Driving forces behind service innovation in knowledge-intensive services with different knowledge bases

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Abstract

Purpose – *The purpose of this paper is to identify and describe the influence of the knowledge base (KB) of the company on driving forces of innovation processes in knowledge-intensive services (KIS) and to compare the level of innovativeness of the final services.*

Design/methodology/approach – *The paper investigates through qualitative research 11 KIS organisations with different KB.*

Findings – *The research results identified and described the influence of the KB on driving forces of innovations processes and its results in companies with four newly identified KBs (analytical, synthetic, symbolic and compliance).*

Research limitations/implications – *Further research, based on a larger number of companies, is needed to confirm the results of this research and to complement the effect of the KB on driving forces of innovation.*

Practical implications – *This research can help organisations understand how to develop strategic plans and new ideas for innovative services depending on the KB of the organisation.*

Social implications – *The description of successful innovation processes and results in several leading companies presented in the study may help other companies in identifying knowledge-integration practices to improve performance and innovation processes that support multiplicity, productivity and creativity.*

Originality/value – *The study systemised the sources of new ideas for innovation in companies with different KB, several driving forces of innovation were identified and how these forces are affected by each KB; lastly, innovation results were compared in companies with different KB.*

Keywords *Innovation, Knowledge bases, Knowledge-intensive services, Sources of knowledge, Driving forces of innovation*

Paper type *Research paper*

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1. Introduction

Innovation is among one of the core topics studied by researchers. It is a result-oriented activity (Prihadyanti, 2019), leading to ideas' transformation into new or improved products (Shahin and Mahdian, 2020). A firm that "has no creativity and innovation vanishes during the time" (Shahin and Mahdian, 2020, p. 409). Firms can concentrate on specific types of innovation – product, process, organisation or marketing– or various types of innovation (Pina and Tether, 2016).

Knowledge-intensive service activities (KISA) are important for the innovation processes as they act as sources, facilitators and carriers of innovation (OECD, 2006). Innovation in knowledge-intensive services (KIS) is usually seen as an evolutionary process based on the creation and (re-)combination of knowledge (Muller and Zenker, 2001) and knowledge-intensive business services (KIBS) as innovators and co-producers of knowledge (Muller and Zenker, 2001).

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KIBS firms are mostly characterised by product rather than process innovation (Pina and Tether, 2016; Radicic, 2020). Innovation can be considered as the "product" when is resulted from a creative process to create a new or improved product, process or method (Prihadyanti, 2019).

Researchers introduced the term "knowledge base" (KB) (Asheim and Gertler, 2005; Asheim, 2007; Strambach, 2008) to characterise knowledge accumulation. The notion has arrived from Aristotelian and Kant's distinction between analytics and synthetics. The traditional classification distinguishes analytical, synthetic and symbolic KB (Asheim and Gertler, 2005; Asheim, 2007; Strambach, 2008). This classification, mostly applied in the studies of regional innovation systems (Asheim and Gertler, 2005; Asheim, 2007; Strambach, 2008; Grillitsch *et al.*, 2016), started to be applied as well to characterise single companies (Liu *et al.*, 2013; Tether *et al.*, 2012; Pina and Tether, 2016; Tuominen and Martinsuo, 2018). One of the reasons became the understanding that distinctive qualities of companies can affect their competitive advantage (Pina and Tether, 2016; Jaakkola and Hallin, 2018; Tuominen and Martinsuo, 2018).

Literature analysis showed that a single approach to innovation processes for KIS is no longer appropriate (Toivonen and Tuominen, 2009; Storey and Hull, 2010; Pina and Tether, 2016; Tuominen and Martinsuo, 2018). For this reason, the present research is aimed at the deep empirical analysis of forces affecting innovation processes of different KIS classified according to their KB.

The summarised classification of KB characteristics developed by Pina (2015) was used to classify the companies according to their knowledge, where, for the first time, a new type of KB for legal companies (traditionally referred as relying on synthetic KB) (Asheim and Gertler, 2005; Asheim, 2007; Strambach, 2008) was proposed – compliance.

Most research dedicated to innovation processes is quantitative and concentrates on the parameters affecting innovation processes in companies and/or its innovation results. The present study can help to overcome the shortage in in-depth qualitative studies of innovation processes in KIS (Pina and Tether, 2016; Biemans *et al.*, 2016; Pellegrino and Savona, 2017) by investigating 11 knowledge-intensive service organisations with different KB taking into account their special relations with clients and differences in their innovation processes depending on their individual characteristics and projects (Miles *et al.*, 2017).

Research results identified several driving forces of innovation process and its results affected by the KB of the company. The influence of four newly identified KB on these forces was not described in the previous research studies. These forces included: product and the general strategy of the company (includes financial strategy for the product/service development), sources of ideas search for new services (divided into internal and external) and collaboration with clients during the innovation process. The last two parameters taken into account – geographical location of the company and time. These forces are interconnected and dynamically interact over time. The research as well systemised in a more precise way the sources of new ideas for companies with different KB: which sources are prevailing in companies with a certain KB. Lastly, research results identified the level of innovativeness of the services depending on the KB. The results partly contradict to conclusions of the previous studies that companies with synthetic and symbolic KB produce mainly not innovative products/services (Pina and Tether, 2016; Grillitsch *et al.*, 2016). The present study showed that they can produce innovative results if it is included in the general strategy of the company, the KB of the company is influenced by analytical KB or if it is requested by companies' clients and creatively elaborated by employees.

