation model of entrepreneurship education in Chinese universities. Taking the university of Texas at Austin and the national university of Singapore as examples, Yao et al (2016) extracted seven key elements of the entrepreneurial ecosystem of open universities. However, the research on the ecosystem of local characteristic education is missing. Moreover, nowadays, the evaluation system of higher education is not suitable for the regional specialized universities (Hu et al 2008). These universities need the new evaluation system with aim to propose the growth strategy from the perspective of the whole ecosystem.

Huang (2016) concludes that the current literatures focus on the following three aspects: University positioning research from the ecology position perspective, the

relation between ecology position and university competitiveness and specific events study of higher education by using ecology position theory.

3 Main actors and the characteristics of a regional specialized education ecosystem in Shanghai

By means of a mixed-methods approach, we identified the main actors of the regional specialized education ecosystem in Shanghai from the ecosystem theoretical framework. Following the basic structure of higher education ecosystem the connotation and extension of higher education ecosystem and its basic characteristics are analyzed.

3.1 Main actors of the regional specialized education ecosystem in Shanghai

From the perspective of ecology, higher education, like the natural world, also has a complete ecosystem. We call this system “higher education ecosystem”, which can be understood as the organic unity of internal elements of universities and their interaction with the external environment. Compared with the whole ecosystem of higher education, universities in a region or an area constitute the community ecology of higher education. This paper studies the higher education ecosystem constituted by local universities in Shanghai, especially the regional specialized universities.

The system has its own specific generation and succession process as well as structure, function, bearing capacity and productivity. It is a subsystem of the complex system of society, economy and nature. Stability and health are the key to the sustainable development of the system. The ecosystem of higher education has three functions: talent cultivation, academic research and social service in the process of material, energy and information flow and exchange.

Main body

The main body of regional specialized education ecosystem includes producer and consumer. Producers in the ecosystem refer to the regional specialized universities and their affiliated scientific research institutions, scientific and technological cultural organizations, or other organizations or individuals with higher education functions. The most important product of the ecosystem is the amount of human capital saved by individual students, followed by scientific research achievements that can directly or indirectly interact with the market and the social services provided. Consumers of the ecosystem include students, employers, beneficiaries of university culture, scientific and technological achievements and patents, and even the whole society. They receive various services from producers in different ways according to their own needs.

Decomposer

The decomposer of natural ecosystem can decompose various substances produced by producers and consumers into various elements and restore them to the environment of the ecosystem through physical, chemical or biological decomposition process, so as to provide continuous use for producers. Any material object which performs this function may be included in the category of the decomposer.

In regional specialized education ecosystem, education administrative departments such as the Shanghai educational committee and its subordinate functions as the decomposition, by performing functions, formulating related policies and regulations, implementing education funding and macro guidance and management, to ensure the stable, healthy and sustainable development of the ecosystem.

Environment

The ecological environment of the natural ecosystem is a combination of various ecological factors in the ecosystem, relative to the main body of the ecosystem. The environment of higher education ecosystem can be analyzed from three perspectives and three levels. First, it is an individual or compound higher education ecosystem, which is education-centred and combines with external natural environment, social environment and normative environment. Second, the ecosystem of higher education is formed with a certain characteristic university and a certain education level or type as the axis, which reflects the interrelationship within the education system. The knowledge community it creates from the strategic perspective is the key that leads the economy to a successful level and improves the education ecosystem development. Strategic knowledge community is a medium for knowledge exchange among members. It is a communication space formed by individuals with common interests in order to acquire the knowledge they need. The third is to study the external environment, including individual psychological and physiological factors.

Value chain and value network

The biological chain in the natural ecosystem can be equated with the value chain, and producers, consumers and decomposers of all types and levels form a chain and network through value connection, thus organically organizing the whole ecosystem. The value chain in the higher education ecosystem is the channel for the flow of material, energy and information between the inside and outside of higher education system. Because value can form new value through accumulation, the change of each link will cause the rearrangement of the whole regional specialized education ecosystem.

Higher education ecosystem emphasizes not individual elements, but the organic combination of various elements. It is a dynamic system which integrates the main body, decomposer, environment, and value chain and value network. The elements are interrelated, interdependent, interacting, motivating, complementing and restricting each other, thus constituting the whole higher education ecosystem.

3.2 Connotation and extension of higher education ecosystem and its basic characteristics

The characteristics of higher education ecosystem are the key issues concerning the stability, balance, harmony of the system and how to sustain and achieve its functions. Viewing the ecosystem as a complex actor network, each actor has a different background and attributes. In general, the system has the characteristics of focusing on the interaction between producers and consumers, playing the role of decomposers, using the comprehensive support of the environment, and forming the ecological value chain and

value network of higher education (Quan & Wang, 2017). Here we explore the basic characteristics from two aspects.

3.2.1 The intergrowth of the higher education system

Dai (2005) concludes the connotation of higher education ecosystem as the intergrowth relationship between internal and external ecology while harmonious but different. Among the 83 higher education institutions in Shanghai, all can be regarded as regional ones belonged to Shanghai local government or municipal education committee but 9 affiliated to the Ministry of Education or General Administration of Customs. Excluding private, tertiary and subordinate universities, the remaining 21 are public municipal undergraduate colleges. There are one comprehensive category, three sports and art categories, two medical departments, one public security category and two normal schools. The rest are regional specialized universities closely related to the industry. From the introduction of the characteristics of these universities, although they all aim at serving the country and Shanghai's social development and mostly adhere to career-oriented higher education, only three focus on integration with industry and nine pursue all-round development.

The intergrowth mainly includes two aspects: first, the intergrowth of homogeneity, which refers to the reciprocal cooperation between universities of the same type and at the same level, so as to avoid the duplication; second, heterogeneous intergrowth, the interaction and cooperation between different types and levels of universities. Each actor in the ecosystem has different attributes, decision-making principles, and purposes. These differences cause un-intended results at the ecosystem level, although each actor's decisions may be rational. The decision-making principle means the mechanism and priority of the decision may be very different among actors in ecosystem.

Ecology position theory emphasizes the evolution of diversity and using cooperation to avoid competition. University ecology position refers to the relatively favourable living and development space and competitive advantage formed by the interaction between universities and social environment and other higher education communities in the whole social environment (Gong et al, 2011). Individual ecology position of Shanghai regional universities reflect both this particular community and the social environment of living space occupied by it at present, also reflects its gradient formed by the various ecological factors in the environment of the position. The intergrowth relationship in the university ecosystem is conducive to the reduction of mutual functions will also have an important impact on the position of other universities in the system, and these complex influence relations will also react on the university ecosystem.

3.2.2 The overlap of higher education regulation

Higher education regulation niche overlap means that there exists a high degree of similarity or ray gap in the higher education regulation in the role played by the decomposer. The higher the degree of overlaps, the stronger it is subject to the same resources for higher education governance. Under the current situation in China's, the unbalanced distribution of higher education administrative power and resources in the

government and the universities and social organizations and the asymmetry of utilization of resources between the colleges and universities.

Starting from 1995, China launched a series of incentive projects to steer the development of universities towards expressed priorities (“211” in 1995, “985” in 1998 and “double first-rate” in 2017). These policies has formulated universities’ management strategy and generated fierce competition among universities regarding both student enrolment and research productivity. However, we found that the university in the aforementioned projects are always the same with few exceptions, which replicate the so-called “success to successful” system archetype. In this sense, what impact does these policies has on the development of universities, especially the universities that are not selected in the incentive project? How should these universities cope with the challenge to achieve university mission?

Under the higher education regulation circumstance, the government has an absolute advantage and monopolizes most of the jurisdiction and resources of education governance, so that the ecological niche of higher education governance of the government is relatively wide. The research of Liu and Qin (2013) on regional higher education governance showed that: the government monopolizes the higher education and monopolizes the regional higher education regulation system. In terms of the traditional government control system, the traces of administrative order plan control still exist, the internal and external administration of regional higher education governance is extensive, and the autonomy of colleges and universities cannot be truly implemented.

4. Mechanism of how the higher education ecosystem is enacted

In the higher education ecosystem, universities work as both the absorber and supplier of resources, surviving and developing in the interaction with various stakeholders. The effective transformation of these resources and the relationship between resources also further promote the development of the university ecosystem. The multi-actor network is not static, but dynamic. The network changes moment by moment. The purpose of this ecosystem approach is to clarify the dynamic change mechanism of the multi-actor network and find the specific patterns of evolution and extinction. If we can understand the mechanism, we will be able to design and manage the ecosystem strategically. (Tsujimoto et al, 2018)

Higher education ecosystem emphasizes not individual elements, but the organic combination of various elements. It is a dynamic system which integrates the main body, decomposer, environment, and value chain and value network. The elements are interrelated, interdependent, interacting, motivating, complementing and restricting each other, thus constituting the whole higher education ecosystem. The decision-making principle means the mechanism and priority of the decision may be very different among actors in ecosystem. To achieve the three missions of the university,

4.1 Strategy transformation and specialized development

By viewing complex processes as interdependent and intertwined systems rather than separate, single closed problems to be solved, it is possible to shed light on the way businesses can learn, grow, and sustain themselves. Regional specialized universities are special groups in the higher education ecosystem, while exploring specific development strategies is the fundamental way out to seek transformation.

Regional universities need to identify the ecology position of themselves and other universities. The strategic focus can be observed from the ecology position difference based on which to seek for their development directions. In general, regional universities need to build on themselves on a basis of regional characteristics to serve for the society progress and economic development, especially to exploit the discipline advantages to deliver qualified talents to the society and enhance the regional radiant force. Nowadays, the trend of specialized strategy formulation based on the ecology position evolution is increasingly obvious in regional universities, which proves the importance of specialized strategy.

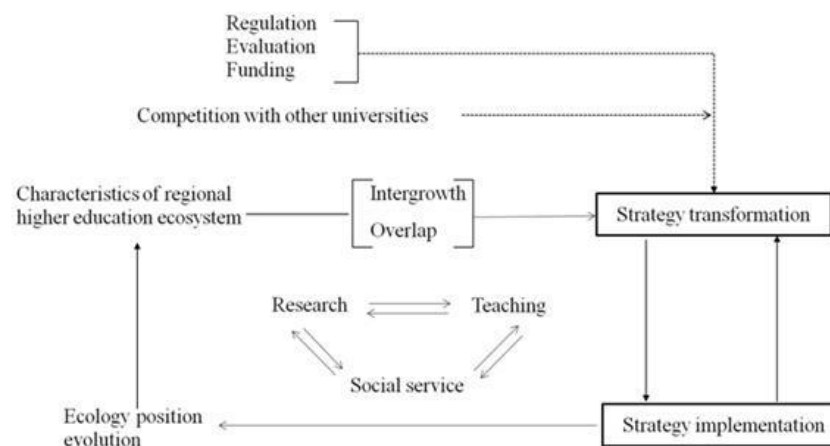


Figure 1. Strategic development of regional higher education ecosystem

In other words, the strategy transformation is embodied in the resources structure and space environment. As Figure 1 shows, under the regulation of decomposers in the ecosystem and the competition with other universities, regional universities need to consider the characteristics of the ecosystem to design the patch of strategy transformation. By taking variety of resources, regional universities form gradually the core strength, innovative capability and quality improvement, which are also the major forces to promote the development of both themselves and the external environment. Those changes are translating the ecosystem to reveal certain ecology characteristics to establish the ecology position evolution. In addition, to avoid vicious competition and keep the intergrowth relationship, regional universities need to possess specific resource

orientation and strategy space. It will serve as support and power source to felicitate the evolution of the ecology position while screening and reselecting variety of ecological factor.

4.2 Creation of strategic knowledge community

With the booming of knowledge economy, compared to the traditional twin missions of teaching and research, nowadays more and more emphasis has been put on the third mission, which involves transferring and commercializing knowledge generated within university and contributing to regional and national economic development. Results reveal that universities act as knowledge intermediaries, knowledge gatekeepers, knowledge providers, and knowledge evaluators (Ardito et al. 2018).

The scientific research of regional specialized universities pays attention to applied research, using scientific research achievements and invention patents to serve economic constructions, which is also in line with the development of university missions focusing not only on the traditional university's goals of teaching and research but also on the third mission of social service. The knowledge community it creates from the strategic perspective is the key that leads the economy to a successful level and improves the education ecosystem development. The strategic knowledge community serves as a medium for knowledge exchange among members. It is a communication space formed by individuals with common interests in order to acquire the knowledge they need. It has the basic characteristics of sociality, regionalism, knowledge and technology which are the key for the higher education ecosystem. To generate advanced knowledge needed by the society and provide high quality education serving the society, higher education should be tightly embedded in the society, which requires active partnership and interaction among different stakeholders, including profit and non-profit enterprises, public organizations and citizens, which forms the environment the ecosystem exists.

5 Policy evaluation and discussion

Any university, as an ecological body, should constantly strengthen the adaptability to the surrounding environment, which means both to make the environment conducive to its own survival by changing the environment and to adapt to environmental conditions by changing its own structural and functional mechanism. As the “success to successful” system archetype depicts that the universities in the incentive projects launched by the government are always the same with few exceptions, getting public funding for new resources is not easy for regional universities. Seeking corporate support with the strengths and experience in specialized disciplines to build strong partnerships with local corporations and other organizations is a way out.

At present, on one hand, university funding has been increasing a lot in scientific research with emerge of technological achievements, but the conversion rate is relatively low. On the other hand, the development mode of university is in the “lock-out” state of “ivory tower”, unable to establish collaborative innovation with other innovative bodies of strategic partnership and inhibit innovation cluster elements integration. The ecology

position a university occupied varies at different types and levels. It needs to relate to both internal and external ecosystem bodies to exchange resources and energies, especially in terms of knowledge transfer in the strategic knowledge community it creates. It is necessary to deregulate the mechanism of higher education ecosystem by giving colleges and universities full autonomy, under which the strategy transformation can be achieved.

The current evaluation system is not suitable for regional specialized universities, which forces them to shift to an overall development to meet the evaluation criteria instead of enhancing the specialized orientation. The strategic evaluation of universities is no longer just a summative performance evaluation, but a controlling process to realize the strategic goals of universities.

In conclusion, to support the effective integration of sustainable development in regional higher education ecosystem, it is recommended to explicit funding flows between institutions in higher education, design deregulatory mechanism to relate with other businesses beyond the ecosystem itself and adjust the higher education evaluation system to be more inclusive.

References

- Ardito, L., Ferraris, A., Petruzzelli, A.M., Bresciani, S., Giudice, M.D., (2018). "The Role of Universities in the Knowledge Management of Smart City Projects", *Technological Forecasting and Social Change*, Available online 21 July 2018.
- Butera, F.,(2000). "Adapting the Pattern of University Organisation to the Needs of the Knowledge Economy", *European Journal of Education*, Vol 35, No.4, pp. 403-419.
- Clark, B.R.,(1996). Substantive Growth and Innovative Organization: New Categories for Higher Education Research". *High Education*, Vol 32, No.4, pp. 417-430.
- Clark, B.R.,(1998a). *Creating Entrepreneurial Universities: Organizational Pathways of Transformation*, International Association of Universities and Elsevier Science, Paris and Oxford.
- Clark, B.R., (1998b). "The Entrepreneurial University: Demand and Response", *Tert. Educ.Manag.* Vo.l 4, No. 1, pp. 5-6.
- Clark, B.R., (2000). Collegial entrepreneurialism in proactive universities: lessons from Europe. In: *Change*, pp. 10-19 (January-February).
- Davies, J.L., (1987). "The Entrepreneurial and Adaptive University. Report of the second US study visit", *Int. J. Inst. Manag. High. Educ.* Vol. 11, No.1, pp. 12-104.
- Etzkowitz, H., (1983). Entrepreneurial Scientists and Entrepreneurial Universities in American Academic Science. *Minerva* 21 (2-3), pp. 198-233.
- Etzkowitz, H. (2004). "The Evolution of the entrepreneurial university," *International Journal of Technology & Globalisation* (1:1), pp. 64-77.
- Ecosystem, (2017). In *Oxford Dictionaries.com*. Retrieved from. <https://en.oxforddictionaries.com/definition/ecosystem>.
- Guerrero, M., Urbano, D., Cunningham, J., Organ, D., (2014). "Entrepreneurial Universities in Two European Regions: a Case Study Comparison", *J. Technol. Transfer*. Vol. 39, No.3, pp. 415-434.
- Hu Y, Liu XL, Wang L. and Su JH., (2009). "The Basic Framework of the Higher Education Ecosystem", *Forestry Education in China*, Vol. 27, No. 1.

- Huang XL., (2016). "On the Orientation and Development Strategy of Applied University in the Perspective of Educational Ecology", Journal of Zhejiang Business Technology Institute, No. 3.
- Tsujimoto M, Kajikawa Y., (2018). "Tomita J, Matsumoto Y, A Review of the Ecosystem Concept-Towards Coherent Ecosystem Design", Technological Forecasting & Social Change, No.136, pp. 49-58.
- Mckelvey, M., Buenstorf, G., & Broström, A. (2018). "The Knowledge Economy, Innovation and the New Challenges to Universities", Innovation Management Policy & Practice, Vol. 20, No.1, pp. 84-86.
- Thorp, H., Goldstein, B., (2013). Engines of Innovation: The Entrepreneurial University in the Twenty-First Century. UNC Press Books, Carolina.
- Yao F., Gao DX.and Sun T., (2016). "The Developmental Pathways and Key Elements of University-based Entrepreneurship Ecosystems: a Comparison between two Typical Cases in US and Singapore", International and Comparative Education, pp. 1003-7667.

The Study of Drug Distributors to Choose Pharmaceutical Suppliers

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Abstract

The pharmaceutical industry is vital in taking care of the health of the people. Pharmaceutical industry that is a high-tech, and highly regulated industry has great influence over people's life and social economy. People have been pursuing a healthy life and devoting to solve the health problems by developing science and technology related to healthcare. The medical industry is improving year after year and many diseases are cured or healed. However, the development of human civilization has not only changed people's lifestyles but also damaged the environment of the world. According to this, people still need to face many health problems. As the result of this increase in medical needs pharmaceutical industry is more important to people's lives than before. The society of Taiwan is facing the problems of aging population. So the medical industry is more important to people's lives, health and safety. Nowadays, the medical market is fiercely competitive in Taiwan and people intent to pay attention to medical quality and service. Pharmaceutical companies manage to adopt newer strategies that reduce purchase costs and improve product quality to make healthcare efficient. Medical industry supply chain companies do their best to creating more corporate presence and profitability. But the most important things are the pharmaceutical companies have to considerate the people's medication safety. The choice of suppliers is one of the most important issues in the field of medical supply chain management. Choosing the right and effective pharmaceutical supplier can improve the competitiveness and greatly benefit the distributor. The main purpose of this study is to understand the role of distributors in the supply chain. The purpose is in order to achieve the good quality of pharmaceutical products, improve corporate reputation ,stable profitability and sustainable operation. This study uses literature review , expert interviews and Delphi Method to study the criteria for distributors to select their suppliers . The guidelines are expected to propose a systematic selection model for pharmaceutical suppliers. According to the study, the distributors can have more objective, fair and effective decision-making modes when conducting supplier selection. The study is expected to further improve Taiwan's pharmaceutical industry supply chain and contribute to people's health and well-being.

The research is further expected to optimize the soundness of Taiwan's pharmaceutical industry supply chain.

Keywords – Distributor, selection of supplier, Delphi Method

Paper type – Academic Research Paper / Practical Paper

1 Introduction

The medical industry is related to people's lives, health and safety. Taiwan is facing the trend of aging population. Medical needs are increasing year by year and medicinal safety is highly concerned. In the medical environment, the medical supply chain has become very important management task in the industry. The aging society is a global population trend. Almost all countries are having the problem of aging population in the world. The main expenditure of global health care has been growing due to the medical needs of the aging population.

For Asian countries, Japan is known as the fastest aging country in the world. However, Taiwan has actually stepped onto the track of an ageing population. The problem of aging population affects the entire population system, social structure, and the country's workforce. With the advent of an aging society that affect long-term care, medical treatment, drug supply, health care and other resources will continue to increase demands. This aging population problem not only affects the distribution of Taiwan's labor force but is also likely to cause serious economic problems because the huge expenditure of medical care in Taiwan. The government has responsibility to protect citizens and to solve concerned problem. The enterprises have also to make the greatest efforts to stabilize the medical industry and optimize the medical supply chains. Nowadays, the medical market is full of fierce competition. Both foreign pharmaceutical companies and domestic pharmaceutical companies are committed to improving their market competitiveness of enterprises. These companies not only devote to reducing the logistics costs but also intent to make more profits. While the corporate seek smooth functioning, it is utterly important to keep the safety of medicines and protect human health.

Medicine is a highly professional industry. The original pharmaceutical factory of Western Medicine tends to focus its resources on its specialized fields. They are willing to entrust other medicine pathway and logistics fields who are more professional distributors. Moreover, the pharmaceutical factories have to globalize to follow the rapidly changing environment that they tend to seek professional distributors as their partners in their respective countries in order to manage overseas markets with a more creative and flexible operating model. Medical suppliers and distributors have become partnerships that require teamwork. Therefore, The distributors when selecting suppliers and agents they need to understand the market demand for the drug and the financial indicators of the supplier. It is known from many documents that the selection of

suppliers is very important and requires many considerations in order to select excellent pharmaceutical supplier to help enterprises create economic benefits.

The pharmaceutical industry, particularity in life, health and safety of humans, need to comply with very strict regulations. The pharmaceutical supply chain (suppliers, logistics distributors, customers) is necessary to ensure the quality of the drug. Therefore, to optimize the management of the pharmaceutical supply chain is necessary and important. To stabilize the pharmaceutical market and guarantee the quality of medicines, which is great significance to people's life. As the result the competitiveness of distributors is directly related to the performance of suppliers. Therefore, it is necessary to regularly evaluate the suppliers of pharmaceutical companies to improve the performance of distributors. This purpose of study shows how to choose the pharmaceutical supplier and how to establish a supplier selection model. This helps to improve performance and profit of the enterprise by the way taking into account the consumer rights and drug safety to achieve sustainable business.

2 Literature reference

At this time of the fierce competition in the global market, the company hopes to create value for customers through the innovation of products and services to get outstanding performance in the competition. In Taiwan, the medical industry pharmaceutical factory has faced the impact of health care price adjustment in recent years, as well as the external environment such as the global aging phenomenon, the homogeneity of products are highly filled with the pharmaceutical market, all of that make the market price competition. In medical industry, all medical-related companies are struggling to increase their market share to achieve sales target. They are eager to seek business transformation or marketing innovations to stand out in fierce market. That is effectively linking upstream and downstream supply chains to enable suppliers and distributors to achieve win-win cooperation and alliances by sharing information and profits that has gradually become a new trend in the world today.

Enterprises hope to operate sustainably in this highly competitive market, so they not only devoted to build their core competencies but also optimize their supply chain. Effectively selecting superior suppliers and keep the long-term partnership are very important i key factors in maintaining corporate competitiveness. Michael Porter (1980) proposed supplier selection as an important consideration in the development of corporate competitiveness. The competition in the consumer market has increased and it has become an important selection condition. In successful supply chain relationship management, trust and commitment are important key factors that contribute to the long-term relationship. Dickson (1966) proposed 23 evaluation criteria for selecting suppliers, the first three of which are quality, delivery, and past performance. Weber et al. (1991) based on Dickson's (1966) 23 evaluation indicators, and the frequency of occurrence in the literature, and analysed the three important indicators of price, delivery, and quality. Desmumukh and Chaudhari (2011) studied related academic articles from 1992 to 2007 to summarize the following criteria:

Table 1 Deshmukh and Chaudhari (2011)

Dickson (1966)		Criteria	Deshmukh and Chaudhari (2011)			Weber et al. (1991)	
Rank	^a Rating		Rank	No	%	No	%
6	1	Net Price	1	44	90	61	80
1	1A	Quality	2	42	86	40	53
2	1	Delivery	3	37	76	44	58
5	1	Production Facility & Capacity	4	22	45	23	30
7	1	Technical Capability	5	16	39	15	20
8	1	Financial Position	6	15	31	7	9
20	2	Geographical Location	7	5	11	16	21
13	2	Management & Organization	7	5	11	10	13
3	1	Performance History	7	5	11	7	9
14	2	Operating Controls	7	5	11	3	4
10	2	Communication System	7	5	11	2	3
11	2	Reputation & Position in Industry	12	3	7	8	11
15	2	Repair service	13	2	4	7	9
18	2	Packaging Ability	13	2	4	3	4
22	2	Training Aids	13	2	4	2	3
9	2	Procedural Compliancre	13	2	4	2	3
19	2	Labor Relations Record	13	2	4	2	3
4	1	Warranties & Claims Policies	13	2	4	0	0
16	2	Attitude	19	1	2	6	8
23	3	Reciprocal Arrangement	19	1	2	2	3
17	2	Impression	21	0	0	2	3
12	2	Desire for Business	21	0	0	1	1
21	2	Amount of Past Business	21	0	0	1	1

^aRating: 1A=Extreme importance 1=Considerable importance
2=Average importance 3=Slight importance

Harris and Chernatony (2001) point out that reputation, innovation, human capital, structural capital, customer capital, organizational learning, standards, etc. Cheraghi et al. (2011) propose to focus on its future development capabilities.

3 Establishment of supplier performance evaluation model

3.1 Development of Supplier Selection Criteria

Dickson (1966) proposed the criteria for selecting suppliers, there are top three criteria quality, delivery and net price. Min (1994) proposed that in the international competition environment, in addition to finance, quality, service and performance, the selection criteria should include trade restrictions, risk indicators and cultural communication. Quality and delivery are still important for selecting suppliers in modern times, and financial status is a important indicators in supplier selection (Deshmukh and Chaudhari, 2011). The researches of Dickson and Weber.et.al. stated that communication system is an essential factor in the world today, so an effective and immediate communication system is an important evaluation index. Ellram (1990) pointed out that the choice of suppliers, in addition to the general quantitative criteria (such as cost, quality and delivery), some soft criteria should be considered, such as management compatibility and

consistent goals. Wilson (1994) believes that supplier selection should consider the four selection criteria are price, quality, delivery and service. Patton (1996) proposed seven evaluation criteria: price, quality, delivery, sales support, equipment and technology, order status, and financial status. Herbig and Milewicz (1994) propose that brand goodwill is a valuable commodity. Lambert (1997) proposes the quality, delivery and service of products in the evaluation of suppliers in the medical industry. Verma and Pullman (1998) have pointed out that in the choice of suppliers, the price and delivery time of products are the key factors affecting the choice of suppliers. Harris and Chernatony (2001) explored that reputation is a kind of capital as same as importance to innovation, human capital, structural capital, customer capital, organizational learning. Pi et al. (2004) select criteria for suppliers based on quality, price, delivery and service. According to environment changing, the select criteria of suppliers have some difference than before. Cheraghi et al. (2011) proposed that companies not only pay attention to the original quality and technology of suppliers, but also focus on their future development capabilities.

Min (1994) proposed the criteria for Financial Position is also important as quality and performance history, Attitude, Cultural and communication. D. Pi et al.(2004) article explored quality, delivery, net Price, attitude are important selection of supplier. J. Chernatony (2001) focused on reputation & Position in Industry is issue as important as other criteria. K. Chaudhuri (2002) proposed reputation and position in Industry in supplier selection.

3.2 Delphi method

1. Definition of Delphi method

The nature of Delphi method is Intuitive Forecasting. It is mainly used for insufficient data or uncertain situations or uncertain factors. Because it cannot be predicted by quantitative data. Delphi method needs to be based on the professional experience, intuition, and value judgment of the experts interviewed. The Delphi method is a forecasting process based on the results of several rounds of questionnaires sent to a group of experts.. The experts are allowed to adjust their answers in subsequent rounds, based on how they interpret the "group response" that has been provided to them. Since multiple rounds of questions are asked and the panel is told what the group thinks as a whole, the Delphi method seeks to reach the correct response through consensus.

2. Advantages and Disadvantages of the Delphi Method

The Delphi method seeks to aggregate opinions from experts, and it can be done without having to bring everyone together for a meeting. Since the responses of the participants are anonymous, individual panellist don't have to worry about repercussions for their opinions. Consensus can be reached over time as opinions are swayed, making the method very effective.

3. Key Takeaways

The Delphi method is a process used to arrive at a group opinion or decision by surveying a panel of experts. Experts respond to several rounds of questionnaires, and the responses are aggregated after each round. The experts can adjust their answer each

round, based on how they interpret the "group response" provided to them. The ultimate result is meant to be a true consensus of what the group thinks.

4 Analysis and Findings

1. *The Delphi Method questionnaire survey process.*

The questionnaire of Delphi Method was conducted and interviewed in person by experts. The study were asked experts from a drug distributor to fill out the two-round questionnaire to find out the model of the measured facet and standard indicators.

The study uses the Delphi Method to build the main and sub-criteria for the drug supplier evaluation and selection model to determine for drug distributors.

Build a model of evaluation and selection: Use the Delphi method to perform the following four steps

Step 1: Define the criteria for supplier evaluation and selection.

Step 2: Form an expert panel.

Step 3: Conduct a questionnaire survey among the experts.

Step 4: Set the standards for consensus in the expert panel.

Step 5: Build a supplier evaluation and selection model of drug distributor

2. *Build a model of evaluation and selection*

Step 1: Define the criteria for supplier evaluation and selection. This study selects 5 criteria and 26 sub-criteria from questionnaire of experts of drug distributor (as described in Table 2)

Table 2. Build selection model of main and sub-criteria.

Criteria	Sub-criteria
Product quality (D1)	C1 Quality C2 Technical Capability C3 Production Facility & Capacity C4 Operating Controls C5 Repair service
Company management (D2)	C1 Training Aids C2 Packaging Ability C3 Geographical Location C4 Procedural Compliance
Reputation and Impression (D3)	C1 Reputation & Position in Industry C2 Management & Organization C3 Labor Relations Record C4 Impression C5 Cultural and communication
Sales and Market (D4)	C1 Delivery C2 Attitude C3 Performance History C4 Communication System C5 Warranties & Claims Policies C6 Reciprocal Arrangement
Finance and Profitability (D5)	C1 Net Price C2 Financial Position C3 Amount of Past Business C4 Relationship with potential suppliers C5 Future development capabilities C6 Desire for Business

Step 2: Form an expert panel.

The experts who serve with the senior executives of various departments of the drug distributor have been working the drug distributor above 10 years. The pharmaceutical logistics company has been in Taiwan for 30 years since its establishment, and has become in the leading company for many years.

Step 3: Conduct two-round questionnaire survey among the experts.

First-round questionnaire is among the 9 experts to define and determine 5 main criteria, and second-round questionnaire is amount 14 experts to select 4 main criteria and related sub-criteria. For the two-round survey that 23 questionnaires were distributed and 23 were returned, creating a return rate of 100%.

Step 4: Set the standards for consensus in the expert panel.

Through second round of the Delphi Method questionnaires were collected. The process were collected, analysed, and screened, as the result that consolidated were four main criteria (the average percentage of consent was over 70%), and a total of 10 criteria (including a percentage of consent of more than 60%).

Table 3 The result of main criteria and sub-criteria.

Criteria	Agreed number	Agreed %	No.	Criteria	Agreed number	Agreed %	Result
Product quality (D1)	14	100%	C1	Quality	14	100%	100%
			C2	Technical Capability	11	79%	79%
			C3	Production Facility & Capacity	10	71%	71%
			C4	Operating Controls	5	36%	
			C5	Repair service	3	21%	
Company management (D2)	5	36%	C1	Training Aids	4	29%	
			C2	Packaging Ability	0	0%	
			C4	Geographical Location	0	0%	
			C5	Procedural Compliance	6	43%	
Reputation and Impression (D3)	14	100%	C1	Reputation & Position in Industry	13	93%	93%
			C2	Management & Organization	6	43%	
			C3	Labor Relations Record	1	7%	
			C4	Impression	12	86%	86%
			C5	Cultural and communication	3	21%	
Sales and Market (D4)	10	71%	C1	Delivery	10	71%	71%
			C2	Attitude	12	86%	86%
			C3	Performance History	4	29%	

			C6	Communication System	1	7%	
			C7	Warranties & Claims Policies	9	63%	63%
			C9	Reciprocal Arrangement	4	29%	
Finance and Profitability (D5)	13	93%	C1	Net Price	6	43%	
			C2	Financial Position	9	64%	64%
			C3	Amount of Past Business	8	57%	
			C4	Relationship with potential suppliers	4	29%	
			C5	Future development capabilities	10	71%	71%
			C6	Desire for Business	10	71%	

Step 5: Build a supplier evaluation and selection model of drug distributor.

The results will be included as a future study factor in the comparative weighting and mutual importance analysis of AHP (Saaty, 1980, Analytic Hierarchy Process, AHP) research analyses.

Table 4: The selection model of main criteria and sub-criteria.

Criteria	Agreed number	Agreed %	No.	Criteria	Agreed number	Agreed %	Result
Product quality (D1)	14	100%	C1	Quality	14	100%	100%
			C2	Technical Capability	11	79%	79%
			C3	Production Facility & Capacity	10	71%	71%
Reputation and Impression (D3)	14	100%	C1	Reputation & Position in Industry	13	93%	93%
			C4	Impression	12	86%	86%
Sales and Market (D4)	10	71%	C1	Delivery	10	71%	71%
			C2	Attitude	12	86%	86%
			C7	Warranties & Claims Policies	9	63%	63%
Finance and Profitability (D5)	13	93%	C2	Financial Position	9	64%	64%
			C5	Future development capabilities	10	71%	71%

5 Conclusions

Supplier selection have drawn the interest and been thought importance of researchers since 1960s. Dickson (1966) defined 23 criteria of supplier selection. Weber et al. (1991) studied 74 articles from 1966 to 1991 related supplier selection criteria. Dickson's 23 criteria have the similar analogical distributions in Weber's study.

This study consolidated the criteria and sub-criteria of supplier selection from several related articles from 1966 to 2011. Net price, quality and delivery were the most

important criteria cited, but this study concluded that quality and delivery still are the important criteria apart from net price in selection of drug supplier.

From this research, it can be concluded important criteria in the selection of pharmaceutical suppliers, which are product quality, reputation and impression, sales and market, and finance and profitability. The preliminary selection sub-criteria derived from the Delphi Method are quality, technical capability, production facility & capacity, reputation & position in industry, impression, delivery, attitude, warranties & claims policies, financial position, future development capabilities.

For future research, supplier selection criteria and methods, will continue to be the important aspects. For supplier selection criteria seems to be an important area. Some new criteria to reflect the whole supplier chain performance should be developed. This selection model is determined by experts of drug distributor. This study presents a new supplier evaluation and selection model for the pharmaceutical industry. The model is mentioned in this study have shortcomings in dealing with the selection problem. New model to develop of human decision making, such as computer programming should be also significant for supplier selection in modern era.

References

- Chaudhuri, K. (2002). Convergence of inflation rates during flexible exchange rate period. *Indian Economic Review*, Department of Economics, Delhi School of Economics, 37(1), pp. 59-68.
- Cheraghi, S. H., Dadashzadeh, M., & Subramanian, M. (2011). Critical Success Factors For Supplier Selection: An Update. *Journal of Applied Business Research*, 20, 91-108.
- Dickson, G. W. (1966), 'Analysis of Vendor Selection Systems and Decisions', *Journal of Purchasing*, Vol. 2, No.1, pp. 5-17.
- Deshmukh, A. J., & Chaudhari, A. A. (2011). A Review for Supplier Selection Criteria and Methods. *Technology Systems and Management*, 145, 283-291.
- Ellram, L. M. (1990), "The supplier selection decision in strategic partnership", *International Journal of Purchasing and Materials Management*, Vol. 26, No. 4, pp.8-14.
- Harris, F. & de Chernatony, L. (2001). Corporate branding and corporate brand performance. *European Journal of Marketing*, 35(3/4), pp. 441-445.
- Herbig, P. & Milewicz, J. (1994). Marketing signaling and its role in business-to-business communications. *Marketing Intelligence and Planning*, 12(4), pp. 27-31.
- Lambert, D.M., Adams, R.J., and Emmelhainz, M.A. (1997). Supplier Selection Criteria in the Healthcare Industry : A Comparison of Importance and Performance, *International Journal of Purchasing and Materials Management*, Vol. 33, No.1, pp. 16-22.
- Min, H. (1994). *International Supplier Selection: a Multi-Attribute Utility Approach*.
- Patton, W.W. (1996), "Use of Human Judgment Models in Industrial Buyer's Vendor Selection Decisions," *Industrial Marketing Management*, Vol. 25, pp. 135-149.
- Porter, M.E. (1980), *Competitive Strategy*, New York : Free Press
- Pi, W-N. and C. Low (2004) Supplier evaluation and selection via Taguchi loss functions and an AHP. *The International Journal of Advanced Manufacturing Technology*.
- Saaty, T. L. (1980) "The Analytic Hierarchy Process" McGraw-Hill, New York, 1980.
- Verma, R., and Pullman, M. E. (1998). An Analysis of the Supplier Selection Process. *Omega*, International Journal of Management Science, Vol. 26, pp. 739-750.

- Weber, C, A, Current, J, R, Benton, W, C (1991), 'Vendor Selection Criteria and Method', *European Journal of Operational Research*, Vol. 50, No.1, pp. 2-18.
- Wilson, E, J (1994), 'The Relative Importance of Suppliers Selection Criteria: A Review and Update', *International Journal of Purchasing and Materials Management*, Vol. 30, No. 3, pp. 35-41.

Discussion on the Key Factors of the Netcom Industry to Introduce Agile Project Management at Diagnostic Stage

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Abstract

Future uncertainty caused by the uniqueness of the project, all project team member all require having enough problem analysis and solving skills, The traditional project management model challenges the need for innovation and agility for project management control under the established process. There will be an accelerated shift from Waterfall to Agile Project Management in larger organizations as they realize the only way to deliver on benefits in the increasingly dynamic and complex environment is to learn and adapt quickly.

The research is to explore the relationship between the existing cognition and the development performance of new products project by introduce the agile project management in the Netcom industry, and the key factors in the introduction. For the team to accurately capture the real needs of customers and to reduce the relationship between the need for unnecessary resources and time in the project, the degree of agility of the organization and the degree of readiness for development, it is necessary to further clarification. The research utilize modified Delphi Survey to understand the mutual connections and feedback loops among the attribution of the organizational culture, the nourishing professionalism, member learning attitude, funding learning incentive factors. Then evaluate via Analytic Network Process, ANP to assess the interdependencies and feed-back issues that may exist between the guidelines, and calculations to understand the project management criteria and weights for improving agile success and for enterprise ecosystems growth of knowledge management.

From Gigabyte senior management supports, (expert samples) 15 copies of Questionnaire, to allow customer contact-employees to provide their views of organization agilization and project performance. Results of this study found, The contribution of this paper has two aspects. The theoretical: the paper can answer the research problem. The practical: this paper can offer insights into organization agilization as to how to enhance the internal project development of the organization. Technical performance and functional performance are also positively correlated. This

knowledge-based strategic, managerial and organisational solutions should be better respond to today's business and managerial challenges and how they can positively impact on growth and well-being of private and public organisations and so forth more widely, of the entire society.

Based on agile principles of acceptance of the four software development project as defined under the Scrum principles of People, Organizational, Process and Technical factor dimensions to explore their awareness of project successful, and related environmental background information analysis and discussed the relationship between Scrum and the project successful cognitive existence in Taiwan.

The research utilize modified Delphi Survey to understand the mutual connections and feedback loops among the attribution of the organizational culture, the nourishing professionalism, member learning attitude, funding learning incentive factors. Then evaluate via Analytic Network Process, ANP to assess the interdependencies and feedback issues that may exist between the guidelines, and calculations to understand the project management criteria and weights for improving agile success.

It is expected that 15 expert questionnaires will be issued for pre-questionnaire surveys and formal surveys. This research institute explores the key factors affecting the success of the Netcom industry's introduction of agile project management. Provide reference for the development direction and strategy of Netcom industry project management services.

Keywords –agile management、stakeholder、fitness、project performance.