The topic is important due to continuous changing environment and increasing competitiveness on the markets. Innovation processes in companies as well as results of their activity should be approached as complex dynamic processes affected by interconnected multiple factors. This research can help organisations understand how to

develop strategic plans and new ideas for innovative services depending on the KB of the organisation. Taking the example of the studied cases, the research results can help companies as well to take advantage of obstacles, affecting innovation processes, and to use them as incentives for innovation.

In the introduction part the definitions of service innovation, types of innovation (product, process, etc.), as well as KIS, KISA and KIBS were introduced. The literature review part is dedicated to the description of innovation process in KIS based on different KB according to latest classification, and to the main forces, studied in literature, affecting innovation process in KIS. Section 3 explains the research method and data used. The results are presented in Section 4, while the implications, limitations and suggestions for future research are discussed in Section 5.

2. Literature review

2.1 Innovation process in knowledge-intensive services with different knowledge bases

As knowledge is the main outcome of KIS organisations (Bettencourt *et al.*, 2002; Storey and Hull, 2010), it has become a competitive advantage for organisations (Pina and Tether, 2016; Tuominen and Martinsuo, 2018).

Having realised the importance of knowledge and its cumulative nature (Strambach, 2008), researchers introduced the concept of KBs, to analyse how innovating firms coordinate and combine different knowledge approaches (Asheim, 2007). Basing on this concept, innovations are divided into smaller stages of knowledge development, characterised by analytical, synthetic or symbolic knowledge approaches (Asheim, 2007).

Innovation process, based on analytical knowledge, usually results in a creation of new knowledge based on scientific rational processes (Asheim and Gertler, 2005). Knowledge inputs and outputs are often codified (Asheim *et al.*, 2007). Innovation process, based on synthetic knowledge, takes place mainly through the application of existing knowledge, by the modification of existing products and processes (Asheim *et al.*, 2007; Strambach, 2008). Tacit practical skills are required in the knowledge production process (Asheim *et al.*, 2007). Innovation process, relying on symbolic knowledge, mostly takes place by recombination of existing knowledge in new ways (Asheim *et al.*, 2007). Prevailingly tacit knowledge in this case is converted in aesthetic symbols, images, (de)signs, artefacts, sounds and narratives and socialisation (Asheim *et al.*, 2007).

Innovation processes in different companies differ if their activities require specific KB (Asheim and Gertler, 2005; Asheim, 2007; Asheim *et al.*, 2007; Pina and Tether, 2016; Tuominen and Martinsuo, 2018). KB characteristics may vary not only between innovation processes but also over time (Manniche *et al.*, 2017).

Inspired by the works of Asheim and his colleagues, Pina (2015) developed the "summary of the main characteristics of the four differentiated KB", which, in a simplified way, is presented in Table 1. This elaboration helps to identify the KB of the companies in a more precise way. The researchers for the first time on a theoretical basis proposed the new KB "Compliance" that could be applied by legal companies (Pina, 2015; Krupskaya and Pina, 2022).

The elaborated summary of characteristics of the KB, which included all characteristics previously developed by researchers mostly on a theoretical base, formed the basis of the study of the innovation processes in the present research. It helped to formulate the questions for the interviews taking into account the characteristics of the KB to describe it's influence on the innovation process.

Table 1 The elaboration of "summary of the main characteristics of the four differentiated KB" (Krupskaya and Pina, 2022)

Summary of KB	Analytical	Synthetic	Symbolic	Compliance
Purpose of knowledge creation/source of initiation	Need of objective analysis	Need of practical solution	Need of distinctiveness	Need of compliance
Knowledge inputs	Codified knowledge Scientific methods	Experience Learning by doing	Inductive and divergent thinking; Development of sociocultural meanings	Interpretation and compliance with laws, regulations
Client' interactions	Rarely involved	Strong client interactions	Client approval	Client initiation and approval
Type of knowledge created	Documented reports	Practical solutions	Creative symbols or forms	Documented and/or verbal advice

Source: Author's own creation

2.2 Knowledge sources for innovation processes

Sources of service concepts or new knowledge are commonly divided into internal and external ones, whereas the latter can be further divided into local, national and international (O'Brien, 2020). Internally, firms acquire knowledge through in-house research and development activities and by learning from continuous improvements in processes. External sources, instead, include: local/international clients and/or customers and/or suppliers; cooperation with other companies; public institutions such as universities, public research centres, local government, etc.; knowledge gained from interactions with semi-public institutions such as chambers of commerce, industry associations, trade unions, etc.; knowledge provided by consultants and private research centres; websites or social media, journals, research papers or publications; professional conferences, seminars, meetings or trade shows (O'Brien, 2020).

Multiple ideas inside and outside the firm are important for the most complex innovation projects (O'Brien, 2020). Acquiring knowledge from different sources reduces their incentive to imitate, because they can develop original solutions by recombining multiple KB (Li Pira *et al.*, 2017, p. 404). According to the resource-based view of the firm, application of external knowledge expands firms' internal KB, i.e. "absorptive capacity" (Radicic, 2020).

The ratio of use between external and internal sources is a subject of continuous investigation; though there is still no agreement about which type of companies' characteristics (e.g. age, size, service sector) influence on applying more external or internal sourcing (Abdul Basit and Medase, 2019; Doloreux *et al.*, 2019).

The combination of different sources can result into different ways of knowledge sources' classification. Local search aims to exploit existing capabilities, resources and markets, reusing and recombining existing knowledge leading to incremental improvements, whereas distant search aims to explore new potentials (Chae, 2012), which is in other words: exploitation and exploration (Figure 1).

Companies tend to increase the application of external knowledge sources (Doloreux *et al.*, 2019). Though the value of different sources is still a discussable issue, e.g. some research results found that knowledge from customers and competitors can be positively associated with innovation (Abdul Basit and Medase, 2019), while other results define suppliers, group companies and customers as the preferred partners for innovation, instead cooperation with competitors is less important (Guisado-González *et al.*, 2017).

Interaction between KIS and their clients is the central element of knowledge creation and processing (Bettencourt *et al.*, 2002; Miles, 2005). Close relations with clients and highly tailor-made services on the one hand can lead to mutual influence of companies and

Figure 1 Six-search mechanism (from Chae, 2012)

Source: Author's own creation

clients, and clients' education (Zieba *et al.*, 2019), but on the other hand, too personalised solutions can reduce the possibility of innovation (Cabigiosu and Campagnolo, 2019).

Customer integration and external relations suggest that knowledge should be stored and managed during the innovation process (Storey *et al.*, 2016). The strategic stimulus to use external knowledge and advanced technologies is defined as "open innovation" (OI), leading to cost and risk reduction due to innovation and greater compliance of products and services with customer needs (Shahin and Mahdian, 2020). Innovation strategy was identified as a distinct strategic orientation of the firm (Storey *et al.*, 2016).

2.3 Innovation results in knowledge-intensive services

The topic on innovation results estimation is one of the most discussable in literature. Researchers propose different methods for results' estimation but still common parameters on estimation are not defined.

The European Commission (2013) defined as innovation output the number of intellectual properties that include number of patents, trademarks, designs, etc. Reputation may also lead to various business and reputational benefits such as customer loyalty and their willingness to pay. Prihadyanti (2019) outlined three domains of innovation quality:product/service, process and enterprise.

Traditionally, innovation results are divided into incremental or "exploitation" of ideas and radical or "exploration" of ideas (Alawamleh *et al.*, 2020). Radical innovators and "firstmovers" have been considered more successful on the market, though recent research finds this parameter on innovation more discussable. One of the proposed reasons is that product innovation results should be measured just in a certain period, e.g. product life cycle, according to "the needs and conditions of a firm" (Prihadyanti, 2019, p. 498).

According to the Schumpeterian model, firm age and size play a fundamental role in determining a firm's innovation results (Schumpeter, 1942). Early start-ups according to this concept are less sensitive to market and demand obstacles when they start an innovative project than mature firms (Pellegrino and Savona, 2017). Mature firms can be more structured and divided into several departments, affecting their innovation activity. Large firms are considered dependent on R&D in their innovative activity (Ahmadi and Osman, 2020) and are more likely to introduce process innovation than smaller ones (Radicic, 2020).

There is no agreement in research results about a universal connection of a firm's size, level of maturity and innovation results (Doloreux *et al.*, 2019; Storey *et al.*, 2016; Chichkanov *et al.*, 2021). This connection deserves further investigation.

2.4 Gaps in the closest empirical research in the topic

Despite the fact that the topic of innovation is one of the most studied in KIS, researchers note that all parameters of successful service innovation in KIS deserve further study (Toivonen and Tuominen, 2009; Storey and Hull, 2010; Pina and Tether, 2016; Ahmadi and Osman, 2020). In the literature review study, Modi and Rawani (2020) noted the need of empirical testing of the impact of the drivers, distinguishing internal and external, studied in literature, on innovation practices of the firm. The authors summarised all drivers of innovation practices in SME studied in recent literature, which are: size of the organisation, finance and economy, technological capabilities, institutional support, consumer relationship, organisational culture, management system, learning capacity, competitive advantage and market orientation (Modi and Rawani, 2020). The present research considers all these drivers under the influence of the KB of the company, with less attention to organisational culture and management system, as these parameters influence more process than product innovations.

Most research on innovation processes and results in KIS is quantitative, and researchers agree that there is a need of a deep empirical analysis of these processes in companies with different KB (Pina and Tether, 2016; Grillitsch *et al.*, 2016; Tuominen and Martinsuo, 2018). In the bibliographic review on new service development process and innovation in general, Biemans *et al.* (2016) noted that "the domain would benefit from a shift in research approaches from the quantitative, large-sample surveys to more exploratory, qualitative research approaches, such as in-depth cases research and participant observation, preferably using a longitudinal perspective", to gain an in-depth understanding of how firms develop innovation and "the factors governing that behavior".

Not all service innovations can be treated in the same way. The effectiveness of innovation antecedents is contingent on the type of service (Storey *et al.*, 2016). The authors of this one of the most influential studies on topic note that more research is needed into how the characteristics of types of services affect the antecedents that drive innovation performance, taking into account as well different cultural dimensions (Storey *et al.*, 2016).