Paper type – Academic Research Paper / Practical Paper

1 Introduction

Facing the era of global competition, how can companies accelerate innovation, timely manage operation information, Expected to combine project management with high cost performance, punctual and flexible integration mechanism, through process design, consulting services, and system tools, assist business teams across time space constraints, comprehensive coherence and integration in operational processes and information, Helping global customers create competitive advantage in a changing market environment is an important part of today's companies to improve their business performance.

The products and services provided by the network communication industry require the stability of the products. The uninterrupted feature is a service that is highly customer-aware. Facing the high sensitivity of customers to product quality requirements. Project crews often have to be in communication and coordination between the R&D team and the customer. During the time for developing new products, project-driven quality and decision-making. It is related to whether the project manager can consider the measurement of his organizational fit in advance. In turn, project performance can be optimized. Thus, in an increasingly competitive business environment. More and more companies pay attention to the efficiency and performance of project development, Therefore, organizations have adopted an organizational optimization strategy. To

achieve positive affect on profits, improve customer satisfaction, and loyalty. (Homburg, Hoyer and Fassnacht, 2002)。

2 Introduction of Agile project management

Enterprise Project Management, EPM takes agile tool is no longer just a theory, but practice. Because information systems have a critical importance in their operations, At the same time, adopting agile management tools can help companies adapt to the changing environment., So many companies are beginning to apply agile methods to areas outside the information department (林裕丞 2018)。

Agile development uses a flexible, timely and responsive development process, while bringing customers into the team, and aggressively initiate work interaction relationship with research development , vendor. So that adaptation of project issues, relative flexibility and flexibility to update development processes in response to rapid market changes、To adopt an agile development model under common goals or concerns, Create contribution values in addition to the original development methods to enhance the performance of new product development.

Based on their combined experience of developing software and helping others do that, the seventeen signatories to the manifesto proclaimed that they value:

- Individuals and Interactions over processes and tools
- Working Software over comprehensive documentation
- Customer Collaboration over contract negotiation
- Responding to Change over following a plan

However, when more and more other countries holding agile project management, Taiwan is rather slow in this field, only software team, this is due to adopt agile practices and values improves the agility originated from software professionals, teams and organizations, almost all books or courses used massive software filed terminologies.

A common characteristic in agile software development is the daily stand-up (also known as the daily scrum). In a brief session, team members report to each other what they did the previous day toward their team's iteration goal, what they intend to do today toward the goal, and any roadblocks or impediments they can see to the goal. Let the outsiders look at it. Even, according to research, most Asian banks do not fully implement agile methods, and managers still use traditional management methods.

Enterprise intend to transform via continue to utilize promoting agile project management mode, with short-term substitution, continuous experiments, and learning, so that organization and process can be continuously improving, while these paths allows the transformation are effective and low risk, organizational metabolism employs' proactiveness, continuing product and service innovation can be achieved. 。 Even though agile can help enterprise an effective and low risk transformation, but most difficulties are leaders' need to change their concept; for example, accept failure and learn from it, accept effectiveness rather the efficiency, allows more space for employee a larger and free will (林裕丞 2018)。

When leaders willing to accept these thinking, work along with agile tool and framework, enterprise can moderate quality, make organization more

healthy, Have an independent and efficient team and provide more valuable products and services.

This research is intend to realize the recognition of agile management among netcom industry, to discuss what are the major factors would let an enterprise can successfully to implement agile methodology, and if enterprises will utilize agile management tools and frequent discussion with customers and vendors, and accurately aim at markets' need to avoid unnecessary resources and time consuming.

3 The dilemma of the introduction of innovative models

Reference to the past research in the technology industry to influence the management of innovative models, Generally, it can be roughly divided into two facets.: 「Personal facets」 and 「Organizational facets」. From 「Personal facets」's point of view, the most frequently used manners are Technology Acceptance Model, which is TAM, Judging the adoption of technology by the personal perception and attitude of policy makers, Harrison, Mykytyn, Riemenschneider (1997) found, Information technology factors for small businesses will be interfered by User's attitude, subjective consciousness and control cognition. Venkatesh and Davis (2000) proposed and proved that social affect procedures and recognition tool procedure significantly affect users' awareness of usefulness and intension to use.

From 「Organization facets」's point of view, Rubenstein-Montano et al.(2001) thinking a enterprise take steps for innovation should include, group Culture, organizational learning. Participative attitude、strategy and knowledge, especially group culture will affect further over the knowledge sharing, date storage, transmission and utilization process. Holsapple and Joshi(2000) thinking to promote success of innovation should include (1) Enterprise culture (2) Leadership (3) Science; (4) Organization adjustment (5) Knowledge management (6) Resource evaluation (7) Knowledge activities (8) Resources management (9) Motivation of occupation (10) Others. On the other hand, if the technology and organizational characteristics are used to explore the adoption of technological innovation by enterprises, Tornatzky, Fleischer and Chakrabarti (1990) think that Organizational background fact、science and external environment factors are the three major perspective affect information system to utilize this methodology.



Group Culture

If structures allow the effective use of capabilities, culture is what enables the organization to acquire the capabilities related to people. With the right kind of pro-innovation culture, the organization is much more likely to be able to recruit and keep the right people in the organization. An appropriate pro-innovation culture encourages the right kind of behavior and discourages the wrong kind. As the effects quickly cumulate, culture can make a tremendous difference for the innovativeness of an organization. Here are some of the more commonly accepted traits for an innovative culture: Emphasizes the need to always think of ways to get better, Values speed, learning and experiments, Considers failure as just a normal part of the process for creating anything new, Provides enough freedom and responsibility and is led primarily with vision and culture instead of a chain-of-command approach

Organizational Learning

On the other end of the spectrum from the phase-gate, there are people who believe that the best innovations come from simply equipping smart people with enough time and the right resources to make their ideas happen.

Participative Attitude

Empower people but hold them accountable for their work and their decisions

Have talented people on all levels of the organization

Have tools and structures in place for making sure things happen and the right things move forward Have a clear vision and a strategy that everyone understands

Are focused on implementing ideas as opposed to just talking about them

Funding Decision

In the field of innovation management, in many cases, look at risk through a broader lens, especially when it comes to innovation. The ability to tolerate risk determines both the potential downside and the potential upside of your investment.

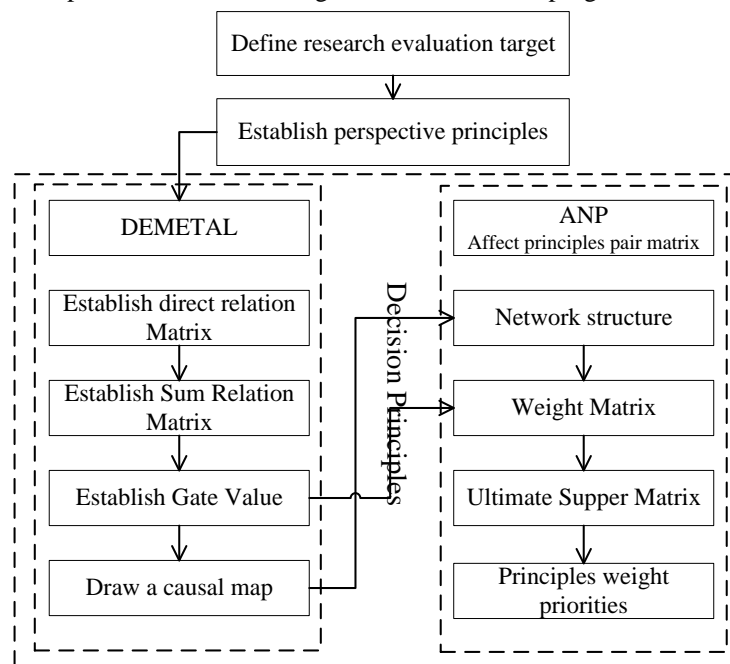
As working on innovation always involves a lot of uncertainty, look at risk as more than just something to minimize.

Incentive Program

To promote or encourage such actions or behavior by a specific group of people during a defined period of time. Incentive programs are particularly used in this

management process to motivate employees and proactively to attract and retain customers.

As above, this study based on references, would like to organize into personal perspective and organizational perspective to explore the factors of enterprise introduction of agile project management, including group Culture, organizational learning. Participative attitude、funding decision , incentive program



4 Conclusions

This study was selected to have been trained in formal project management and familiar with SCRUM agile methodology15 experts, in the netcom industry field fir initial review to conduct inquiry list content modification.。

The main research object of this research is Netcom Technology, including server , network card, STB etc. and he who needs to aware of product development process and agile management project, including manager of research and development , project manager or product manager, By the qualitative principle of Modified Delphi Method, MDM to discuss group Culture, organizational learning. Participative attitude、funding decision , incentive program inter-relationship, then Principle of quantification of Analytic Network Process, ANP to evaluate the To assess the interdependencies and feedback issues that may exist between the guidelines to calculate and weight on implementation of agile project management rules.

References

- Adams, J. S., Toward an Understanding of Inequality, *Journal of Abnormal and Normal Social Psychology*, 1963, Vol.67, pp.422-436.
- Adams, J. S., Inequity in Social Exchange. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology*, 1965, New York: Academic Press, pp. 267-299.
- Ai-Khaldi, M. A., & Ai-Jabri, I. M. (1998). The relationship of attitudes to computer utilization: New evidence from a developing nation. *Computers in Human Behavior*, 14 (1), 23-42.
- Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International journal of project management*, 17(6), 337-342.
- Collier, K. (2012). *Agile analytics: A value-driven approach to business intelligence and data warehousing*. Addison-Wesley.
- Custer, R. L., Scarcella, J. A., & Stewart, B. R. (1999). The Modified Delphi Technique--A Rotational Modification. *Journal of vocational and Technical Education*, 15(2), 50-58.
- Drucker, P. F. (1988). *The coming of the new organization*.
- Gido, J. & Clements, J. P. (1999). *Successful Project Management: South, United States*.
- Harrison, D. A., Mykytyn Jr, P. P., & Riemenschneider, C. K. (1997). Executive decisions about adoption of information technology in small business: Theory and empirical tests. *Information systems research*, 8(2), 171-195.
- Hartman, A. (1981). Reaching consensus using the Delphi technique. *Educational Leadership*, 38(6), 495-97.
- Herzberg, F., Mausner, B., and Snyderman, B., *The Motivation to Work*, 1959, New York, John Wiley and Sons.
- Holsapple, C. W., & Joshi, K. D. (2000). An investigation of factors that influence the management of knowledge in organizations. *The Journal of Strategic Information Systems*, 9(2-3), 235-261.
- Huseman, R., Hatfield, J. & Miles, E., A New Perspective on Equity Theory: The Equity Sensitivity Construct, *Academy of Management Review*, 1987, Vol.12, No.2, pp.222-234.
- Husmann, D.E., Miller, M. T., *Faculty Incentives to Participate in Distance Education.*, Michigan Community College Journal: Research &Practice, 1999, Vol. 5, No. 2, pp.35-42
- Kay, R. H. (1993). An exploration of theoretical and practical foundation for assessing attitudes towards computers: The computer attitude measure (CAM). *Computers in Human Behavior*, 9, 371-386.

Exploring the Key Factors of Taxpayers' Willingness to Mobile Tax Payment base on Technology Acceptance

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Abstract

With the rapid development of smart phones, innovative mobile services, constant introduction of new Apps and the facilitation of mobile networks, mobile-based payment models have gradually begun to be applied to our daily life. To make it easier for citizens to pay tax, the government also continues to promote electronic services. The available applications are getting broader, leading the payment of tax to an era of cashless transactions. People only need mobile devices and network as well as the added channels so that tax payment can improve the timeliness, convenience and information accuracy for taxpayers.

When the government introduces new services, taxpayers' intentions and attitudes toward their use are topics that researchers are concerned about and want to explore. So what do taxpayers know about "paying taxes"? Is there any willingness to use the new policies promoted by the government? And The incentives, willingness to use and key factors that make taxpayers use are also concerns and desires of researchers. Therefore, this is the main research motivation of this study.

This study attempts to analyze factors affecting the use intention of tax payment by mobile wallet for taxpayers encountering the trends of financial technology. What are the significance of these factors? What can the Ministry of Finance do to facilitate the current taxpayers switch from their old habits with tax payment to paying with mobile payment?

We summarize five main dimensions based on the past references: Mobile devices, Ease of use, Transaction security, Technology acceptance and Special offers. This research is intend to explore the key factors of taxpayers' willingness to mobile tax payment base on technology acceptance through the decision-making trial and evaluation laboratory (DEMATEL) is then used to clarify the effect and relationship between each variable. each factors or parts may exert on and obtain from other higher or lower level factors. One of excellence of this technique rather than others decision making method in applying feedback application. This study will provide recommendations based on the

analysis results, hoping that they can serve as a reference for service providers in the business of tax payment by mobile wallet and further enhance the use intention. It is expected that questionnaires will be issued for pre-questionnaire surveys and formal surveys. This research institute explores the key factors affecting the success to explore the key factors of taxpayers' willingness to mobile tax payment

Keywords – tax payment by mobile wallet, mobile payment, technology acceptance, use intention.

Paper type – Academic Research Paper / Practical Paper

1 Introduction

Depending on the growing of the smart phone technology, the latest mobile service and APPs get more and more convenient, the mobile payment affects not only the commercial action but also our daily life. McKitterick and Dowling (2003) pointed out that mobile payment is a consumer who owns a mobile device and is willing to use it to pay for a service or product. Karnouskous (2004) pointed out that in terms of consumption habits, the new type of mobile payment needs to be related to the consumer's past payment behavior, and the mobile payment systems developed by different manufacturers need to be interactive and compatible. Bai et al. (2005) believe that mobile devices can be used anytime, anywhere, regardless of space and time, because of the combination of mobile devices and the Internet. If government wants to let mobile technology more and more upgrowing and develop the relative business, promoting the mobile payment is necessary. Ministry of Finance indicates the mobile payment will let people more convenient, make the commercial business more effective, reduce the cost of cash flow handling. Base on all the reasons that the mobile payment becomes the trend of E-commerce and digital economy. To utilize the mobile payment on paying tax will realize no-cash trade off and easy paying tax on time. All of the mobile payment benefits will make the future financial technology comes true.

No matter the technology is getting more and more modern, safety of trade process is always the most important thing that buyers care about. The first untrusty of mobile payment is for taxpayers is people always think that the Hackers will try to hack the payment platform to get personal information. If Ministry of Finance promote most of people to pay the tax by mobile payment, the most important thing is how to build a safety payment platform that to prevent the hackers and other risks. Davis, Bagozzi, and Warshaw (1989) point out that potential users subjectively believe that the operation of a particular information system technology is easy to use. The easier it is to use the system, the more confidence the user will have in self-expression and the willingness to accept the system. Lee, Warkentin, and Choi (2004) argue that an individual's level of anxiety about technology affects the user's willingness to use action payments, which refers to the new technology that users generate when considering or using innovative technologies. The degree of fear. Dertouzos (2001) pointed out that the ease of use of the system is user-

oriented, and the design of the system interface is friendly and easy to operate, allowing users to work easily and happily. HSUEH-YU TSAI (2016) The future development of global e-commerce, the characteristics of the network is that consumers' online behavior is fully recorded, and various Internet giants such as Amazon, eBay, Google, and Facebook all use big data technology. Analyze all types of consumption data, explore users' various hobbies, and then use mobile devices as a media platform. With its mobile features, they can meet the needs of consumers at any time, and use smart devices or applications to serve customers. Create a brand new shopping and service experience, let customers have the feeling of customer service staff to visit the scene, and more instantly cut the real needs of consumers, and expand the future market of e-commerce. As consumers become more accustomed to mobile commerce, the number of payments and completions directly on mobile phones will naturally increase, and they will immediately enjoy the benefits and satisfaction of shopping and the entire economic market.

2 Mobile Tax Payment

In this section, to purpose how to make the tax mobile payment more popular in four parts, the mobile device, the convenience, the safety, the acceptance of tax mobile payment.

2.1 Mobile device

Guo, Ke-Yu(2012)The most using device on mobile payment is all kind of mobile device, like smart phone, pads. Buyers can downloads serval mobile payment APPs to decide which bank account to pay tax.

2.2 Convenience

This author defines that convenience of payment is buyers using the less time and spirit to get what buyer's want. Berry and Grewal (2002) This author defines that convenience of payment is the process of buying a product or service. This reference separates the convenience of service in serval type: decision convenience, access convenience, transaction convenience, benefit convenience, post benefit convenience. Chao-Jung Chang (2014) To raise buyers using rate of the mobile payment, the convenience is the most consideration in all kinds of payment tools.

Tax mobile payment is one of the mobile payments, the taxpayers can make easy tax payment, but also can share all the benefit of mobile payment. Ying-Chiang Cho (2017) This reference indicates that mobile payments can be the replacement of cash. Besides the Electronic ticket, credit card, financial apps, the mobile payment also can add more service to make it more perfect, like taxi payment, express delivery payment, Taobao, and most of small cash payment. All of these can make the mobile payment to be more wide uses and make daily life more depends on this kind of behavior.

2.3 Safety

Safety always the most important thing that buyers care about. When a successful mobile payment is built, it needs provide your personal information through internet. Li-chung Lin(2007) That the privacy and safety are the most serious consideration that buyers care. Tsao, Hsun (2012) Because the crime of cheating through internet, and share personal information without your permit. These reasons let mobile payment untrusted by buyers. Yuan-Yu Shih(2014) Now most of us have smart phone and internet service. The mobile payment becomes a part of life. The safety is the most serious consideration for buyers. Fu, Hsin-Pin(2009) indicates that when buyers use the mobile payment to pay something, except the normal access, some of emergency protect process are needed. If the buyer is paying on threatening, the buyer can enter a special code to operate his account in security mode to protect his own. This process also can contract to the bank and police to prevent extra loss.

2.4 Acceptance

Mobile payment is a new tool to handle our payment. The personal cognition and acceptance are also important elements to increase the using rate of mobile payment. Lee et al.(2004) Buyers' anxiety of mobile payment will influence their willingness to use this kind of tools. Anxiety of mobile payment is when the you use modern technology, the unbelieve level on this kind of technology. Chao-Jung Chang(2014). indicates someone who wants to use the modern technology base on how well-known about this technology.

In this section, to analysis the reference and collect the data from buyers that new technology acceptance is the main reason influence the using rate of mobile payment.

3 Conclusions

In this reference, we use strategy changing test and DEMATEL to discuss the key point the willingness of mobile payment for taxpayers. Base on the four parts are mentioned, analysis how the variables influence the buyers and decide the treatment. I

References

- Bai, L., Chou, D. C., Yen, D. C., & Lin, B. (2005). Mobile commerce: its markeanalyses. *International Journal of Mobile Communications*, 3(1), 66-81.
- Berry, L. L., Seiders, K., & Grewal, D. (2002). Understanding service convenience, *Journal of marketing*, 66(3), 1-17.
- Chao-Jung Chang, (2014).User Intention of Mobile Payment Adoption, Department of Information Management College of Management National Taiwan University Master Thesis.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989) User acceptance of computer technology: A comparison of two theoretical models, *Management Science*, 35(8), 982-1002.
- Dertouzos, M. L. (2001). *The unfinished revolution: Human-centered computers and what they can do f or us*. New York: Harper Collins.

- Guo, Ke-Yu (2012). Exploiting Mobile Devices to Assist Identification of Photos System, Department of Computer Science and Information Engineering, Aletheia University Master Thesis..
- Hsueh-Yu Tsai(2016) A Study of Use factor and Business Model in Mobile Payment, Graduate Institute of Management College of Management National Taiwan Normal University Master Thesis.
- Karnouskos (2004). Moblie payment: a journey through existing procedures and standardization initiatives. *IEEE Communications*, 6(4), 44-66.
- Lee, C. P., Warkentin, M., & Choi, H. (2004). The role of technological and social factors on the adoption of mobile payment technologies. *AMCIS 2004 Proceedings, Americas Conference on Information Systems (AMCIS)*, 2781-2786.
- Lee, C. P., Warkentin, M., & Choi, H. (2004). The role of technological and social factors on the adoption of mobile payment technologies. *AMCIS 2004 Proceedings, Americas Conference on Information Systems (AMCIS)*, 2781-2786.
- Li-chung Lin (2007). The factor of affecting consumers to use multi-purpse motion payment.
- Mbogo, M. (2010). The impact of mobile payments on the success and growth of micro-business: The case of M-Pesa in Kenya, *Journal of Language, Technology & Entrepreneurship in Africa*, 2(1), 182-203.
- McKitterick, D., & Dowling, J. (2003). State of the art review of mobile payment technology. Retrieved September, 14(2003), 2003-2024.
- Tsao, Hsun (2012) The empirical study of users' behavioural intention towards NFC mobile payment
- Yuan-Yu Shih (2014). Exploring the Consumer's Intention of Using Mobile Payment Service – An Example of NFC

Exploring the Key Factors of Taxpayer's Willingness to Change Tax Return Habits From The Perspective of Innovation Resistance

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Abstract

Our government has put great efforts in promoting e-tax filing so that citizens will not be restricted by time and space constraints, thereby enjoying a "More network, less walk," barrier-free tax service environment. E-filing of taxes can correctly and quickly read report information and avoid human errors caused by the manual re-registration of the tax authorities, which greatly reduce the cost of data entry and shorten processing time. E-file is essentially an integration of an online service combined with filing taxes. Due to the strain in the operation of an online system along with the complexity of utilizing an online interface, in order to allow tax payers to overcome the difficulty in filing his/her individual income tax once a year, which affects his/her willingness to file tax online, this study uses an innovation resistance theory to explore the key factors contributing to the change in tax payment habits of taxpayers when filing their income tax.

Keywords – innovation resistance, Individual income tax, tax payment habits, manual declaration, internet declaration

1 The definition of innovation resistance

According to Rogers's (1983) theory of diffusion of innovation, innovation is delineated as when a new concept, behavior, or quality of a new thing is different from the current pattern and nature. Since new products rolled out by most companies have a high failure rate, only a few of them will be accepted by consumers. Therefore, many studies focus on the reason why innovation is successful and scrutinize the positive aspects. Innovation resistance is an act of boycott from consumers when faced with changes brought by innovations (Ram, 1987.)

S. Ram (1987) proposed the innovation resistance model, claiming that innovation has its own lifecycle, during which “resistance” and “adoption” can coexist. That means there is a portion of people who accept that innovation while another portion of people exhibit actions of rejection or resistance. Therefore, conducting research on “the people who show resistance” is, in fact, a reverse approach toward the dissemination of innovation. Innovative products, services, or ideas can only be introduced to the social situation once the factors of resistance found in the people who show resistance are understood. According to the research conducted by Ram and Sheth (1989), there are two pivotal resistance barriers: Functional barrier and psychological barrier. They proposed corresponding strategies and methods to grapple with these barriers. Additionally, under the perspective of consumers’ refusal to adapt to innovation, Ram and Sheth (1987) investigated factors of consumers’ refusal to use from both functional and psychological aspects. There are three parts to “the functional aspect”: Usage barrier, value barrier, and risk barrier, and two parts to “the psychological aspect”: Image barrier and tradition barrier. Functional barrier

1. Usage barrier: Sheth (1981) proposed that when consumers are satisfied with their current life pattern, they might show resistance to innovation because it changes their habits. The more they are familiar with their current learning and behavioral habits, the greater their intensity of resistance toward the thought of changing the status quo will be, which in turn takes a long time for consumers to get accustomed to innovation.
2. Value barrier: Consumers will refuse to change unless they find out that the values and benefits of the innovative product are more than that of the currently used one after they have evaluated the values of both the innovative product and the currently used one.
3. Risk barrier: When faced with innovative technologies, consumers tend to refuse them due to the insufficiency in the understanding of them, which is result of his/her inability to evaluate the risks and uncertainties generated after using them.

(i). Psychological barrier

1. Image barrier: Psychological barrier occurs when consumers have a bad impression on the origin of the innovation.
2. Tradition barrier: The barrier occurs when a conflict exists between the innovation and the consumer’s traditional culture. The greater the conflict is, the stronger the resistance is.

According to the research conducted by Ram and Sheth (1989), there is a difference in degree in consumers’ resistance toward innovation. The pair proposed the following three forms of innovation resistance.

1. Inertia in consumers: Consumers’ refusal to adopt the innovation is due to their propensity for inertia and unwillingness to change the status quo.
2. Active resistance: Consumers’ postponement to adopt the innovation might be based on the risks they think the innovation
3. Very active resistance: Consumers might insist that the innovation is unsuitable

for them and disapprove of it.

Szmigin and Foxall (1998) suggested that there are three forms of innovation resistance.

1. Rejection: When consumers decide to reject the innovation after evaluating information.
2. Postponement: When consumers need more time and information to evaluate if the innovation is worthy of adoption. For example, the major reason why students don't use credit cards is out of the concern on income. However, after they graduate and have a steady and full-time job, most of them will choose to use this financial instrument.
3. Opposition: When consumers oppose the innovation out of their own habit or situational factors. The discrepancy between the individual recognition and the nature of the innovative product also accounts significantly for this.

Sheth (1981) looked at innovation resistance from a different angle and came up with four categories for innovation resistance based on the aspect of perceived risk and the aspect of behavioral inertia (as shown in Fig. 2-1.) We will give each category a brief introduction.

1. Dual resistance innovations: When consumers encounter innovations that are high-risk and significantly different from their previous habits at the same time, such as changes in social activities like the education system, salaries, and welfares (Sheth and Wright, 1974.)
2. Habit resistance innovations: When consumers encounter innovations that are low-risk but still need to alter their current habits to adapt to it. Continuous innovations wanting to replace current products or services but fail can be categorized under habit resistance innovations.
3. Risk resistance innovations: When consumers do not have to change their current behaviors and habits and might have the chance to form new habits. Consumers will experience very high perceived risks when faced with such innovations. Such resistance stems mainly from non-continuous innovations, like innovations derived from a breakthrough in development. For example, birth control pills, video phone calls, and others. These non-continuous innovations might persuade consumers to form new habits but will also expose them to higher perceived risks.
4. No resistance innovations: When the innovation does not require consumers to change their current habits and poses very low perceived risks.

2 Research related to the innovation resistance theory

The innovation resistance theory reveals that perceived risks will affect the extent of risk intake of trust and a relationship based on trust. Therefore, to avoid risks, organizations will opt for a more secure or safer mechanism; that is to say, the extent of perceived risks and trust of an innovative technology will affect the decision whether to adopt it. An enterprise's perception of perceived risks is best embodied in its security

awareness of trade risks. Ratnasingham (1999) thought that security and risks are not only problems caused by technologies, but are also responsibilities that an organization should tackle with management and coordination. When an enterprise is involved in commercial trading, it should properly control all risks it might face.

In the study of information management, users' resistance is defined as a reverse response, where users refuse to change (Kim and Kankanhalli, 2009). Piderit (2000) thought that users' refusal is a multi-layered personality comprised of behaviors, emotions, and cognition. Users will refuse to change if they think that the change is going to create loss, stress, or risks.

Gatignon and Robertson (1989) thought that one of the factors that causes refusal to innovation is the postponement from one side, and the refuser has to acquire more information or time to understand the new information technology. Therefore, to successfully make innovation accepted by people, one must exclude factors of refusal in consumers (Ram and Sheth, 1989).

According to the definition of innovation resistance made by Ram and Sheth (1989), there are two forms resistance barriers: Functional barrier and psychological barrier.

I. Functional barrier

(i). The aspect of computer and Information Literacy

“Information Literacy” The term “Information Literacy” refers to the cultivation of citizens' understanding of the value of information. McClure (1994) regarded Information Literacy as a concept as well as the ability to solve problems, further incorporating Computer Literacy and Internet Literacy into it.

“Computer Literacy” Abruscato (1986) pointed out that “Computer Literacy” is people's computer knowledge and skills that are used to organize and process information. Mangan's (1992) interpretation of Computer Literacy is people's proficiency in common and general computer skills and the ease they feel when using computers. According to Hunter (1983), Computer Literacy is an individual's computer knowledge and skills needed to adapt to life in this society of technology that is highly dependent on information and the solution of complex problems. Watt (1980) pointed out that Computer Literacy is an aggregate of knowledge, skills, and values, all of which can make our lives better and more convenient in this society of computer and information.

“Internet Literacy” “Internet Literacy” is the attitude to accept internet and fuse it with our daily life as well as the ability to use it to improve our lives. McClure (1994) pointed out that Internet Literacy is the fundamental ability to use the internet.

“Computer Anxiety” “Computer Anxiety,” according to Donald and Richard (1993), is a bad feeling experienced when using or communicating to a computer. The feeling will make a person afraid of using computers. It is the comprehensive response mixed with emotions such as fright, anxiety, and anticipation people expect to experience before using a computer or that actually occur during the use of a computer.

(ii). Tax-filing knowledge

The aspect of “tax system”: This includes the filing of the annual income tax return form, in which a taxpayer should calculate the annual income tax return and file it to the taxation institute before the declaration period ends. The tax system has the following characteristics: (1) Short tax season and too many taxpayers, (2) confusing and various taxing items, and (3) multiple choices of tax calculation methods.

The aspect of “tax knowledge”: This includes countless tax regulations that are highly professional, confusing, and esoteric. Taxpayers will have to compile evidence of their incomes and expenditures to continue the online declaration system.

The aspect of “system operation”: Taxpayers are required to install declaration software to finish the task online. The online declaration system imposes many limitations on data upload, and there are also internet security concerns.

II. Psychological barrier

(i). The aspect of perceived risk

Proposed by Bauer (1960), the rudimentary concept of perceived risk is derived from the development of psychology. It views consumer behavior as an instance of risk taking and can be used to explain plenty of consumers’ “switch” behaviors.

(ii). The aspect of behavioral inertia

According to Yu’s (1980) theory of habitual domains, people’s decision making is confined to their inherited habits. Once these ideas are stabilized, their response to people, matters, problems, and information, including their acknowledgment, understanding, judgment, and approach, will become habitual, turning into what we call programmed or formulated behaviors. Oliver (1999) stated that inertia reflects some behaviors that follow. Once behavioral inertia is generated, people will repeat the action habitually. Therefore, when consumers have accumulated experience of consuming a certain product or service, it will then form learning for that consumption or use of service (Assael, 1992.) In the meanwhile, consumers will gradually become familiar with information related to the product or service (Alba and Hutchinson, 1987.)

In order to gain a deeper understanding of the key factors contributing to taxpayers’ unwillingness in adopting online declaration and choosing to stay with manual declaration, this study first compiles related literature of the past on the unwillingness in using online declaration for tax filing and then builds/confirms a comprehensive research framework to understand why people are not willing to file online. In addition, the decision-making trial and evaluation laboratory (DEMATEL) method is used to understand the complex causal structure and the effects between each variable and use matrix operations to obtain the causal relationship and the strength of effect between the elements. Finally, the method of analytic network process is adopted to assign weight values of these factors to obtain the order of significance for these factors contributing to the unwillingness to file tax online. We hope that this study can understand the factors affecting the changes in tax payment habits of taxpayers and rank the factors by their significance. The results of the study can serve as a reference for the tax authorities to improve the rate of online declaration.

References

- Abruscato, J. (1986). *Children, computers, and science teaching: Butterflies and bytes*. Englewood Cliffs, NJ: Prentice-Hall.
- ALA. (1989). *American Library Association Presidential Commission on Information Literacy, Final Report*. Chicago: American Library Association. Retrieved May 20, 2013, from <http://www.ala.org/ala/mgrps/divs/acrl/pubHcations/whitepapers/presidential.cfm>
- Alba, J. W., & Hutchinson, J. W. (1987). Dimensions of consumer expertise. *Journal of consumer research*, 13(4), 411-454.
- Assael, H. (1992). *Consumer Behavior and Marketing Action*. Fourth Edition. Boston, MA: Kent.
- Bauer, R. A. (1960). Consumer behavior as risk taking. In R. S. Hancock (Ed.), *Dynamic Marketing for a Changing World*. Chicago: American Marketing Association, 389-398.
- Donald G. Gardner, Richard Discenza & Richard L. Dukes, The Measurement of Computer Attitudes: An Empirical Comparison of Available Scales, *Journal of Educational Computing Research*, 9(4), 1993, 487-507.
- Gatignon, H. & Robertson, T. S. (1989). Technology diffusion: an empirical test of competitive effects. *The Journal of Marketing*, 53(1), 35-49.
- Hunter, B. (1983). *My Students Use Computers: Learning Activities for Computer Literacy*, Virginia: Reston Publication.
- Kim, H. W. & Kankanhalli, A. (2009). Investigating user resistance to information systems implementation: a status quo bias perspective. *MIS Quarterly*, 33(3), 567-582.
- Lapointe, L. and Rivard, S. (2005). A multilevel model of resistance to information technology implementation. *MIS Quarterly*, 29(3), 461-491.
- Mangan, J. M. (1992). *The Ideology of Computer Literacy in School*, ED349940.
- McClure, C. R. (1994). Network literacy: A role for libraries? *Information Technology and libraries*, 13(2), 115.
- Meeting of Association for Educational Communications and Technology, Dallas, Tx.
- Oliver, R. L. (1999). Whence consumer loyalty? *Journal of marketing*, 63(4), 33-44.
- Piderit, S. K. (2000). Rethinking resistance and recognizing ambivalence: A multidimensional view of attitudes toward an organizational change. *The Academy of Management Review*, 25, 783-794.
- Ram, S. and Sheth N. J. (1989). Consumer resistance to innovations: the marketing problem and its solutions. *The Journal of Consumer Marketing*, 6(2), 5-14.
- Ram, S. (1987). A Model of Innovation Resistance, *Advances in Consumer Research*, 14(1), 208-212.
- Ram, S., & Sheth N. J. (1987). *Bringing innovation to market: To break corporate and customer barriers*, NY: Wiley and Sons.
- Ratnasingham, P. (1999). Implicit Trust in the Risk Assessment Process of EDI, *Computers and Security*, 18(4), 317-321.
- Rogers, E. M. (1983). *Diffusions of Innovations*. (3rd edition.). New York: The Free Press.
- Sheth, J. N. & Wright, P. L. (Eds.) (1974), *Marketing Analysis for Societal Problems*, Bureau of Economic and Business Research, University of Illinois.
- Sheth, J. N. (1981). Psychology of Innovation Resistance, *Research in Marketing*, 4(2), 273-282.
- Szmigin, I., & Foxall, G. (1998). Three forms of innovation resistance: The case of retail payment methods. *Technovation*, 18(6/7), 459-468.
- Watt, D. H. (1980). Computer literacy: What should schools be doing about it, *Classroom Computer News*, 1(2), 1-26.

Yu, P.L(1980), Behavior Bases and Habitual Domains of Human Decision/Behavior Concepts and Applications, in Multiple Decision Making and Application, G. Fandel and T. Gal(eds.), Springer-Verlag, New York, 511-539.

Exploring the Relationship between Consumers' Perceived Risk of Electronic Invoice Carrier, Behavioral Inertia, and Willingness of Use

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Abstract

In Taiwan, Electronic invoices had already been promoted since year 2000. This is to fulfill paper reduction, for the sake of environment friendly, and moving towards from less paper to paperless. How to attract more people to accept and use electronic invoices vehicle Cloud invoice is an important issue for everyone.

According to the “energy saving and carbon reduction policy” of the government it has been constantly encouraging people to act green, such as enable people to hold electronic invoice vehicles for green consumption to accelerate the use of various types of vehicles. Upload the electronic invoice data to the cloud server via these carriers. After years of hard work, the number of electronic invoices opened in the year of 106 has reached 6.8 billion sheets. More than 80% of all invoices in the year of 2017, reached planned target, but the invoice past through the vehicle (Cloud invoice), the rate of achieving true paperlessness is still low, still need to be upgraded. Therefore, most people develop the habit of taking the initiative to request paper invoices after consumption. To change people's habits, Change to electronically invoice in a paperless manner, It is not easy.

In this study, utilized from the view points of innovation resistance to explore the relationship among consumers' perception of electronic invoice carrier utilization, the behavioral inertia, and willingness of using. This study also explores interference relationship of perceptual risk behavioral inertia and willingness towards the use of incentives methods for electronic invoice vehicles

This study was conducted by questionnaire, facilitating sampling by the general public over the age of 16, The regression analysis is to verify the hypothesis. research shows

- 1 The perceived risk of the electronic invoice vehicle negatively affects the willingness to use.*
- 2 The inertia of the electronic invoice vehicle will negatively affect the willingness to use.*
- 3 The preferential measures of the electronic invoice vehicle will positively affect the willingness to use.*

4 *Preference measures, perceived inertia and use of electronic invoice vehicles willingness relationship has interference effect.*

Cloud invoices not only do our best for the planet, can also bring competitiveness to countries and enterprises, The results of this study can provide suggestions for the future research and government for reference

Keywords – electronic invoice carrier ,perceived risk, behavioural inertia, willingness of use.

Paper type – Academic Research Paper / Practical Paper

1 Introduction

The continuous opening and use of paper electronic invoices is often contrary to the government's policy of “energy saving and carbon reduction”, “green economy” and “green living”. At the same time, the store also prints such discount coupons, merchandise coupons, transaction details, credit card details, advertisements, etc. The hottest papers are more and more printed, and the environmental problems that have been created in an endless stream have further highlighted the fact that electronic invoices deviate from the original target and purpose. Therefore, when the global warming, the disappearance of rainforests, the depletion of natural resources, and the serious problem of ecological consumption, countries should not delay and vigorously promote the laws and regulations on energy conservation, carbon reduction and environmental protection.

According to data released by the Executive Yuan in 2017 to promote diversified waste disposal – making waste change resources, Taiwan's garbage collection rate reached 58%, and the resource recovery rate was higher than the world's second, second only to Germany. It shows that the environmental awareness of the people of Taiwan has reached a certain level. At the same time, whether electronic invoices can do the best for the earth, do their best for environmental protection, change the habit of requesting paper invoices, and it has become a new environmental awareness of consumers.

In the case of the government's long-term promotion of obtaining uniform invoices, consumers have developed the habit of actively requesting paper invoices after consumption for more than 60 years. Therefore, it is not easy to change the people's habits and request electronic invoices in a paperless manner.

In the process of promoting electronic invoices, the demand for paper invoices by different ethnic groups and the proficiency in the use of information by urban and rural gaps are considered. For consumers without vehicles, electronic invoice certificates are still provided for convenience. Therefore, most consumers still I am used to requesting an electronic invoice certificate. Even the electronic invoice certificate has caused some consumers to misidentify from the traditional two-way cash register invoice.

As far as the current implementation results are concerned, it is still low for consumers to obtain electronic invoices from vehicles to achieve a really small paper and paperless ratio. Although the implementation results have indeed increased year by year,

they still need to be improved. The business person prints the consumption details, coupons or marketing advertisements. When people want to use the vehicle to obtain an electronic invoice, they need to provide payment tools (cash or credit card) at the time of consumption checkout, and they must present the vehicle (such as mobile phone barcode) and tell the store service personnel to open an electronic invoice. This study suggests that consumers may feel that it is faster and more convenient to request paper invoices. Therefore, in the process of promoting electronic invoices, in order to meet the needs of different ethnic groups for paper invoices and to consider the digital gap between urban and rural information, electronic consumer invoice certificates are still given to consumers who do not have vehicles. So far, most of the consumption has been They are still accustomed to obtaining an electronic invoice certificate, and the ratio of obtaining electronic invoices to achieve true paperlessness is still low. The most important thing is to start with environmental education and change the concept and habits of consumers to obtain paper invoices.

Inertia behavior theory is often used in new product purchase decisions to explore the tendency of users (consumers) to focus on their familiar familiar product habits (Chintagunta, 1998; Ye, 2005). Inertia is also related to personal traits (perception, attitude, concept and environmental awareness) or social background (income, age and physical barriers). Consumers use the habit of cash consumption, most of which are still in cash transactions. When an electronic invoice vehicle is used, this behavior is more biased in the change of customary behavior. If this behavior change is reflected in the selection of the mode function, the effect of inertia can be measured.