The abstract nature of knowledge makes hard the evaluation of innovation processes and especially results in KIS companies (Pina and Tether, 2016); that is why, every company should consider its particular characteristics for developing its own innovation process (Jaakkola and Hallin, 2018; Pina and Tether, 2016; Chichkanov *et al.*, 2021). There is little research dedicated to the connection of innovation results with the KB of the firm. Most research on KB innovation results is based on the analysis of regional innovation systems (Asheim and Gertler, 2005; Asheim, 2007; Strambach, 2008; Grillitsch *et al.*, 2016). Some researchers noted that analytical knowledge at the level of the firm and the region has the strongest effect on firm innovativeness (Grillitsch *et al.*, 2016; Pina and Tether, 2016). Pina and Tether (2016) revealed that companies with analytical KB investing in R&D produced more innovative products while with synthetic and symbolic investing in design – less, but they found no connection of geographical position of the company with the innovation. Grillitsch *et al.* (2016) found less influence of synthetic KB on innovative results and symbolic – with no effect, while a combination of KB, especially with analytical KB tends to bring to more innovative results (Grillitsch *et al.*, 2016).

"Exploration of the ways in which KB are drawn upon and applied is bound to be of fundamental importance" (Miles *et al.*, 2018). The existing innovation models should take into account the KB of the services to better describe the process in companies and to arrive to successful results. The present research aims to overcome this gap.

3. Research approach

Literature analysis showed the lack of qualitative studies that could describe in depth the process of innovation in KIS and that can be missed in quantitative studies (Pina and Tether, 2016; Pellegrino and Savona, 2017; Biemans *et al.*, 2016).

This study adopts the case study method due to the exploratory nature and goals of the research (Yin, 2014). Case studies are particularly appropriate as the specific aim of the study is to describe innovation processes in companies with different KB (Miles and Huberman, 1994; Yin, 2014).

Previous qualitative studies investigated mostly one or few KIS sectors, and mainly in a single country (Tether *et al.*, 2012; Liu *et al.*, 2013; Pina and Tether, 2016). To overcome this shortcoming, 11 organisations of various KIS based in two different countries, several of which multinationals with offices around the world, were studied. The sample was based on the classification of KIS sectors defined by the statistical classification of economic activities in the European Community (Nace Rev.2 codes). The main criteria for organisations' selection – to include the maximum variety of KIS representing all four KB (analytical, synthetic, symbolic and compliance) proposed in latest research (Pina and Tether, 2016; Krupskaya and Pina, 2022). The application of these KB was checked and confirmed in the present research. Though the organisations have different institutional conditions, they all act as business structures and can be compared as business companies.

Most of the investigated organisations have strong competitive positions on the market, some with international reputation. Their position allows hypothesising that they had developed innovative processes with successful results. For this reason, their innovation processes can be compared and taken as a template for the rest companies. Some companies instead are small-medium enterprises (SMEs), working in highly competitive environment. Parameters, such as size and level of maturity, were taken into consideration, but the results of their influence on the innovation processes are contradictive (Storey *et al.*, 2016; Doloreux *et al.*, 2019; Chichkanov *et al.*, 2021), some research prove that they influence innovation process, others have opposite results. That is why, the companies of different size and level of maturity were included in the selection. Analysis of this influence deserves further research.

The geographical location and competitive environment of the service company can have high impact on the company's knowledge pools, for learning and exchanging knowledge (Sunley *et al.*, 2008). Capital regions in Europe and core metropolitan regions comprise the highest amount of KIBS employees with similar professional level (Strambach, 2008; Tether *et al.*, 2012; Schricke *et al.*, 2012). That is why, in this research, the organisations based in region capitals: London (UK), Milan (Italy) and Rome (Italy) were chosen (Table 2).

3.1 Data collection and analysis

The research questions were formulated as follows:

Q1. What are the driving forces of innovation in companies with different KB?

Q2. How the KB of the company affects the level of innovativeness of the services?

Founders and managers directly involved in the search of ideas and development of new services, as well responsible for the product and general strategy, were interviewed for this research. In several companies, it was possible to conduct interviews with different informants to view the process from different points of view.

The data was collected through multiple sources: semi-structured interviews, further email correspondence, observation of the organisations' results over several years and visits to some organisations, study of available materials about the organisations to ensure the data completeness, i.e. organisations' websites, structures' presentations materials, founders'

Table 2 The studied companies

Case	Activity of the structure, position on the market	No. of employees, year of foundation location	Main services/knowledge
1	Leading clinical and research centre in Italy	> 1,000 1953 Rome, Italy Offices in major Italian cities	Diagnostics and treatment in specialist medicine; research results publication in scientific journals
2	A scientific-cultural association in medical psychology Collaborates with European research centres	> 20 1996 Rome, Italy	Research and education in medical psychology, publication in scientific journals
3	Online executive MBA programme in a leading Italian university, striving to market leaders in Italy and Europe	>100 > 5,000 in the university 1979 Milan, Italy	Executive MBA programmes adopted for the online Microsoft platform
4	Multinational IT company One of the leading companies, the main competitors are IBM, OpenText, which acquired the company's innovative startups	~ 400 2005 Head office in London, UK	Free software and enterprise content management (ECM) system for Microsoft and Unix-like operating systems; support, consulting, training and documentation for its clients
5	Multinational leader in consulting; included in the top rankings of the most professional firms in the USA and worldwide, employs Nobel laurates	> 4,000 1982 London, UK Head offices in the USA and UK, offices in 29 countries	A vast range of services: • Transactional • Operational • Financial • Legal • Political and Regulatory • Reputational
6	Multinational group in online multiple insurance; awarded in Italy and UK for the best website and for the clients' assistance. In 2017 included in the list of the best companies in Italy	~ 500 employees in Italy > 7,000 worldwide 1999 Subsidiary in Rome, Italy opened in 2005 Head office in the UK, offices in UK, Italy, France, Spain and the USA	Multi car insurance, multiple insurance
7	Digital innovation partner; in the ranking of the best 50 digital companies in London in 2015	> 15 2011 London, Amsterdam and Wales	Digital innovation partner for big companies (e.g. Unilever, Admiral Group, British museum etc.) in developing new services
8	Leader in Italy in online media for automotive; the company share acquired by an American multinational group	~ 50 2004 Rome, Italy	Tailor-made solutions in online advertisement and media
9	World-leading interior and architecture design agency for major chain hotels, e.g. Marriot, Grand Hyatt, Sheraton, Radisson, Kempinski, etc.	> 20 1999 Head office in London, UK	Tailor-made solutions in architecture and interior design
10	Graphic design studio; Competes due to low prices and professional competences	4 2012 London, UK	Tailor-made solutions in graphic design for Russian and UK brands
11	Legal firm Competes due to low prices and professional competences	4 1996 Rome, Italy	Tailor-made solutions in civil and administrative trials and consultancy

Source: Author's own creation

published interviews. The interviews were held between November 2015 and February 2017, each interview lasted in average 2–3 h. All semi-structured interviews were recorded and transcribed. After the interviews, auxiliary questions in some cases were clarified via email or online messengers. Short visits were undertaken to several organisations to observe their working environment. To collect the maximum of information, it was important to observe personally the activity of organisations for a period of time. For this reason, the choice of companies was restricted. The communication lasted between five and ten years with several respondents to follow the changes in organisations' positions on the market.

The interviews usually started with the description of the organisation, its organisational structure, main stages of development and main clients. The respondents were asked to estimate from 1 to 10 points, according to their opinion, the importance for the innovation process and its results the parameters studied and summarised in the recent literature: size of the organisation, finance and economy, technological capabilities, institutional support, consumer relationship, organisational culture, management system, learning capacity, competitive advantage and market orientation (Modi and Rawani, 2020). The respondents were also asked to indicated the parameters not presented in the proposed list, which they consider the most important for the process. Basing on their answers, the main parameters were defined. Special attention was dedicated to the description of the organisations' competitive position on the market, main competitors and competitive sides of the organisations.

The description of the innovation processes usually started with the delineation of the general and product strategy of the organisations and the detailed classification of the new ideas' origin, classified into external and internal ones according to the existing classification (O'Brien, 2020; Doloreux *et al.*, 2019). The description of the new ideas search and innovation process followed by specific questions on the processes, e.g. "Which kind of knowledge is used? Is it codified?". To estimate the connection of the innovation process with the KB of the company, it was important to understand the differences (if they were) among innovation processes and results depending on different projects and relations with the clients. As authors reckon that KB and related investments are more closely connected to product/service innovation than to other kinds of innovations (Pina and Tether, 2016; Radicic, 2020), special questions were formulated about their investment strategy and product innovation estimation.

The respondents were asked which new or improved services had been developed (according to their understanding of the term) during the period of their experience. At the end, the respondents were asked to estimate the level of innovativeness of the final products/services according to their personal estimation basing on its success on the market, future perspectives of the services or the results of the innovation processes. In this research, knowledge, products or services as the knowledge-based results are considered as synonyms as different respondents could define innovation results with any of these terms. The comparison of the innovative level of the services according to the respondents' opinion can be subjective. That is why, the innovation results were not classified according to the existing literature into radical, incremental, etc. The goal of the research was to understand the level of innovativeness of the services in relation to the intention of the organisations to develop more or less innovative results and how they develop their strategy and processes to achieve these innovative results (Table 3).

4. Research results

The main characteristics of four KB developed by Pina (2015) and Krupskaya and Pina (2022) allowed to classify the companies according to their dominant KB (Table 3). The prevailing type of the KB influenced the whole innovation process and its results (Table 4).

Table 3 Empirical data collection of the studied cases

Case	Number of interviews, interviews' location	Email exchange with additional questions; Visits to structures	Contacts about company's competitive position and services Study of additional materials
Analysis of all 11 organisations' websites			
1	2 interviews with head doctor in the centre, > 30 years in the structure, a professor in the leading university Rome, Italy	3 visits	Contacts > 5years
2	1 interview with head doctor in the structure, professor in the leading university of since 2010 and an author of articles in scientific journals 1 interview with an associate researcher of a structure Rome, Italy	3 emails	
3	1 interview with the director of the MBA programme, an honorary researcher at the university and director of the ICT and digital learning, developed and launched Flex EMBA since 2012 Milan, Italy		Participation in the conference dedicated to the programme history, organisational structure and strategy, analysis of the slides and materials of the presentation
4	1 interview with a product development manager London, UK	2 emails	
5	1interview with a senior manager in the tax and human capital department London, UK		Services presentation Compared to the personal working experience in the same department of the consulting company (Big 4)
6	2 interviews with the co-founder of the Rome subsidiary and head of marketing and innovation Rome, Italy	1 visit	Contacts for 10 years
7	1 interview with the co-founder London, UK		Analysis of the company's presentations on innovation process and services
8	1 interview with the founder 1 interview with the leading photographer Rome, Italy		Contacts for 5 years
9	1 interview with the senior designer London, UK	4 emails	Analysis of the published interview of the company's founder
10	1 interview with the founder and leading designer of the company London, UK	3 emails	
11	3 interviews with the co-founder and a lawyer of the firm Rome, Italy	>5 visits	Contacts with founders for 10 years