Hancock and Humphrey (1997) argue that concessions are one of the key factors affecting consumer adoption barriers and adopting e-banking. Therefore, The preferential measures will cause interference between the rejection and rejection of the electronic invoice carrier. If the benefits offered by the government are more and more attractive, and can continue to implement exclusive awards. It will probably reduce the rejection and rejection of users, and thus have a willingness to use.

2 Conclusions

Sheth (1981) explores the Innovation Resistance Theory from a psychological perspective, And propose a two-dimensional facet of the degree of inertia and perceived risk of existing things. The innovation resistance is divided into four categories: double resistance innovation, custom resistance innovation, risk resistance innovation and non-resistance innovation. Difference: 1. Dual resistance innovation: refers to a consumer who is exposed to high perceived risks and is unwilling to change existing habits, causing them to resist. 2. Habit resistance innovation: refers to a consumer who is confronted with a low perceived risk but is unwilling to change existing habits. 3. Risk resistance innovation: refers to the fact that consumers face high perceived risks and do not need to change existing habits, but instead may have to accept new habits, causing them to resist. 4. Non resistance innovation: refers to the fact that consumers face low perceived risk and do not need to change existing habits, so that they do not have resistance. Ram (1987)

believes that innovation has its life cycle, and that the conditions adopted or resisted during the period may coexist at the same time. Those who accept innovation have people who have rejected or resisted. Ram and Sheth (1989) further revise and explain the definition of innovation boycotts. Consumers facing innovation may be influenced by innovations due to certain obstacles and innovation resistance. Ram and Sheth (1989) argue that these barriers are mainly due to consumer perceptions, and that resistance may be rejected or delayed. Functional barrier refers to the change that consumers feel about innovation, the inability to adapt to innovation, and the perceived barrier to functionality. Functional barriers can be seen as consumers' incompatibility with innovation. Define functional barriers: usage barrier, value barrier, risk barrier. Psychological perceptual disorder, Ram and Sheth (1989) believe that it depends on consumers' self-recognition. When innovation and original beliefs of consumers are violated, psychological barriers may arise and influence the adoption of innovation. Define psychological barriers: traditional barriers, image barriers, and propose strategies and methods for these two barriers. Consumers are not totally resistant to innovative products, ideas or services, but to the extent of resistance, as follows: 1. Inertia: Consumers come from the original lazy inertia, which makes them unwilling to change the situation and resist. 2. Subjective: Consumer subjective cognitive innovation may have a high degree of risk and make a decision to delay adoption. 3. Faith: Consumers are convinced that they are not needed or suitable for innovation and are resisted with a strong degree.

In the face of innovation, consumers may have the above five obstacles and the willingness to resist innovation will affect the willingness to adopt innovation. The overall theoretical concept is clearer and more complete.

In addition, Sheth (1981) explores the theory of innovation resistance from a psychological point of view and proposes two major facets of "perceived risk" and "behavioral inertia" of existing things. (1) Perceptual risk: It was first developed by Bauer (1960) from psychology and led to the field of sales management. It is believed that the marketing plan adopted by marketing decision makers may not predict the development of the results, so the decision makers make decisions. Behavior can be said to be the contract of risk. (2) Behavioral inertia: Sheth (1981) argues that the innate perception or perception of human beings tends to maintain consistency in current conditions rather than innovations that are inconsistent with current conditions. Ram and Sheth (1989) When the adoption of innovation must change the habits or behaviors established by the people, it takes a relatively long time to develop the acceptance process before the people accept innovation.

Inertia will reflect some of the behavior that follows, and once inertial behavior occurs, it will habitually repeat the action (Oliver, 1999). You Bolong (1980) theory of habitual domain suggests that human decision-making is subject to inherent habits. Once these ideas are stabilized, they have a habit, that is, the procedural or formulation of behaviors, in response to people, things, problems, and messages, including understanding, understanding, judgment, and practice. When consumers perceive risk, they try to delay adoption of innovation until they learn more about innovation (Ram and Sheth, 1989). In a study by Dodson et al. (1978), it was pointed out that when the margin

of a transaction increases, it will have a positive impact on the transaction, increasing the likelihood of more transactions being completed. (Andrews et al., 2010) also believes that if the content of the offer can bring value, it will be more effective for consumers, and induce consumers to generate more purchase behavior. The research mentioned that the marketers in the market spend each year. The discounted fees (for example, winning prizes, gifts) amount to billions of Taiwan dollars, and the expected purchase intention will increase with the perceived increase. Consumers must pay a considerable price when they get the value of a product or service. At this point, the consumer will have a so-called Perceived monetary sacrifice for the amount actually paid. Therefore, when the preferential rate of a product or service is higher, the actual consumer pays a drop or compensation, and the consumer's original perceived monetary sacrifice will be reduced, and the consumer's willingness to purchase the product or service will be increased (Dodds, Monroe & Grewal, 1991). In Gupta and Cooper (1992), consumers believe that consumers will influence their behavior through pre-consumer collections, and preferential information is one of the factors that influence consumer behavior.

The government's policy of energy conservation and carbon reduction continues to encourage people to act green, enable people to use electronic invoice vehicles for green consumption, and accelerate the use of various types of vehicles. The invoices are carried to the cloud through vehicles. After years of efforts, The number of electronic invoices opened in 106 has reached 6.8 billion, accounting for more than 80% of all invoices issued in the current year. It has reached the stage goal, but the invoices (cloud invoices) are used to achieve a truly paperless The ratio is still low and needs to be improved.

In this study, we use innovative resistance to theoretical perspectives to explore consumer perceptions of perceived risk, behavioral inertia, and use intentions of electronic invoice vehicles. At the same time, it also discusses the relationship between consumers' preferential measures and willingness to use electronic invoice vehicles. Finally, the relationship between the perceived risk, the behavioral inertia and the intention of use of the electronic invoice vehicle is further analyzed. Cloud invoices can not only do our best for the earth, but also bring competitiveness to the country and enterprises.

References

- Andrews, M. L., R. L. Benedictus, and M. K. Brady, The Effect of Incentives on Customer Evaluations of Service Bundles, *Journal of Business Research*, 63(11), (2010): 71-76.
- Dodds, W. B., K. B. Monroe, and D. Grewal, Effects of Price, Brand, and Store Information on Buyers Product Evaluations, *Journal of Marketing Research*, 28(3), (1991): 307-319.
- Dodson, J. A., A. M. Tybout, and B. Sternthal, Impact of Deals and Deal Retraction on Brand Switching, *Journal of Marketing Research*, 15(6), (1978): 72-81 Oliver, R.L. (1999). Whence consumer loyalty?. *The Journal of Marketing*, 33-44.
- Gupta, S. and L. G. Cooper, The Discounting of Discounts and Promotion Thresholds *Journal of Consumer Research*, 19(3), (1992): 401-411

- Hancock, D. and Humphrey D. B. (1997). Payment Transactions, Instruments, and Systems: A Survey. *Journal of Banking & Finance*, 21(11-12), 1573-1624.
- Ram, S. & Sheth, J. N. (1989). Consumer Resistance to Innovations The Marketing problem and Its Solutions, *Journal of Consumer Marketing*, 6 (2), 5-14.
- Ram, S. (1987). A model of innovation resistance. *Advances in Consumer Research*, 14, 121-125.
- Sheth, J. N. (1981). An integrative theory of patronage preference and behavior (pp.9-28). College of Commerce and Business Administration, Bureau of Economic and Business Research, University of Illinois, Urbana-Champaign.

Exploring the Human Recruitment System from the Perspective of Learning Organization

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Abstract

All activities in the organization, from the completion of simple work to the operation of the entire enterprise, require "people" to execute or manage. In a fiercely competitive environment, excellent talents are an important key factor in a company's success. From how employees enter the company, how to adapt, learn, and grow in the enterprise, and be properly used to take on tasks, human resource management plays a very important role. . Therefore, how companies can make good use of human resources at the right time, get enough manpower, quality talents, and promote their good development depends on the success of human resources. The structure of Taiwan's social population has evolved to "age", prices are getting higher and higher, and wages are not rising. As a result of the decline in fertility, various social change factors and economic problems, the vicious circle has led to the growing number of children in recent years. The impact on employment has not been found to be suitable for talents, and the development of financial owners is still to cultivate outstanding professional talents, and regard talents as a competitive advantage. In response to changes, the project is responsible for the recruitment, development and training of responsible personnel. Continue to compete for talent. The difficulty in the recruitment of human resources has increased, and in the face of severe competition in response to innovation, companies have also realized that they must change the traditional concept and nature of work. In particular, learning-oriented enterprise organizations must constantly learn, grow, change and innovate, and education and training is the driving force for improving human quality. Through the implementation of education and training, the members of the organization can have the ability to adapt. The organization can adjust the operation policy and business strategy in a timely manner, and strengthen the strength of the company's survival

Keywords –manpower recruitment system, project management, system thinking, causal feedback

Paper type – Academic Research Paper

1 Introduction

The advent of the era of knowledge economy and the continuous advancement of industrial technology have had a great impact on the learning and work of organizations.

Financial organizations must focus on the individual learning capabilities of their members to make the organization more “learning.” Employees have been seen as an asset. Whether an organization can maintain its competitive advantage and its ability to operate sustainably depends on whether the organization Get instant access to information, use information and create knowledge. Due to changes in the working environment, the organization's pre-employment conditions and work content will be continuous learning and innovation, and the "talent" will be the key. Therefore, in the economic era, all levels of the organization will challenge and develop new knowledge. One of the important duties of managers is to create a learning environment that can increase the knowledge and skills of employees, which is the birth of a learning organization.

The organization is a group of people. In order to achieve common goals, they will work horizontally and divide vertically, and be vertically stratified according to their functions. Through communication, coordination, leadership, supervision, etc., the cooperation will be achieved and the organizational goals will be achieved. The organization is also a complete organization. The organism, and self-adjustment with the changes of the times or the environment, and through the members of the organization from the psychological level of cognition, emotions and attitudes, etc., to establish group awareness. Therefore, the organization's performance, including static, dynamic, ecological, mental state and other four states, are indispensable. Organizational elements are the focus of organizational behavior. Elements determine the structure, function, nature, attributes, characteristics, etc. of the system, and at the same time determine the nature of the system. Hodgetts (1975) believes that the organization assigns its responsibilities and coordinates its work to all members of the organization, and achieves the most efficiency in achieving the goals.

The concept of "learning organization" is from the 1970s to the 1990s. It is rooted in organizational learning and its development is based on the evolution of management thoughts over the past few years. The rise of this concept pays attention to the effectiveness of teamwork and group learning among members. The enterprise is a learning organization. The organization continuously uses a single-loop learning cycle and a two-loop learning cycle to operate within the organization, progressive learning, and adjust with the evolution of the mission and competitive environment of the enterprise. In view of the significance of learning organizations, many scholars have discussed and put forward many different views. Peter Senge believes that “learning organizations” can continuously expand the ability of individuals in the organization, create truly satisfactory results, and foster new ones. And the malleable thinking style enables a shared vision to be realized, and members continue to learn how to learn together. Organizational management is to establish organizational structure, stipulate positions or positions, and clarify the relationship of rights and responsibilities, in order to play the role of the organization and accomplish the goals of the organization. In the organizational structure, the "members of the organization" are considered to be the users of the resources, and have the actual status and role. Therefore, the corporate culture is

valued by the managers of the company and plays an important role in the management of the company.

Systematic thinking about a practice of "seeing the whole", it is a framework that allows us to see interrelated rather than single events, with a causal feedback loop and time delay as the dynamic whole of the structure, the first step of thinking, It is necessary to expand the scope of time and space of thinking, and then to think in the system in which it operates, to expand the space and time of thinking of the individual, and to identify the subtle characteristics of its overall operation. Therefore, in the face of rapid response, companies must constantly review the core of internal value to respond instantly to strategic partners and customer needs, enhance competitiveness, commit to innovative services, improve quality, streamline processes, and reduce costs..

2 Literature reference

In recent years, the implementation of project management has been very fast, and it is one of the most common modes of work in most enterprises. The project management infrastructure operation method is (starting, planning, executing, monitoring, and closing five processes), and selecting tools suitable for the characteristics of the enterprise for each process, specifically, time, cost, resources, and target categories. Under the constraints, to complete the work of the established mission, and the results of the operation, naturally directly affect the competitiveness of the enterprise, to help the company achieve its goal of success. The project organization is a cross-functional team composed of executive and completion projects. Its members come from inside and outside the organization and are composed of different departments. Through horizontal cooperation, the technology of each department is integrated to reduce the level of decision-making. Make communication between related work orders smoother..

According to Kerzner's (1984) definition, the so-called project management is to plan, organize, control, and use resources to engage in relatively short-term work to achieve a clear work goal, and to manage the system in different ways. Assigned to the relevant project work. Yazici (2009) studies project management maturity and organizational performance, and organizational culture is an important key to the success of the project. Meredith & Mantel (1989) argues that a project is a special and limited task, technically complex, and continually coordinated to control schedules, processes, costs, and job performance. Project management is the application of knowledge, skills and technology to make project execution more efficient and effective, and to use organizational strategy to achieve business goals and to be more competitive in the market. Huang Zhengwei (2010) knowledge management resources have significantly improved the performance of innovation after the impact of project management capabilities. Xu Xiuying (2015) pursues the success of all projects, depending on the overall maturity of the project's project management. The high maturity means that most projects can accurately estimate the project schedule and cost, and can grasp the scope and quality of the project and achieve the expected goals. The results of the project bring the highest value to the

organization. Yazici (2009) studies project management maturity and organizational performance, and organizational culture is an important key to the success of the project.

3 Establishment of supplier performance evaluation model

3.1 Understand the overall performance of the job and the problem

This research question will first find out the past literature and grasp the phenomenon neglected in the execution of the recruitment process, and combine the system thinking mode to construct a research tool graphically, and use the causal feedback loop diagram to understand the past to find hidden key problems. The misperception of each link in each process, and the problems caused by a series of changes in the loop, followed by the results of the questionnaire, field case interviews and loop diagram analysis, and detailed enough deep mental and thinking to explore the recruitment The dynamic problem of complexity in execution and the overall thinking management strategy.

Constructing the Causal Loop Diagram (CLD) of "causal feedback and loop diagram" in the overall thinking mode of System Thinking, showing the influence of each behavioral element in dynamic change over time, and literature The discussion suggests that a systematic thinking model can influence each behavior and give back to each other, which will help to understand the dynamic behavior of the entire recruitment project. Because of the close interrelationship, it can be deeply understood. The overall operation and problems of the operation are carried out. Systematic thinking methods are used to find out the causes and solutions of the problems, and avoid the researchers' influence on the objectivity with their own ideas and opinions. Through this model, they can find the problems and feasible solutions..

This research survey method is conducted by the head office of the law collection and participates in the questionnaire survey of recruitment routines and project executives. It also conducts the same questionnaire survey of the branch business department co-organizers to understand their opinions and suggestions on recruitment and implementation. As a measure of comparison. The case study asks mainly to understand the current situation of the research object, and then conduct a preliminary analysis of the review and data collation, and thoroughly examine and ignore the existing problems and solve the improvement management strategy.

Interviews with specific people (department supervisors), through interviews with each other, to learn more about the causal development process, phenomena, and even undiscovered issues behind the specific project execution situation.

3.2 System Dynamics

1. System Dynamics Modeling Analysis Software Tool

This study uses Vensim's modeling software tool to build a dynamic model using Vensim. Through the graphical use of arrow symbols to connect various variable symbols, in the process of building a model in software, we can understand the causal relationship between input and transmission. Understand the schema architecture,

supplement the content and modify the content of the schema. System dynamics is a process of simulating internal feedback through the system, and observing how the system structure, policies, delays and other factors interact to affect the growth and stability of the system.

2. This research model is established and the program

Proposing a meaningful and worthwhile research and research is the beginning of research work. Identifying research problems or problem formulation is an important step. Researchers can explore the problems that can be studied according to their own observations or experiences; and through careful reference to relevant literature and reference experts and scholars, they will put forward the issues they want to study. (2005, Li Zenglu)

3. Dynamic planning assumptions (problem assumptions)

This study takes the hypothesis of the problem, using the Venusim software to construct the system dynamics, first based on the actual situation to create a causal feedback loop diagram for analysis, and then further identify to find the most critical issues, and related factors between each other The dynamic and complex characteristics under the interlocking relationship begin with the keyword word: (project, labor increase, time delay, overtime, error rate), and then think about the topic analysis. Therefore, this study uses Vensim to establish a dynamic model. Through the process of building a model, we can understand the causal relationship and loop between variables. In the causal relationship of project execution, find out the root cause of the original problem and think about finding the best countermeasure. , effectively solve the problem.

4 Analysis and Findings

Based on the learning organization and systematic thinking, this study identified 10 influencing factors and 10 improvement strategies. The following are the following:

1. Influencing factors:

- (1) Increase in the rate of heavy work and increase costs
- (2) Increased labor demand, resulting in work fatigue
- (3) The shortage of manpower is heavy, and the work assignment cannot be properly scheduled.
- (4) The time for supervisor communication is small, lack of listening, resulting in communication suspension, team morale is low, work enthusiasm
- (5) Talents are broken, and the company's talents cannot find suitable employees, resulting in a rising rate of work.
- (6) Increased overtime frequency, resulting in fatigue
- (7) Routine workload, time compression and rush, work without quality and efficiency, work and life imbalance.
- (8) Poor work atmosphere, affecting work efficiency
- (9) Annual budget preparation, affecting the implementation plan
- (10) The equipment is too old, the work is too cumbersome, the efficiency is poor, the execution is limited, and the quality is not good.

2. Improve strategy :

- (1) Equipment update, reduction of operations, improvement of work execution quality
- (2) Increase in the number of new students' courses and guidance
- (3) Mutual activities (physical and mental stress), employee benefits
- (4) Improve the quality of personnel, strengthen skills training and professional knowledge, and improve performance growth or competitiveness.
- (5) Reduce the chances of heavy work and ensure that the target is in line with the direction.
- (6) Increase (submerge) manpower to solve the problem of the unit's business volume and increasing threats, uneven work and rest.
- (7) Leaders care, get the approval and care of the supervisor, and the employees are focused on the organization.
- (8) Improvement of work environment quality and reasonable working environment to reduce labor fatigue and pressure
- (9) Reduce the number of overtimes, and the error rate will not occur.
- (10) Budgeting is more efficient to achieve the goal.

5 Conclusions

According to the research results, the reasons for the difficulties in the execution of the project in the manpower recruitment system are summarized into two categories, as follows:

(1) Organizational system level

The code of conduct, business philosophy and corporate culture that must be observed in the organizational system of the enterprise will affect the ideas and behaviors of employees. Competition in the environment, continuous innovation of the company, more and more employees work, everyone is under heavy time pressure, and in the case of manpower, it may need to be supported by other departments or other units. The concept of support for colleagues is not consistent, and the leader indicates that the implementation target is not clear enough, so that the work is repeated again and again, and the situation of uneven workload distribution may occur. The enthusiasm is repeatedly exhausted by excessive working hours, resulting in excessive fatigue of employees. Morale is reduced. Therefore, in the implementation, only the command can be repeated, and the personnel of each unit should be required to cooperate. The members cannot interact closely, which may delay the implementation of the project and may not be promoted smoothly.

(2) Project management issues

Successful projects require a complete management approach and processes, and carefully manage members, budgets, resources, and ensure that projects are completed before the deadline. From the case study project analysis, we can also learn that the lack of manpower for the implementation of the unit project and the high workload have led to each person having to work in multiple roles or to fight alone. Other support manpower has no project experience and it is difficult to control the project's work objectives,

content and progress, and it is impossible to achieve the goal within the specified time. Therefore, when the work item often fails, it needs to be re-started, resulting in the failure of the work to be completed smoothly.

References

- French, W. (1993). *Human Resources Management*. 3rd ed. MA.: Houghton Mifflin Co.
- Kofman, Fred, (2006). *Conscious Business: How to Build Value Through Values*,
- Schein, E. H. (1996). "Three cultures of management: The key to organizational
- Ryan, A. M., & Polyhart, R. E. (2000). Applicants' perceptions of selection procedures and decisions: A critical review and agenda for the future. *Journal of Management*, 26, 3, 565-606.
- Bies, R. J., & Moag, J. S. (1986), Interactional justice: Communication criteria for fairness. In B. Sheppard (Ed.), *Research in organizational behavior*, 9, 289–319. Greenwich, CT: JAI Press.
- Stephen P. Robbins (1998). *Essentials of Organizational Behavior*, Organization Structure, 194-210
- Katz, D. & Kahn, R. L. (1978). *The social psychology of organizations*. New York: Wiley.
- Mintzberg Henry, *The Structuring of Organizations: A synthesis of the Research*, Englewood Cliffs, N. J. : Prentice-Hall, pp. 466-71, 1979.
- Mintzberg Henry, "The Effective Organization: Forces and Forms", *Sloan Management Review*, pp. 771-789, Winter 1991.
- Daf t, R. L. (1995). *Organizational theory and design*. New York: West.
- Kluckhohn, Clyde (1962), Values and value-orientations in the theory of action: An exploration in definition and classification, in T. Parsons & E. Shils Eds., *toward a general theory of action*, N. Y.: Harper.

Succession and Cultivation of Successors in SMEs in Taiwan

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Abstract

Small and medium-sized enterprises (SMEs) provided economic benefits with Taiwan Economic boom. When SMEs faced the daunting challenge of external environment, successors of SMEs brought opportunities for creativity and innovation, but SMEs also had undergone enormous change. In Taiwan, most of SMEs were at crisis points in the succession and struggled to survive. The purpose of this study was to point out key factors of succession and cultivation of successors in SMEs. We used Delphi technique to select dimensions and criteria. When we found out dimensions and criteria, we used DEMATEL and AHP in the future to find their mutual influence degree and weighted value of key factors of succession and cultivation of successors in SMEs. We could provide this study for owners to make decisions about succession and cultivation strategies to enhance the ability and skill of successors and his performance.

Relevant researches pointed out that 53% SMEs in Taiwan were sole proprietor companies, 51% SMEs in Taiwan operated more than ten years, 53% owners of SMEs in Taiwan were over 50 years of age, but only 40% SMEs in Taiwan had succession plans. Many family businesses operated by successors reported heavy losses in Taiwan. Owners of SMEs were key factors in the initiation of succession. When owners created favorable environments for successors, and successors who made good use of knowledge and skills received social resources from owners and the companies achieved the goal of sustainable development.

This study used Delphi technique. From literature on the exploration into SMEs, owners, successors, succession and cultivation plans, and by initial interviews with two experts, we got initial dimensions and criteria. Then we chose a group of experts in this topic, and wanted anonymous experts to fill in open-ended questionnaires which we designed by using initial dimensions and criteria. According to results of first questionnaires, we set up agreed thresholds of anonymous experts. If anonymous experts reached a consensus, we got the most important dimensions and criteria. If anonymous experts failed to reach a consensus, we modified the questionnaires, and anonymous experts filled in closed questionnaires again until they reached a consensus.

This study was limited by the scope of research, research samples, data sources, and research methods, but it was expected to contribute to the key factors of succession and cultivation of successors and systematic analysis techniques for owners of SMEs to train successors.

Keywords –Small and medium-sized enterprises (SMEs), Successors, Delphi technique.

Paper type –Practical paper

1 Introduction

Small and medium-sized enterprises (SMEs) provided economic benefits with Taiwan Economic boom. SMEs stabilize the country's economic development, and create a large number of employment opportunities. When SMEs faced the daunting challenges of external environment such as globalization and the advance of science and technology, successors of SMEs brought opportunities for creativity and innovation (Kesner and Sebra, 1994; Mone, McKinley, and Barker III, 1998), but SMEs also had undergone enormous change in the structure, corporate culture, internal employee relations, and so on. Senior staff must change their mind to adapt to new environments, or they will be eliminated. Let's assume that the generation of an enterprise is 30 years, the average age of Taiwanese SMEs is 28 years, and Taiwanese SMEs are facing a large-scale succession. If owners of SME have suitable successors who can forecast trends of future, stay one step ahead of competitors, promote the upgradation and transformation of industry, and carry out diversified development of enterprises, successors of the enterprises become key indicators of the enterprises to overcome the challenges.

Family businesses account for about 75 percent of the entire global enterprises and also make up more than 73 percent of Taiwanese SMEs. Only 39.61 percent of Taiwan's enterprises have succession plans, and among them, 86.52 percent of owners divided the enterprises among his generations, 11.35 percent of owners handed over the enterprises to professional managers, and only 2.13 percent of owners sold the company. The succession of family business is a formidable challenge (Sharma and Irving, 2005). Some studies pointed out that 30 percent of companies could be transferred from the first generation to the second generation, 12 percent of companies could be successfully transferred to the third generation, but only 3 percent of companies could be passed down from generation to generation. Even though companies complete their succession plans, companies usually execute succession plans within a fairly long time frame, and there is a slight chance to succeed. 53.71 percent of Taiwanese SMEs are wholly-owned enterprises. If the company does not have succession plans in advance and successors take over companies in an emergency, companies are easily in crisis. Therefore, this study hopes to solve the succession crisis faced by Taiwanese SMEs. How to choose successors and cultivate successors as suitable successors for Taiwanese SMEs is a very important issue, and is an important driving force for the sustainable development and successful transformation into global enterprises (Lauterbach, Vu, and Weisberg, 1999).

The purposes of this study are as follows: First, there is literature on the steps and processes of SMEs' succession planning, or how to start succession planning in the past. This research is aimed at how business owners choose the company's successors to achieve the company's goals of sustainable development. Second, through qualitative interviews and quantitative analysis, we find out the dimensions and criteria between the key factors for selecting successors. Third, this study provides business owners with the methods how to choose and cultivate suitable successors. Business owners can improve the ability of successors from certain dimensions, or establish a set of priorities to enhance the ability of successors in order to improve the performance of the business.

2 Literature Review

There are 9 foreign studies among 15 researches on Taiwanese SMEs. White Paper on Small and Medium Enterprises in Taiwan (2018) pointed out that sole proprietor companies account for about 53 percent of Taiwanese SMEs, companies whose operation years more than 10 years account for 51 percent of Taiwanese SMEs, and companies whose owners' age older than 50 years old account for 53 percent of Taiwanese SMEs, but only 40 percent of Taiwanese SMEs have succession plans.

There are 8 foreign studies among 15 researches on successors of companies. The first generations of business owners who were born after 1945 have already handed over companies to the second generations, and these companies are cultivating the third or fourth generations. But Family governance review pointed out that family business which operated by the third generation in Taiwan reported heavy losses. A key factor for successors to undertake companies successfully is the attitude of business owners (De Massis, Sieger, Chua, Vismara, 2016).

There are 13 foreign studies among 21 researches on cultivating successors. Distelberg and Schwarz (2013) suggested that business owner should create favorable environments for successors who can undertake the social resources from business owners and make good use of knowledge and skills in order for sustainable development. There are four steps for Taiwanese business to select successors, including confirmation of candidates, development of educational plans, regular assessment, and promotion (Jin-Chang Zheng, 2015).

Some studies have conducted a career analysis of 100 CEOs, pointing out that business owners will pay attention to the accumulation of human capital of successors. For example, before choosing a successor, business owners will first confirm that the successor's character, ability, experience and interpersonal relationship meet their expectations. (Salvato, Minichilli, and Piccarreta, 2012). According to factors such as the degree of trust of business owners to successors (Brockhaus, 2004), the succession and performance of successors (Brun de Pontet, Wrosch, Gagne, 2007), the successor's willingness to take over the business (Sharma, Chrisman, and Chua 2003), business owners can choose the most suitable successors. After business owners transfer the control and ownership to the successors, in order to avoid the drastic changes of the business and affect the operation of the business, business owners will guide successors to ensure that successors can take over the responsibility (Distelberg and Schwarz, 2013).

3 Research Methodology

3.1 *The development background of Delphi method*

The word "Delphi" is derived from the temple of the ancient Greek god Apollo. It is the place where the gods of the future can be foreseen. The gods of "Delphi" have the meaning of prophecy and prediction. In the early 1950s, the RAND Corporation provided intelligence analysis services to the US military. The development of Delphi Technique

helped the military to develop a strategic plan for the Soviet Union. Later, that was applied to other fields, and it was used by industry, business, academics, and government agencies to evaluate matters.

3.2 The characteristics of Delphi method

1. Anonymity: Experts can freely express their opinions.
2. Iteration: The questionnaire is rounded back and forth several times. After the second questionnaire, experts can use the statistical data to correct their opinions.
3. Feedback: Experts can be modified by other experts to correct their own views.
4. Statistics: The final expert opinions are presented in a statistical manner, providing a ranking, selection or optimization of the evaluation criteria.

3.3 The implementation steps of Delphi method

The implementation steps of Delphi method are as follows:

Step 1: Set the goal and find out the possible dimensions and criteria.

From the literature, we sort out and summarize the dimensions and criteria that others have done.

Step 2: Pick the right team of experts.

The selection of the expert group is the primary task of the Delphi method, in order to make the research more forward-looking and accurate.

Step 3: The selected dimensions and criteria are open or semi-structured. We ask the anonymous experts to fill in the first questionnaire, and evaluate the importance or fill in other opinions according to the scale.

Step 4: Set the threshold based on the initial results. (e.g. 80% of the experts agree.)

(1) If there is consensus, the goal is achieved.

(2) If there is no consensus in part, they fill in the second questionnaire.

3.4 The purpose of applying Delphi method in this research

This research starts from defining the problem formulation and research purpose. As literature has suggested, we find out several relevant dimensions and criteria for SMEs choosing successors. We use the Delphi method (1950) to invite experts in the case of unknowns to provide their professional knowledge and experience to reach their consensus on the important dimensions and criteria for SMEs to choose successors. Delphi method (Gordon and Helmer, 1964; Gupta and Clarke, 1996) uses a series of systematic questionnaires to consult experts and scholars whose specialization on research issues. In the case of anonymity, we conduct a number of questionnaires to find out results that experts reach their consensus (Dalkey and Helmer, 1963; Hartman, 1981). This method will decompose complex key factors of SMEs choosing the successors into two-tier structural hierarchy (as shown in Figure 1.), so decision makers of companies can easily and clearly analysis factors of choosing successors. Through questionnaires and interviews with five experts and scholars getting their opinions, this

research finds out several dimensions and criteria for Taiwanese SMEs choosing successors and makes some very helpful suggestions for Taiwanese SMEs.

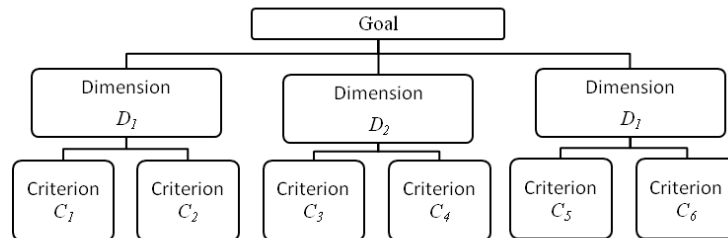


Figure 1. Two-tier structural hierarchy

4 Research Results

4.1 The analysis process

First, we obtained several dimensions and criteria from the literature and interviews. We build the research model of dimensions and criteria in the Table 1.

Table 1. Research model of dimensions and criteria

dimension	criterion
(D ₁) Professional ability	(C ₁)Strategic orientation (C ₂)Financial management ability (C ₃)Insight (C ₄)Crisis management ability (C ₅)Interpersonal communication skills (C ₆)Logical ability (C ₇)Professional technology (C ₈)Business expertise (C ₉)Education (C ₁₀)Foreign language ability (C ₁₁)Performance (C ₁₂)Industry experience (C ₁₃)Interpersonal relationship management
(D ₂) Values	(C ₁₄)Follow strong moral values (C ₁₅)Corporate culture values and strategic continuity (C ₁₆)Inheriting clear corporate core values (C ₁₇)Family tradition or previous generation of value-oriented leadership (C ₁₈)Have a recognition of the organization (C ₁₉)Have a sense of mission
(D ₃) Potential	(C ₂₀)Act decisive (C ₂₁)Positive (C ₂₂)Ability to change, learn and grow (C ₂₃)Thinking (C ₂₄)Diligent and responsible (C ₂₅)Extroverted, ambitious, persevering (C ₂₆)Affinity, cooperation (C ₂₇)Adaptability (C ₂₈)Leadership trait (C ₂₉)High EQ (C ₃₀)Active, open, curiosity

Second, we made these dimensions and criteria into a questionnaire and then asked five experts to fill it out. The content of the questionnaire contains whether the experts agree with the criterion under the dimension, and what do the experts think about the importance of the criterion under the dimension? The scale of importance is from one to five. The “1” (one) means “extremely unimportant”. The “2” (two) means “unimportant”. The “3” (three) means “ordinary”. The “4” (four) means “important”. The “5” (five) means “extremely important”.

Third, we received the questionnaires. We set the threshold of the agreement of 80% of the experts on the initial results. Because the experts reach a consensus, our research has achieved its goals. (See the (1) in the Table 2.)

Forth, we calculated the average of the scale of importance about the criterion in the dimension and then ranked them. We have the result in the (2) and (3) of the Table 2.

Table 2. The result of dimension and criterion.

Dimension	Criterion	Agreed number (1)	Average of the scale(2)	Rank (3)
(D ₁) Professional ability	(C ₁)Strategic orientation	5	4.8	2
	(C ₂)Financial management ability	5	4.2	9
	(C ₃)Insight	5	4.8	2
	(C ₄)Crisis management ability	5	4.8	2
	(C ₅)Interpersonal communication skills	5	4.7	6
	(C ₆)Logical ability	5	5	1
	(C ₇)Professional technology	4	3.8	12
	(C ₈)Business expertise	5	4.8	2
	(C ₉)Education	4	3	13
	(C ₁₀)Foreign language ability	4	4.2	9
	(C ₁₁)Performance	4	4.3	7
	(C ₁₂)Industry experience	4	4	11
	(C ₁₃)Interpersonal relationship management	4	4.3	7
(D ₂) Values	(C ₁₄)Follow strong moral values	5	4.8	1
	(C ₁₅)Corporate culture values and strategic continuity	5	4.5	5
	(C ₁₆)Inheriting clear corporate core values	5	4.6	4
	(C ₁₇)Family tradition or previous generation of value-oriented leadership	4	3.5	6
	(C ₁₈)Have a recognition of the organization	5	4.8	1
	(C ₁₉)Have a sense of mission	4	4.7	3
(D ₃) Potential	(C ₂₀)Act decisive	5	4.8	4
	(C ₂₁)Positive	5	5	1
	(C ₂₂)Ability to change, learn and grow	5	5	1
	(C ₂₃)Thinking	5	4.5	6
	(C ₂₄)Diligent and responsible	5	4.3	9
	(C ₂₅)Extroverted, ambitious, persevering	4	4.3	9
	(C ₂₆)Affinity, cooperation	5	4.5	6
	(C ₂₇)Adaptability	5	4.8	4
	(C ₂₈)Leadership trait	5	5	1
	(C ₂₉)High EQ	5	4.5	6
	(C ₃₀)Active, open, curiosity	5	4.3	9

4.2 The results

We screened the top 25% as a result for this research. (See the Table 3.)

Table 3. The result for this research

Dimension	Criterion	Agreed number (1)	Average of the scale(2)	Rank(3)
(D ₁) Professional ability	(C ₁)Strategic orientation	5	4.8	2
	(C ₃)Insight	5	4.8	2
	(C ₄)Crisis management ability	5	4.8	2
	(C ₆)Logical ability	5	5	1
	(C ₈)Business expertise	5	4.8	2
(D ₂) Values	(C ₁₄)Follow strong moral values	5	4.8	1
	(C ₁₈)Have a recognition of the organization	5	4.8	1
(D ₃) Potential	(C ₂₁)Positive	5	5	1
	(C ₂₂)Ability to change, learn and grow	5	5	1
	(C ₂₈)Leadership trait	5	5	1

The objective of this research is to explore the key influencing factors of successor's selection for Taiwanese SMEs. Using literature review and expert interviews, we find out three major dimensions, including professional competence, values, and potential. The dimension of professional competence can decompose into thirty criteria. The dimension of value can decompose into six criteria. The dimension of potential can decompose into eleven criteria. We use the Delphi method to invite five experts in the case of unknowns to provide their professional opinions by questionnaires. According to the Delphi method, with the consent of 80 percent of the experts, we reserve the top quartile for options, so we can get the three dimensions and ten criteria. We can see the research model in Figure 2. The dimension of professional competence includes five criteria, such as strategic orientation, insight, crisis management ability, logical ability, and business expertise. The dimension of value includes two criteria, such as strong moral values and recognition of the organization. The dimension of potential includes three criteria, such as positive, leadership trait, and ability to change, learn and grow. It is useful for business owners to cultivate successors from these ten criteria.

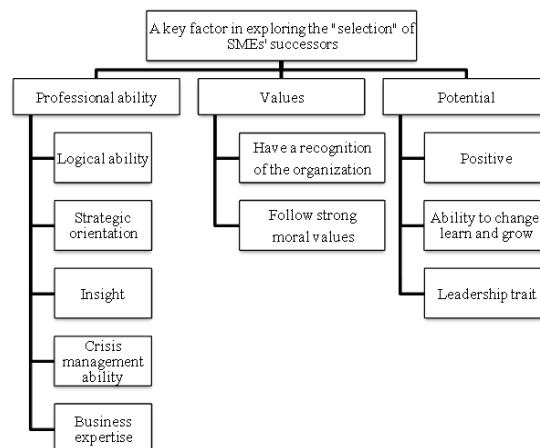


Figure 2: Research model

5 Research limits

This research is still limited by the following three limitations:

(1) A limit on scope

This research is mainly aimed at Taiwanese SMEs or experts in related fields to explore the key factors of choosing successors for business owners. Because each of the industries has the different characteristic, management model and products, the results of this study may not be applicable to all industries. Researchers can conduct follow-up studies in the future.

(2) Limits on research samples and data sources

With limited resources, samples of this research are limited to the business owners who are carrying out succession plans or who have completed successful succession to the companies in Taiwanese SMEs. Because of case interviews in this research, not random interviews or statistical sampling, we can view issues from different angles, solutions may become more obvious.

(3) Limitations of the research methodology itself

This research uses Delphi method which has limits on methodology itself. For example, when using the Delphi method, we sometimes may not get the general consensus among experts. It depends on the ratio of experts' consensus. Therefore, this research focus on screening out and analyzing key factors of successors in a systematic way, and understanding mutual influence relationship and weight of key factors to provide the dimensions and criteria for business owners to select and cultivate successors.

6 Expected contribution

This research have the following contributions to SMEs:

(1) After expert interviews, literature review and decision-making questionnaire analysis, we systematically collect, collate and analyze the experience and knowledge of experts to identify key factors of successors.

(2) This research constructs a hierarchical evaluation model to select successors for Taiwanese SMEs to select the successor as reference.

(3) This research provides Taiwanese SMEs which need succession plans. Companies select suitable successors and start to train them efficiently as soon as possible in order to achieve sustainable development for Taiwanese SMEs.

(4) After confirming successors, business owners find out criteria which are the weakness for successors and ask successors to improve their abilities in order to improve performances.

7 Conclusions

There are a large number of SMEs in Taiwan and significant differences between SMEs. No one has solved the problem of how to screen out unsuitable candidates and cultivate successors for Taiwanese SMEs. At present, there is no practical research for

Taiwanese SMEs to refer to. Therefore, how to choose and cultivate suitable successors for Taiwanese SMEs is especially worthy of notice. This study uses the Delphi method to construct the decision-making model of screening successors for Taiwanese SMEs and propose several dimensions and criteria that companies can use to improve the ability of successors, and assist companies in establishing methods for assessing and coaching successors. The later researchers will use the other research methods, such as DEMATEL (Decision-Making Trial and Evaluation Laboratory) (Tzeng and Shen, 2017) or AHP (Analytic Hierarchy Process) (Saaty, 1980, 2008), to find out the mutual influence relationship or the weight ratio between the dimensions or the criteria.

If business owners can create fruitful environments for successors to inherit, and successors are also trained and able to take responsibility, succession plans can introduce new thoughts for the company (Tirdasari and Dhewanto, 2012). Successors must successfully undertake the social networks and other resources from business owners, and make good use of management knowledge and business skills to lead the company to sustainable operation.

References

- Brockhaus, R. H. (2004). Family business succession: Suggestions for future research. *Family Business Review*, 17(2), 165-177.
- Brun de Pontet, S., Wrosch, C., & Gagne, M. (2007). An exploration of the generational differences in levels of control held among family businesses approaching succession. *Family Business Review*, 20(4), 337-354.
- Davis, P. S. & Harveston, P. D. (1963). The phenomenon of substantive conflict in the family firm: A cross-generational study. *Journal of Small Business Management*, 39(1), 14-30.
- De Massis, A., Sieger, P., Chua, J. H., & Vismara, S. (2016). Incumbents' Attitude Toward Intrafamily Succession: An Investigation of Its Antecedents. *Family Business Review*, 29(3), 278-300.
- Distelberg, B. J., & Schwarz, T. V. (2013). Mentoring across family-owned businesses. *Family Business Review*, 28(3), 193-210.
- Gordon, T. J. & Helmer, O. (1964). Report on a long-range forecasting study [Online]. Available: <https://www.rand.org/content/dam/rand/pubs/papers/2005/P2982.pdf> [1964, January 1].
- Gupta, U. G., & Clarke, R. E. (1996). Theory and applications of the Delphi technique: A bibliography (1975-1994). *Technological Forecasting and Social Change*, 53(2), 185-211.
- Hartmann, H. (1981). The Family as the Locus of Gender, Class, and Political Struggle: The Example of Housework. *Signs*, 6(3), 366-394.
- Jin-Chang Zheng (2015), Talent Management Strategy: The key business technology that determines a company's long-term prosperity or short-term success, Taipei: capitalized publishing.
- Kesner, I. F., & Sebor, T. C. (1994). Executive succession: Past, present and future. *Journal of Management*, 20(2), 327-372.
- Lauterbach, B., Vu, J. & Weisberg, J. (1999). Internal vs. external successions and their effect on firm performance. *Human Relations*, 52(12), 1485-1504.
- Mone, M. A., McKinley, W., & Barker III, V. L. (1998). Organizational decline and innovation: A contingency framework. *The Academy of Management Review*, 23(1), 115-132.
- Printed by the Ministry of Economic Affairs of the Ministry of Economic Affairs (2018), White Paper on SMEs in 2018, Taipei: issued by the Ministry of Economic Affairs.

- Saaty, T. L. (1980). The analytic hierarchy process. New York: McGraw-Hill.
- Saaty, T. L. (2008). Decision making with the analytic hierarchy process. *International Journal of Services Sciences*, 1(1), 83-98.
- Salvato, C., Minichilli, A., & Piccarreta, R. (2012) . Faster route to the CEO suite: Nepotism or managerial proficiency? *Family Business Review*, 25(2) , 206-224.
- Sharma, P., & Irving, P. G. (2005). Four bases of family business successor commitment: Antecedents and consequences. *Entrepreneurship Theory and Practice*, 29(1), 13-33.
- Sharma, P., Chrisman, J. J., & Chua, J. H. (2003) . Succession planning as planned behavior: Some empirical results. *Family Business Review*, 16(1) , 1-15.
- Tirdasari, N. L., & Dhewanto, W. (2012). Family business succession in Indonesia: A study of hospitality industry. *Procedia-Social and Behavioral Sciences*, 57, 69-74.
- Tzeng, G. H., & Shen, K. Y. (2017). New concepts and trends of hybrid multiple criteria decision making. UK : CRC Press.

The Research of Leadership Style and Learning Organizational Culture in Furniture Industry

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Abstract

In a rapidly changing world of technology, organizations need forward-thinking and insightful leaders to lead the team. Leaders can plan their vision and drive others to act, lead the organization with a positive and enthusiastic attitude, personal intuition, vision, and enthusiasm, in accordance to market trends and adapt to environmental dynamics, adjust the pace at any time., facing upcoming risk, can still hold confidence, lead the organization to move forward during uncertain times, to obtain richness and mind. Leaders expect organizations to be sustainable, so they will continue to innovate and integrate into learning organization culture, so that each member can transcend their own abilities, thinking complexity from a more comprehensive perspective point of view, and examine their own mental models. Change the original deep-rooted, share the views through deep talks, learn how to learn together, so the learning culture of the organization is considered to be a key element of business success. Take imported furniture company as an example, whether it is manufacturing for export or import for domestic sales, as it is transparent to the Internet, it faces a global market. The industrial environment is quite complicated and people's buying habits is now more different than past and more diversified. The furniture industry has been caught in a fierce price war. In order to maintain and develop unique core competitive advantages and attract consumers' attention, imported furniture companies must not only pay attention to international industry trends and fashion trends, but also provide diversified choices and innovative services in today's dynamic and complex world. To make effective decisions, you must first become a system thinker.

Therefore, outstanding leaders can lead the team with macro-thinking, so that the organization can not only continue to learn but also integrate the "collective learning" atmosphere into the organization, breaking through the growth limitation and bottlenecks.

In this study, The interview case was imported from Y Furniture Company and conducted by face-to-face interview. After observation and preliminary interview, the system based model was used as the theoretical basis, and the system thinking mode was used to draw the case system feed-back. Explore the leader-ship style of the case to assist enterprernure to convert their strategic thinking into a more wide open mind for the future of the company and come to operation model compliance and provide enterprise a reference to establish continuous learning organization culture.

Keywords –Leadership Style、Learning Organization、System thinking

1 Introduction

In today's fierce competition in the corporate environment, but also full of opportunities, leaders must play the role of pioneers on the road of changeable and unclear prospects. They don't only have good interpersonal relationships, but also need to promote cooperation, build effective teams, create an atmosphere that can play the potential of the organization, and lead the organization to climb to the peak, which is very important for organizational accomplishment. By James M. Kouzes & Barry Z. Posner, 《The Leadership Challenge》 propose that outstanding leaders must lead by example, clarify their own values, lead the organization with conviction, reform and innovation from continuous experimentation, continuous learning and progress, and understand the members and strive for their support to outline the blueprint for the future, and encourage others to act and build mutual trust. In a complex environment beyond human control, a person who evokes a shared vision and who can contribute to the organization's goals, sincerely and publicly praises, can consolidate the collective identity and community consciousness, and walk through the thorns of thorns.

By American scholar Peter M. Senge《The Fifth Discipline》It is believed that the establishment of a learning organization will be the best strategy for obtaining a competitive advantage. In this book, he proposes the management concept of a learning organization, which is characterized by rapid changes and threats in response to the external environment. Not only the ability to learn among the members of the organization, but also to learn together, share common values, develop a forward-thinking thinking model and work towards a shared vision. Therefore, in addition to the need to develop a flexible corporate strategy, leaders must also pay attention to the value of learning in the organization, and encourage the formation of a self-growth learning organization culture, so that enable each member of the organization to continually create new knowledge from work, learn from mistakes, and share what they have learned, and thus improving organizational performance and employee identification, can not only maintain the competitive advantage of the company, resolve the recession crisis, but also continue to open up the global market to achieve a common vision mission.

However, at this fast pace, it is possible to seize the business opportunities in the digital age, corporate organizations to adapt to environmental changes, continue to proliferate and grow rapidly, but unconsciously slow down, pause, or even decline, this is the "Limits to Growth" in learning organizations; Also because growth begins to slow down, leaders or high-level managers intervene directly in order to quickly resolve member errors or problems, so that members can not learn from mistakes, in addition to causing the same mistakes or problems may occur again and again, and also make members Long-term reliance on leaders or high-level managers, causing partial disability, this is the "Shifting the Burden " in learning organizations, What is worrying is that "Shifting the Burden" is accelerating the phenomenon of Limits to Growth in the organizational system, but the leader or senior manager does not know. Therefore, when leaders or senior managers do not understand the overall operation of the organization from a macro perspective, they may encounter various constraints and bottlenecks.

Therefore, the spirit of the learning organization is to help leaders or senior managers to use deeper thinking in a systematic way. A broader mindset examines the complexity issue so that the crux of the problem can be identified.

2 Research Background

Furniture has always played an important role in human life. In 1992, the average national income exceeded 10,000 US dollars. Under this rapid economic growth, the level of consumption has been continuously improved, and the comfort and exquisiteness of life have become more and more stressful, and the imported furniture market has gradually expanded.

Taking the furniture industry as an example, Taiwan's early furniture industry was originally a traditional industry. Before 1956, the furniture manufacturing and sales model was the front of the business, and the manufacturing plant was behind, saving transportation costs. After 1980, due to the development of the country's economy, the urban land was inundated, and the majority of factories gradually declined. The current furniture industry is mostly separated by production and sales. When the society begins to be rich, the people's living ,For Taiwan, which is based on foundry, in order to respond to the aggression from European and American brands, it is also actively transforming the domestic market through design innovation. However, with the advancement of technology, the transparency of online information, online stores have joined the battle, consumption patterns and never the same in the past, In order to be able to continue to be the leader in the furniture industry, whether it is furniture manufacturing or importing furniture, it is necessary to continuously develop new markets. The customers and manufacturers facing the world are more complicated, so the furniture industry practitioners Professional skills must be continuously improved and continuous learning.

This case takes the case of imported furniture company as an example, discusses leadership style and learning organization, assists leaders and high-level managers to change their thinking to think more about the future direction of the company and formulate strategies in line with the business operation mode. Explore the leadership style of case companies and the construction of learning organization culture.

3 Reserch Approach

3.1 System Theory of Rreserch

From a country, a company, a family, or even any body, it is inevitable to belong to an interdependent ecosystem. All behavioral activities are inevitably affected by the system in which each other is active. Understand the ins and outs of the overall event, and from a systemic perspective, you can have a more comprehensive insight into the root of the problem. For a complex and rapidly changing industry environment, systematic thinking for understanding dynamic complexity is a must-have core competency for leaders and supervisors.

The study interviewed the personnel of Y Import Furniture Company, based on the theory of system thinking and the current situation of the researchers through long-term observation. Conducting preliminary interviews with some supervisors and grassroots personnel in a non-structural conversation. According to the interview, the company has the phenomenon of "Limits to Growth" and "Shifting the Burden" system. Therefore, based on these two theories, the causal feedback loop graph model belonging to the case reality is drawn. The "Limits to Growth" fundamental model consists of three continuously enhanced loops and an adjustment loop. The "Shifting the Burden" model is exacerbating the regulation loop. Understand dynamic feedback relationships and design expert interview questionnaires for each variable. After collecting interview records and related company data and literature, analyze the leadership style to explore how to establish and influence the learning organization culture to explore its relevance. Hope that by systematically thinking about the theoretical basis, we will provide companies with an organizational culture of continuous learning. Leaders and department heads can avoid "Shifting the Burden" and break through the "Limits to Growth" reference proposal to achieve a sustainable business.

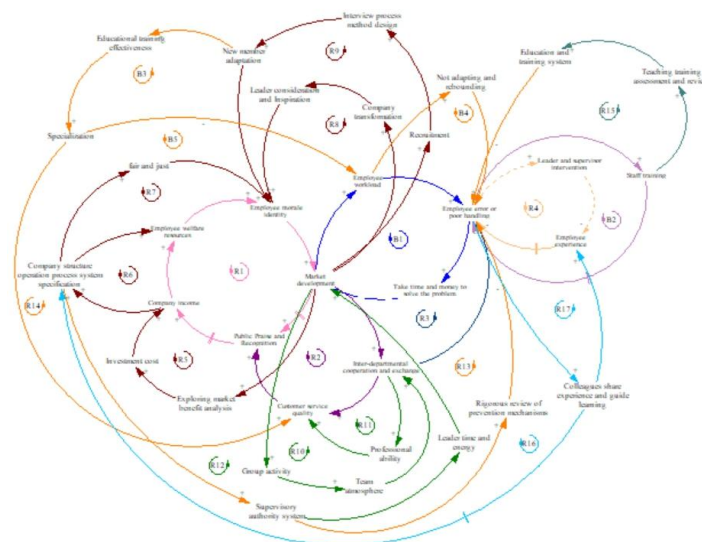
To make effective decisions in today's dynamic and complex world, companies must first become system thinkers, that is, expand the boundaries of our mental models. The basic model of by Peter Senge《The Fifth Discipline》system reveals the simple beauty behind the management of complex phenomena. The contribution of system thinking lies in the deep understanding of the counter-intuitive behavior of dynamic systems, explaining the patterns of behavior patterns through the structural causes (interaction mechanisms) behind complex behaviors, and distinguishing the differences between high-lever solutions and low-lever solutions. Assisting leaders in dealing with the linkages between multiple variables, that is, the leadership style's understanding of the relationship between organizational performance, teamwork and its learning organization culture, and integrating the continuous learning atmosphere into the organization. Therefore, the main reason for using system thinking as a research tool for this study.

3.2 Case Company Analysis

Y imported furniture was established in 2001, acting as the main consumer group of JOHN HUTTON and MOOD. With its keenness to the market and unique taste, coupled with high-standard professional services, it gradually became famous in the luxury market and introduced GIOR , RK, HH and other neo-classical European and American brands. After the market gradually stabilized, the California American style brand JRS store was established in 2005. In 2008, B&B established the Contemporary Space Pavilion to showcase the furniture configuration according to different spaces. For many years, the case has always believed in the importance of art to the aesthetics of life. Every year, domestic and foreign artists are invited to plan exhibitions. Not only do they devote themselves to Taiwan, but also to Greater China, Japan and the United States. In 2018, they entered the mainland market and established a branch in Shanghai. With the transparency of network information, the consumption pattern is gradually changing, and the industry competition is intensifying. In order to continue to consolidate the market

position, the case company develops an innovative operation mode, introduces the world famous furniture decoration brand, provides comprehensive professional integration planning proposals, and the original authorization. Perfect after-sales service.

In addition to the general store customers, they will also work with interior designers to plan projects. Therefore, it is necessary to invest a lot of business manpower and time to develop designers, provide innovative services, cross-departmental cooperation and exchange (experience sharing), and regularly arrange brand awareness and planning. Training courses can enhance the team's professional core competence and service quality. Such word-of-mouth and influence effects among customers can further promote the growth of the company, so that the morale and identity of the business manpower will increase greatly, and the market will continue to grow and expand, forming a positive cycle. However, when the market continues to develop (including the introduction of global furniture brands), in addition to maintaining customer service quality and providing multiple choices, more professional and innovative integration planning capabilities are needed. Therefore, in order to provide fast and diverse services to customers in a highly competitive environment, errors or incomplete treatment may occur, and under the consideration of time and cost, the leader or manager intervenes to solve the problem. Although the crisis situation is quickly lifted, it also reduces the ability of members to solve problems on their own, and reduces the skills that are recognized from mistakes, resulting in the same or similar mistakes in the future. If the leader or supervisor continues to intervene to solve the problem, the result is the long-term reliance of the team member on the leader or supervisor. The team member may continue to make mistakes, which in turn affects the development of the market. Therefore, leaders and managers should encourage members to think and cultivate their ability to solve problems, and to stimulate reflection and questioning with an open attitude, so as to enhance organizational learning and innovation capabilities and improve organizational effectiveness.



4 Conclusions

Based on the systemic thinking theory, the study uses the system's basic model structure to observe the case companies have the Limits to Growth and Shifting the Burden phenomenon. By drawing a questionnaire on the design of the causal feedback loop diagram design, an in-depth interview was conducted with 17 department heads and staff of the case company. The following is a summary of the content after the interview.

In such a turbulent and dynamic environment, the competitive industrial environment can continue to operate, and it is necessary to continue market development, whether it is products or customers, and to develop a sound corporate structure operation system. For the annual promotion salary reward system can be more clear, rewards and punishments are more fair, so that employee morale, identity and willingness to increase. This not only makes the products and customers more active, but also enables employees to improve their self-improvement and enrich their abilities, during this process Inter-departmental cooperation and exchange can enhance the professionalism of customer service and enhance the customer's visibility to the case company. However, the atmosphere of inter-departmental cooperation and communication is harmonious, and it requires more and more good interaction. For example: group activities. Collaboration between department heads can also contribute to this good cycle. Due to market development, both products and customers come from the global market, which is quite strange to the members of the organization. Case companies must face transformational change that causes an increase in workload and complexity. It is easy to produce unsuitable or even rebound, which may lead to errors or incomplete handling. Leadership or supervisor care and encouragement can enhance employee recognition and morale, and reduce negative atmosphere and error rate. In addition to recruiting the best talents to improve the professional division of labor by designing and improving the interview process, Conduct regular market benefit analysis to understand development effectiveness. Conducting employee training and sharing experience and learning exchanges with colleagues in the face of unfamiliar errors or incomplete management. Incorporate implicit knowledge into the company's framework of operational process systems to provide a more complete education and training system, It also enables the supervisor to follow the rules and implement the rigorous review mechanism, thereby reducing employee errors and incomplete handling, and sharing the leaders' efforts and time.

References

- Alavi, M., & Leidner, D. E. (1999) "Knowledge Management System: Issues, Challenges, and Benefits. Communications of the AIS, Vol.1(7),pp. 1-37.
- Bass, B.M. (1985) *Leadership and Performance Beyond Expectation*. New York Free Press
- Bennett, J, K, & O'Brine, M.J. (1994), *Training*, 31(6), pp. 41-4
- Burns, J.M., (1978) *Leadership* N.Y:Harper & Row
- Di Xie, M. S. (2005), *Exploring organizational Learning Culture, job satisfaction, Motivation to learn, organizational commitment, and internal service quality in a sport organization*, Unpublished doctoral dissertation, University of Ohio, The Ohio state

- E. H. Schein (1983) "The Role of the Founder in Creating Organizational Culture. *Organizational Dynamics*, pp. 13-28
- Forrester, J.W. (1971). *Counterintuitive Behavior of Social Systems*, *Technology Review*, 73(3), also in *Collected Papers of Jay W. Forrester*, 1975, The MIT Press, Cambridge, Mass, USA.
- Forrester, J.W. (1968). *Principles of System: text and workbook*, chapters 1 through 10. Cambridge, Mass: Wright-Allen Press
- Garvin, D. A., (1993) "Building a Learning Organization", *Harvard Business Review*, 71(4), 78-91.
- H. S. Becker, (1982) "Cultrue: A Sociological View" *Yale Review*, pp. 512-27,
- Hollander, E. P. (1978), *Leadership Dynamics: a practical guide to effective relationships*, NY: Free Press
- Jago, A. G. (1982). *Leadership Perspectives in theory and research* *Management Science*, 28, 315
- James M. Kouzes & Barry Z. Posner (2002). *The Leadership Challenge* pp 36-48
- Jashapara, A. (1993). *The Competitive Learning Organization: A Quest for Holy Grail*, *Management Decision*, 31 (8), pp. 5-15
- Marquardt, M. J. (1996) "Building the Learning Organization: A system Approach to Quantum Improvement and Global Success" London: McGraw-Hill.
- Mohr, N. & Dichter, A. (1985) *Building a learning organization*. *Phi Delta Kappan*, 82, pp. 744-747
- Robbins, S. P. (1998), "Organizational Behavior" Prentice Hall International, Inc., Upper Saddle River, New Jersey. pp 434-445
- Richman, B. M. and Farmer, R. N. (1975), "Management and Organization" N.Y Random House Press, pp. 364
- Schein, E. H. (1985). *Organizational Culture and leadership*. San Francisco: Jasssey-Bass.
- Senge, P. M. (1990) *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday Currency

Implementation of AI E-Commerce Model for Medical Beauty Industry: a Case Study in Taiwan

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Abstract

Medical beauty is a global trend and a popular, emerging industry in development. It is believed that the integration of medical beauty sector and e-commerce platforms operated in Taiwan offering virtual reality experience supported by artificial intelligence technology would have quite a significant economic impact on the markets across the globe.

The research is to study the effects on the development of medical beauty applications, innovations, the dynamics of the incorporation of online platforms and the medical beauty sector and efficient ways of promoting sales; applying artificial intelligence and virtual reality to the products of growing e-commerce platforms, the improvement of user experience given much easier access to product information and well-designed user guidance to boost sales of products or services and strengthen the ties between industries, creating new trends to highlight the competitiveness of local merchants among competitors across the globe based on the theoretical constructs. The research also explores the business models of medical beauty industry.

The research applies Task-Technology Fit Theory (TTF), Theory of Reasoned Action (TRA) and Transaction Cost Theory (TCT) as the foundations, questionnaire as the technique and Structural Equation Modeling (SEM) to conduct the statistical analysis.

Keywords – Medical beauty, Artificial intelligence, Task-Technology Fit, Theory of Reasoned Action, Transaction Cost Theory

1 Introduction

1.1 Research Background

Medical Cosmetology, known as Medical Beauty, is medical procedures using surgery, medicine, machinery, biological material or invasive, inverse ale medical treatments to improve, repair appearance. The earliest trace of Medical Cosmetology can be found is cosmetics use by ancient Egyptian. Cosmetics was considered by ancient Egyptian a magic of beauty.

Taiwanese medical beauty research has been leading score among top competitors for cutting-edge surgical techniques. It is believed that the integration of medical beauty sector and e-commerce platforms operated in Taiwan offering virtual reality experience supported by artificial intelligence technology would have quite a significant economic impact on the markets across the globe. Dr. Chen and Dr. Tsai (2011) pointed out that the focuses on consumer relationship and user experience are left to be desired in medical beauty research such as providing distinct, innovative medical beauty services to differentiate products on Taiwanese market. Business has to pay attention to customer's needs or raise budgets to attract prospective customers (Kotler, 1997). Offering services meeting customers' needs are the keys to success of business parse.

1.2 Research Purposes

The research is to explore the implementation of AI in VR mode technology for the capabilities of e-commerce platforms and contributing factors for desired model fit. By using task-technology fit, the model should be able to predict effects of technology for consumer interests. Theory of Reasoned Action enabled the research model to predict outcomes according to Theory of Transaction Cost. After cost structure was also evaluated, the research finally moved on to validating the model to provide conclusions with sound empirical evidences.

1. Enhanced user's performance by implementing AI in VR mode for e-commerce platform of medical beauty industry.
2. Directed efficiency to the operation of AI in VR mode technology in detail based on established models.
3. The concepts of this research can be applied to other medical beauty related subjects for gaining global recognition or competitiveness of services.

2 Chapter II Literature Review

2.1 Task-Technology Fit Theory, TTF

TTF is proposed by Vessey (1991) from his research of Cognitive Fit Theory.

The individual's performance of a task could be improved with technology fit presented for the task. The relationship between technology fit and individual performance is the foundation of TTF. User's experience is directly related to the decision if incorporating technologies to tasks or not. The better the user's experience is, the more likely that the user will incorporate the technology to the task. The adaptation of

technology implies improvement of efficiency and decrease of required time of completing a task. Therefore, the Task-Technology Fit Theory proposed by Goodhue and Thompson (1995) is also supplementary to Cognitive Fit Theory.

The researcher added the factor, information security, as the seventh variable to the model based on the research conducted by Jagannathan (2018) regarding the subject. The model constructs are shown in the fig. 2.4.2.

As the fig. 2.4.2. shown, Goodhue believed that the increase of technology fit will lead to enhance of task fit, and this effect will compound to increase the demand of tasks. The increase of demand for the tasks can lower the task-technology fit. This research tested the assumed correlation between the demand of task and the increase of task-technology fit.

H1: The "Task Characteristics" by combining AI in VR mode in medical beauty related procedure has positive correlation with the "Goodness of Fit."

H2: The "Technical Characteristic" by combining AI in VR mode in medical beauty related procedure has positive correlation with the "Goodness of Fit."

H3: The "Safety" by combining AI in VR mode in medical beauty related procedure has positive correlation with the "Goodness of Fit."

H4: The "Goodness of Fit" by combining AI in VR mode in medical beauty related procedure has positive correlation with the "User's Preference."

H5: The "Goodness of Fit" by combining AI in VR mode in medical beauty related procedure has positive correlation with the "User's Utility Level."

H6: The "User's Utility Level." by combining AI in VR mode in medical beauty related procedure has positive correlation with the "User's Preference."

2.2 Theory of Reasoned Action · TRA

Theory of Reasoned Action is widely used in various subjects (Sheppard et al., 1988). Theory of Reasoned Action was studied by Fishbein and Ajzen in 1975 who thought the underlying reasons of human behaviour are all based on rational choices, and human are also capable of acting on collected information.

Extensive Research of Theory of Reasoned Action

Fishbein and Ajzen (1975) once mentioned the origin of Theory of Reasoned Action is Social Psychology. The methodology of Social Psychology has been usually deducting a complicate human behaviour from a series of events. The purpose of Social Psychology is to exploring and predicting human behaviour with assumptions of underlying human intentions. Fisher and Ajen conducted many researches about attitude, subjective norm, intention and other possible variables regarding intentions of human actions in 1970s. There were many adjustments and testing's during this period. The complete model structure was finally presented by Fisherbein and Ajzen with the theories of Attitude Toward Behaviour and Subjective Norm, to modify the previous theory of Fishbein Model. The Fishbein Model was originally based on two variables, attitude and subjective. Thus, the complete model structure was depicted as fig.

H7: The "Behavioural Belief" by combining AI with VR mode in medical beauty related procedure has positive correlation with the "Attitude Toward Behaviour."

H8: The "Normative Belief" by combining AI with VR mode in medical beauty related procedure has positive correlation with the "Subjective Norm."

H9: The “Attitude Toward Behaviour” by combining AI with VR mode in medical beauty related procedure has positive correlation with the “Behaviour Intention.”

H10: The “Subjective Norm” by combining AI with VR mode in medical beauty related procedure has positive correlation with the “Behaviour Intention.”

H11: The “Behaviour Intention” by combining AI with VR mode in medical beauty related procedure has positive correlation with the “Goodness of Fit”

2.3 Transaction Cost Theory, TCT

There are three characteristics of Transaction Cost Theory; first, Asset Specificity; second, Uncertainty; third, Frequency that are determining the transaction cost. The three characteristics are explained as below:

Williamson (1985) thought the most critical variable among the three characteristics is Asset Specificity. The more the Asset Specificity is, the less the cost of transaction would be because the organization will incline to internalize the transaction. The Asset Specificity is defined as the existence of tangible investment acquired to complete a certain transaction. There are three kinds of Asset Specificity: Site Specificity, Physical Asset Specificity, Human Asset Specificity and Dedicated Assets.

Uncertainty refers to unpredictable change from economical activities causing changes of expected outcome for the transaction. Koopmans (1965) clarified Uncertainty as two parts: the first part is unexpected events due to limited human rations; the second part is incompleteness, fabricated or twisted information due to deception or fraud. The higher the uncertainty is, the higher the cost of monitoring the transaction will be. Robertson & Gatignon (1998) further clarified the variety of Uncertainty: internal uncertainty (behaviour uncertainty) and external uncertainty (demand and technology uncertainty).

Williamson (1985) said that the transaction cost on e.g. communication, negotiation drafting contracts, etc., will rise for higher transaction frequency. Watjatrakul (2005) explained the Theory of Transaction Cost with characteristics of Asset Specificity, Uncertainty and Transaction Frequency, and specified two kinds of Uncertainty: Behavioral Uncertainty and Environmental Uncertainty (Watjatrakul 2005; Rindfleisch & Heide, 1997; Williamson, 1975). Kwon and Suh (2004) said that knowledge sharing between groups is a key factor after the supply chain partners has been determined. T.P. Liang and J.S. Huang (1998) also saw the three characteristics of Theory of Transaction Cost as factors if e-commerce platforms can make customers to decide to purchase products or not.

Transaction is the activity for all industries. The cost generated by economical activities conducted by business is transaction cost (Arrow, 1969). It is important to low the transaction cost for performance of the management and the business (Williamson, 1996). Hence, transaction cost of any activity is the top priority for business.

Transaction Cost Theory was originally proposed by Coase in 1937. According to Coase, market is imperfect instead of the then dominated theory of perfect market in economics. He pointed out that there are factors could affect transaction cost such limited human rations, uncertainty of the environment and asset specificity, and etc. Coase’s view of transaction cost was favoured by the academics at that time; hence, more specifications

had been defined until Williamson compiled organization, strategy, transaction and other related journals based on Coase's theory to create a more complete Theory of Transaction Cost. Williamson's work started to draw attention to the Theory of Transaction Cost.

The research is based on T.P. Liang & J.S. Huang's study of customer acceptance of electronic products that using Theory of Transaction Cost to propose the following assumptions:

H12: The "Asset Specificity" by combining AI with VR mode in medical beauty related procedure has positive correlation with the "Transaction Cost."

H13: The "Uncertainty" by combining AI with VR mode in medical beauty related procedure has positive correlation with the "Transaction Cost."

H14: The "Transaction Cost" by combining AI with VR mode in medical beauty related procedure has positive correlation with the "Performance."

2.4 Knowledge Sharing

Hendriks (1999) considered Knowledge Sharing as a process of communication and Reconstruction of knowledge. Reconstruction refers to knowledge receivers using collected information to learn and share knowledge. There are two essential parts of the main research structure:

1. Knowledge Owner has inclination of Externalization behaviour.
2. Knowledge Reconstruct or has Internalization behaviour.

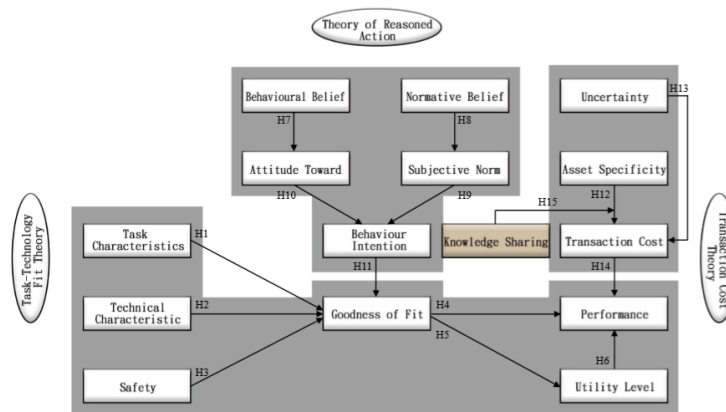
Hislop (2005) introduced the intentions of a group member sharing or hiding knowledge, and concluded the factors of the decision of sharing or hiding knowledge are: (1) Conflict of interests between groups and individuals (2) influence toward institutions (3) feeling toward justice and fairness of the group (4) trust between individuals (5) commitment between individuals (6) organization culture (7) reward system of human resource sector (8) reach and value of information sharing to the management. Corporation will keep competition edge by the active flows of knowledge in the economic system, therefore, corporation must produce knowledge to keep it as an invaluable advantage.

Petrash thought knowledge sharing between members can help improve the essential competitiveness of a corporation (Petrash, 1996). Giannetto & Wheeler said that employees should improve the process of knowledge sharing to create continuous improvement for the corporation (Giannetto & Wheeler, 2000). van den Hooff & de Ridder and Geppert & Clark also proposed the pros and cons of knowledge sharing in a corporation (Geppert & Clar, 2003; van den Hooff & de Ridder, 2004). As mentioned, studies above, business should encourage flows of knowledge among members to improve its competitiveness.

This research considered the action of knowledge sharing as a positively correlated variable of the model, and attempted to explore the influences of Attitude Toward Behaviour and Behaviour Intention to knowledge sharing. The assumptions of the above structure are as followed:

H15: The "Asset Specificity" and "Transaction Cost" in medical beauty related institution has positive correlation with "Knowledge Sharing."

3 Research Methods



3.1 Research Design

This research applied questionnaire and Structural Equation Modeling (SEM) to analysing the key variables. Structural Equation Modeling (SEM) is a statistical method consisted of sets of observed events and outcomes; usually, it is composed of multiple variables to form a theory based on “Cause and Effect” analysis (Byrne, 2010). Structural Equation Modeling (SEM) is also used to assess correlations between variables for theories in economics, social science and behavioural science (Golob, 2003). SEM combined various models to describe observed and latent variables, and also allowed quantitative tests on hypothetical models. Thus, the relationships between proposed variables of various hypothetical models can be tested to specify the model structure (Schumacker and Loman, 2004).

Adamantios Diamantopoulos, Judy A. Siguaw (2000) thought Path Analysis of Structural Equation Model (SEM) includes eight steps as followed: First, Conceptualization; second, Path Modeling; third, Confirmatory Factor Analysis; fourth, Model Specification; fifth, Factor Evaluation; sixth, Model Fit Evaluation; seventh, Model Respecification (repeat the first to the sixth step when any specification required); eighth, Cross Confirmation.

The research applied Random Sampling Method to choosing the anonymous participants by randomly giving away questionnaires. The questionnaires were collected later for further data analysis. The questionnaire was designed to understand the consumer behaviours in the medical beauty industry. The questionnaires were limited to maximum 200 questionnaires and given away to three major demographics of Northern Taiwan (55%), Central Taiwan (25%) to Southern Taiwan (20%) by proportions. The recycle rate of the questionnaires was 93%, 186 questionnaires in total; the disqualified questionnaire rate was 7%, 14 questionnaires. This questionnaire collecting was starting from January 1st, 2019 and ended on January 30th, 2019.

3.2 Research Analysis Method

The research applied statistical software, SPSS, Descriptive Statistics, the participants' information e.g., gender, age and education level from the second section of questionnaires to understanding the distribution of the samples and the recycle rate. The research also combined SEM, Regression Analysis and Cause and Effect method to analyse possible correlations between observed and latent variables and process control of deviations. PLS is a Diverse Statistical Analysis Method proposed by Herman (Herman, 1975), now to be widely used in various areas such as economics, marketing and psychology, etc. PLS is one of the model evaluation methods of SEM, using mostly Principal Components Analysis and Regression Analysis to allow the regression analysis to converge. The observed variables were evaluated before the latent variables for the step of model evaluation. This research is to illustrate the key variables influencing user's behaviours while implementing AI and VR technologies for tasks using Model Structure Diagram.

4 Research Results and Analysis

The research compiled data of qualified 186 questionnaires out of 200 questionnaires with 14 disqualified questionnaires, which made the recycle rate of the questionnaires 93%. The participants are whoever purchased medical beauty services or products in Northern, Central and Southern Taiwan.

4.1 Section I. Descriptive Statistics

The data is shown as Table 4.1. By gender, there is 76 male and 110 female participants of 186 participants that makes 40.9% of male participant and 59.1% of female participants. By age, there is 0 participant under age of 20 (0%), 54 participants between the age of 20 to 29 (29%), 40 participants between the age 30 to 39 (21.5%), 60 participants between age 40 to 49 (32.3%), 28 participants between age 50 to 59 (15.1%), 4 participants above than age 60 (2.2%). By education, there is 9 participants holding junior high degree (2.8%), 59 participants holding high school degree (18.6%), 145 participants holding bachelor's degree or equivalent (45.6%), 105 participants holding master's degree or equivalent (33%), 0 participant holding PhD degree or equivalent. By industry, there is 67 participants working in medical beauty industry (21.1%), 29 participants working in information industry (9.1%), 222 participants working in other industries (69.8%). By annual income, there is 1 participant earning annual income under NTD 290,000 (0.3%), 5 participants earning annual income between NTD 300,000 to 390,000 (1.6%), 13 participants earning annual income between NTD 400,000 to 490,000 (4.1%), 77 participants earning annual income between NTD 500,000 to 590,000 (24.2%), 222 participants earning annual income between NTD 600,000 to 690,000 (69.8%).

4.2 Section 2. Measurement Model Analysis

The research used Smart PLS 2.0 to conduct Path Analysis to test the credibility and quality of the questionnaire design. SEM and Measurement Model were tested for credibility and effectiveness. Structural Model was later validated for its variable significance and precision of predictability.

Confirmatory Factor Analysis is to test measurement model itself with PLS in the SEM to proceed the evaluation of models. Normal Distribution condition is not a requirement of PLS software nor large sample size. Minimum Square Analysis was applied to estimating measurement (Franz Michael Fischer, 2010). Thus, measurement model is composed of two parts as followed:

1. The convergence validity

Convergent Efficiency is the degree of fit of multiple variables to the same construct. The internal consistency is measured by Composite Reliability, CR.

However, the results of Composite Reliability are considered to be acceptable when the results meet the requirement CR value > 0.6 suggested by Fornell and Larcker (1981) and Cronbach's Alpha > 0.5 proposed by Nancy E. Waldeck (2000). Fornell and Larcker (1981) and Bagozzi and Yi (1988) all recognized that the ideal Average Variance Extracted, AVE value of the test results needs to be more than 0.5. However, AVE value is considered acceptable when the value is at least 0.3 or 0.4; it implied suffice Convergent Validity of the model. In short, the research results have shown there are suffice Convergent Validity of the assumed research models. See Table 4.2 for the test results.

Table 4-2 Convergence validity analysis results of measurement modes

	CR Value	Cronbach's Alpha	AVE
Task Characteristics	0.930	0.887	0.816
Technical Characteristic	0.939	0.919	0.755
Safety	0.947	0.888	0.899
Goodness of Fit	0.959	0.916	0.922
Behaviour Intention	0.904	0.840	0.758
Attitude Toward	0.887	0.807	0.725
Subjective Norm	0.885	0.806	0.720
Behavioural Belief	0.910	0.802	0.834
Normative Belief	0.923	0.833	0.857
Performance	0.940	0.872	0.887
Utility Level	0.959	0.916	0.922
Transaction Cost	0.942	0.876	0.890
Asset Specificity	0.921	0.857	0.853
Uncertainty	0.835	0.616	0.717
Knowledge Sharing	0.902	0.838	0.757

2. The discriminant validity

Joseph F. Hair (1998) suggested that the correlation coefficient between two different constructs should be smaller than the square foot of AVE value of either construct. If the

measurement of the two different constructs showed low correlation coefficient, it will mean there is Discriminant Validity between two constructs (Wu & Lin 2002).

As Table 4.3 shown the Discriminant Validity possible test results; by number, No. 1 refers to uncertainty; No. 2 refers to subjective norm; No. 3 refers to transaction cost; No. 4 refers to task fit; No. 5 refers to security; No. 6 refers to effectiveness; No. 7 refers to knowledge sharing; No. 8 refers to technology fit; No. 9 refers to performance; No. 10 refers behaviour belief; No. 11 refers to behaviour intention; No. 12 refers to attitude toward behaviour; No. 13 refers to normative belief; No. 14 refers to asset specificity; No. 15 refers to model fit.

Based on Table 4.3, the diagonal is the square foot of AVE value, non-diagonal is the correlation coefficient between variables. This research only targeted any two of different constructs with square foot of AVE value greater than the correlation coefficient. The test results showed consistency with Joseph F. Hair (1998) assumption about the correlation coefficient and square foot of AVE value.

Table 4-3 Analysis of discriminant validity of potential variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.8468	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0.3799	0.8485	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0.3829	0.1652	0.9434	0	0	0	0	0	0	0	0	0	0	0	0
4	0.2406	0.3987	0.2252	0.9033	0	0	0	0	0	0	0	0	0	0	0
5	0.2323	0.4855	0.1215	0.7267	0.9482	0	0	0	0	0	0	0	0	0	0
6	0.2916	0.4750	0.1984	0.7550	0.7974	0.9602	0	0	0	0	0	0	0	0	0
7	0.3716	0.5841	0.2125	0.3780	0.4590	0.4538	0.8701	0	0	0	0	0	0	0	0
8	0.3296	0.4186	0.1782	0.8339	0.8297	0.8343	0.4243	0.8689	0	0	0	0	0	0	0
9	0.2990	0.4578	0.2271	0.7328	0.7712	0.8617	0.4542	0.8270	0.9418	0	0	0	0	0	0
10	0.3343	0.5072	0.1956	0.7268	0.7538	0.7658	0.4150	0.8270	0.7663	0.9132	0	0	0	0	0
11	0.3083	0.8031	0.1645	0.4678	0.5503	0.5706	0.6270	0.5020	0.5616	0.5189	0.8706	0	0	0	0
12	0.2991	0.5935	0.2469	0.5881	0.5932	0.6034	0.5084	0.6244	0.6192	0.6433	0.6744	0.8515	0	0	0
13	0.2599	0.7233	0.1569	0.4704	0.5275	0.5025	0.5402	0.4735	0.4964	0.4600	0.7905	0.6560	0.9257	0	0
14	0.3482	0.4679	0.1908	0.2899	0.3352	0.3865	0.4495	0.3314	0.3454	0.3290	0.4180	0.4512	0.4527	0.9236	0
15	0.3115	0.3906	0.1446	0.7890	0.8060	0.8264	0.4055	0.8744	0.8098	0.7472	0.4843	0.5393	0.4549	0.2779	0.9602

4.3 Analysis of Structural Models

In this section, Path Coefficient is applied to analysing the statistical significance for data interpretation and the precision of outcome prediction for proposed research model. R^2 shows the precision of outcome predication by calculating the deviation percentage of Endogeneous Variable to Exogeneous Variable; the larger the value of R^2 is, the better the precision of outcome prediction is. The value of R^2 is defined to be between 0 to 1.