Source: Author's own creation

Table 4 The summary of the interviews elaborated according to the main characteristics of four KBs

Case KB	*Purpose of knowledge creation/source of initiation* (interviews' citations)	*Knowledge inputs*	*Client' interactions*	*type of knowledge created*
Analytical	***Need of objective analysis***	***Codified knowledge Scientific methods***	***Rarely involved***	***Documented reports***
Case 1, 2 Medical research centres	"*Both from concrete needs of the patients resulting from pathological situations not enough studied in the past and from cases of difficulties in finding therapies*"	Codified knowledge and process	Almost no interactions	Innovative medical approaches, publications in research journals
Synthetic	***Need of practical solution***	***Experience Learning by doing***	***Strong client interactions***	***Practical solutions***
Case 3 International MBA programme	"*The service should be a response of a trend*", it is *"introduced if both professors and managers realise the need on the market"*. External sources of new ideas: the managers follow more companies of other KIS, e.g. LinkedIn, Lynda books, than their competitors. 70%–80% of new ideas for services appear inside the company	Codified knowledge and process in the phase of knowledge creation and tacit knowledge in the phase of its release "*A more structured process of following competitors is necessary", "we should follow the competitors but we do not"*	"*The goal of the online education is to satisfy the students' needs in the flexibility of the learning process, time management and learning process accessibility"* 20–30% ideas arrive from the University clients	The programme's aim – to change the market, in a belief that the first-mover advantages are important, "*being pioneers we can proceed as leaders*"
Case 4 Multinational IT company	All employees are responsible for introduction of new ideas, "*Analysis of information, feedback, ideas and needs from existing customers and competitive actions that require a response"*	Mostly tacit knowledge and process. The crucial aspect is that new ideas are "*always discussed and supported"*	Constant interactions and support of clients after service release	IT programs facilitating companies' organisation
Case 5 Multinational consulting company	The ideas come from internal knowledge of employees; the company also tends "*to adhere to the approaches which their competitors use in their work*"	Tacit and codified knowledge and process	"*Personalisation or codification of services depends on every individual case and the client; every case is different and should be coordinated with the clients' needs"*	Standardised consulting services
Case 6 Multinational group in insurance	Takes examples for new services from the world leading companies, of different sectors: "*the benchmarking companies where the team takes inspiration are Amazon and Fineco*"	Mostly tacit knowledge and process	Highly personalised services coordinated with their clients	Services in insurance
Case 7 Online marketing and innovation developer	The use of brainstorming technics to develop new ideas is the responsibility of all the employees	Mostly tacit knowledge, but codified repetitive innovation process aimed at producing highly personalised services with the maximum speed	Fast market analysis, based on a limited number of people, *"Large companies spend high budgets for marketing research, and when it is done, the situation on the market had already changed"*	Services for online marketing and services promotion for big companies

(*continued*)

Table 4

Case KB	*Purpose of knowledge creation/source of initiation* (interviews' citations)	*Knowledge inputs*	*Client' interactions*	*type of knowledge created*
Symbolic	*Need of distinctiveness*	*Inductive and divergent thinking* *Development of sociocultural meanings*	*Client approval*	*Creative symbols or forms*
Case 8 Online media for automotive	The creative responsible is constantly searching for ideas in all sources, companies of different sectors in different countries	Mostly tacit knowledge and process of developing new ideas, discussing them with other employees	Every service is initiated by the clients	Services in new methods of advertising
Case 9 Design and architecture agency	"E*very new project is unique and ideas can arrive from different sources*". Internal sources: employees' knowledge and previous experience, the company's own collection of art materials, portfolios; external ones: clients, suppliers, competitors, exhibitions, companies of other KIBS sectors, e.g. fashion companies	Tacit knowledge and mostly codified process. Inspiration is extremely important, "*an impulse that can push the designer to create a unique project''*, "*inspiration for different projects can arrive from unexpected sources, depending on the place, time and project''*	Every service is initiated by the client "*The extent of the creativity and originality of ideas in the projects and the influence of the client's desire differ in every project''*	Innovations depend mostly on the clients' orders and changes in the market
Case 10 Graphic design studio	Ideas for new services are the ideas based "*in the brief, particularly in the message that the company should deliver to the client's potential audience''. ''Experience, observation and education of people who are involved in the project''*	Tacit knowledge and mostly codified process. "*Everything can spark inspiration*" when the designer works for the project. If "*there is a clear idea and a message'',* inspiration is found *''around, in books, streets, exhibitions, other projects, and online sources like Pinterest that can be used to create boards and share ideas''*	Every service is initiated by the client *''Quality is the most important aspect of our company, spending more time with the clients and accomplishing their requests; and producing more volume of work for lower budget''*	Services in graphic design
Compliance	*Need of compliance*	*Interpretation and compliance with laws, regulations*	*Client initiation and approval*	*Documented and/or verbal advice*
Case 11 Legal firm	Aim to expand the range of the provided services. Every lawyer is free to propose and introduce new services for the company	Tacit and codified knowledge, strictly codified process	Every service is performed in close and constant collaboration with the client	Legal services, that can change laws in a long term

Source: Author's own creation

Basing on the answers received during the interviews, the main forces of service/product innovation process in companies were identified. These forces include:

- the general and service strategy of the company, which includes the estimation and financing of the new service;
- the source of new ideas/knowledge for new services, the knowledge can be internal or external, codified or tacit; and
- the influence of clients resulting in low or high personalisation of services.