When T value > 1.65, it shows that the P value is possibly < than 0.05; when T value > 1.96, it shows that the P value is possibly < 0.01; when T value > 2.57, it shows that the P value is possibly < than 0.001.

Table 4-4 Study of Structural Model Hypothesis Verification Results

Hypothesis content	Relation	Path coefficient	T value	Significantne ss	Result
H1 : Task Characteristics→ Goodness of Fit	+	0.168	2.0100	**	Support
H2 : Technical Characteristic →Goodness of Fit	+	0.534	5.3574	***	Support
H3 : Safety→ Goodness of Fit	+	0.236	2.8886	***	Support
H4 : Goodness of Fi→ Performance	+	0.312	3.4012	***	Support
H5 : Goodness of Fit→ Utility Level	+	0.826	29.0863	***	Support
H6 : Utility Level→ Performance	+	0.591	7.0805	***	Support
H7 : Behavioural Belief→ Attitude Toward	+	0.643	11.1951	***	Support
H8 : Normative Belief→ Subjective Norm	+	0.723	18.1243	***	Support
H9 : Subjective Norm→ Behaviour Intention	+	0.542	8.5174	***	Support
H10 : Attitude Toward→ Behaviour Intention	+	0.385	2.3132	**	Support
H11 : Behaviour Intention→ Goodness of Fit	+	0.007	0.1373		Invalid
H12 : Asset Specificity→ Transaction Cost	+	0.065	0.8539		Invalid
H13 Uncertainty→ Transaction Cost	+	0.360	4.4404	***	Support
H14 : Transaction Cost→ Performance	+	0.065	2.0045	**	Support
H15 : Uncertainty→ Knowledge Sharing	+	1.171	2.0771	**	Support

When T value > 1.65, it shows that the P value is possibly < than 0.05; when T value > 1.96, it shows that the P value is possibly < 0.01; when T value > 2.57, it shows that the P value is possibly < than 0.001.

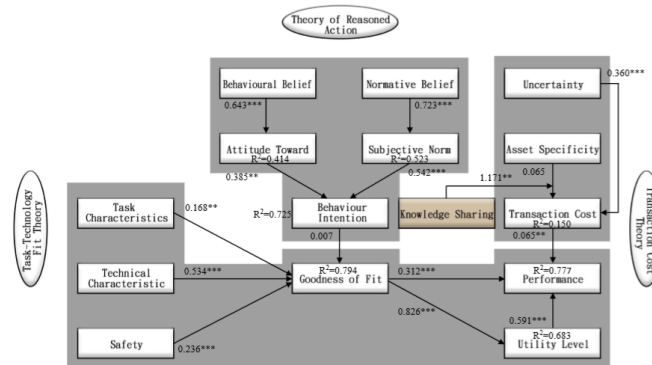
There are two kinds of moderator: mediated moderator and continuous moderator. Mediated moderator is the fixed data can be collected before the test such as gender, age, income, and etc. But it also could not be observed such as preference of product quality or price. If the variable is a mediated moderator, PLS-MGA (Keil et al., 2000) will be applied to the test. If the variable is a continuous moderator such as knowledge sharing, product-indicator approaches then the two-phase method will be applied to the test instead. If continuous moderator is affecting the correlation between two latent variables even a change of direction on such as observed value, the two latent variables will not be able to determined; yet, fluctuated with the moderator. This change or said deviation induced by the moderator is considered to be the center of the study, yet, Henseler and

Chin (Henseler & Chin 2010) thought product-indicator approaches would be a better choice unless prediction is the only goal of a study then two-phase method could take on.

If the correlation between A variable and B variable is 0.491 (the effect in the moderator mode), when the intervening variable is higher e.g. increasing one standard deviation, the dependence between A variable and B variable will weaken; on the other hand, when the intervening variable is lower e.g. decreasing one standard deviation, the dependence between A variable and B variable will strengthen. Hence, the dependence between A, B variable needs to be incorporated as a specification for model fit test (Joseph et al. 2017).

The study showed “model fit” was determined by task fit, technology fit, security and behaviour intention with the degree of dependence of 79.4%; “behaviour intention” was determined by subjective norm, behaviour belief, normative belief with the degree of dependence of 72.5%; “attitude toward behaviour” was determined by knowledge sharing with degree of dependence of 41.4%; “subjective norm” was determined by normative belief with the degree of dependence of 52.3%; “performance” was determined by attitude toward behaviour and subjective norm with degree of dependence of 77.7%; “Utility Level” was determined by normative belief with degree of dependence of 68.3%; “transaction cost” was determined by asset specificity and uncertainty with degree of dependence of 15%. The study results showed great structures of dependence between variables as Table 4.5.

Table 4-5 Verification Results of PLS Structure Mode



not significant $p > 0.05$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5 Research Conclusions and Recommendations

5.1 Research Conclusions

The study compiled established researches to form theories and models by exploring underlying human intentions, behaviour's and contributing factors of implementing AI technology for medical beauty procedure and its potential of creating value around task-technology fit, theory of rational actions and theory of cost transaction. By adapting

research tool of PLS 2.0 (PLS-SEM), the conclusion was drawn that employees of medical beauty industry can improve performance of task and dependence between variables such as the three models of technology fit, rational behaviour, transaction cost and assumed fourteen constructs by executing task with AI in VR mode.

5.2 Research Contribution

AI in VR mode is a trendy research subject and popular topic nowadays. Breakthrough of AI and computer science could transform medical resource and digital technology around the world, and Taiwan of course will be one of the beneficiaries (John Gutttag, 2018). There is increased demand of AI technology from various industries, yet, one of the contributing factors of industry efficiency is whether or not equipping this technology. Since AI technology can help fetch the most fitting answers for the users in the enormous information database to reduce the requirements of time and slash the uncertainty during the process, the coexistence of human and AI technology is inevitably ubiquitous in modern days.

AI technology will allow the future to become “self-resolved”, and issue-oriented is not one-way transmission or old-fashioned memory testing anymore. Immersion education will be emphasized to free the learning from classrooms, yet, hands-on experience will be much valued in order to solve issues in the real world. People will be able to simulate situations with assumptions using VR technology to learn the solution with an empirical approach beforehand.

VR can be strategic to benefit and attract more users for medical beauty industry. The study concluded that VR mode in e-commerce is favored by the users, and one of the most crucial factors among all is task-technology fit. Because medical beauty procedure is very involved with issues of implemented technology and system, learning about the issues helped find their solutions. The researcher started to find the specifications by studying user’s subjective experience, needs and limitations of medical beauty products. After specified the variables, the convenience and security were further evaluated for the products. The function and efficiency were designed to meet user’s expectation of the products; therefore, technology fit has become an important reference to cope the ever-changing the economic environment for any updates of information.

The success of VR mode implementation can also be used in the subject of small business management. Disruptive innovations have brought important reform to traditional medical beauty business, not only changed its ecosystem but also directed to expansion and creativity for the industry. Small business has been proven that it can be a sustainable, explanatory business model that also create job opportunities and quality for human life. The profitability and cost level of small business hopefully can be improved by using VR mode and facial recognition with case studies of medical beauty industry.

5.3 Research Suggestions

This section continues to draw suggestions from mentioned research conclusions.

1. Management Suggestion

AI has been widely used in various areas. It is anticipated that this technology will make huge impact on the world. There are many concerns about loss of jobs by using AI technology. However, the researcher thought the implementation of AI and VR in e-commerce and medical beauty will help increase human's capacity and free people from jobs that merely repeating simply tasks. Furthermore, AI technology will also encourage people to work on innovation and creativity-cantered tasks that required human emotions. From a large picture, advance of technology improves society, economic development so it's good definitely outweighs the bad. We should wield the power of technology to improve environment for the human kind.

2. Poverty Reduction and Social Business Development

Many social entrepreneurs are trying to improve our society by exploiting their resources. Early business had hard time finding cutting-edge technologies, cultural resources, financial and medical resources. Established in 1981, the Ashoka Foundation dedicated to supporting social entrepreneurs. More than 90% of hundreds of millions of US dollars went to support the changes of national policies. They all replied on the continuous supports and strict criteria for the participants. When the leaders of the society stood out for creating more values for the society such Michael E. Porter's Creating Shared Value or Bill Gates's Creative Capitalism, it proved that business profitability and society merit are not exclusive anymore.

Social responsibility has been extended to the core values of private sector not merely a philanthropic act anymore. The Nobel Prize winner of 2007, Mohan Munasinghe, suggested ways of supporting sustainable growth of business, environment, and etc. Thus, it is utter paramount for businesses in Taiwan to support and create a better society with missions and values.

References

- Lee, M. H., Yun, J. H. J., Pyka, A., Won, D. K., Kodama, F., Schiuma, G., Park, H. S., Jeon, J., Park, K. B., Jung, K. H., Yan, M. R., Lee, S. Y., and Zhao, X. (2018) How to Respond to the Fourth Industrial Revolution, or the Second Information Technology Revolution? Dynamic New Combinations between Technology, Market, and Society through Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 4(3), 21.
- Park, S. K., and Choi, S. Y. (2018). Sustainable Production Scheduling in Open Innovation Perspective under the Fourth Industrial Revolution. *Journal of Open Innovation: Technology, Market, and Complexity*, 4(4), 42.
- Kwon, L. N., Park, J. H., Moon, Y. H., Lee, B. Shin, Y. H., & Kim, Y. K. (2018). Weak signal detecting of industry convergence using information of products and services of global listed companies - focusing on growth engine industry in South Korea. *Journal of Open Innovation: Technology, Market, and Complexity*, 4(1), 10.
- Pyka, A. (2017). Dedicated innovation systems to support the transformation towards sustainability: creating income opportunities and employment in the knowledge-based digital bioeconomy. *Journal of Open Innovation: Technology, Market, and Complexity*, 3(4), 27.
- Park, H. S. (2017). Technology convergence, open innovation, and dynamic economy. *Journal of Open Innovation: Technology, Market, and Complexity*, 3(4), 24.

Construction of AI model of trust fund raising

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Abstract

The revolutionary changes in the financial environment in the past decade have led to changes in the convenience of information system users and the quality of the services. The investment industry fund raising fund uses the AI framework to create a smart fundraising model.

The use of AI framework by the investment fund raising foundation to create a smart model of fundraising to meet the goals set by the executives of the company will become an important issue.

This study is based on the task-technical fitness model and explores the positive growth of performance when the technical characteristics meet the goodness of fit of the task characteristics it supports.

Then, using the knowledge management system to investigate the historical fundraising model, and continue the successful knowledge management through AI, improve the user satisfaction of the information system, to achieve the company's desired fundraising goal, so that the growing performance of the fund can continue. The literature in the past does not combine the three theoretical relationships. This study combines the Task Technology Fit theory, the Knowledge Management System, and the Expectation Confirmation theory to explore the use of the AI model for the asset management industry. The key factors for the successful funds raised from the various enterprises are extracted. Through statistical analysis, these serve as a reference for relevant decision-making, increase the performance of raised funds and the efficiency of corporate organization, and to achieve the desired goal of raised funds set by the management. The subjects of this study are those who have not used the AI model structure and the users of the AI system, and use the online questionnaire to conduct convenient sampling, using questionnaires and SEM structural equation models for analysis.

The research result is to construct the AI model of fund-raising in the asset management industry, and proposes the main strategic direction for the asset management industry and the concept of the research results can be applied to the four major funds of the Taiwan government.

1 Introduction

This study holds that investment companies should develop artificial intelligence technology to replace the traditional fund-raising methods, to become a core player and possess long-term competitive advantages. Using the AI model strategy, the companies can actively monitor the market capital pulsation, aim for the future target market, and create the perspective of global investment layout.

The purpose is to investigate the funds raised by the asset management industry under the AI framework, the successful cases of fundraising of the past, the sharing of knowledge and utilizes the information system devices to extend the successful model, so that it can meet the growth expectation of the raising funds as set by the executives.

1.1 Motivation of Study

After the global financial crisis in 2008, the emergence of Financial technology ("Fintech") changes the traditional business model and financial domain, in the 2016 "FinTech 100 Financial Technology Innovator" research report by KPMG, Asia accounts for four of the top 100 companies, which is obvious that the power of continuance development in the Asia-Pacific region is strong. Closely related to Asia, we should actively expand the financial technology.

1.2 Purpose of Research

The purpose of this study:

- 1, To construct the AI mode for the asset management industry raising funds
- 2, The purpose of this study is to propose the main strategic direction for the asset management industry.
- 3, The concept of this research can be applied to the four major government funds.

2 Discussion of Literature

2.1 Task Technology Fit Theory

The Task Technology Fit (TTF) mainly originated in 1991 when Vessey mentioned the Cognitive Fit Theory. The major purpose is to understand the extension of the goodness of fit of the technological characteristics to the task characteristics it supports. When the adaptation mode between the two meets the goodness of fit, it will enhance the performance.

The study of system and performance based on goodness of fit is based on the Task Technology Fit model. The ability of Task Technology Fit technology to support tasks is represented by a formal model called TTF, which is defined as goodness of fit between the task characteristics and the technological characteristics (Goodhue, D. L. and Thompson, R. L, 1995). The TTF model holds that the goodness of fit between tasks, technology and information system users has a positive impact on the effectiveness and

performance of the system. When feature supports task, it assists the information system users to perform tasks more smoothly and the cost of performing tasks is reduced.

And when information technology supports task, users are accustomed to using new information technology. The function of information technology assists the task, which will reduce the cost of task execution and easy completion of the task.

2.1.1 Summary

In 2018, an information security incident occurred in the global semiconductor foundry leader, Taiwan Semiconductor Manufacturing Co., Ltd. The information security incident caused the company to lose NTD 5.2 billion, thus highlighting the importance of adding "safety" to the Task Technology Fit model.

The information system success model based on the results of Jagannathan et al. (2018) shows that the security and information quality of online banking applications will be the determining factor for success, thus it is extended to the model framework.

Base on the above, this study is based on the Task Technology Fit model proposed by Goodhue and Thompson (1995), and combining the concepts proposed by Jagannathan, Balasubramanian, & Natarajan in 2018, adding "safety" to the Task Technology Fit model as the third major aspect, emphasizes the importance of safety to technology.

Extend the theory mentioned above to this research, and establish the following assumptions:

- H1 The "task characteristics" of the fund raising AI model has a positive impact on the "goodness of fit" of the asset investment users.*
- H2 The "technology characteristics" of the fund raising AI model has a positive impact on the "goodness of fit" of the asset investment users.*
- H3 The "safety" of the fund raising AI model has a positive impact on the "goodness of fit" of the asset investment users.*
- H4 The "goodness of fit" of the fund raising AI model has a positive impact on the "IU satisfaction" of the asset investment users.*
- H5 The "goodness of fit" of the fund raising AI model has a positive impact on the "performance" of the asset investment users.*

2.2 Knowledge management system

Knowledge management is the academic and commercial application by Alavi and Leidner, which emerged in the mid-1990s. It is an activity that collects, stores and knowledge sharing of all organizations and members. Knowledge management is mainly a continuous process to help enterprises to enhance their performance, and by implementing knowledge management into technology to form the knowledge management system KMS (knowledge management system), providing knowledge to the information system users in need, and in turn, the knowledge of users of enterprise information systems is enhanced, and thus to improve their personal capabilities and external competitive advantages.

2.2.1 Summary

Based on the theories of all scholars, we derive at three aspects of goodness of fit of knowledge management and information systems, this paper attempts to construct a new strategic model of knowledge management system (KMS), which is based on personal traits, knowledge management system support, knowledge transfer has a positive impact on the degree of information system adaptation and continuous use of the inference.

Extend the theory mentioned above to this research, and establish the following assumptions:

H6: The fund raising AI mode uses the "personal traits" to positively influence the user's "goodness of fit".

H7: The fund raising AI mode uses the "system support" to positively influence the user's "goodness of fit".

H8: The fund raising AI mode uses the "knowledge transfer" to positively influence the user's "goodness of fit".

2.3 Expectation-Confirmation Theory

Oliver (1980) proposed the expectation confirmation theory ECT to explore the infrastructure, with expectation, confirmation, information system user satisfaction and utility level, performance has a total of five facets, and combining with "A Post Acceptance Model of IS Continuance (Bhattacharjee 2001), the proposed concept, expects to confirm that the Expectation Confirmation model ECM focuses on the variables after acceptance, and believes that the variables before acceptance are included in the degree of recognition and satisfaction; Expectation Confirmation Theory ECT only measures the pre-purchase expectations, but does not examine the consumer's subsequent expectations of the product which will change over time, so in the mode of continuous use of IS, ECM is more focused on the post-acceptance measurement model than ECT. ECM is a more suitable model for this study.

2-3-1 Summary

In summary, the effect of perceived performance is covered in the "confirmation" and this concept is defined as "after-the-event expectation". This study does not incorporate perceived performance. It attempts to construct a new theoretical model based, and base on the expectation and confirmation of the positive impact on the user satisfaction of the information system and the continuous use of the inference.

Extend the theory mentioned above to this research, and establish the following assumptions:

H9 The "expectation" of the fund raising AI mode has a positive influence on the "confirmation" of the asset management industry information system user.

H10 The "expectation" of the fund raising AI mode has a positive influence on the "goodness of fit" of the asset management industry information system user

H11 The “confirmation” of the fund raising AI mode has a positive influence on the “information system user’s satisfaction” of the asset management industry information system user

H12 The “information system user’s satisfaction” of the fund raising AI mode has a positive influence on the “utility level” of the asset management industry information system user

H13 The “utility level” of the fund raising AI mode has a positive influence on the “performance” of the asset management industry information system user

H14 The “information system user’s satisfaction” of the fund raising AI mode has a positive influence on the “performance” of the asset management industry information system user

2.4 Knowledge sharing

The aim of knowledge sharing is by organizing the exchange or discussion of knowledge between employees within the organization or between two organizations, and to create a synergy of knowledge. Nonaka & Takeuchi believe that in an uncertain economic system, knowledge is a mean of maintaining competitive advantages, and in order to uphold their superiority, enterprises must constantly create knowledge.

2.4.1 Summary

Based on the above, it can be known that knowledge sharing has a positive impact on enterprises. Therefore, this study, through the sharing of knowledge as a factor of positive adjustment effect, attempts to explore the impact of knowledge sharing on the willingness to use and satisfaction of use.

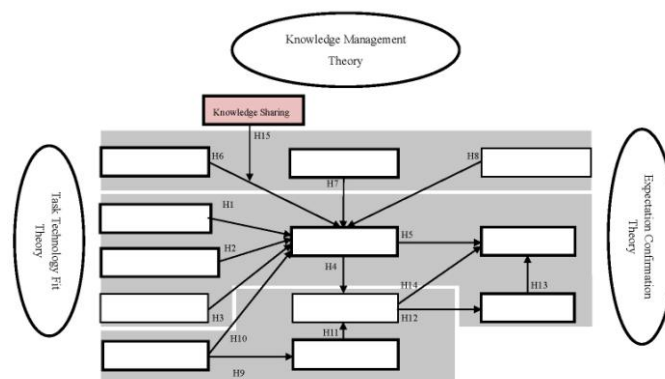
Extend the theories mentioned to this study, the following hypothesis are established:

H15 In the process of “personal traits” influencing the “goodness of fit” of the investment fundraising in the AI artificial intelligence model, knowledge sharing can have a positive adjustment effect

3 Research Method

3.1 Research framework

This section describes the exploration of the three theoretical frameworks of Task Technology Fit theory, Knowledge Management System and Expectation Confirmation Theory, and investigates the introduction of the AI model into the asset management industry, and so as to create new value of this research. The theoretical framework of the above research is drawn as the following:



1 Research Participants

In order to more objectively find out the key factors of the AI framework used in the asset management industry, the participant sample is selected as follows:

- (1) Questionnaire survey respondents are users of the asset management industry investment system, and they are picked by random.
- (2) Questionnaire survey respondents are users of the asset management related industry information system, they are picked by random.

To consider the convenience and effectiveness of sample collection, about 250 questionnaires will be distributed according to the normal distribution. The estimated effective questionnaires recovery is 77%, that is 191copies, and the invalid questionnaires are estimated at 5%, which is 9 copies, the survey will be carried out from January to March 2019.

2 Design of the Questionnaires

In order to ensure the quality of the questionnaire and the objectivity of the data, the facets and questions as designed in this study are based on the local and overseas related theories and literatures. This research questionnaire is divided into four parts and the questionnaire uses the Likert five-point scale for measurement, and uses the past literature theory as the basis for the questionnaire structure.

3.3 Research analysis method

The empirical tool for this research uses Smart PLS 2.0, with Smart PLS 2.0, the research model can be established, path coefficient and t-test can be calculated. The empirical method adopts the Structural Equation Modelling (SEM), and the structural model is to explore the causation between different latent variables and latent variables, and the “cause” assumed in the model refers to the exogenous latent variable, and the “effect” refers to the endogenous latent variable. This is to analyse and examine the relationship between the variable and the latent variable as well as to inspect the causation between latent variables, and to treat the errors of the control measurement, and so forth.

Partial Least Square (Partial Least Square, PLS) is a multiple statistical analysis method proposed by Herman (Herman, 1975), which is widely used in various research fields such as economics, marketing, psychology, and so forth. It is one of the ways to estimate the structural equation model which mainly uses the parameters of principal component analysis combined with multiple regressions to estimate and minimizes the residual error of the parameter of the given other parameters and repeat the estimation until convergence. When estimating the model, firstly, measure the relationship between each latent variable and the observed variable, and then measure the relationship between the latent variables.

4 Results of the research analysis

4.1 Descriptive statistics analysis

The basic data analysis of the research samples is shown in Table 4-1. In terms of gender: 72 males, accounting for 39.6%; 110 females, accounting for 60.4%, mainly are female.

In terms of age, 0 under 20 years old, accounting for 0%; 11 people in the 20 to 29 age group, accounting for 6%; 36 people in the 30 to 39 age group, accounting for 19.8%; 85 people in the 40 to 49 age group, accounting for 46.7%; 36 people in the 50~59 age group, accounting for 19.8% and 14 people over 60 years old, accounting for 7.7%, and most people are fall in the 40 to 49 age group.

In terms of education level: 0 below high school level, 0%; 5 from high school, accounting for 3.3%; 99 with general degree, accounting for 54.4%; 73 with master degree, accounting for 40.1%; 4 with doctorate degree, accounting for 2.2%, mostly are general degree. Employment: 51 in the financial sector, accounting for 28%; 50 in the service sector, accounting for 27.5%; 41 in other industry, accounting for 22.5%; 28 in commercial industry, accounting for 15.4%; 12 in the industrial , accounting for 6.6%; mostly are from financial sector.

In terms of annual income: 2 with NTD300K or less, accounting for 1.1%; 27 in the range of NTD 300K to 590K, accounting for 14.8%; 45 in the range of NTD 600K to 990K, accounting for 24.7%; 85 in the range of NTD 1000K to 1,990K, accounting for 46.7%; 23 in with more than NTD 2 million and above, accounting for 12.6%, mostly are from the group of NTD 1000K to 1.99 million.

Table 4-1 Sample basic data analysis

Total sample 182	Number of people(person)	Proportion(%)	Total sample 182	Quantity (人)	Proportion(%)
Gender			Employment sector		
Male	72	39.6%	Financial industry	51	28%
Female	110	60.4%	Service industry	50	27.5%
Age			Others	41	22.5%

Below 20	0	0	Business	28	15.4%
20~29years old	11	6%	Industrial	12	6.6%
30~39 years old	36	19.8%	Annual income		
40~49 years old	85	46.7%	Below 300K	2	1.1%
50~59 years old	36	19.8%	300K~590K	27	14.8%
Above 60 years old	14	7.7%	600K~990K	45	24.7%
Education level			1000K~1,990K	85	46.7%
Below high school level	0	0	Above 2000K	23	12.6%
High school	5	3.3%			
General degree	99	54.4%			
Master degree	73	40.1%			
Doctorate degree	4	2.2%			

4.2 Analysis of measurement method

In order to test the reliability and validity of the questionnaire, this study adopts the Smart PLS 2.0 to analyse and to further understand the path relationship and impact of this model. In order to understand the quality of the structural equation model (SEM), first of all, the reliability and validity of the Measurement Model must be tested, after which the path coefficient significance and predictive power of the Structural Model are examined.

In this section, in the analysis of the measurement mode, the Confirmatory Factor Analysis (CFA) is a test in the measurement mode. The evaluation of the measurement mode analysis uses the PLS in the structural equation to verify the mode. It is not necessary to consider the multivariate normal distribution on the PLS. It is also not necessary to consider large samples, and the estimation measurement adopts the least squares method for estimation (Franz Michael Fischer, 2010). Therefore, the reliability and validity analysis of the measurement model is divided into two parts:

1, Convergent validity

Convergence validity means that the multiple variables are measured on the same facet with the same degree of conformity. The internal consistency assessment criteria are based on the composition reliability.

When the results of Composition Reliability (CR) are in accordance with the recommended values of $CR > 0.6$ as proposed Fornell and Larcker (1981) and Cronbach's Alpha > 0.5 , proposed by Nancy E. Waldeck (2000), these can be accepted.

Fornell and Larcker (1981) and Bagozzi and Yi (1988) also suggest that the Average Variant Extracted (AVE) of individual facets should preferably be > 0.5 , but when the

average variable extraction (AVE) meets the standard of at least 0.3 or 0.4, it is generally accepted, that is, the facet has sufficient convergence validity. In summary, it shows the latent variables in the measurement mode of this study possesses good convergence validity. The analysis results are shown in the following table.

	CR Value	Cronbach's Alpha	AVE
Task features	0.906	0.792	0.827
Technology features	0.889	0.750	0.800
Safety	0.900	0.832	0.750
Goodness of fit	0.830	0.612	0.712
Personal features	0.880	0.733	0.786
Expectation	0.915	0.860	0.782
Support of system	0.898	0.773	0.815
Knowledge transfer	0.892	0.758	0.805
Knowledge sharing	0.881	0.731	0.788
Performance	0.932	0.854	0.873
Utility level	0.894	0.764	0.808
IU satisfaction	0.906	0.844	0.762
Confirmation	0.879	0.725	0.784

2, Differential validity

According to suggestion made by Joseph F. Hair (1998), the correlation coefficient between two different facets should be less than the square root of AVE of each facet. The two different facets are measured and the results are correlated. If the degree of correlation is very low, it means that the two facets have different validity (Wu Wanyi, Lin Qinghe, 2002).

As shown in the table below, the results of the differential validity analysis of each latent variable. The value of the diagonal is the square root of AVE, and the non-diagonal is the correlation coefficient between each variable. The square root values of AVE of all facets in this study are greater than the correlation coefficients between the two facets, indicates that it is compliance with the suggestion made by Joseph F. Hair (1998): the correlation coefficient between two different facets should be less than the square root of AVE of each facet.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1.Task features	0.9094												
2.Personal traits	0.3825	0.7860											
3.Security	0.7365	0.4811	0.8660										
4. Utility level	0.5513	0.3298	0.5911	0.8989									
5.Expectations	0.5155	0.3448	0.4925	0.6626	0.8843								
6.IU satisfaction	0.5638	0.4141	0.6705	0.7529	0.6442	0.8729							

7.Knowledge sharing	0.4994	0.3787	0.5579	0.6082	0.5284	0.5506	0.8877						
8.Knowledge transfer	0.4571	0.2537	0.4854	0.4950	0.4920	0.4922	0.5009	0.8972					
9.Confirmation	0.4592	0.3021	0.5040	0.6419	0.7258	0.7159	0.5194	0.5244	0.8854				
10.Technology features	0.7224	0.4568	0.7394	0.5304	0.5093	0.5836	0.6004	0.4930	0.4274	0.8944			
11.System support	0.4257	0.4217	0.4710	0.5790	0.4835	0.5261	0.5412	0.6689	0.4562	0.5079	0.9028		
12.Performance	0.5936	0.3784	0.6551	0.5667	0.5208	0.5687	0.5665	0.4861	0.4208	0.6131	0.5064	0.9343	
13.Goodness of fit	0.6096	0.4266	0.5953	0.5913	0.6014	0.5337	0.5223	0.5085	0.4586	0.6269	0.5225	0.5906	0.8438

4.3 Analysis of Structural Models

There are two steps to the Structural equation modeling (SEM) analysis and interpretation:

The first step is to verify the reliability and validity of the measurement mode, and the second step is to detect the significance and predictability of the path coefficients of the structural mode.

After confirming that the reliability and validity analysis of each facet has reached a certain level, this study adopts the Smart PLS 2.0 to perform causation analysis and research hypothesis verification of the structural model latent variables, and judges the research model by R^2 explanatory power

In the analysis of structural models, this section considers whether the standardized Path Coefficient is statistically significant and to gauge the explanatory power of the model. R^2 refers to the percentage of exogenous variables which explain the variation of endogenous variables, and represents the predictive power of the research model. The value is between 0 and 1.

The bigger the value, the better is the interpretation ability of this model.

When the T value > 1.65 , it means that the significant level of P value < 0.05 has been reached, which is represented by *; when the T value is > 1.96 , it means that the significant level of P value < 0.01 has been reached, which is represented by **; when the T value is > 2.57 , it means a significant level of P value < 0.001 has been reached, which is indicated by ***.

Therefore, from the results of the verification of the overall mode relationship path, it can be found that: Except for H3 : The "safety" of the fund raising AI model has a positive impact on the "goodness of fit" of the asset investment users; H6 : The fund raising AI mode uses the "personal traits" to positively influence the user's "goodness of fit"; H7 : The fund raising AI mode uses the "system support" to positively influence the user's "goodness of fit"; H8 The fund raising AI mode uses the "knowledge transfer" to positively influence the user's "goodness of fit", the above four hypotheses did not reach $p < 0.05$ significant level. The relationships of the other ten paths are significant, and the hypotheses are valid. This is shown in the table

Interference variable H15 In the process of "personal traits" influencing the "goodness of fit" of the investment fundraising in the AI artificial intelligence model, the

hypothesis that knowledge sharing has a positive adjustment effect has not reached $p < 0.05$ significant level

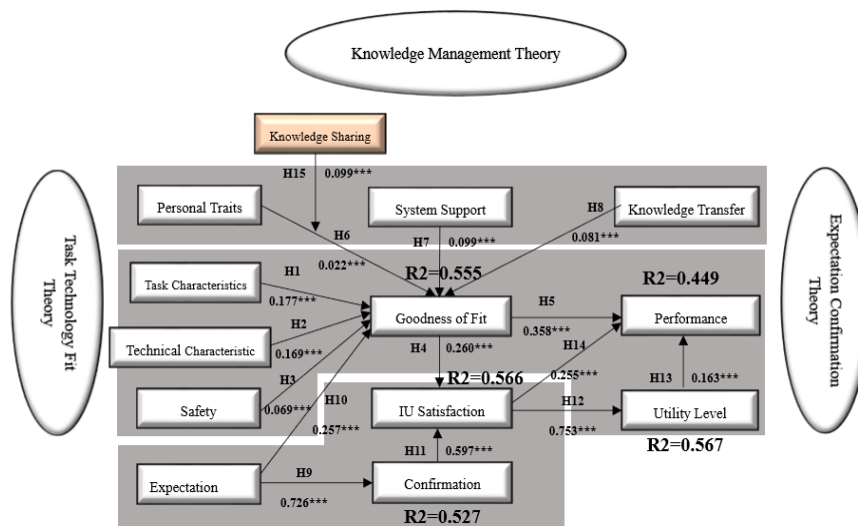
Hypothesis	Relationship	Path coefficient	T value	Significance	Verification results
H1 The "task characteristics" of the fund raising AI model has a positive impact on the "goodness of fit" of the asset investment users.	+	0.177	2.2003	**	Valid
H2 The "technology characteristics" of the fund raising AI model has a positive impact on the "goodness of fit" of the asset investment users	+	0.169	1.8380	*	Valid
H3 The "technology characteristics" of the fund raising AI model has a positive impact on the "goodness of fit" of the asset investment users	+	0.069	0.7636		Not valid
H4 The "goodness of fit" of the fund raising AI model has a positive impact on the "IU satisfaction" of the asset investment users.	+	0.260	3.9665	***	Valid
H5 The "goodness of fit" of the fund raising AI model has a positive impact on the "performance" of the asset investment users.	+	0.358	5.0314	***	Valid
H6 The fund raising AI mode uses the "personal traits" to positively influence the user's "goodness of fit".	+	0.022	0.0660		Invalid
H7 The fund raising AI mode uses the "system support" to positively influence the user's "goodness of fit".	+	0.099	1.0593		Invalid
H8 The fund raising AI mode uses the "knowledge transfer" to positively influence the user's "goodness of fit".	+	0.081	1.0687		Invalid
H9 The "expectation" of the fund raising AI mode has a positive influence on the "confirmation" of the asset management industry information system user	+	0.726	18.2199	***	Valid
H10 The "expectation" of the fund raising AI mode has a positive influence on the "goodness of fit" of the asset management industry information system user	+	0.257	3.7536	***	Valid
H11 The "confirmation" of the fund raising AI mode has a positive influence on the "information system user's satisfaction" of the asset management industry information system user	+	0.597	9.2612	***	Valid
H12 The "information system user's satisfaction" of the fund raising AI mode has a positive influence on the "utility level" of the asset management industry information system user	+	0.753	22.4283	***	Valid
H13 The "utility level" of the fund raising AI mode has a positive influence on the "performance" of the asset management industry information system user	+	0.163	1.7711	*	Valid
H14 The "information system user's satisfaction" of the fund raising AI mode has a positive influence on the	+	0.255	2.4658	**	Valid

"performance" of the asset management industry information system user					
H15 In the process of "personal traits" influencing the "goodness of fit" of the investment fundraising in the AI artificial intelligence model, knowledge sharing can have a positive adjustment effect	+	0.099	0.196		Invalid

Note: When the T value is > 1.65, it means that the significant level of P value < 0.05 has been reached, which is represented by *; when the T value is > 1.96, it means that the significant level of P value < 0.01 has been reached, which is represented by **; when the T value is > 2.57, it means A significant level of P value < 0.001 has been reached, which is indicated by ***.

Finally, the study found that the goodness of fit was affected by task technology, technology characteristics, security, personal traits, system support, knowledge transfer and expectations, and the variation of the goodness of fit is 55.5%; confirmation is affected by expectations, and the variation explanatory power for confirmation is 52.7%; "Information System User Satisfaction" was affected by confirmation and the goodness of fit, and the variation explanatory power of "Information System User Satisfaction" is 56.6%; the "utility level" is affected by the user satisfaction of the information system, and the variation explanatory power of the "utility level" is 56.7%;

"Performance" is affected by goodness of fit, information system user satisfaction and utility level, and the variation explanatory power of "performance" is 44.9%. This shows that the variation explanatory power of this research model is good, which is as shown:



This study found that the path coefficient of "personal traits" to "goodness of fit" is 0.022, and the path coefficient of the adjustment variable of "knowledge sharing" to "goodness of fit" is 0.099.

The variables of the knowledge management system are "personal traits", "system support" and "knowledge transfer", and because they do not have significant effect, the natural interference variable "knowledge sharing" also failed to achieve significant effect.

Therefore, under the premise of being invalid, there are two main reasons for analysis:

1, Knowledge Management System (KMS) is usually supported by the computer system support, which belongs to part of the technology, whereas "personal traits", "system support" and "knowledge transfer" have no such fitness with technology.

2, Knowledge management system, in the past, is the extension of academic theory applied to medical treatment, and the continuation of manufacturing know-how.

Because the asset management industry is part of the financial industry and this group of customers usually belong to the top level of the pyramid, and in recent years, under the advocacy of individual capital laws, the confidentiality of customer is very important. The use of fund raising model in the asset management industry is not applicable, therefore, the moderating effect does not have any significant adjustment effect on the relationship between the variable A and the variable B.

5 Conclusions

5.1 Research conclusion

The conclusion in this section is based on the purpose of this study, and achieves three specific research contributions:

5.1.1 Construction of a AI model for raising funds in the asset management industry

This study explores the key influencing factors for the introduction of AI models in the asset management industry. Base on the three theories of Task Technology Fit theory, Knowledge Management System, and Expectation Confirmation Theory, and combining the variables of Information Technology, variables of Management Science and variables of Psychology, to form a new structural equation model (SEM).

Furthermore, this study is based on the Task Technology Fit theory, Knowledge Management System and Expectation Confirmation theory. With these three theories as foundation, the sample questionnaire is used to modify and construct the main facet and evaluation criteria, and the structural equation model (SEM) is used as the statistical analysis. Finally, these three theoretical structural equation models (SEM) summarize the important indicators of the conclusion - the explanatory power R^2 , in the order: utility level (56.7%), information system user satisfaction (56.6%), user satisfaction (68.9%), goodness of fit(55.5%), confirmation (52.7%) and performance (44.9%). The above shows that the explanatory power of this study is good.

5.1.2 This study proposes the main strategic direction for the investment industry.

Based on the model constructed in the preceding paragraph, this study proposes the strategic direction of the AI model for investment fundraising:

The import of AI model results in the users of the information system dedicated to deep learning. The study found that the user satisfaction of the information system will positively affect the user's effectiveness in using the information system, and affect the performance of the fund-raising industry. According to the study, the asset management industry can strengthen the on-the-job training, enhance the personal computer literacy of the information systems users, enhance the self-efficacy of computer users, and enable them to fully understand the support of the information system, provide technical support and transfer of knowledge, so that task can be completed by the flexible use of the functions provided by the information system, and thus to improve the work performance.

Innovation differentiation - The extension of the positional differentiation theory from the "five competitive forces" and "three competitive strategies" proposed by Michael Porter, positioning the asset management industry AI model, in addition to reducing cost, it can also expand the services to customer base, shorten the space which affects the variables, and improving the performance of the fund-raising rate. Therefore, strengthening the core knowledge or competitiveness of the asset management industry, generate specific business models through appropriate strategic innovation, and then use information and network tools to match the physical market, to promote sales of the asset management industry.

5.1.3 The concept of this research can be applied to the four major funds of the Taiwan government.

The four major funds commissioned by the Taiwan government are the Labor Insurance trust, Labor retirement fund, pension trust and the post savings fund. In accordance with the government's decree, each affiliated institution shall, depending on the performance of each investment, the amount is adjustable or the account is discontinued each year.

To apply the research results of the AI model of the asset management industry to the application and operation of the four major funds of the government, to avoid disintermediation due to human factors, will effectively reduce the cost of commission of the four major funds. The performance of the agency assigned with the funds will be effectively achieved, and the four funds under the control of the government can be used flexibly, and the welfare of the whole nation can be recycled in the positive direction.

5.2 Research suggestions

After the specific research conclusions are obtained in this study, the research proposes that it can provide the application to the Ashoka Foundation in conjunction with social enterprises to promote public welfare.

Established in 1981, the Ashoka Foundation is dedicated to fostering social enterprises. Tens of millions US dollars have been invested and more than 90% of the social enterprises have achieved the original entrepreneurial goals. Even more than half of the social enterprises have promoted changes in national policies, which rely on the strict selection criteria and follow-up resources of the Ashoka Foundation. It shows that corporate profit and social value are no longer two strange parallel lines, so the asset

management industry can further cooperate with the Ashoka Foundation in the future, and to promote public welfare actively.

References

- Bhattacharjee, A., & Premkumar, G. (2004). Understanding Changes in Belief and Attitude Toward Information Technology Usage: A Theoretical Model and Longitudinal Test (Vol. 28).
- D'Ambra, J., Wilson, C. S., & Akter, S. (2013). Application of the task-technology fit model to structure and evaluate the adoption of e-books by academics. *Journal of the American Society for Information Science and Technology*, 64(1), 48-64.
- El-Hajji, M. A. (2010). Teachers' demographic characteristics, attributes and students' cognitive dimensions: A correlation analysis. *International Journal of Educational Administration*, 2(4), 603-608.
- Kuo, R.-Z., & Lee, G.-G. (2011). Knowledge management system adoption : exploring the effects of empowering leadership, task-technology fit and compatibility. *Behaviour & Information Technology*, 30(1), 113-129.
- Lee, M., Yun, J. J., Pyka, A., Won, D., Kodama, F., Schiuma, G., . . . Zhao, X. (2018). How to Respond to the Fourth Industrial Revolution, or the Second Information Technology Revolution? Dynamic New Combinations between Technology, Market, and Society through Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 4(21), 1-24.
- Mustapha, S. A. (2018). E-Payment Technology Effect on Bank Performance in Emerging Economies—Evidence from Nigeria. *Journal of Open Innovation : Technology, Market, and Complexity*, 4(4), 43
- Pyka, A. (2017). Dedicated innovation systems to support the transformation towards sustainability: creating income opportunities and employment in the knowledge-based digital bioeconomy. *Journal of Open Innovation: Technology, Market, and Complexity*, 3(27), 1-18.

The Effect of Quality Perception of Blockchain Service Relationship on Investment Behavior and Intention -- a Case Study of Virtual Currency

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Abstract

Blockchain is the most disruptive innovative technology and application after the Internet. Acceptance of the users for blockchain technology from potential adopters to acceptance rate between real adopters, through the transaction risk, transaction cost and transaction piping, word of mouth penetration, perceived intentions and feelings after use, will affect the acceptance and the amount and speed of use of satisfaction and loyalty. The objectives of this study were to examine the perception of blockchain investors on the quality of investment relationship (integrity, commitment, and satisfaction) of virtual currency, and the impact on investors' investment behavior (behavioral loyalty) and investment intention (attitude loyalty) in virtual currency. We conducted a questionnaire survey in early 2019. After a rigorous screening of valid questionnaires and statistical analysis, 515 valid questionnaires were collected. We used SPSS statistical package to performed the multiple regression analysis to explore the multivariable analysis of relationship quality perception and customer loyalty. The regression model showed that the commitment, integrity, and satisfaction together can explain 82.6% variance of customer loyalty, while behavior loyalty and attitude loyalty are 79.9% and 80.0%, respectively. In sub-dimensions of investment relationship, integrity ($b=0.269$ to 0.540 , $p<0.001$) and satisfaction ($b=0.657$ to 1.389 , $p<0.001$) were positively associated with behavioral loyalty, attitude loyalty, and customer loyalty. The trading platform of integrity, commitment, and satisfaction for investors in the investment behavior of virtual currency — has a positive influence on behavior loyalty. This research enhanced our understanding of the determinants of consumer complaining behaviors. The study results can provide implications to the enterprise, to allocated limited resources to meet the actual needs of customers, and shorten the gap between the customer's expectation and actual perception of the service quality, and further Increase customer satisfaction and the positive image of the company.

Keywords –Virtual currency, Block chain, Relationship quality, loyalty

1 Introduction

The blockchain is a technology that connects numerous blockchains, and it is a technology that does not rely on a third party to store, verify, transmit and communicate data through distributed nodes in the network. Due to its key characteristics of disintermediation, consistency, source traceability, and unalterability, blockchain is the most disruptive innovative technology and application after the Internet. Acceptance of the users for blockchain technology from potential adopters to acceptance rate between real adopters, through the transaction risk, transaction cost and transaction piping, word of mouth penetration, perceived intentions and feelings after use, will affect the acceptance and the amount and speed of use of satisfaction and loyalty, after all is critical for the popularity of new technology. With the development of the virtual economy, the virtual business model has been evolving, which is closely related to the real economy. Therefore, in order to attract and meet the needs of investors, virtual currency platform operators must first understand the important psychological factors of different investment groups in the investment of virtual currency. In this paper, we were answering the research question: do blockchain investors' perception of the integrity, commitment, and satisfaction of the virtual currency trading platform affect their investment behaviors and intentions in the virtual currency trading platform? The objectives of the current research were: 1. To explore the perception of blockchain investors on the quality of investment relationship (integrity, commitment, and satisfaction) of virtual currency, and the impact on investors' investment behavior (behavioral loyalty) and investment intention (attitude loyalty) in virtual currency. 2. To explore the influence of investment on the characteristics of virtual currency, platform involvement and investment loyalty of investors.

1.1 Relationship quality integrity

Integrity is defined as the belief that one party's needs will be met in the future by the actions of the other party (Anderson and Weitz, 1992).

1.2 Commitment to relationship quality

Commitment to a relationship may occur only if the exchange relationship is worth the effort to maintain, and once committed relationships to occur, neither party will easily change the relationship, even if a third party offers a more valuable piece (Ulaga and Eggert, 2006).

1.3 Satisfaction with relationship quality

Customer satisfaction is defined from the two concepts of customer evaluation and comparison, which is considered as a cognitive state of whether the customer is appropriate between the purchase and payment (Hunt and Sheth, 1969).

2 Methods

In this study, we conducted a questionnaire survey, followed up and collected for nearly half a month in March 2019. The questionnaire collection was completed in early 2019. After a rigorous screening of valid questionnaires and statistical analysis, a total of 530 questionnaires were distributed and 520 were recovered (98% recovery rate). Among them, 515 valid questionnaires were collected (98% recovery rate).

We conducted the statistical analysis based on the research framework. This paper puts forward several investors involved in the relationship quality on consumer behavior loyalty and attitude loyalty of community, platform research hypothesis, to investigate whether loyalty type of RBL and RAL construction investment has positive influence on differences and relationship quality at the same time with the three dimensions (commitment, integrity, satisfaction) as the important connotation of the index, and relevance of the investment behavior loyalty and attitude loyalty, individual analysis to explore the various dimensions of relationship and interaction between possible impact. We used SPSS statistical package to performed the following analysis: (1) descriptive statistics: describe sample traits, perception of relationship quality, and customer loyalty; (2) reliability analysis: the test of the consistency of the scale; (3) independent t-test: multivariate analysis of relationship quality perception and customer; (4) correlation analysis: a bivariate analysis of relationship quality perception and customer loyalty; (5) regression analysis: to explore the multivariable analysis of relationship quality perception and customer loyalty.

3 Results

The Characteristics of the blockchain investors were shown in Table 1. In terms of the purpose, frequency, cost and method of investment of investors, the proportion (92.80%) of asking whether they have heard of virtual currency; This ratio is higher than that of those who have heard of blockchain (79.6%), indicating that some groups are still unfamiliar with the new field of blockchain (Table 2). On average, the cost of each investment in virtual currency is the highest among those who have not invested (53.6%), while the cost of those with investment experience is the highest among those who have spent more than 160,001 (15.7%). The interesting part of this option is that the groups that have not invested are relatively conservative, and those that have not been contacted have greater doubts about their risks and legitimacy. Investors who have invested in virtual currencies will spend a relatively large amount of money to make investment bets. The purpose of investing in virtual currency is to gain investment profit (43.8%) is the highest; Why the option of not investing in virtual currency is the highest with no relevant knowledge (36.1%), it can be seen that people who have not invested yet will worry about the volatility of their investment risk because they have no relevant information about blockchain.

Influence of commitment, integrity, and satisfaction on customer loyalty table shows the correlation coefficient and significance of all variables with attitude loyalty and

behavior loyalty (Table 3). The results show that all variables, including integrity, commitment, and satisfaction, have a significant and positive relationship with behavior loyalty and attitude loyalty.

As shown in Table 4, commitment, integrity, and satisfaction can explain 80.7% variance of customer loyalty, while behavior and attitude loyalty are 79.9% and 80% respectively. Meanwhile, the overall regression model has a significant effect (customer loyalty, $F=807.794$, $p<0.001$). Behavioral loyalty, $F=682.786$, $p<0.001$; Attitude loyalty, $F=678.173$, $p<0.001$). Furthermore, the parameters were positive and the sub-dimensions of customer loyalty were significantly tested, such as sub-dimension commitment (customer loyalty, $=0.934$). Behavioral loyalty, $=0.675$; Attitude loyalty, $=1.022$); Sub-dimensions of integrity (customer loyalty, $=4.241$, $p<0.001$; Behavior loyalty, $=4.09$, $p<0.001$; Attitude loyalty, $=3.714$, $p<0.001$), sub-dimension satisfaction (customer loyalty, $=12.339$, $p<0.001$). Behavioral loyalty, $=11.283$, $p<0.001$; Attitude loyalty, $=11.361$, $p<0.001$).

Table 1. Characteristics of the blockchain investors

Variables	Number	%
Gender		
men	275	53.40
women	240	46.60
Age group		
Under 20 years old	7	1.40
21~30 years of age	110	21.40
31~40 years of age	176	34.20
41~50 years of age	162	31.50
50~60 years of age	48	9.30
More than 60 years of age	12	2.30
Marital status		
single	261	50.70
married	254	49.30
Education level		
High school diploma	33	6.40
Junior college degree	57	11.10
University degree	201	39.00
Graduate school and above	224	43.50
Occupation		
Military public education personnel	53	10.30
business	81	15.70
Industrial/ manufacturing	56	10.90
services	65	12.60

The financial industry	63	12.20
Fisheries/ forestry/ agricultural/ Animal husbandry	1	0.20
Free industry	23	4.50
A housewife	17	3.30
Research and development personnel	58	11.30
The medical industry	24	4.70
students	65	12.60
The unemployed	2	0.40
retired	2	0.40
other	5	1.00
Average monthly income		
Less than 30,000	95	18.40
30,001~50,000	122	23.70
50,001~80,000	137	26.60
80,001~120,000	90	17.50
120,001~160,000	41	8.00
160,001 the above	30	5.80

Table 2. The purpose, frequency, cost and methods of consumer investment

Variables	Number	%
Have you ever heard of virtual currency		
yes	478	92.80
no	37	7.20
Have you heard of blockchain		
yes	410	79.60
no	105	20.40
Your average cost per investment in virtual currency costs about		
No investment	276	53.60
Less than 30,000	58	11.30
30,001~50,000	22	4.30
50,001~80,000	26	5.00
80,001~120,000	25	4.90
120,001~160,000	27	5.20
160,001 the above	81	15.70
The purpose of your investment in virtual currency is		
The investment profit	170	43.80
High reward	43	11.10

Try new investments	65	16.80
Curious	62	16
Shopping	9	2.30
Development research use	7	1.80
Other	32	8.20
Why don't you invest in virtual currency		
Risk	99	30.80
No relevant knowledge	116	36.10
No more money	41	12.80
Reasonable allocation of assets has been made	59	18.40
Other	6	1.90

Table 3. Correlation analysis

Dimensions	Loyalty	Relationship quality	Behavioral loyalty	Attitude loyalty	Commitment	Integrity	Satisfaction
Loyalty	1						
Relationship quality	0.908**	1					
Behavioral loyalty	0.979**	0.892**	1				
Attitude loyalty	0.899**	0.986**	0.886**	1			
Commitment	0.825**	0.948**	0.812**	0.900**	1		
Integrity	0.878**	0.974**	0.864**	0.971**	0.905**	1	
Satisfaction	0.905**	0.975**	0.889**	0.984**	0.880**	0.930**	1

*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$

Table 4. Regression analysis

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Behavioral loyalty	Attitude loyalty	Customer loyalty	Behavioral loyalty	Attitude loyalty	Customer loyalty
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Constant	0.243**	-0.352**	-0.109	0.128	-0.467***	-0.339
Relationship quality				0.988***	1.09***	2.078***
Commitment	0.037	0.062	0.098			
Integrity	0.269***	0.271***	0.54***			
Satisfaction	0.657***	0.732***	1.389***			
R square	0.80	0.799	0.826	0.781	0.781	0.807
The F value	682.786	678.173	807.794	1833.363	1829.206	2140.308

*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$

4 Discussion

4.1 Main findings

From the perspective of consumer behavior, this paper analyzes the platform loyalty and investment behavior of investors. The paper also discusses how virtual currency investors perceive the relationship quality of trading platforms. In addition, how the relationship quality of trading platform affects the behavior loyalty and attitude loyalty of investors is the motivation of this paper. Tarkinen & Sundqvist (2009) believes that the cognitive process of consumers' attitudes towards products is different from the actual buying process. In this context, this study intends to explore the factors of investors' participation in the cash transactions of virtual currencies and to understand the effect of the factors of loyalty dimensions through the relationship quality theory. It is expected that the results of this study can bring many valuable Suggestions to the new field of virtual currencies.

Investment for today are doing financial planning of the investing public, is not willing to contact virtual currency this reason may not be understood in the field of block smelting technology and operation principle, so can't understand the value of the virtual currency, or feel that the quality of the virtual currency risk is too high, uneven and news reports often exchange is formidable, lead to the currency is transferred and so on. The virtual currency lacks the same quality and meaningful investment analysis as stocks and funds, as well as the real-time information pipeline, which is what repealing the general public.

Through the statistical data, the operators of the blockchain virtual currency platform can better understand the investors and potential investors who have not yet been involved, and can better understand the basic demand of investors. The questionnaire platforms filled in by investors from the questionnaire samples include Bitoex, bitopro, Maicoi, niudun, ACE Exchange, huobin, Okex, Gate, Joyso, Binance, Mbaex, Wcee, Eunex, Cex, taichi, Bittrex, Hitbtc, Bibox, btc-e, Mt Gox, coinec, Ktrade, TideBit, starbit, Coinbase, Bitfinex, Bitasset, Mbaex and other virtual trading platform operators. The questionnaire respondents gave the following suggestions to the industry: user preferences become fast! Service is not good enough, it will only be replaced by the exchange of ability to provide better service, the survival of the fittest, virtual currency are often the culprit of fraud, bad image, increase service quality, investors are more at ease, no more public commentary, speed, and price transparency can sharpen and optimization, technology, can let a person more comfortable, more credit than other currencies, credit is to value, strengthen information security, more investors will be assured, eliminate the doubts of the information technology and increase the credibility of the market, we will invest, virtual currency is a great potential market, Need to do a good job of customer relations with investors and so on the virtual currency industry advice.

Further analysis, which can be found that the relationship quality and customer loyalty behavior loyalty and attitude loyalty achieves very significant positive correlation, said investors for block smelting industry promised, the greater the degree of virtual currency investors to block the affected virtual currency smelting industry in

recommended to others or continue to use the investment platform will charge. The hypothesis (the relationship quality of trading platforms has a positive impact on investors' investment behavior in virtual currency - behavioral loyalty) and the hypothesis (the relationship quality of trading platforms has a positive impact on investors' investment intention - attitude loyalty in virtual currency) is also initially supported here.

It shows that investors' trust and satisfaction positively affect their customer loyalty. However, its commitment does not reach a significant standard for investors, and its commitment does not significantly affect their loyalty. As can be seen from the table, when the constant is negative, it means that when the commitment, integrity, and satisfaction are all zero, the intention of investors is basically negative, and loyalty to the virtual currency platform will not be generated actively. When the behavior loyalty constant is positive, investors will be willing to come back and reinvest, and they will also want to continue to invest for profit. However, when the attitude loyalty constant is negative, investors are willing to invest, but they will not actively recommend it to other investors due to risks or other factors, which is also consistent with the investment environment and current situation of the entire virtual currency.

Comprehensive the above, the relationship between the overall quality of behavior loyalty and attitude loyalty, and overall customer loyalty to support, but individual dimensions observation, we for the virtual currency industry, its commitment to relative to the other sub-dimensions, the virtual platform providers are not important, operators should be more focus on investors' satisfaction first, followed by the good faith. Since the services provided by virtual platform, operators are complex and difficult to understand, and trust has the function of reducing investors' cognitive risk, the results of this study suggest that to gain investors' trust, we should first obtain their satisfaction. Finally, the more trustworthy the investor is, the higher the promise will be likely to be generated. Therefore, in order to obtain the promise of the investor, the first step is to gain his trust.

4.2 Management implications

With the rise of the virtual world and the innovative business model of the blockchain industry linking various industries and the business opportunities of the virtual currency platform, the trading mode is also between the virtual and the real. Such trading mode is not only a means but also an inevitable path. This paper discusses the relationship quality of virtual trading platform and the loyalty between investors. The statistical results prove that the relationship quality and its sub-aspects have a profound impact on investors and their sub-aspects.

After a complete analysis, the results of this study have important implications for the management practices of virtual trading platform operators, as described below. For the virtual trading platform of the blockchain, few researchers have investigated the relationship quality and loyalty of the virtual trading platform. Therefore, the research in this paper is of great significance to the sample data of the operators of the virtual trading platform. The model of relationship quality and loyalty has been widely used in academic and practical fields. In the field of the innovative blockchain, operators of virtual trading platforms should think about how to improve the relationship quality to enhance the

loyalty and integrity of investors, strengthen the commitment and obligation of virtual trading platforms to investors, and improve the satisfaction of investors in the use of virtual trading platforms.

This study confirms that relationship quality can effectively increase the willingness of investors to continue to use the virtual trading platform and promote their positive recommendation to others. For investors, the services provided by virtual currency traders will directly influence their buying intentions to consumers. The higher the perception of relationship quality, the higher the degree of potential consumer psychology. Contact and discuss with the filling volume, most of the known virtual platform trading patterns and virtual trading terms, in the actual operation situation or subsequent derived problems, there are some shortcomings, may block is a very new industry chain, this research clearly noted that the investors of risk associated with virtual platform of cognition and doubt, hope through the finishing and the results of this study, combined with the past literature evidence and information integration, allows users to further know more about the virtual trading platform operators, and further understand the importance of virtual currency trading behavior. Therefore, this research can help virtual currency managers to have a deeper understanding of investors' attitudes and behaviors, and to develop potential investors easily. It is expected that this research will provide them with practical Suggestions.

4.3 Research limitations

There are two major limitations regarding the generalizability of this study. First, this study is focused on the consumers based in the metro Taipei area, the results might not be applied to all kind of customers in the market. Second, this study is focused on one particular product and service. The study results might not generalized to all the industry.

4.4 Conclusions

The trading platform of integrity, commitment, and satisfaction for investors in the investment behavior of virtual currency — has a positive influence on behavior loyalty. This research enhanced our understanding of the determinants of consumer complaining behaviors. The study results can provide implications to the enterprise, to allocated limited resources to meet the actual needs of customers, and shorten the gap between the customer's expectation and actual perception of the service quality, and further Increase customer satisfaction and the positive image of the company.

References

- Smith, J. B.(1998). Buyer-seller relationships: Bonds, relationship management and sex-type. Canadian .Journal of Administrative Sciences Vol.15, 1,76-92.
- Garbarino, Ellen and Mark S. Johnson (1999). The different roles of satisfaction, trust, and commitment in customer relationships, *Journal of Marketing*, Vol.63, 70-87
- Crosby, L. A. , Evans, K. R. and Cowles, D. (1990). Relationship quality in services selling: An interpersonal influence perspective. *Journal of Marketing*. Chicago, Vol. 54, Iss. 3, 68-81

- Backman, S. J., & Crompton, J. L. (1991). Differentiating between high, spurious, latent, and low loyalty participants in two leisure activities. *Journal of Park and Recreation Administration*, 9(2), 1-17.
- Dick, Alan S. and Kunal Basu (1994). Customer loyalty: Toward an integrated conceptual framework. *Journal of the Academy of Marketing Science*, Vol.22, No.2, 99-114.
- Gelb, B. & M. Johnson, (1995). Word-of-mouth communication: Causes and consequences, *Journal of Health Care Marketing*, No. 15, pp. 54-58.
- Dutta, S. and A. Segev (1999). Business Transformation on the Internet. *European Management Journal*, "17, No. 5, pp. 466-76.
- Moorman, C., Deshpande, R., & Zaltman, G. (1993). Factors affecting trust in market research relationships. *Journal Marketing*, 57(1), 81-101.
- Schurr, P. H. & Ozanne, J. L. (1985). Influences on exchange processes: Buyers' preconceptions of a seller's trustworthiness and bargaining toughness, *Journal of Consumer Research*, 11, 939-953.

Discussing the Customer's Willingness on the Mobile Customer Service APP through the Technology Acceptance Model an Example of Telecommunication Industry

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Abstract

Facing progressively more intense competition, telecom carriers think on how to evaluate servicing business customers and optimize the relationship in between, so as to increase revenue and profits. With the Rapid development of network technology and popularization of smart phones devices, the mobile APP (Application, referred to as APP) has penetrated into our lives. Telecom service provider has launched customer service mobile Applications (for many years). In addition to save the human burden of the customer service system, more importantly, it can provide more service experience and construct new virtual channels for product sales.

There are limited studies on the comparison of technology acceptance model and switch cost among online and traditional channel while a lot of researches related to the effectiveness of switching costs was published. This study uses the Unified Theory of Acceptance and Use of Technology Model (UTAUT) as the main architecture to explain behavioral intention. The main variables are performance expectation, effort expectation, social influence and facilitating conditions, and plus conversion costs, to observe whether there is a regulatory effect between the conversion cost and the relationship between behavioral intention and usage behavior.

Keywords –unified theory of acceptance and use of technology (UTAUT), application, willingness, conversion cost

Paper type – Academic Research Paper

1 Introduction

It shows that for a long time, telecom operators have achieved stable revenues through traditional communication services. But in fact, the value of domestic telecommunications is in a recession. It shows that the global telecommunications industry is facing a transformational challenge, and it must be transformed from a pure information highway to a more Yuan service provider. According to the statistics of the National Communications and Communications Commission, the output value of Taiwan's mobile communications in the first half of 2018 has decreased by 4.67% compared with last year. In recent years, the voice income has been declining year by year, which is more than expected. Therefore, telecom operators must seek to provide differentiated services to users, trying to open up new businesses with higher margins and higher added value, in an attempt to transform into overall service providers.

With the increase in social labor costs and the rapid advancement of technology, many companies have begun to encourage the development of more technology-based services within the organization (Dabholkar, 1996). In this context, the creation of a model that allows customers to complete services without having to contact the service staff is called "self-service technologies (SSTs). The development of SSTs not only improves the efficiency of the company, but also allows Customers can flexibly choose the time of use and have more choices on service models. The telecom customer service APP proposed by various telecommunication industries is a self-service technology belonging to consumers.

The era of smart phones is also the era of APP. The mobile app has penetrated into different industries and our life scenes, such as daily shopping, transaction transfer, market intelligence and so on. For enterprises, APP is not only an interactive platform with customers, but also a strategic tool for enterprises. It can also help business owners to deepen their channel management and internal operation monitoring. Although there are many physical stores, official websites and telephone customer service, all major mobile operators also have their own customer service APP, in addition to saving the human resources of the customer service system, more importantly, it can provide users with more immediate services.

In order to make telecommunications services closer to customers and save customers' troubles, telecom operators have launched customer service APPs to provide customized and mobile service content. The 24-hour transaction has zero time difference, and the service functions provided by various telecom operators' customer service APPs are similar. However, which service functions are truly capable of generating value to the user, which cognitive values are affected by different service functions, and the impact of the user's perceived value on subsequent behaviors, using the results of this study to provide telecom operators in marketing Management decisions.

This study considers that the use of telecom customer service APP by customers is also an act of accepting new technology. Therefore, the research department combined with the integrated technology acceptance model (UTAUT) as the framework of this study plus " conversion cost " as the interference variable, and through the literature Inductively and through the distribution of questionnaires to obtain data and analysis to

explore the causal relationship between various factors affecting consumer behavior, the research conclusions provide telecommunications operators in the management and formulation strategies as a reference, so the research objectives of this study are:

1. Exploring the relationship between the UTAUT research variables and the "behaviour intentions" of the telecom customer service APP.
2. Exploring the relationship between consumers' "behavior intentions" and "actual use behaviors" of telecom customer service APP.
3. Using "conversion cost" as the interference variable, examine the interference effect of the conversion cost on the relationship between the "behavior intention" and the "actual use behavior" of the telecom customer service APP.

2. Literature research

This section collects relevant literature for the research purposes proposed in this study. The content is divided into four sub-sections, including four topics: " Unified Theory of Acceptance and Use of Technology ", "Telecom Customer Service App", " conversion cost ", and " willingness ". Discuss it.

2.1 Unified Theory of Acceptance and Use of Technology

Theory of Reasoned Action (TRA) is one of the most fundamental and influential theories of human behavior. Besides, there are seven other commonly used theories as follows: the Motiva Model (MM), the Model of PC Usage (MPCU), as well as the Social Cognitive Theory (SCT) and the Innovation Diffusion Theory (IDT). Including the famous Theory of Planned Behavior (TPB/DTPB), the Technology Acceptance Model (TAM/TAM2), and also the combination model between the Technology Acceptance Model and the Theory of Planned Behavior (C-TAM-TPB).

Unified Theory of Acceptance and Use of Technology was proposed by Vakatesh et al. (2003) in order to review and consolidate the previous eight theories, which then is referred to "the originating article" because of numerous authors cited it. The eight models were examined through four different organizations in half a year. In comparison to UTAUT, the eight models had 17% less capability to explain the variation of the same database (Abraham et al., 2016). In other words, this theory alone is capable to explain around 70 percent of the variance of behavioural intention and around 50 percent of the variance of use behavior (Abed et al., 2015). In addition, UTAUT does not only provide a useful tool to evaluate the potential success of new technology initiation, but also identify factors likely to influence adoption of technology.

UTAUT categorizes the intention of use information technology (IT) from the eight models into four main constructs: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI) and Facilitating Condition (FC). According to Vakatesh et al. (2003), definition of every construct listed below:

(1)Performance Expectancy

The degree to which an individual believes that using the system will help him or her attain gains in job performance

(2) Effort Expectancy

The degree of ease/effort associated with the use of the system. (3) Social Influence

The degree which an individual perceives the important others believe that they should use the new system.

(4) Facilitating Conditions

The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.

The original model of UTAUT suggested four moderators that are Gender, Age, Voluntariness of Use, and Experience. UTAUT does measure individual's intention to adopt and use the new technology.

2.2 Telecom Customer Service App

Mobile device users can download mobile software applications for free or for a fee via the wireless network to the mobile software app store. In addition to browsing and trading through a web browser such as a general online store, the mobile software app store usually also has a proprietary app that allows users to enter with one click and the interface is more convenient than the web page.

From the development of the customer service center, it can be found that the multimedia service center of the multi-service pipeline has indeed entered the service center. In addition to telephone, fax, network, MSN, and now even the development of the telecom customer service APP, the customer service center can communicate with customers. The diversification of customer service channels has also added a lot of convenience. The mobile communication industry is a representative of service and technology competition in all walks of life. He needs to face the fierce challenges of customer and service innovation. When mobile devices continue to grow, operators must care about the needs of customers. The pipeline of communication between customers and customer service personnel must also constantly seek new changes. In this era of creativity, innovative customer service is needed, and the research theme of this research is the customer service pipeline "Telecom Customer Service APP".

2.3 Conversion Cost

The conversion cost was first proposed by Porter (1980) and refers to the one-time cost incurred when a consumer moves from one provider of a product or service to another. The so-called one-time cost refers to the cost incurred in the conversion behavior, not the converted continuous cost, and includes the information search, evaluation, transaction, post-transaction learning and adaptation, etc., which is not only economically It is also time, energy and emotion, and it is an important factor that constitutes a competitive barrier for enterprises. If a customer moves from one company to another, they may lose a lot of time, effort, money, and relationships, so even if they are not completely satisfied with the company's services, they will think twice.

Most scholars agree with the existence of customer conversion costs, but different scholars have different understandings about their categories and forms of expression. In the study of customer conversion cost categories, the marketing scholars Burnham, Frels,

and Mahajan (2003) are most representative and are grouped under three broad categories of potential variables: time-dependent program-based conversion costs, Financial conversion costs related to monetary benefits, and relationship-related conversion costs related to emotions. The sub-facial aspects of the study have yielded significant results in testing both the US credit card and long-distance telephone companies. The three major facets are as follows:

1. Procedural switching costs
2. Financial switching costs
3. Relational switching cost

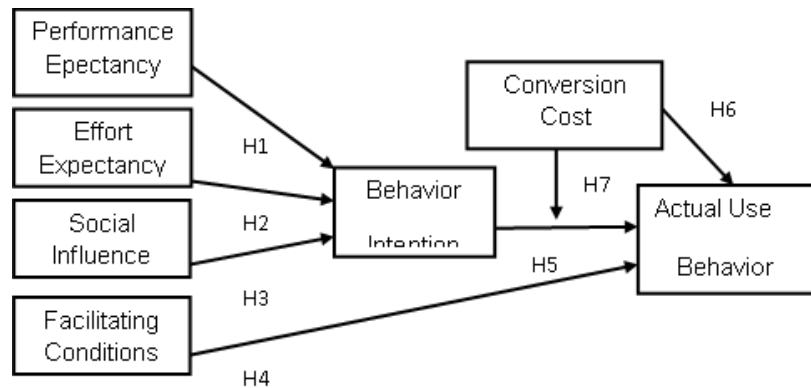
2.4 Behavior Intention

According to Ajzen (1998), behavioral intentions represent the subjective probability that an individual wants to engage in a certain behavior, the so-called behavior intention. Many studies using the theory of rational behavior (TRA) in social sciences point out that In an ethical situation, if an individual's determination of an act is correct or beneficial to oneself, it means that the individual is more likely to engage in the act; from a behavioral theory point of view, the more intention to perform an act Strong, the chances of engaging in this behavior are higher (Sheppard, Harrwick, and Warshaw, 1988; Venkatesh and Davis, 2000; Venkatesh and Agarwal, 2006). In the past, many related research paradigms have pointed out that there is a significant relationship between behavioral intentions and actual use behaviors and high explanatory power (Randall and Wolff, 1994; Sheeran and Orbell, 1998). Therefore, Peter and Olson (1987) proposed a measure of behavioral intentions that can be used to presuppose the actual use behavior and can be applied to the marketing market to predict consumer behavior. Therefore, the measurement of the actual use behavior in behavior theory by behavioral intention is also called the intention mode (Fishbein and Ajzen, 1975).

3 Research design and methodology

This chapter builds research design and methodology based on the research motivation and background, research purposes and related literature. The content is divided into five sections, including "research structure", "research hypothesis", "questionnaire design", "research distribution and research objects". "Data Analysis Methods and Tools."

This study uses (Unified Theory of Acceptance and Use of Technology, UTAUT) as the theoretical framework to explore the customer's willingness and behavior to use the telecom customer service APP with performance predictions, effort expectations, social influences, promotion conditions and behavioral intentions. And use the program-type conversion cost, financial conversion cost and relational conversion cost in the conversion cost as the interference variable to explore the influence of user behavior on the behavior of the telecom customer service APP. Research structure is as follows



The research model and research hypothesis of this study is shown in Figure 3-1, which integrates the four theoretical aspects of UTAUT: performance expectations, effort expectations, social impact, promotion conditions, and behavioral intentions and actual use behavior, plus the process of switching costs. Three types of conversion costs, financial conversion costs, and relational conversion costs.

H1: The use of the "performance expectations" of the telecom customer service app has a positive impact on "behavioral intentions".

H2: The "effort expectation" of using the telecom customer service APP has a positive impact on "behavioral intentions".

H3: The "social impact" of using the telecom customer service app has a positive impact on "behavioral intentions".

H4: The "promotional conditions" of using the telecom customer service APP have a positive impact on the "actual use behavior".

H5: The "behavior intention" of using the telecom customer service APP has a positive impact on the "actual use behavior".

H6: The higher the conversion cost of using the telecom customer service APP, the negative impact on the "actual use behavior".

H7: The "conversion cost" of using the telecom action customer service app has a regulatory effect on "behavioral intention" and "actual use behavior"

4 Conclusions

Therefore, the era of smart phones is also the era of APP. The mobile application APP has penetrated into different industries and our life scenes, such as daily shopping, transaction transfer, market intelligence and so on. For enterprises, APP is not only an interactive platform with customers, but also a strategic tool for enterprises. It can also help business owners to deepen their channel management and internal operation monitoring. Although there are many physical stores, official websites and telephone customer service, all major mobile operators also have their own customer service APP,

in addition to saving the human resources of the customer service system, more importantly, it can provide users with more immediate services.

References

- Abed, S. S., Dwivedi, Y. K., & Williams, M. D. (2015). Consumers' Perceptions of Social Commerce Adoption in Saudi Arabia. *International Federation for Information Processing*, 133-143.
- Abraham, R. D., Moriguchi, S. N., & Andrade, D. F. (2016). Intention of adoption of mobile payment: An analysis in the light of the Unified Theory of Acceptance and Use of Technology (UTAUT). *Science Direct*, 221-230.
- Burnham, T. A., Frels, J. K. & Mahajan, V. (2003). Consumer switching costs a typology antecedents and consequences. *Journal of the Academy of Marketing Science*, 31(2), 109-126.
- Dabholkar, P. A. (1996). Consumer evaluations of new technology-based self-service options: An investigation of alternative models of service quality. *International Journal of Research in Marketing*, 13(1), 29-51.
- Porter, M. E. (1980). *Competitive strategy: techniques for analyzing industries and competitors*. New York: The Free Press.
- Sheppard, B. H., Hartwick, J. & Warshaw P. R. (1998). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research*, 15(3), 325-343.
- Venkatesh, V. & Agarwal, R. (2006). Turning visitors into customers: A usability-centric perspective on purchase behavior in electronic channels. *Management Science*, 52(3), 367-382.
- Venkatesh, V. & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186-204.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478.

Financial and Societal Value Creation in Cultural Startups: the Role of Entrepreneurial Universities

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Abstract

The purpose of this study is to illustrate the process that ended in a pilot project titled “Incubiamo Cultura” (a label playing with the words Incubator-Love and Culture), presented by some academic entrepreneurs who envisaged the possibility to create a network among public (i.e. the university, the Municipality, public cultural organisations) and private actors.

Based on a sound literature review in both the field of entrepreneurial university and cultural ecosystems, the authors adopted an action research approach to analysing a paradigmatic case study.

This paper contributes to filling a gap of research on the role of universities in a cultural ecosystem, focusing on how to design a new value chain for the launch of startups in the creative and cultural sector, where universities can play a catalyst and pivotal role.

Keywords – Cultural Startups, Entrepreneurial University, Value creation, Networking approach

Paper type – Academic Research Paper

1 Introduction

Within the field of entrepreneurial university research (Etzkowitz 2003, 2004; Guerrero & Urbano, 2012; Secundo et al. 2010, 2016), this paper investigates an issue neglected in literature concerning the role universities can play in incubating startups in the cultural and creative sectors as well as in promoting participatory cultural initiatives (Piber et al., 2019).

For this reason, this paper is the first bridge between two different streams of research, that is: “entrepreneurial university” and “cultural ecosystems”.

Research carried out in the area of cultural ecosystems has investigated under what conditions culture triggers an economically effective, socially sustainable development, and it may even be defined as “a leading growth engine” (Sacco et al., 2014). These studies share the assumption that special patterns of collaboration between diverse actors should be pursued in order to create value out of particular cultural-creative initiatives (Borin & Donato, 2015).

Supporting a networking approach in culture and creative contexts requires get together diverse actors, ranging from public to private, industrial associations, local communities, as well as citizens. The literature clarifies that, through a participatory approach, creative clusters, as well as cultural initiatives, lead to urban development (Throsby, 2010) and regeneration (Bailey et al., 2004; Sasaki, 2010).

In particular, the purpose of this study is to illustrate the process that ended in a pilot project titled “*Incubiamo Cultura*” (a label playing with the words Incubator-Love and Culture), presented by some academic entrepreneurs who envisaged the possibility to create a network among public (i.e. the university, the Municipality, public cultural organisations) and private actors. The rationale of that project is to respond to the cultural needs that emerge from the degraded and/or peripheral neighbourhoods of medium-sized Italian cities like Genoa. Despite the fact that the city holds a UNESCO heritage of great value, Genoa has undergone a strong economic and social decline in recent years and lately has represented the need of our country to invest in the regeneration of its infrastructural heritage, due to the collapse of its highway bridge.

The expected result of the *Incubiamo Cultura* project is to generate cultural and creative enterprises in urban spaces and make use of underused or abandoned cultural heritage assets. The goal can be achieved thanks to the leading role that the universities, and in particular entrepreneurial academics, can carry out through networking and training, incubation and acceleration of cultural and creative enterprises.

2 Literature Review

In the last few years, the university system has undergone a profound process of rethinking and reorganisation (Etzkowitz, 2004), and its institutional aims have also changed, including teaching, research and economic and social development (Etzkowitz, 2002; 2003). Universities should also play a role in the exploitation of research results and fostering the economic and cultural growth of regions and countries (Etzkowitz, 2002).

Our literature review focuses on the role that academic organisations can play in our society. In detail, we are interested in the role that an entrepreneurial university can play in creating and supporting a cultural ecosystem with the aim to create economic and social value. In line with the four pillar of sustainability (Hawkes, 2001) and the Sustainable Development Goals (SDG), we deem that in a knowledge economy universities might play a central role in creating societal value and fostering sustainable development goals. This is true if at least two conditions are satisfied:

- The first is that a university undergoes a strategic and managerial path to create the conditions to be systematically engaged in entrepreneurial activities;
- The second is that a university opens up to the external environment, strengthens interactions with its stakeholders and actively promotes collaborative relationships with business and institutional partners to contribute to the development of its ecosystem(s).

2.1 Entrepreneurial Universities

An entrepreneurial university can be any university that contributes and provides leadership for the creation of entrepreneurial thinking, actions, institutions and entrepreneurship capital (Audretsch et al., 2008).

Universities engage, for example, in entrepreneurial activities such as technology transfer, intellectual property management, participation in science parks, incubators, university spin-offs and other processes aimed to implement the third mission of the university (Wright, 2014). These activities can be referred to as forms of academic entrepreneurship mostly conceived as a practice performed with the intention to transfer knowledge from the university to the external environment in order to produce economic and social value.

For the sake of our research, it is important to highlight that most of the literature on academic entrepreneurial activities has investigated the issue of academic, technological spin-offs (Venturini and Verbano, 2017). Special emphasis has been put on the setup of spin-offs and factors affecting their creation, competitive success and profitability (Dameri et al., 2015; Dameri & Garelli, 2016).

Furthermore, up to this point, many scholars have delved into the topic of how a university that has included the third mission in its strategy should be managed (Etzkowitz, 2004; Secundo et al., 2016).

Academic entrepreneurship arises from internal as well as external impetuses. Referring to external drivers, scholars question how public policies have called for the growing engagement of universities within their regions and localities in the last few years (Slaughter et al., 2004).

As far as the inner impulse is concerned, some scholars have focused on how specific organisational units, such as the Technology Transfer Offices (TTO) can facilitate the commercialisation of the research output (Friedman and Silberman, 2003). Others discuss that collaborative, entrepreneurial learning processes between entrepreneurs and university students provide a coherent and systematic approach to generate, select and implement entrepreneurial practices (Simeone et al. 2018). Etzkowitz (2003) addressed the topic of how universities should support research groups that he defines as “quasi-firms”. The creation of research communities that transcend the single institution is, in fact, the first phase of a process that may subsequently result in the economic exploitation of the products of research, which Etzkowitz (2003) called the “capitalisation of knowledge”.