These forces were compared and coordinated with the main characteristics of the KB developed in literature to describe the influence of the KB on the innovation process and results (Table 5).

Table 5 shows that few organisations develop a formal strategy (Cases 3, 5, 6, 9). Case 3, a university, proposing online educational programmes, aims to rise to the top of international rankings by offering highly innovative personalised educational programmes that can change the market. They are striving to market leaders. Company 6, an insurance company, is modifying its organisation to become completely telematic and expand its range of services to achieve the level of the benchmark leaders Amazon and Fineco. Other companies that develop a formal strategy aim at keeping their already leading position on the market by expanding existing services to new countries or to new fields of application. Company 5, a multinational consulting group, continuously expands its activity to new countries and broadens the range of the proposed services. Few companies plan not only to expand but also to diversify their service offering, as companies in Cases 6 and 9. Company 9, a design leader, aims at expanding its services to new categories, not only luxury hotels, but also private apartments, houses and hostels and countries.

Those structures that do not develop a formal strategy tend to react on obstacles or incentives that affect their innovative processes. For example, companies are forced to look for ways to innovate services in line with changing technologies and to reduce costs, IT companies and companies applying IT programs need continuously modernise its equipment (Cases 4, 9, 10).

Despite that client interactions are included as one of the main characteristics of the KB, they also act as driving forces in innovation, as every innovation project can have varied levels of clients' interactions even in companies with the same KB (e.g. Cases 3 and 7). Relations with the clients affect the service strategy. The more the service is affected by clients' orders, the more personalised services the structures develop. The studied organisations can be divided into those that proactively are searching for ideas for new services and those that reactively are developing new services on the basis of their clients' order. This stage of the innovation process at the end affects the service strategy of the companies.

The results of this study allowed the development of a framework summarising the driving forces behind innovation in the studied organisations (Figure 2).

The innovation processes in companies with the presumed analytical KB are characterised by the formal strategy predefined for conducting highly codified research process. The processes result from the necessity to investigate problems not studied in the past, in the presented cases, search of new methods of medical treatment, even if the funds for the process development are not calculated in advance. The search of new knowledge is codified as well. The processes and results are not affected by the clients; they depend just on the research findings arrived from the analytical process of investigation.

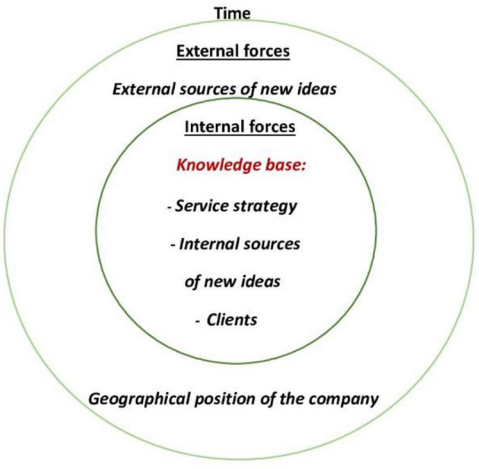
The innovation processes in companies with the presumed synthetic KB are more diverse, as include different kind of services. They can rely on both formal and informal general strategy to determine the company's goals, which depends as well on the size and maturity

Table 5 Factors affecting innovation process and the level of innovativeness of the service

Case	Company's strategic innovation plans	New knowledge source	Influence of clients	Level of innovativeness of results
KB	*Purpose of knowledge creation*	*Knowledge inputs*	*Clients' interactions*	*Knowledge created*
Case 1, 2 Analytical	Formal strategy aimed at conducting new research with or without funds' approval	Problems not studied in the past	Not affected by clients, low personalisation of services	Innovative or highly innovative results
Case 3 Synthetic, affected by analytical	Formal strategy, revised every 3 years, main investment in digital tools to improve proper position in international ranking, use of business case method to assess new services	Internal knowledge of employees based on scientific research		Innovative or moderately innovative results that aspire to change the market
Case 4 Synthetic	Informal strategy process due to company's start-up heritage, little use of business case method	Internal knowledge of employees based on market analysis	Highly affected by clients, high personalisation of services	Moderately innovative or innovative
Case 5 Synthetic affected by compliance	Formal strategy: diversify services and geography, improve approaches for performance, budget is coordinated by top management and constantly reviewed	Internal knowledge of employees		Moderately or not innovative
Case 6 Synthetic	Formal strategy: invest in telematics services, possible services diversification, business case method	Internal knowledge of employees and ideas searched in the competing companies and other KIBS	Highly affected by clients, high personalisation of services	Moderately innovative
Case 7 Synthetic	Informal strategy: improve speed and quality, clients and company's investment in services	Internal knowledge of employees		Innovative or moderately innovative
Case 8 Symbolic	Informal strategy: continuous search for new services and sponsors, clients' investment in services	Ideas searched in companies of all sectors and countries		Innovative or moderately innovative
Case 9 Symbolic affected by Synthetic	Formal strategy: expand similar services to diversified areas, clients' investment in services	"Made-to-order" basis of ideas initiated by company's clients and creatively developed inside the company		Innovative or moderately innovative
Case 10 Symbolic affected by Synthetic	Informal strategy: improve quality and speed, clients' investment in services			Moderately or not innovative
Case 11 Compliance/ Interpretive	Informal strategy: expand a range of services, clients' investment in services	"Made-to-order" basis of ideas initiated by company's clients; ideas searched in the competing companies	Moderately affected by clients, medium-high personalisation	Not innovative or periodically innovative results that can change the market or society in long term