The decisions by individual faculty members to actively engage in technology transfer and, generally, in the third mission have been investigated by many scholars (Franklin 2001; Bercovitz & Feldman, 2008 D'este, P., & Perkmann, 2011), but, in our opinion, still deserve further consideration. Related to the last argument is the role of the academic entrepreneur. "The academic entrepreneur is a university scientist, most often a professor, sometimes a PhD student or a post-doc researcher, who sets up a business company in order to commercialise the results of his/her research" (Formica et al., 2008). However, academic entrepreneurship can also be understood as a particular behaviour to be adapted by researchers in order to modify the pattern of university research activities (Balasz, 1996). We deem that this issue is a key aspect of the existing debate in literature. We wonder whether projects concerning the third mission have to be governed by a central, top-down logic or the university should play its role in creating favourable conditions so that the so called entrepreneurial academics—thanks to their pro-activity, commitment and creativity—can develop, in a bottom-up approach, entrepreneurial initiatives and activities.

2.2 Entrepreneurial Ecosystem

Recently, the entrepreneurial ecosystem has emerged as a popular concept to explain the birth of high-growth entrepreneurship within regions. Entrepreneurial ecosystems can be defined as "the union of localised cultural outlooks, social networks, investment capital, *universities*, and active economic policies that create environments supportive of innovation-based ventures" (Spigel, 2017).

In the literature on regional development, it is well known that universities play a pivotal role in providing knowledge and innovation stimuli to the firms of the territory (Roberts and Eesley, 2011; Corbett et al. 2014).

Generally speaking, ecosystems can vary by network intensity and organizational variety. However, ecosystem conceptualisations generally focus on the role of networks and their ability to provide firms with resources and information to challenge a constantly changing competitive environment. Specifically, Autio and colleagues (2014) focused on the potential of ecosystems, among other perspectives, to provide a more nuanced understanding of entrepreneurial performance, emphasising the role of individuals and inter-organizational networks.

Referring to academic entrepreneurship, while a considerable body of literature investigates individual and firm-level characteristics associated with the success of university spinoffs, only recent works have also emphasised the importance of the ecosystem for academic entrepreneurship (Miller et al., 2017; Hayter et al. 2018).

Similarly to Autio et al. (2014), Hayter (2016) within the context of academic entrepreneurship, posits that the efficacy of academic entrepreneurship ecosystems depends on the interconnectivity of constituent elements and their collective ability to provide information and resources important for spin-offs' success.

Moreover, it is worthwhile to underline, even with reference to the field of study on ecosystems, from the meta-analysis by Hayter et al. (2018), that "hard" disciplines (i.e. Biotechnology, Engineering, Information technology, Life sciences, Physics) and

technologies transfer conditions (i.e. broad scope, patenting and licensing versus spinoff) are the variables that scholars concentrate on. To conclude, as far as we know, the role universities can play in incubating startups in the cultural and creative sectors as well as in promoting participatory cultural initiatives is neglected in the literature.

2.3. Cultural Ecosystems

Research carried out in the area of cultural ecosystems has investigated under what conditions culture triggers an economically effective, socially sustainable development (Sacco et al., 2014).

These studies share the assumption that special patterns of collaboration between diverse actors should be pursued in order to create value out of a particular cultural-creative initiative.

The cultural initiatives promoted by institutional partners and/or public-private partnerships, as well as the creation of cultural clusters, can lead to the regeneration of the urban fabric (see the emerging literature on creative cities) and an impact on quality of life and the well-being of citizens (UNESCO, 2003).

Culture is an intangible good that comes from previous generations and represents our identity as citizens. As per the definition of Bourdieu (1986), cultural capital (a person's knowledge and intellectual skills) provides the advantage of achieving a higher social status in society. From a collective point of view, culture is the substructure of society because it gives meaning to our lives and society. Indeed, through culture, people and groups define themselves, conform to society's shared values and contribute to society.

Spreading and increasing culture is a mission for universities but, in democracy, it is also an assignment for policymakers and public officials to ensure that culture remains a common good (Gielen et al., 2015). For this reason, in recent years the United Nations has emphasised the fundamental role of culture for sustainable development, and the European Union has promoted initiatives to preserve our cultural heritage and supports cultural and creative industries (Damien & Galeazzi, 2016). However, despite this sharing of intents between institutional actors and universities, no scholar has investigated the role that universities can play in promoting a cultural ecosystem.

In conclusion, this analysis shows the following research gaps:

- The literature on entrepreneurial universities and entrepreneurial ecosystems focuses mainly on the role of universities as incubators of high-tech startups or technology transfer actors, despite the emerging relevance of creative and cultural initiatives for regeneration and local development.
- The literature on cultural ecosystems has neglected to investigate the role that an entrepreneurial university can play as a leading engine to create economic and social values.

This paper aims to contribute to filling this gap, focusing on how to design a new value chain for the launch of startups in the creative and cultural sector, where universities can play a catalyst and pivotal role.

In particular, it sheds light on:

- the process through which academic entrepreneurs can give impetus to the improvement of the University third mission;
- the catalyst role that Universities can play in activating and sticking to different resources/capital/actors/stakeholders for the success of cultural initiatives with high socio-economic impact and the birth of new ventures in the cultural and creative sector.

3 Methodology

Based on a sound literature review in both the field of entrepreneurial university and cultural ecosystems, the authors adopted an action research approach to analysing a paradigmatic case study.

3.1 Case selection

The case investigated concerns the process that ended in a pilot project titled “Incubiamo Cultura”. The latter was launched by an academic entrepreneur, who envisaged the possibility to design an initiative that leads the University of Genoa in playing a pivotal role in supporting new ventures in the cultural and creative sector. Meanwhile, it responds to the cultural needs emerging from the degraded neighbourhoods of the city in order to foster urban regeneration.

The main reasons why we selected this case are because it is an exemplary case due to the fact that the authors are directly involved in the project (one as the founder and orchestrator of the initiative and the other being involved as an observer-participant). In addition, it is a successful initiative and it is a very rare case of an Italian university acting as a leading engine actor in a cultural project for urban regeneration.

3.2 Action research approach

According to Reason and Bradbury (2006, p. 1), action research is a process that “seeks to bring together action and reflection, theory and practice”. Consistent with the interpretative approach, this is a case study whereby the researchers are involved in the initiative, offering solutions for actual problems and contributing to theory at the same time (Dumay, 2010).

Action research as a methodology considers not only the observations of the researcher but also the impact the interventions have on the real world. The researcher's main benefit is the ability to develop insights into the implementation of management actions.

There is not an agreed set of methodological protocols, or rules, shared by all researchers; however, action research usually begins with the Entry Stage, which in our case can be aligned with the launch of the initiative in 2017. Diagnosis is a pivotal stage in action research, as the researcher(s) may introduce organizational members to conceptual schemes and/or theories that enable them to reinterpret how they perceive their situation. The ultimate goal of this phase is to develop a conscious understanding

among organizational members and to co-determine and plan possible interventions. This paper, coming from a period of discussion and debate with the different stakeholders engaged, is an outcome of the diagnosis phase of the project.

The intervention stage will follow, during which both practitioners and researchers try to implement management innovation.

3.3 Data collection and data analysis

Data were collected from 2018 to 2019 by the authors, who acted as “participant-observers.”

Data used for the analysis come from different sources:

- (1) notes from meetings and discussions about the goals, opportunities and threats of the project “Incubiamo Cultura” that have been produced throughout two years, from the inception of the project so far (March 2019);
- (2) proprietary reports and documents;
- (3) No. 7 unstructured interviews with relevant stakeholders from the project (Fontana and Frey 1998). They helped the promoter of the project to reach a better understanding of the complexity of the phenomena and its dynamics (Qu and Dumay 2011). The interviewees were one manager of the University’s TTO; five experts from the commission in charge to assess the business models drawn by the students and one councillor for culture and events from the city of Genoa.

Data analysis was an ongoing process. In the first step of the data analysis, the author/founder of the project created a rich description of the case, drawing on her experience and putting together interviews and data from different sources. Then each author read the empirical material independently and categorised the stream of words into meaningful categories, via manual open coding. Subsequently, the results obtained by each author were compared and discussed to highlight the main levers of the success of the initiatives and the possibility to replicate them in other contexts.

4 Case study - the main constituent elements

Incubiamo cultura is a pilot project currently in progress in the Department of Economics and Business Administration at the University of Genoa. It was born from a successful educational experience, a Master class in Entrepreneurship for cultural heritage, which obtained a grant under the European Social Fund–Education, Skills, and Life-long learning axis. The Master class was the occasion used to observe the needs emerging from aspiring entrepreneurs and conceptualise the idea of an entrepreneurship value chain, where universities play a pivotal role in supporting new ventures, especially in the cultural and creative domain (Joglekar and Lévesque, 2013).

This program is innovative, as numerous previous actions of universities in supporting and incubating start-ups are especially focused on hi-tech companies, neglecting other business sectors and especially cultural and social entrepreneurship. In the meantime, educational initiatives in the cultural and creative sector focus mainly on management and not on entrepreneurship (Comunian and Gilmore, 2016).

Incubiamo cultura aims to create physical spaces in urban areas and neighbourhoods, where cultural and creative start-ups can work closely with citizens, to restore abandoned cultural assets and deliver cultural initiatives (Rinaldi et al., 2018). It works by carrying out initiatives for the co-working, incubation and leveraging of new companies in the cultural and creative sector.

However, the final goal of this pilot project is also (or especially) to investigate the replicability and transferability of the core constituent elements of the project and the main processes to realise it.

The peculiar aspects of this project are the processes, actors, participatory approach and values.

The core constituent elements of the project are represented in Figure 1 as they emerged gradually in the creative path underlying the project design. In detail, there is not a hierarchic logic but an increasing degree of interconnections and complexity among the different depicted elements.

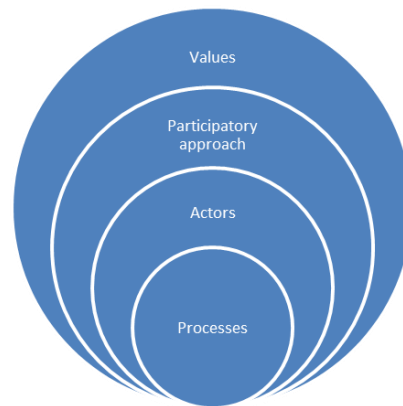


Figure 1- “Incubiamo cultura” project main constituent elements

Processes

The underlying belief in planing Incubiamo cultura is that young people attending a Master class in entrepreneurship want to become entrepreneurs, but they have not got enough instruments for success in their venture. The start-up phase is a difficult path requiring mentoring and support, and also an ecosystem able to incubate the “newborn” firm.

For this reason, the Master class is only one step towards building entrepreneurial capacity in a city, neighbourhood or region. To really create value thanks to educational programs in entrepreneurship it is necessary to implement the following main processes:

- *Scouting*, that is, a selection of the best aspirant entrepreneurs and, concurrently, the best business ideas in the cultural and creative sector;
- *Education*, that is, master programs especially addressed to the selected aspiring entrepreneurs;

- *Incubation*, that is, setting up a physical place and mentoring activities that support new ventures in their first steps;
- *Dissemination*, because “one swallow does not a summer make ”: the pilot project should be communicated, participated and especially replicated thanks to a protocol that is able to reproduce the experience in different cities, urban areas and neighbourhoods to multiply the positive impacts.

Actors

To start the project the pivotal role is played by academic entrepreneurs, as they have the characteristics and capability to transform their competence into triggers for the initiative. Moreover, innovative academic entrepreneurship is the outcome of a mix of different university activities, emerging from research, education and third mission, that is, the transfer of academic knowledge into business practice. However, cultural entrepreneurship is a particular field of business, involving not only entrepreneurship *strictu sensu* but also special patterns of collaboration between diverse actors, such as local government, citizens, not-for-profit organizations, district communities, neighbourhood committees, local schools and other actors of the civil society. In a single word, it is “territory” where the physical space of Incubiamo Cultura will be settled. This peculiar aspect determines the crucial role of local networks.

Incubiamo cultura involves five main actors in a network cooperation:

- The University of Genoa that, thanks to its academic entrepreneurs, can play a catalyst and pivotal role in leading the whole project;
- the Municipality of Genoa, especially the Culture Directorate and the Real estate Directorate: the former will support the individuation of cultural needs of the neighbourhoods, the latter will provide buildings belonging to the Municipal cultural heritage, which are currently abandoned and tattered;
- Palazzo Ducale, a cultural foundation playing the role of the main partner in supporting the cultural start-ups in developing their cultural programs;
- Talent Garden, a private company leader in managing co-working space for innovative startupper, delivering courses and supporting meetings amongst potential business partners. Its role is to transfer knowledge about co-working and fostering business;
- Day One, a private company leader in cultural communication, to implement communication strategies for both start-ups and the pilot project.

It is worth underlining that the representatives of all the partners have already been involved in teaching or mentoring during the Master class, and it is thanks to the experience of Incubiamo cultura that synergies have been individuated and pursued.

Participatory Approach

Incubiamo cultura aims to create several spaces where cultural and creative firms can spring up, grow and flourish, restoring abandoned cultural assets and delivering artistic and cultural performances to citizens. This cultural profile requires the active

participation of people in defining their cultural needs, restoring the cultural heritage and enhancing the neighbourhood (Demartini et al. 2018). Therefore, a participated, bottom-up approach is required to grant the initiative success, as the initiative is carried out to respond to the cultural needs that emerge from the neighbourhoods.

Values and aims

Differently from hi-tech start-ups, cultural start-ups pursue not only financial value but also social value (Evans, 2005). Financial value is not only a driver of wellness and richness for a community but also a driver for job creation and economic development in the long term. Social value regards culture dissemination, arts promotion and civilisation. Restoration and the upgrading of cultural assets and valorisation of cultural heritage are a must. For these reasons, creating a cultural incubator is not only an economic initiative, but a complex initiative and the not-for-profit nature of universities is crucial to support and spread these values among the different actors of the network and the stakeholders involved.

5 Discussion: a lesson to be learnt

Incubiamo Cultura has been designed keeping in mind some pivotal aspects and drivers of success:

- the implementation of a set of activities linked to an “Entrepreneurial Value Chain”;
- the creation of a network of actors involving academic players, public and private bodies;
- pursuing a mix of values (i.e., cultural, social, economic and environmental);
- the sustainability and replicability of the experience, thanks to a collection of best practices to be translated in standard processes.

As far as the Entrepreneurial Value Chain is concerned, the project is mainly based on the linking of a sequence of processes—the Entrepreneurial value Chain—aiming to create a mix of economic and social values through the activities that support entrepreneurship in the creative and cultural sector. This value chain faces the main problems affecting aspiring entrepreneurs, especially in the cultural and creative sector. In a nutshell, a university can offer the education to fulfil the lack of managerial skills affecting most potential entrepreneurs, whose education has been built in the Arts and Humanities domain, services for the implementation of the business idea and networking and relationships.

The project focuses on some core processes:

1. the entrepreneurial education, conceived as leverage to settle innovative and sustainable cultural start-ups, able to overcome the seed stage of their life also thanks to mentoring (Kuhlke et al., 2015);
2. the process of incubating and accelerating new ventures, as a leverage to create economic value, skilled jobs and cultural milieus;

3. co-working, intended not only like a space or a new way to organise labour but especially like a tool to develop a cultural community of creative entrepreneurs working in the urban areas spread throughout the city (Spinuzzi, 2012; Merkel, 2015);

The main success factor of this initiative is the chain of processes, in which each process exploits the value created by its antecedent and feeds the value creation of the one that follows. As shown in Figure 2, the value creation process is an incremental path from the selection of participants to the acceleration of the created firms.

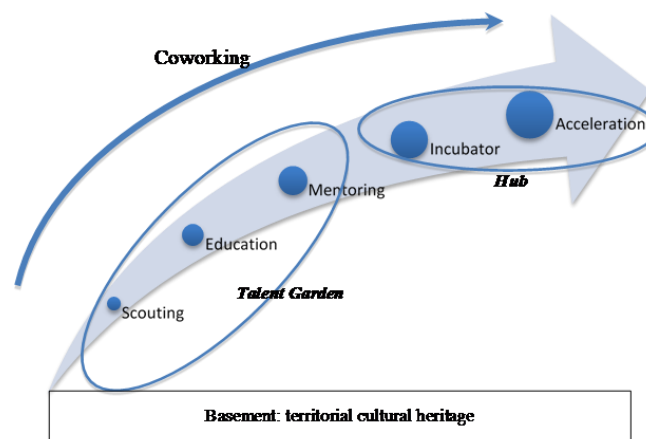


Figure 2- The Entrepreneurial Value Chain

The first three stages—scouting, education and mentoring—create a sort of Talent Garden (Mariotti et al., 2017; Bianchi et al., 2018), that is, a place where they can cultivate talents and grow. The latter two—incubation and acceleration—form a hub, where entrepreneurial activities are supported by the entrepreneurial university, delivering services and competencies.

The basis for the Entrepreneurial Value Chain of the project Incubiamo Cultura is the establishment of the cultural start-ups in tattered and abandoned locations, to exploit the city cultural heritage and favour urban regeneration.

6 Conclusions

As seen in our case study, universities can play a leading role in regenerating the cultural context of their territories.

Up to this point, many scholars have delved into the topic of how a university that has included the third mission in its strategy should be managed according to managerial logic (Etzkowitz, 2004; Secundo et al., 2015, 2016). However, today not one scholar has addressed the issue of how universities can support value creation in urban regeneration thanks to the activities of academic entrepreneurship.

Relationships and networking are the key factors for success, especially in the cultural and creative sector. Indeed, relationships can be seen as antecedent factors of a new model of iterative and collaborative innovation between entrepreneurial universities and their ecosystems.

Moreover, the specific nature of cultural and creative firms and the public value of cultural heritage define a peculiar set of processes and a different way in which the Entrepreneurial Value Chain is realised.

All these aspects are new respect to previous experiences, especially based on hi-tech ventures incubation.

Further research

This paper focuses on the design of a network and a value chain for the launching of startups in the cultural and creative sector, where universities can play an orchestrator role. Nevertheless, further research is needed on its implementation and to assess its replicability in other contexts.

As a second and noteworthy issue, we deem that evaluating the alignment between strategic orientation and performance within universities has become of paramount relevance. However, we deem that traditional indicators used to rank an entrepreneurial university (such as the no. of patents or the no of spinoffs) are not enough to account for the societal value that universities can create.

References

- Audretsch, D. B., Bönte, W., & Keilbach, M. (2008). Entrepreneurship capital and its impact on knowledge diffusion and economic performance. *Journal of business venturing*, 23(6), 687-698.
- Autio, E., Kenney, M., Mustar, P., Siegel, D., & Wright, M. (2014). Entrepreneurial innovation: The importance of context. *Research Policy*, 43(7), 1097-1108.
- Bailey C, Miles S and Stark P (2004) Culture-led urban regeneration and the revitalisation of identities in Newcastle, Gateshead and the north east of England. *International Journal of Cultural Policy* 10(1): 47–65.
- Balazs, K. (1996). Academic Entrepreneurs and their Role in 'Knowledge' Transfer (PDF). *Science Policy Research Unit*, University of Sussex
- Bercovitz, J., & Feldman, M. (2008). Academic entrepreneurs: Organizational change at the individual level. *Organization science*, 19(1), 69-89.
- Bianchi, F., Casnici, N., & Squazzoni, F. (2018). Solidarity as a byproduct of professional collaboration: Social support and trust in a coworking space. *Social Networks*, 54, 61-72.
- Borin, E., & Donato, F. (2015). Unlocking the potential of IC in Italian cultural ecosystems. *Journal of Intellectual Capital*, 16(2), 285-304.
- Bourdieu, P. (1986). The forms of capital.
- Bradbury, H., & Reason, P. (2006). Conclusion: Broadening the bandwidth of validity: Issues and choice-points for improving the quality of action research. *Handbook of action research*, 343-351.
- Comunian, R. and Gilmore, A. (2016). *Higher Education and the Creative Economy. Beyond the campus*. Routledge, London.
- Corbett, A. C., Katz, J. A., & Siegal, D. S. (Eds.). (2014). *Academic entrepreneurship: Creating an entrepreneurial ecosystem*. Emerald Group Publishing.

- Council of the EU (2014) Conclusions on cultural heritage as a strategic resource for a sustainable Europe and on participatory governance of cultural heritage. May and November 2014.
- D'este, P., & Perkmann, M. (2011). Why do academics engage with industry? The entrepreneurial university and individual motivations. *The Journal of Technology Transfer*, 36(3), 316-339.
- Dameri, R. P., Fontana, F., & Garelli, R. (2015). Innovation and Entrepreneurship by Academic Spin-Offs: The UNITI Business Case. *Innovation Intermediaries for Entrepreneurship and Innovation: Case Studies and Perspectives*, 117.
- Dameri, R., & Garelli, R. (2016, April). Intellectual Capital Disclosure and Awareness in Academic Spin-offs. In *ECIC2016-Proceedings of the 8th European Conference on Intellectual Capital: ECIC2016* (p. 61). Academic Conferences and publishing limited.
- Damien H., Galeazzi G. (2016). Culture in EU development policies and external action, *Briefing notes, Ecdpm*, n. 92
- Demartini, P., Marchiori, M., & Marchegiani, L. (2018). Citizen Engagement as a Criterion to Select the European Capital of Culture: a Critical Appraisal, *IFKAD Proceeding* 2018.
- Dumay, J. C. (2010). A critical reflective discourse of an interventionist research project. *Qualitative Research in Accounting & Management*, 7(1), 46-70.
- Etzkowitz, H. (2002), "Incubation of incubators: innovation as a triple helix of university-industry government networks", *Science and Public Policy*, Vol. 29 No. 2, pp. 115-128.
- Etzkowitz, H. (2003), "Research groups as 'quasi-firms': the invention of the entrepreneurial university", *Research Policy*, Vol. 32 No. 1, pp. 109-121.
- Etzkowitz, H. (2004), "The evolution of the entrepreneurial university", *International Journal of Technology and Globalisation*, Vol. 1 No. 1, pp. 64-77.
- Evans, G. (2005). Measure for measure: Evaluating the evidence of culture's contribution to regeneration. *Urban studies*, 42(5-6), 959-983.
- Formica, P., Varblane, U., Mets, T. (2008). *Knowledge Matters*. Palgrave Macmillan, London. pp. 21-51.
- Franklin, S. J., Wright, M., & Lockett, A. (2001). Academic and surrogate entrepreneurs in university spin-out companies. *The Journal of Technology Transfer*, 26(1-2), 127-141.
- Friedman, J., & Silberman, J. (2003). University technology transfer: do incentives, management, and location matter?. *The Journal of technology transfer*, 28(1), 17-30.
- Gielen, P., Elkhuisen, S., Van den Hoogen, Q., Lijster, T., & Otte, H. (2015). *Culture: the substructure for a European common*. Rijksuniversiteit Groningen.
- Gilmore, A., & Comunian, R. (2016). Beyond the campus: higher education, cultural policy and the creative economy. *International journal of cultural policy*, 22(1), 1-9.
- Guerrero, M., & Urbano, D. (2012). The development of an entrepreneurial university. *The journal of technology transfer*, 37(1), 43-74.
- Hayter, C. S. (2016). A trajectory of early-stage spinoff success: the role of knowledge intermediaries within an entrepreneurial university ecosystem. *Small Business Economics*, 47(3), 633-656.
- Hayter, C.S., Nelson, A.J., Zayed, S. and O'Connor, A.C., 2018. Conceptualizing academic entrepreneurship ecosystems: A review, analysis and extension of the literature. *The Journal of Technology Transfer*, 43(4), pp.1039-1082.
- Hawkes J., (2001). The fourth pillar of sustainability: Culture's essential role in public planning. *Common Ground*.
- Joglekar, N., & Lévesque, M. (2013). The role of operations management across the entrepreneurial value chain. *Production and Operations Management*, 22(6), 1321-1335.
- Kuhlke, O., Schramme, A., & Kooyman, R. (2015). *Creating cultural capital: cultural entrepreneurship in theory, pedagogy and practice*. Eburon Uitgeverij BV.

- Mariotti, I., Pacchi, C., & Di Vita, S. (2017). Co-working spaces in Milan: Location patterns and urban effects. *Journal of Urban Technology*, 24(3), 47-66.
- Merkel, J. (2015). Coworking in the city. *ephemera*, 15(2), 121-139.
- Miller, D. J., & Acs, Z. J. (2017). The campus as entrepreneurial ecosystem: the University of Chicago. *Small Business Economics*, 49(1), 75-95.
- Piber, M., Demartini, P., & Biondi, L. (2019). The management of participatory cultural initiatives: learning from the discourse on intellectual capital. *Journal of Management and Governance*, 1-24.
- Qu, S. Q., & Dumay, J. (2011). The qualitative research interview. *Qualitative research in accounting & management*, 8(3), 238-264.
- Rinaldi, C., Cavicchi, A., Spigarelli, F., Lacchè, L., & Rubens, A. (2018). Universities and smart specialisation strategy: From third mission to sustainable development co-creation. *International Journal of Sustainability in Higher Education*, 19(1), 67-84.
- Roberts, E. B., & Eesley, C. E. (2011). Entrepreneurial impact: The role of MIT. *Foundations and Trends® in Entrepreneurship*, 7(1-2), 1-149.
- Sacco P, Ferilli G and Blessi GT (2014) Understanding culture-led local development: a critique of alternative theoretical explanations. *Urban Studies* 51(13): 2806–2821.
- Sasaki M (2010) Urban regeneration through cultural creativity and social inclusion: rethinking creative city theory through a Japanese case study. *Cities* 27: S3–S9.
- Secundo, G., Dumay, J., Schiuma, G. and Passiante, G. (2016), “Managing intellectual capital through a collective intelligence approach: an integrated framework for universities”, *Journal of Intellectual Capital*, Vol. 17 No. 2, pp. 298-319
- Secundo, G., Margherita, A., Elia, G. and Passiante, G. (2010), “Intangible assets in higher education and research: mission, performance or both?” *Journal of Intellectual Capital*, Vol. 11 No. 2, pp. 140-157.
- Simeone L., Secundo G., Schiuma G. (2018) Arts and design as translational mechanisms for academic entrepreneurship: The metaLAB at Harvard case study, *Journal of Business Research*, Volume 85, 2018.
- Slaughter, S., Slaughter, S. A., & Rhoades, G. (2004). *Academic capitalism and the new economy: Markets, state, and higher education*. JHU Press.
- Spigel, B. (2017). The relational organization of entrepreneurial ecosystems. *Entrepreneurship Theory and Practice*, 41(1), 49-72.
- Spinuzzi, C. (2012). Working alone together: Coworking as emergent collaborative activity. *Journal of Business and Technical Communication*, 26(4), 399-441.
- Throsby D (2010) *The Economics of Cultural Policy*. Cambridge, UK: Cambridge University Press.
- UNESCO (2003) Text of the convention for the safeguarding of the intangible cultural heritage. Available at: <http://www.unesco.org/culture/ich/en/convention>. (accessed August 2018).
- Venturini, K., & Verbano, C. (2017). Open innovation in the public sector: Resources and performance of research-based spin-offs. *Business Process Management Journal*, 23(6), 1337-1358.
- Wright, M. (2014). Academic entrepreneurship, technology transfer and society: where next?. *The journal of technology transfer*, 39(3), 322-334.

Elderly & Artificial Intelligence: Evidence of the Main Determinants of the Intention to Use a Virtual Coach for Healthy Ageing through a TAM-extended Model

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Abstract

Ageing is a relevant and urgent priority on the agenda of all the most industrialized countries. Ageing is harming the sustainability over time of the national healthcare systems as we know them nowadays. While policymakers are paying major attention to chronic care and the emerging new needs of patients who are aged 60+, less light has been shed on how to enable population-wide Healthy Ageing initiatives that offer the opportunity to postpone the need of institutionalized care and thus guarantee a longer healthy life to elderly.

This study aims at furthering the debate about Healthy Ageing initiatives for elderly aged 60+ by shedding new light on the behavioural determinants of elderly's intention to use a personalized, artificial intelligence-enabled, virtual coaching system for healthy ageing. Being the use of these systems based on individual "voluntariness", understanding what might enable or inhibit such behaviour is of paramount importance for policymakers, professionals and developers. In fact, recent evidence shows that, despite the demonstrated benefits of these systems, the level of adoption among citizens aged 60+ falls far short of the expectations.

This study develops and empirically tests an original model that, adopting the Technology Acceptance Model (TAM) as overarching theory, adds three other explanatory variables, i.e. Subjective Norm, Health Literacy and Information Technology (IT) Literacy. This study has been carried out within the NESTORE H2020 research project (ID 769643).

Data from 436 Italian citizens aged 60+ were collected to test the hypotheses via Structural Equation Modelling. Results confirmed that Intention to Use a virtual coaching system is explained by Perceived Ease of Use and Perceived Usefulness. While Subjective Norm was found to have an indirect influence. Health Literacy has a negative effect on the Perceived Usefulness. Finally, IT Literacy positively influenced Intention to Use through the partial mediation of Perceived Ease of Use.

Our results contribute to theory by unfolding the role played by Subjective Norm, Health and IT Literacy, being the last two factors at the core of numerous improvement

strategies. With respect to practice, the study offers implications to different stakeholders to facilitate the adoption of digital technologies for healthy ageing.

Keywords – Healthy Ageing, Technology Acceptance Model, Health Literacy, IT Literacy, Elderly, Artificial Intelligence

Paper type – Academic Research Paper

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This study has been developed within the NESTORE H2020 research project – ID 769643.

1 Introduction

Ageing is a significant challenge that the most industrialized countries must face seriously to guarantee the sustainability of their societies as well as of their national healthcare systems. Citizens 60+ are expected to get to 2.1 billion in 2050 and they will outnumber children aged 0-9 (World Health Organization, 2015). This global megatrend poses inevitably new challenges to policymakers. In this view, “How to enhance elderly’s ability to live a longer healthy life?”, “How to empower citizens on the engagement into healthy behaviours?” are salient and urgent questions on the agenda of both policymakers and academicians. The World Health Organization (WHO) introduced the concept of “Healthy Ageing”, intended as the process through which an individual can maintain or enhance her well-being within the ageing process. Accordingly, the WHO outlined the importance that citizens embrace a proactive approach to maintain good health conditions over the entire lifetime and it recognised the powerful role of digital technologies that can incorporate and administer the professional knowledge required.

In this regard, virtual coaching systems represents a paradigmatic example of supportive digital technologies applied to citizens’ decision-making that are based on artificial intelligence and heterogeneous sources of knowledge, such as clinical guidelines, citizens’ lifestyle behaviour, etc. These systems leverage real-time data gathering and processing capabilities to guide the user through repeated interactions, feedback and recommendations based on behavioural theories operationalized in a plan of action (Kamphorst, 2017). Virtual coaching systems, being a promising example of innovative ways to store and exploit medical knowledge, offer the potential to support healthy ageing on a population-wide scale with cost-effective solutions (Robbins et al., 2018). Despite this potential, the rate of adoption among citizens aged 60+ falls far short of the expectations (Carroll et al., 2017).

Within this background, our study aims at furthering the ongoing debate on the exploitation of heterogeneous sources of knowledge through supportive digital technologies to promote healthy ageing and thus contributing to the sustainability of the healthcare systems of the most industrialized countries. Specifically, this study sheds light on the determinants of elderly’s intention to use a virtual coach for healthy ageing, targeting people aged 60+.

2 Theoretical Framework and Hypothesis Development

We developed our theoretical framework to identify the main determinants that shape elderly's intention to adopt (and consequently to use) a virtual coaching system for engaging in healthy ageing behaviours grounding on the original formulation of the Technology Acceptance Model (TAM) by Davis (1989). We extended the original formulation by investigating the role played by three additional factors that were found significant within the literature about VCSs and are at the core of numerous improvement strategies implemented by the national healthcare systems worldwide. These factors are expected to improve the explanatory power of the original model. First, we considered the social influence exerted by people who are relevant to the individual, conceptualised as *Subjective Norm* (Venkatesh and Davis, 2000). Second, we introduced *Health Literacy*, considered as the degree to which an individual perceive to be able to find, process, and understand health-related information to ground her decisions (U.S. Department of Health and Human Services, 2010). Third, we included the individual's *Information Technology (IT) Literacy*, intended as the degree to which an individual perceives to be confident in using a technological device to perform a desired task (Lynch, 1998).

Figure 1 offers an overview of our theoretical framework with the main hypotheses that will be empirically tested. Each hypothesis will be introduced briefly in the followings.

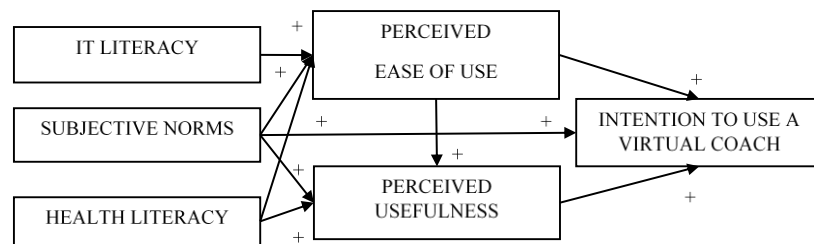


Figure 4. Theoretical model and hypotheses (control variables are not displayed)

Past studies confirmed the underlying hypotheses of the TAM theory in healthcare, i.e. the positive influence of both PEU and PU on the Intention to adopt wellbeing, wearable technologies (e.g., Kalantari, 2017). Indeed, we proposed the following hypotheses:

H1: Perceived Ease of Use has a positive influence on the Intention to Use a virtual coaching system for healthy ageing.

H2: Perceived Usefulness has a positive influence on the Intention to Use a virtual coaching system for healthy ageing.

The positive effect of PEU on PU has been widely confirmed by previous studies in healthcare, e.g., Weng (2016) and Liu et al. (2013). Accordingly, we formulated the following hypothesis.

H3: Perceived Ease of Use has a positive influence on the Perceived Usefulness of a virtual coaching system for healthy ageing

Subjective Norm – defined as the social influence of relatives, friends, doctors and other people who are perceived as relevant by the individual – can affect significantly the intention to embrace a novel technology (e.g., Venkatesh and Davis, 2000). Subjective Norm can influence the intention to use a virtual coaching system both directly and indirectly. Especially older adults, who do not own commonly a consistent background on new digital technologies, can be influenced favourably by their family members' (e.g., Teo and Pok, 2003) as well as by doctors' (e.g., Wu et al. 2007) opinions. Other contributions (e.g., Cho et al., 2014; Kim and Park, 2012) showed that others' opinions can affect positively the intention to use health information technologies through PU and PEU, because these opinions can be useful in developing a deeper understanding of the technology (e.g., Hartwick and Barki, 1994). Accordingly, we made the following hypothesis.

H4: Subjective Norm has a positive influence on the Intention to use a virtual coaching system for healthy ageing. Perceived Usefulness and Perceived Ease of Use partially mediate the relationship.

Health Literacy refers to how an individual obtains, understands, uses and communicates health information to make informed decisions. Mackert et al. (2016) found that people with a higher health literacy perceived health information technology as more useful and easy to use. Similarly, the ability to gather and interpret health information was found to be related to the perceived easiness of using online health Apps (Cho et al., 2014). Accordingly, we hypothesized that:

H5: Health Literacy has a positive influence on the Intention to a virtual coaching system for healthy ageing through the mediation of (a) Perceived Usefulness and (b) Perceived Ease of Use.

Information Technology (IT) Literacy refers to the perception of the individual of her ability to use a digital device (Lynch, 1998). Previous studies highlighted that the capability to use digital technologies is a predictor of the adoption of a health-related digital technology (Weng, 2016). The frequency and the ability of using a personal computer influence the individual in evaluating if a computer-based technology is easy to handle or not (Princely, 2015). Similarly, another contribution by Melas et al. (2011) proved that knowledge about ICTs affects indirectly the behavioural intention to use clinical information systems through PEU. Accordingly, we hypothesized that:

H6: IT Literacy positively affects Intention to Use a virtual coaching system for healthy ageing through the mediation of Perceived Ease of Use.

3 Methods

Data were collected within the NESTORE H2020 project by means of an online survey compliant to the GDPR requirements and administered in Italy to citizens 60+ between June and August 2018. All constructs were measured by adapting previously published scales. The final sample was composed of 436 high-quality answers. Hypotheses were tested using Structural Equation Modelling in STATA14. The validity and reliability of the constructs, as well as the significance of the hypothesized

relationships among the latent variables, were verified through the output of the measurement and structural model respectively. Finally, the goodness of fit of the proposed model was assessed.

4 Results

4.1 Measurement Model

Table 1 shows the Average Variance Extracted (AVE) and the Composite Reliability (CR) for all constructs included in the model. The values are higher than commonly accepted thresholds (equal to 0.50 and 0.70 respectively), indicating a good convergent validity for all constructs.

Table 1. Confirmatory Factor Analysis

Construct	AVE	CR
Intention to Use (ITU)	0.6420	0.9146
Perceived Usefulness (PU)	0.7105	0.8303
Perceived Ease of Use (PEU)	0.5973	0.8549
Subjective Norms (SN)	0.7520	0.8746
Health Literacy (HL)	0.5227	0.8136
IT Literacy (ITL)	0.6083	0.7564

4.2 Structural Model

Table 3 reports the path coefficients and the related p-values from the Structural Model.

Table 2. Results of the Structural Model

Path	Coefficient	Std. Err.	p-value
PEU → ITU	0.1915	0.0555	***
PU → ITU	0.8563	0.0742	***
PEU → PU	0.4224	0.0452	***
SN → ITU	- 0.1187	0.0644	n.s.
SN → PU	0.5871	0.0386	***
SN → PEU	0.3198	0.0462	***
HL → PU	- 0.0906	0.0439	*
HL → PEU	0.3327	0.0486	***
ITL → PEU	0.3641	0.0492	***
CIV → ITU	- 0.0395	0.0298	n.s.
GEN → ITU	- 0.0037	0.0304	n.s.
EDU → ITU	- 0.0228	0.0320	n.s.
JOB → ITU	- 0.0385	0.0298	n.s.
RES → ITU	- 0.0192	0.0309	n.s.
HEA → ITU	0.0114	0.0295	n.s.
*** p ≤ 0.001; ** p ≤ 0.01; *p ≤ 0.05; n.s. p > 0.05			

4.3 Goodness of Fit

Finally, a set of indexes were computed to assess the goodness of fit of the proposed model. As anticipated, four indexes were taken into account as recommended by the academic literature, i.e., the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Residual (SRMR), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI). As reported in Table 2, all indexes' values are in line with common values accepted in the literature (e.g., Hair et al., 2010).

Table 2. Goodness of Fit Indexes

Index	Value	Suggested Threshold
RMSEA	0.06	< 0.07
SRMR	0.05	< 0.08
CFI	0.91	> 0.90
TLI	0.91	> 0.90

5 Discussion

Although Virtual Coaching Systems (VCSs) proved to contribute positively to healthy ageing in elderly, their rate of adoption by citizens aged 60+ is still far short of the expectations. In this regard, this study aimed at shedding novel light on the determinants of elderly's intention to use a VCS for healthy ageing purposes. To this end, a set of hypotheses was developed for the specific case of VCS for health ageing starting from the original formulation of the TAM model (Davis, 1989). In particular, the original model has been extended by introducing three additional external variables, i.e., Subjective Norms, Health Literacy, and IT Literacy.

Our results confirm the basic linkages posited by the TAM theory. In fact, more the PEU of a VCS, more the intention to use it. Similarly, more the perception that the use of a VCS will bring effective improvements with respect to healthy ageing, more the intention to use. These findings are aligned to past studies that applied TAM to healthcare (e.g., Wang et al., 2014).

As original contribution, we found that the direct relationship between Subjective Norm and Intention to Use is not significant. This implies that the degree to which people relevant to the individual judge positively (or not) the use of a VCS does not influence directly its adoption by the individual. This result is thus not consistent with our initial hypothesis. However, we found the relationship between Subjective Norm and Intention to Use resulted to be fully mediated by PU and PEU. Given the target population and their voluntariness of using a VCS, we can assume that the positive (or not) opinions of friends, family and doctors have an impact on the intention to use a VCS only when they are fully internalized in the elderly's belief structure (Venkatesh and Davis, 2000). Additionally, the opportunity of receiving help and indications by friends, family and doctors on how to use the technology can contribute to the perception that its actual use is manageable and easy.

Contrary to expectations, our findings suggest a negative influence of Health Literacy (HL) on the PU of a VCS. Our novel evidence points out that a higher degree in HL has a negative impact on the PU of the system. One possible interpretation for this result is that if an elderly person already has a good capability to find information about her personal well-being and a good degree of understanding of this information, she would find it unnecessary and of little value added to use an additional digital tool (i.e., the VCS) to maintain her well-being.

On the other hand, our results confirm that a higher level of HL leads elderly to perceive the VCS as easier to use. This result is coherent to previous studies in the e-health field (e.g., Cho et al., 2014).

Finally, our results offer significant support of the positive relationship between IT Literacy (ITL) and PEU. This result is consistent to the theoretical arguments in literature according to which good familiarity with technological devices increases the ease of use of personal health and lifestyle digital systems (e.g., Kalantari et al., 2017).

Our results contribute to practice, too. In fact, health policymakers, healthcare professionals, and developers of digital solutions for citizens' healthy ageing might benefit from the novel evidence gathered in this study. The first suggestion deals with the design and the sponsoring of a solution that appears easy to use and in which the virtual coach is perceived as easy to follow. Indeed, when searching for a VCS, the potential user who is aged 60+ should have the perception of an easy to use tool. This goal can be achieved by showing that only a few steps are required to engage with the system as well as by communicating that only few data will be required to initiate the coaching program. Furthermore, a graphical interface that expresses an idea of simplicity could increase even more this perception. Second, developers of VCSs are advised to make the actual utility of these systems more evident to the users to increase their adoption. They should act to make elderly aware of the actual benefits of virtual coaching, for example by sponsoring successful cases of application. Similarly, about health literacy and its negative effect on the Perceived Usefulness, developers and healthcare professionals need to provide clear evidence of the effective benefits and value added driven by the ability of such systems to act upon the behaviour of a person.

6 Limitations, Future research and Conclusions

Our results should be interpreted in the light of the limitations of this study, that we suggest future research should address. First, we implemented a cross-sectional design. Consequently, we cannot offer definitive conclusions on causation, even if past contributions supported the development of our hypotheses. Future longitudinal research would be useful in establishing causality. Second, data were collected by means of an online survey. This means that seniors with limited access to the Internet or low digital skills may have been underrepresented in the final sample that may not be perfectly representative of the entire population. Moreover, our data come from a single country (Italy). Hence, the generalizability of our results should be proven by future research. In this regard, we encourage scholars of healthcare management to test our hypotheses in

different contexts (e.g., developed and developing countries). Finally, because of the unexpected negative effect of Health Literacy on the Intention to Use a VCS, and because our construct was mainly focussed on the well-being information domain, it could be interesting to further investigate the role of Health Literacy, for example considering different Health Literacy orientations.

In conclusion, despite the limitations of our study, we claim that our results shed novel light on the determinants and the inner mechanisms that shape elderly's intention to use a VCS for healthy ageing, contributing to the theoretical understanding of user discretionary acceptance of technologies as a mean for pursuing health-related goals. Moreover, our findings provide health policymakers, healthcare professionals and technology developers with evidence-based recommendations on how to promote and enable population-wide interventions about healthy ageing through digital technologies.

References

- Ajzen, I., 1991. "The Theory of Planned Behavior. Organizational Behavior and Human Decision Processes", 50: 179–211.
- Ajzen, I., 2002. "Constructing a TPB Questionnaire: Conceptual and Methodological Considerations".
- Albaina, I., Visser, T., Van Der Mast, C. and Vastenburg, M., 2009. "Flowie: A persuasive virtual coach to motivate elderly individuals to walk". In *Pervasive Computing Technologies for Healthcare, 2009. Pervasive Health 2009. 3rd International Conference*, (1-7).
- Cajita, M. I., Hodgson, N. A., Budhathoki, C., and Han, H. R., 2017. "Intention to use mHealth in older adults with heart failure". *Journal of Cardiovascular Nursing*, 32:E1-E7.
- Callejas, Z., Griol, D., McTear, M. and López-Cózar, R., 2014. "A Virtual Coach for Active Ageing Based on Sentiment Computing and m-health". *International Workshop on Ambient Assisted Living*, pp.59-66.
- Carroll, J., Moorhead, A., Bond, R., LeBlanc, W., Petrella, R. and Fiscella, K., 2017. "Who Uses Mobile Phone Health Apps and Does Use Matter? A Secondary Data Analytics Approach". *Journal of Medical Internet Research*, 19:e125.
- Cho, J., Quinlan, M., Park, D. and Noh, G., 2014. "Determinants of Adoption of Smartphone Health Apps among College Students". *American Journal of Health Behavior*, 38:860-870.
- Coles, C., 1998. "IT in public libraries: seeking out the user's perspective. *Library and Information Research News*", 22:35-42.
- Davis, F., 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology". *MIS Quarterly*, 13: 319-340.
- Fasola, J., and Matarić, M. J., 2013. "A socially assistive robot exercise coach for the elderly". *Journal of Human-Robot Interaction*, 2:3-32.
- Fishbein, M., Ajzen, I., 1975. "Belief, attitude, intention and behavior: An introduction to theory and research", Reading (MA): Addison-Wesley.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E., 2010. "Multivariate Data Analysis", 7th Edition, Pearson Prentice Hall.
- Hartwick, J., Barki, H., 1994. "Explaining the role of user participation in information system use". *Management Science*, 40:440-465.
- HLS-EU Consortium, 2012. "Comparative Report of Health Literacy in Eight EU Member States. The European Health Literacy Survey HLS-EU" Online publication: <http://www.health-literacy.eu>

- Kalantari, M., 2017. "Consumers' adoption of wearable technologies: literature review, synthesis, and future research agenda". *International Journal Technology Marketing*, 12: 274–307.
- Kamphorst, B., 2017. "E-coaching systems". *Personal and Ubiquitous Computing*, 21:625-632.
- Kim, J. and Park, H., 2012. "Development of a Health Information Technology Acceptance Model Using Consumers' Health Behavior Intention". *Journal of Medical Internet Research*, 14:e133.
- Kool, L., Timmer, J. and Van Est, R., 2013. "De opkomst van de e-coach". Rathenau Instituut Den Haag, Netherlands.
- Liu, C., Tsai, Y. and Jang, F., 2013. "Patients' Acceptance towards a Web-Based Personal Health Record System: An Empirical Study in Taiwan". *International Journal of Environmental Research and Public Health*, 10:5191-5208.
- Lynch, C., 1998. "Information and digital literacies: a review of concepts. *Journal of Documentation*", 57: 218-259.
- Mackert, M., Mabry-Flynn, A., Champlin, S., Donovan, E. and Pounders, K., 2016. "Health Literacy and Health Information Technology Adoption: The Potential for a New Digital Divide". *Journal of Medical Internet Research*, 18:e264.
- Maniam, A., Dhillon, J. and Baghaei, N., 2015. "Determinants of Patients' Intention to Adopt Diabetes Self-Management Applications". In *Proceedings of the 15th New Zealand Conference on Human-Computer Interaction* (pp. 43-50).
- Melas, C., Zampetakis, L., Dimopoulou, A. and Moustakis, V., 2011. "Modeling the acceptance of clinical information systems among hospital medical staff: An extended TAM model". *Journal of Biomedical Informatics*, 44:553-564.
- Morris, M., 2007. "Technologies for Heart and Mind: New Directions in Embedded Assessment". *Intel Technology Journal*, 11(01).
- Ochoa, S. and Gutierrez, F., 2018. "Architecting E-Coaching Systems: A First Step for Dealing with Their Intrinsic Design Complexity". *Computer*, 51:16-23.
- Rahimi, B., Nadri, H., Afshar, H. L., and Timpka, T., 2018. "A systematic review of the technology acceptance model in health informatics". *Applied clinical informatics*, 9:604-634.
- Robbins, T. D., Keung, S. N. L. C., and Arvanitis, T. N., 2018." E-Health for Active Ageing; A Systematic Review". *Maturitas*, 114: 34-40.
- Schomakers, E., Lidynia, C. and Ziefle, M., 2018. "Exploring the Acceptance of mHealth Applications - Do Acceptance Patterns Vary Depending on Context?". In: Ahram T. (eds) *Advances in Human Factors in Wearable Technologies and Game Design*. AHFE 2018. *Advances in Intelligent Systems and Computing*, vol 795. Springer, Cham Sun, H. and Zhang, P. (2006). Causal Relationships between Perceived Enjoyment and Perceived Ease of Use: An Alternative Approach. *Journal of the Association for Information Systems*, 7(9), pp.618-645.
- Teo, T. and Pok, S., 2003. "Adoption of WAP-enabled mobile phones among Internet users". *Omega*, 31:483-498.
- U.S. Department of Health and Human Services, 2010. "Healthy people 2010: with understanding and improving health and objectives for improving health". 2nd ed. Washington: U.S: Government Printing Office.
- Venkatesh V., Morris M.G., Davis G.B., Davis F.D., 2003. "User Acceptance of Information Technology: Toward a Unified View". *MIS Quarterly*, 27:425–478.
- Venkatesh, V. and Davis, F., 2000. "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies". *Management Science*, 46:186-204.
- Wang, B. R., Park, J. Y., Chung, K., and Choi, I. Y., 2014. "Influential factors of smart health users according to usage experience and intention to use". *Wireless Personal Communications*, 79:2671–2683.

- Weng, M., 2016. "The acceptance of wearable devices for personal healthcare in China". Unpublished doctoral dissertation, University of Oulu, Oulu, Finland.
- World Health Organization, 2015. "World report on ageing and health 2015". Available at: <http://www.who.int/ageing/events/world-report-2015-launch/en/>

Assessing the Impacts of Culture and Cultural Impacts: a Planning and Evaluation Challenge

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Abstract

The increasing demand for measures of economic and social impacts of culture is somehow connected to a declining social perception of its intrinsic value. Coupled with a declining consensus on its necessity, spending on culture has increasingly been justified by a growing number of politicians and decision makers in its instrumental dimension, and its proved usefulness. This has undermined the automatic legitimacy of relevant investments in the sector, unless returns could be expected (best if economic and in the short term). In those countries where the bulk of financial resources for culture is public, scarcity, spending review, economic crisis, combined with the lowering of the social appreciation of culture, have dealt a heavy blow on the sector, but the same can be said of those countries where culture derive its main resources from private support.

Initially welcomed as a deserved acknowledgement of the collateral merits of culture, the social and economic benefits it is expected to generate have progressively outgrown and replaced its intrinsic value.

It is in this context that measurement of the social and economic impacts of the arts and culture has become a recurring topic in the literature of the last two decades or more. It is also a common aspiration of many cultural organisations that depend on public or private funding.

As instrumental approaches to culture and its role have gained a growing weight on the intrinsic ones, evidence sought to provide a sound basis and reliable information, upon which funding decision and policies are made, tends to document the benefits of culture for the local or national economy, social inclusion and cohesion, reduction of inequalities, and so on, while cultural impacts remain virtually unaccounted for.

The paper elaborates on the idea that intrinsic value is not to be underrated, and discusses why cultural impacts are worth investigating.

Keywords – Cultural impact assessment, cultural indicators, cultural participation, European Capital of Culture.

1 Introduction

The increasing demand for measures of economic and social impacts of culture is somehow connected to a declining social perception of its intrinsic value. Coupled with a declining consensus on its necessity, spending on culture has increasingly been justified by a growing number of politicians and decision makers in its instrumental dimension,

and its proved usefulness. This has undermined the automatic legitimacy of relevant investments in the sector, unless returns could be expected (best if economic and in the short term). In those countries where the bulk of financial resources for culture is public, scarcity, spending review, economic crisis, combined with the lowering of the social appreciation of culture, have dealt a heavy blow on the sector, but the same can be said of those countries where culture derive its main resources from private support.

Initially welcomed as a deserved acknowledgement of the collateral merits of culture, the social and economic benefits it is expected to generate have progressively outgrown and replaced its intrinsic value.

In the last 25 years, while its intrinsic value was progressively shrinking in the collective imagination, culture has been the object of great expectations because of its instrumental value.

During the 1990s, in Europe, potential culture-based job and business creation were a common topic of debate. This is one of the reasons why the greatest source of EU funding for culture, starting in 1994-1999, have in fact been the Structural Funds, i.e. the funding tool of the Union's economic cohesion policy. Their rate of contribution to the EU expenditure for culture reached at a certain point 83%, against 7.7% from the sectorial programmes ("Culture", "Media", etc.).

It is in this context that *measurement* of the social and economic impacts of the arts and culture has become a recurring topic in the literature of the last two decades or more. It is also a common aspiration of many cultural organisations that depend on public or private funding.

Scepticism, to various degrees, about their measurability coexists with an increasing demand of accountability, and trust in quantitative score-based methods, as in SROI (Social Return On Investments), coexists with purely qualitative or narrative-based techniques, as in MSC (Most Significant Change).

As instrumental approaches to culture and its role have gained a growing weight on the intrinsic ones, evidence sought to provide a sound basis and reliable information, upon which funding decision and policies are made, tends to document the benefits of culture for the local or national economy, social inclusion and cohesion, reduction of inequalities, and so on. But cultural activities do generate cultural impacts, after all. Alas, those cultural impacts remain virtually unaccounted for.

The paper elaborates on the idea that intrinsic value is not to be underrated, and discusses why cultural impacts are worth investigating.

It also points to the fact that often, reports of the impacts of the arts and cultural activities appear disembodied from any planning frame of reference. It is so in many ex post evaluations, where unplanned and unintended outcomes and spill-overs of cultural projects of various nature represent the most part of the report. It occurs also when the only measurables or reportables are inputs or processes, but they are disconnected from target or output indicators.

With its 30 years of existence, the European Capital of Culture Programme -ECoC has increasingly developed a praxis – not only a formal procedure – for planning, monitoring

and short term and medium term evaluating the desired impacts of the cultural investments, activities, events, etc. for candidate and selected cities to follow.

In view of this, the paper investigates the potential use of cultural impact and result indicators for Matera, the Italian 2019 ECoC, and proposes an evaluation approach focused on measuring, with appropriate indicators, changes in the levels of cultural participation, practice and consumption.

2 Defining a cultural impact

For a very long time and largely still today, in Italy, the only *cultural* indicator used to measure the impact (any kind) of projects and programmes focused on cultural heritage is the “Number of admissions to State museums, per year”. Indeed, the 478 state structures, barely 10% of the entire museum universe, attracted over 44% admissions in 2017, i.e. 53 million, with nearly 112,000 visitor on average per museum, vs. 66.2 million, on average 17,000, for the remaining 90%, the 4,411 non-State museums.

The choice of that indicator is largely data-driven, as only State museums are surveyed – if only about number of admissions and revenues from the public - every year, with time series covering over 20 years. The entire universe of museums are investigated only occasionally, alternatively with an extended questionnaire and a shorter form, about organisation, activities, services provided, etc.¹

While it can be considered an acceptable proxy of the attraction force of individual cultural sites in a given area, “Number of admissions to State museums” is by no means a measure of their individual or collective *cultural impact*, as “admissions” only count people who enter a museum, without distinction of age, gender and nationality, one-time or returning visitors, not to mention purpose, duration, content and quality of the experience.

The available data do not separate tourists from resident visitors. It is reasonable enough to suppose that, if it is a *cultural impact* what we have in mind, a cultural experience should have a minimum duration, or be repeated.

Technically speaking, an impact is a special form of change, generally fast, violent and irreversible, due to the clash between an active agent (*impactor*) on a *impacted* area. Originally, impact has been used mainly in a negative sense (as in *environmental impact*), with the induced changes mainly understood as loss or shock or collapse and subsequent positive or negative feedback on the side of the impacted system. In our case, instead, impact is instead a desirable change, due to exposition to/participation in/practice of art and culture in various forms. It is 'a dynamic concept which pre-supposes a relationship of cause and effect. It can be measured through the evaluation of the outcomes of particular actions, be that an initiative, a set of initiatives forming a policy or set of policies which form a strategy.' (Landry *et al.*, 1993).

As for culture, the pioneering work led by Matarasso (1997) listed 50 social impacts of participation in the arts and posed a set of fundamental conceptual and methodological

¹ <https://www.istat.it/it/archivio/167566>

questions. The critics of the conclusions reached by Matarasso object that, while it is difficult to disagree in principle with any of his 50 statements, his method, being, as Matarasso himself acknowledged, not fully developed, is unable to provide a conclusive evidence that they are empirically and verifiably true (Belfiore, 2006).

However, Matarasso's list does help segmenting the complexity of the specific semantic field of impacts of cultural practice. In that list, 15 pertain to the intrinsic value of culture, namely:

1. Increase people's confidence and sense of self-worth
2. Stimulate interest and confidence in the arts
3. Provide a forum for intercultural understanding and friendship
4. Promote intercultural contact and co-operation
5. Develop pride in local traditions and cultures
6. Help people feel a sense of belonging and involvement
7. Create community traditions in new towns or neighbourhoods
8. Make people feel better about where they live
9. Help people develop their creativity
10. Erode the distinction between consumer and creator
11. Allow people to explore their values, meanings and dreams
12. Help community groups raise their vision beyond the immediate
13. Raise expectations about what is possible and desirable
14. Have a positive impact on how people feel
15. Provide a unique and deep source of enjoyment.

They may be grouped into three main classes, one a) about personal and community growth, satisfaction, wellbeing and contentment; one b) about appreciation of the arts, creativity and self-expression; one c) about identities, belonging and vision:

- a) Increase people's confidence and sense of self-worth; Have a positive impact on how people feel; ; Make people feel better about where they live; Provide a unique and deep source of enjoyment;
- b) Stimulate interest and confidence in the arts; Help people develop their creativity; Erode the distinction between consumer and creator;
- c) Provide a forum for intercultural understanding and friendship; Promote intercultural contact and co-operation; Develop pride in local traditions and cultures; Help people feel a sense of belonging and involvement; Create community traditions in new towns or neighbourhood; Allow people to explore their values, meanings and dreams; Help community groups raise their vision beyond the immediate; Raise expectations about what is possible and desirable.

To the purpose of the present exercise, I propose to adopt operationally the above three conceptual clusters as basic components of a desirable *cultural impact*, and to proceed from there to elaborate a viable list of indicators.

In particular, with reference to Italy, I will distinguish two subsets of the list: available measures, related to existing datasets that only need to be adjusted from the point of view of territorial scale or updated; and additional or new measures, technically possible with

minor adjustments or targeted questionnaires. The tools I propose could be useful in assessing cultural impacts of Matera ECoC 2019.

3 Cultural impact in the ECoC planning and evaluation process

ECoC is Europe's most ambitious collaborative cultural project both in scope and scale, with budgets far exceeding those of any other cultural event. Until 2004, the designation of European Cities of Culture was an inter-governmental affair in the hands of the Council of Ministers, without the involvement of external experts or any formal assessments. In 1999, the European Parliament and the Council of the European Union decided to call the European Capital of Culture scheme a Community Action, and set up a new designation process that would apply for the 2005-2012 titles. Member States were listed in chronological order so that they could take turn to host the event. An international panel was set up to assess the suitability of cities proposed by Member States and criteria for the selection formally established. Today, a selection panel made up of experts chosen by the European institutions (Commission, Parliament, Council of Ministers and Committee of the Regions) and by the concerned Member State assesses the proposals and settles its choice. The EU Council of Ministers then officially designates the city. As well as the management of the formal selection and monitoring processes, the Commission has published a guide for candidate cities. According to Decision 445/2014/EU, a pecuniary prize of EUR 1.5 million (Melina Mercouri Prize) is awarded to all designated cities. The Prize is paid, provided that a designated city continues to honour the commitments it made at the application stage, complies with the criteria of the Decision and takes into account the recommendations contained in the selection and monitoring reports. Now in its 34th year, the ECoC programme has gradually formalised key planning concepts and methodologies for the stage of presentation of the candidate cities, their selection and the winner's four years of preparation.

The city of Liverpool, ECoC 2008, has greatly contributed to the quality of the planning/evaluation process through the Impacts 08 programme, led by the University of Liverpool, Liverpool City Council and Culture Liverpool. Impacts08 has produced a vast amount of research, data, analysis and publications and the group was subsequently involved as leading partners in the European Capitals of Culture Policy Group, funded by the European Commission's Culture Programme in 2009-2010. The Policy Group set itself the goal of sharing good practice in relation to the delivery process of the European Capital of Culture title and developing a common research framework to assess the impact of a title year (ECoC Policy Group, 2013).

The Policy Group has provided a broad research framework, with six thematic clusters that aim to encompass the broad range of potential impacts and a small core set of priority indicators supporting each theme:

1. *Cultural vibrancy and sustainability*
2. *Cultural Access and Participation*
3. *Identity, Image and Place*

4. *The Philosophy and Management of the Process*
5. *European Dimension*
6. *Economic Impacts.*

Of the six themes, only three contain direct or indirect references to cultural impacts. *Cultural vibrancy* considers the programme content of the ECoC year itself and the impact upon the vitality and sustainability of the cultural system and creative economy of the event host-city. Sub-themes include: artistic vibrancy of the year (cultural offer, innovative productions); profile of the sector (number and type of organisations, facilities and jobs); sustainability of the system (e.g. skill development in the cultural sector); the ECoC contribution (e.g. direct investment/funding of the city's cultural system) and contribution of other relevant regional, national or international institutions. *Cultural Access and Participation* attempts to understand: what is the cultural offer; how access to it is encouraged; who is accessing it; why are they accessing it; and what value do they derive from it. Answering these questions requires the assessment of demographic and geographic data on participants and non-participants in cultural activities, and access to opportunities for cultural involvement. In addition, it focuses on particular sub-cultures and groups and explores experiences, cultural values, changing levels of participation and interests, and reasons for participation. *Identity, Image and Place* explores the perceptions and awareness of both the ECoC programme and the host city, and how these change as a result of the ECoC year. The sub-themes for this area include the positioning/repositioning of the host-city before and after becoming ECoC, the changing perceptions of the city by local communities, event visitors, and non-visitors; and the strength of local identity and self-confidence.

4 Matera, ECoC2019

The final Matera 2019 Bidbook¹ is the official source to identify measures of expected cultural impacts, as well as other kind of impacts.

At the time of the candidacy, the indicators for the Basilicata Region of the BES - Benessere equo e sostenibile, the national project of wellbeing measures by the National Statistical Institute, ranked quite poorly in the area of culture. The index of cultural participation (percentage of people aged 6 and over who had participated at least in three cultural activities - going once to museums/archaeological sites, theatre, concerts; going at least four times to the cinema; reading newspapers at least three times a week; reading at least four books in one year -) was declining, from 23.2% in 2009 (was 30% at the national level) to 18.9% (25.9% at the national level). Even worse in 2014, with 15.6%. The rise in 2015 (20.1%) and 2016 (24.7%) could be ascribed as a positive effect of the successful process of ECoC candidacy, but in 2017 the value fell again as low as 19.7% (in Italy was 25.8%).

The final Matera 2019 Bidbook lists the City's expectations about culture for the Capital year:

¹ <https://www.matera-basilicata2019.it/en/matera-2019/bid-book.html>

- To strengthen broad-ranging, open and diversified cultural citizenship;
- To transform Matera into the most important platform of open culture in Southern Europe;
- The propellant to imagine a future in which they will not be forced to quit their native land, a future in which their hopes can be nurtured and expanded.
- To strengthen the breadth and diversity of citizens who actively participate in the cultural programme, encourage them to learn and infuse them with a sense of ownership and responsibility for the care, protection and regeneration of our culture”.

The Bidbook sets out a few target indicators for that:

- Prepare infrastructure and actions in the sphere of open design, culturally motivated social innovation, digital storytelling to fully leverage heritage, involving at least 5.000 between 2015 and 2020 and fostering the establishment of 25 new economic entities.
- By 2020, 70% of people will say that Matera is a city attractive to young people.
- By 2020, 90% of people will believe culture has a very important role in the economy of the future.
- By 2020, 70% of people will say that Matera is an innovative and creative city.
- 80% of the cultural programme must provide for the direct involvement of citizens through co-creation and co-production of projects.
- All elementary and junior high schools of Matera and Basilicata will be directly involved in the implementation of the cultural projects.
- By 2017, 60% of citizens will declare themselves willing to do volunteer work for Matera 2019.
- By 2017, 60% of citizens will declare themselves willing to act personally to make the city more beautiful.
- By 2019, Matera will have expanded its web of international and European relations by consolidating its network presence, by intensifying the inward and outward flow of people and projects, by encouraging the internationalization of operators in creative innovation and cultural development, and by bringing online a broadcasting service dedicated to culture and events.

Two relevant questions the selected city must answer are “What are the enduring aspects of the event, and how can it become an integral part of cultural and social development of the city in the long term?” and ” Are any parts of the proposed Project aimed at specific groups (young people, minorities, etc.)? If so, what are they?”. Here is what the Bidbook proposes: “A fundamental requirement for the cultural development of Basilicata is to increase capacities (among socio-cultural operators, public officials and citizens) as well as a sense of personal civic responsibility, also with a view to stimulating innovation. (...) Improving access to and participation in culture for all people who live in Matera and Basilicata is one of the primary aims of the candidature. Statistics show that the consumption of culture in Italy is one of the lowest in Europe, and Basilicata has traditionally lagged farthest behind. It is not, however, merely a question of increasing the consumption of culture. Rather, the concept of “inhabiting culture” postulates that culture

must be understood as consisting of a diversified array of options that also and especially includes the effective practice of the same and the full immersion of those who “consume” it. Rather than objectives, these are preconditions for a programme such as ours that is underpinned by belief in community involvement and the co-generation of processes and recognizes that a considerable time may have to elapse before aspirations can be turned into reality. Capacity-building activities will also serve to improve the planning skills of Basilicata operators with regard to accessibility, understood in its broadest sense.

As 129 out of 131 municipalities in Basilicata have fewer than 10,000 inhabitants, an objective problem exists regarding the scarcity of demand, which often makes it impossible to maintain a diffuse supply of culture throughout the territory. This is a problem that affects not only Basilicata, but many areas of Europe, and the candidature has opened the door to innovative outreach initiatives for areas with low-density populations and reduced opportunities. (...). Matera 2019 legacy: one of the most important legacies of Matera 2019 will leave to the city itself and all Basilicata will be immaterial: a revived self-confidence in its own potential. After decades of disgrace, marginalisation and closure, Matera will finally look to Europe with renewed self-esteem; its younger generations will set foot on the European stage not as migrant escaping the impoverished provinces but as proud citizens of a city that has had the strength to reinvent itself by continuing to innovate”.

The excerpts from the Bidbook reveal a strong convergence with the three key dimensions of cultural impact that I proposed earlier: a) personal and community growth, satisfaction, wellbeing and contentment; b) appreciation of the arts, creativity and self-expression; and c) identities, belonging and vision.

5 Measuring cultural impact: a modest proposal.

In this section, I propose three feasible sets of indicators of cultural impact, relating to the three dimensions I described earlier (Tab.1).

Tab.1. Proposed measures of cultural impact			
	Personal and community growth, satisfaction, wellbeing	Appreciation of the arts, creativity and self-expression	Identities, belonging and vision
Available	Level of life satisfaction (subjective indicator) of resident people with varying intensity of cultural participation (per age and gender), per year	Intensity of cultural participation of resident people (per age and gender), per year	Percentage of resident people (per age and gender) who think cultural heritage is important for themselves personally

	Percentage of resident people (per age and gender) who think that living close to places related to Europe's cultural heritage can improve people's quality of life	Current public expenditure for cultural heritage, city level, per year	Percentage of resident people (per age and gender) who think cultural heritage is important for their local community
		Percentage of resident people (per age and gender) who are involved at least in three ways in cultural heritage.	Percentage of resident people (per age and gender) who feel pride in a historical monument or site, work of art or tradition (e.g. crafts, festivals, music, dance etc.) from their region or from their country
Additional	Varying levels of cortisol prior and after cultural activities (museum visits, participation in shows or concerts, etc.)	Duration of museum visits - electronic check of entrance and exit via barcoded admission tickets	Targeted questionnaires
	Targeted questionnaires	Targeted questionnaires	

Own elaboration, on Istat and Eurobarometer 466 metadata

They are divided in two subsets: one is made of existing indicators that need adjusting their territorial detail, as at present their data (the source is in parenthesis) only cover national or regional levels¹:

- Intensity of cultural participation of resident people (per age and gender), per year (Istat);
- Level of life satisfaction (subjective indicator) of resident people with varying intensity of cultural participation (per age and gender), per year (Istat);
- Current public expenditure for cultural heritage, city level, per year (Istat)²
- Percentage of resident people (per age and gender) who think that living close to places related to Europe's cultural heritage can improve people's quality of life (Eurobarometer 466);
- Percentage of resident people (per age and gender) who are involved at least in three ways in cultural heritage (Eurobarometer 466);
- Percentage of resident people (per age and gender) who think cultural heritage is important for themselves personally (Eurobarometer 466);
- Percentage of resident people (per age and gender) who think cultural heritage is important for their local community (Eurobarometer 466);
- Percentage of resident people (per age and gender) who feel pride in a historical monument or site, work of art or tradition (e.g. crafts, festivals, music, dance etc.) from their region or from their country
- Index for positive attitude towards cultural heritage (Eurobarometer 466);

¹ Istat data are collected on a yearly basis, while Eurobarometer 466 is so far a single data collection.

² Note that this is an indicator of public appreciation of the strategic relevance of culture, not a financial indicator. Detailed financial measures are well developed within the proceedings of ECoC.

- Proportion of people indicating lack of interest as the main barrier to access cultural heritage sites or activities (Eurobarometer 466)

The second subset is of additional measures, technically possible, but not implemented yet:

- Duration of museum visits - electronic check of entrance and exit via barcoded admission tickets (MiBAC);
- Targeted questionnaires for participants in cultural activities, aimed at investigate self-perceived changes in the three key cultural dimensions;
- Varying levels of cortisol prior and after cultural activities (museum visits, participation in shows or concerts, etc.).

The proposed set of measures could be applied, with appropriate samples, to the desired territorial scale in two waves: one prior the beginning of the planned cultural activities and events, and one 12 months after. The targeted questionnaires could help focusing, where needed, on specific events, programmes or places. The output of the proposed list is a simple dashboard. Of course, synthetic indexes could be calculated for each of the three dimensions of cultural impacts.

References

- AEGIS (2005), *Social impacts of participation in the arts and cultural activities* [online]. Available at: http://www.arts.tas.gov.au/__data/assets/pdf_file/0020/23627/Social_Impacts_of_the_Arts.pdf [Accessed 10 February. 2015]
- Aked, J., Marks, N., Cordon, C. and S. Thompson (2008), *Five ways to wellbeing: The Evidence* [online]. Available at: <http://www.neweconomics.org/publications/entry/five-ways-to-wellbeing-the-evidence> [Accessed 11 February. 2015]
- Albano, R. e A. Bollo (2015), "ECoC: impatti, sfide della valutazione. Il caso italiano", *Economia della cultura* n.1/2015: 65-80.
- Arts Council England (2013), *Great art and culture for everyone: 10year strategic framework 2010-2020*, Manchester, Arts Council England. Available at: http://www.artscouncil.org.uk/media/uploads/Great_art_and_culture_for_everyone.pdf [Accessed 11 February. 2015]
- Bakhshi, H., Lee, N. and J. Mateos-Garcia (2013) *Capital of culture? An econometric analysis of the relationship between arts and cultural clusters, wages and the creative economy in English cities* [online]. Available at: <http://www.nesta.org.uk/publications/capital-culture> [Accessed 10 February. 2015]
- Belfiore, E. (2006), "The social impacts of the arts – myth or reality?", in M. Mirza (ed.), *Culture Vultures. Is UK arts policy damaging the arts?*, Policy exchange.
- Belfiore, E. and O. Bennett (2009), "Researching the social impact of the arts: literature, fiction and the novel", *International Journal of Cultural Policy*, 15(1): 17-33. Available at: <http://wrap.warwick.ac.uk/41278/> [Accessed 11 February. 2015]
- BMJ (1996), *Attendance at cultural events, reading books or periodicals, and making music or singing in a choir as determinants for survival: Swedish interview survey of living conditions* [online]. Available at: <http://www.bmj.com/content/313/7072/1577> [Accessed 10 February. 2015]
- BOP Consulting (2013), *The Economic, Social and Cultural Impact of the City Arts and Culture Cluster* [online]. Available at: <http://www.cityoflondon.gov.uk/business/economic-research->

- andinformation/research-publications/Documents/research2013/Economic-social-cultural-impact-of-the-city-arts-and-cultureclusture-ForWeb.pdf [Accessed 10 February. 2015]
- Campbell, D.T. (1976), "Assessing the Impact of Planned Social Change", *Occasional Paper Series*, Paper #8, The Public Affairs Center, Dartmouth College.
- Carnwath, J. and A. Brown (2014), *Understanding the value and impacts of cultural experiences. A literature review*, The Arts Council England, http://www.artscouncil.org.uk/media/uploads/pdf/Understanding_the_value_and_impacts_of_cultural_experiences.pdf [Accessed 11 October, 2015]
- Cicerchia, A. (2015a), *Culture and wellbeing: theory, methodology and other challenges. An itinerary, report for Culture Action Europe*, http://cultureactioneurope.org/document/cae-20142015-final-reflection-papers-toolkits/cae2015_cultureandwellbeing/. (Last accessed September 28th, 2015).
- Cicerchia, A. (2015b), "Why we should measure, what we should measure", *Economia della Cultura* n. 1/2015: 11-22. DOI: 10.1446/80344.
- Crease, R.P. (2013), "Measuring culture", *Physics World*, April 2013: 21.
- Dal Pozzolo, L. (2015), "L'impatto sociale che vorremmo", *Economia della cultura* 1/2015, 47-56. DOI: 10.1446/80346.
- Donovan, C. (2013), *A holistic approach to valuing our culture: a report to the Department for Culture, Media and Sport*, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197826/Holistic_Approach_10_May_2013finalforweb.pdf
- ECOC Policy Group (2013), *An international framework of good practice in research and delivery of the European Capital of Culture programme*, European Commission, DG Education and Culture.
- ECOTEC Research & Consulting (2009), *Ex-Post Evaluation of 2007 and 2008 – European Capitals of Culture. Final Report*. Birmingham: Author.
- Edgar, D. (2012), *Why should we fund the arts?* <http://www.theguardian.com/culture/2012/jan/05/david-edgar-why-fund-the-arts?INTCMP=SRCH>
- European Communities (2009), *European capitals of culture: the road to success from 1985 to 2010*, Luxembourg. Available at: http://ec.europa.eu/programmes/creative-europe/actions/documents/ecoc_25years_en.pdf [Accessed 10 September, 2015]
- EY (2014), *Creating growth: Measuring cultural and creative markets in the EU* [online]. Available at: [http://www.ey.com/Publication/vwLUAssets/Measuring_cultural_and_creative_markets_in_the_EU/\\$FILE/Creating-Growth.pdf](http://www.ey.com/Publication/vwLUAssets/Measuring_cultural_and_creative_markets_in_the_EU/$FILE/Creating-Growth.pdf) [Accessed 12 February. 2015]
- Garcia, B. (2005), "De-constructing the City of Culture: The long term cultural legacies of Glasgow 1990", *Urban Studies* 2005: vol. 42. N5/6: 841-868.
- Hill, K. (2014), *Making a Holistic Case for the Arts: Canadian Evidence regarding the Relationship between the Arts and the Quality of Life, Well-being, Health, Education, Society, and the Economy*. Discussion paper prepared for Strategic Development Meeting of the Canadian Public Arts Funders (CPAF) network in June 2014 [online]. Available at: <http://www.cpa-fopsac.org/en/themes/documents/CPAF-Making-a-Holistic-Case-Hill-Strategies-June2014-Final-FR.pdf> [Accessed 10 February. 2015]
- Holden, J. (2004), *Capturing Cultural Value: How culture has become a tool of government policy*. London: Demos. Available at: <http://www.demos.co.uk/files/CapturingCulturalValue.pdf?1240939425> [Accessed 11 February. 2015]
- Iglesias, M., Kern, P. and V. Montalto (2012), *Use of structural funds for cultural projects*: <http://www.keanet.eu/docs/structuralfundsstudy.pdf> [Accessed 30th September. 2015]

- Marradi, A. (1982), "An Overloaded Term: 'Measurement'", in Fred W. Riggs (ed.), *Proceedings of the Conference on Conceptual and Terminological Analysis in the Social Sciences*, Frankfurt: Indeks, 1982: 26-36.
- Matarasso, F. (1997), *Use or ornament? The Social Impact of Participation in the Arts*, Comedia.
- Matarasso, F. (2012), *On 'the very idea of measuring cultural value'*, <http://parliamentofdreams.com/2012/01/20/on-the-very-idea-of-measuring-cultural-value/>.
- McLellan, R., Galton, M., Steward, S. and C. Page (2012), *The impact of creative initiatives on wellbeing: a literature review*, Newcastle: CCE. Available at: <http://www.creativitycultureeducation.org/the-impactof-creative-initiatives-on-wellbeing-a-literature-review> [Accessed 11 February. 2015]
- McMaster, B. (2008), *Supporting Excellence in the Arts. From Measurement to Judgement* <http://webarchive.nationalarchives.gov.uk/+http://www.culture.gov.uk/images/publications/supportingexcellenceinthearts.pdf>
- Mirza, M. (ed.) (2006), *Culture Vultures. Is UK arts policy damaging the arts?*, Policy exchange. ?????
- Montalto, V. and M. Iglesias (2014), "The Evaluation of the ECoC: Evolution and challenges", *Economia della cultura* n. 2/2014: 171-182.
- Palmer, R. and G. Richards (2007), *European Cultural Capital Report*. Issue No. 1, October 2007
- Palmer, R. and G. Richards (2007), *European Cultural Capital 2 Report*. Issue No. 2, January 2009
- Radbourne, J., H. Glow, and K. Johanson (2010), "Measuring the intrinsic benefits of arts attendance", *Cultural Trends*, 19: 4, 307-324.
- Rao, V. and M. Walton (2004), "Culture and Public Action" ???? Stanford: Stanford Social Sciences. Available at: http://www.wds.worldbank.org/external/default/WDSCContentServer/IW3P/IB/2004/08/19/000160016_20040819153703/Rendered/PDF/298160018047141re0and0Public0Action.pdf [Accessed 11 February.2015]
- Ratti, M. (2015), Outcome indicators for the cultural sector, *Economia della Cultura* n. 1/2015: 23-46, DOI: 10.1446/80345.
- Reeve, M. (2002), *Measuring the economic and social impact of the arts: a review*, The Arts Council, UK
- Richards, G. (2002), "The European Cultural Capital Event: Strategic Weapon in the Cultural Arms Race?", *Journal of Cultural Policy*, Vol. 6(2): pp. 159-181.
- RSPH (2013), *Arts, Health and Wellbeing Beyond the Millennium: How far have we come and where do we want to go?* [online]. Available at: <https://www.rsph.org.uk/en/policy-and-projects/areas-of-work/artsand-health.cfm> [Accessed 11 February. 2015]
- Selwood, S. (2006), "Unreliable evidence. The rhetorics of data collection in the cultural sector", in Mirza (2006) cit.
- Sen, A. (2002), *How does culture matter?* [online]. Available at: <http://www.cscs.res.in/dataarchive/textfiles/textfile.2009-0824.9377468545/file> [Accessed 11 February. 2015]
- Sharpley, R. and P. R. Stone (2011), "Socio-cultural impacts of events: meanings, authorized transgression, and social capital", in Page, S. and Connell J. (Eds) *The Routledge Handbook of Events*, London, Routledge.
- Stanley, D. (2006), "The Social Effects of Culture", *Canadian Journal of communication* [online], 31(1). Available at: <http://www.cjconline.ca/index.php/journal/article/view/1744/1856> [Accessed 11 February. 2015]
- Steiner, L., Frey, B. and S. Hotz (2013), "European capitals of culture and life satisfaction", *Working Paper n. 117, University of Zurich Department of Economics Working Paper Series*.

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