Source: Author's own creation

Figure 2 Driving forces behind innovation in KIS



Source: Author's own creation

of the company. SMEs and young companies tend to use more informal strategies. But, it is possible to notice that companies that have strong influence of two KBs use more formal strategies and codified processes (Cases 3, 5, 9). Most companies with synthetic KBs use a business case method to estimate the introduction of new services. Even the companies that follow informal strategies tend to estimate the costs and revenues of new services in advance. The common source of new knowledge for companies with prevailing synthetic knowledge is internal knowledge of their employees, while the process of search of new ideas is mostly tacit. Companies with the influence of two KBs apply both codified and tacit knowledge. The collaboration with the clients is very high, clients are usually involved in the process of innovation, e.g. by testing new IT programs (Cases 3, 4, 6), or preparing consulting materials (Case 5) or testing new marketing solutions (Case 7).

Companies with the presumed prevailing symbolic KB mostly rely on informal strategy, with the exception of a company with the influence of two KBs (Case 9). It can be explained by the necessity of flexibility in the creative innovation process characteristic for symbolic knowledge. Every innovation process relies on clients' investment – the managers do not start a process until they do not find the clients' order and funds for it. The new knowledge is developed on "made-to-order" principle, creatively elaborated by the employees of the companies. The processes are mostly tacit. The innovations completely depend on clients and highly personalised.

Legal firms with the presumed newly proposed interpretative or compliance KB rely on informal general strategy but use strictly codified processes predefined by the rules and regulations of the legal activity. The firm depends completely on their clients in initiation of new processes, applying "made-to-order" knowledge and their clients' investment. The lawyers do not just comply with the existing knowledge but interpret this knowledge to arrive to necessary for their clients' knowledge results. This shows the novelty compared to previous literature where law companies were considered applying synthetic KB.

The geographical location of the structure influences companies with different KB in general in an equal manner. The location affects the process of new ideas search, whether through the economic situation of a country, such as high competition in the market (Case 11), specific national or cultural client requirements (Case 6: adapting of personalised insurance services to specific requirements in different countries of Europe), or environmental

conditions (Case 9: the necessity to adapt the design and architecture projects to natural and environmental requirements in different countries).

The last force affecting the innovation process is time. IT services (Case 4) underline the necessary modernisation of technical equipment every year (Case 7), companies in Cases 3 and 6 are transforming their structure to become completely telematic to respond to changes in society. A demonstrative example of the influence of time on innovative results is the legal firm in Case 11. Results of lawyers' activity may impact the creation of new laws, which can change different aspects in society, but this is a result of continuous evolutionary changes.

Such parameters as size, level of the structure maturity, organisational structure seem to have certain influence on the innovation process but not on the final service. For example, mature companies have more developed structures consisting of several departments (Cases 5, 6, 9), their innovation processes are influenced by the coordination of the work between these departments. The level of maturity of the company seems to influence on the development of the formal strategy of the company, as young companies stressed the lack of developing of formal strategy due to their "start-up heritage" (Cases 4, 7, 8, 10). The influence of these parameters on the innovation process and results deserves further investigation.

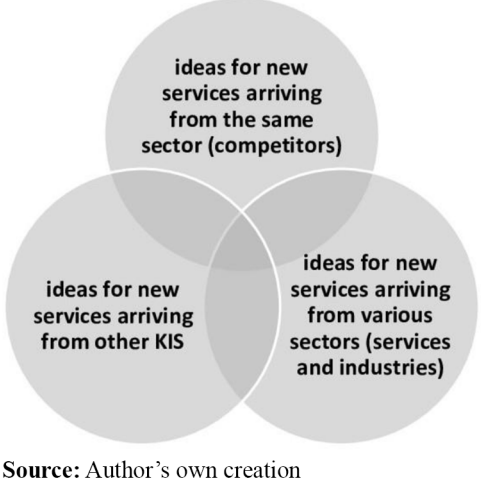
In some cases (6, 7, 8, 11), managers look for ideas for new services not just in competing companies but also in companies of other KIBS sectors. For example, insurance company in Case 6 for which the benchmark companies are leaders in other business sectors, the creative responsible in the media company in Case 8 looks for new ideas in a different sector, particularly in the countries with the highest share of KIBS firms. The investigated processes lead to the convergence of ideas for new services in KIS predicted by previous research (Strambach, 2008; Pina and Tether, 2016), and as a result, to the convergence of services in KIS (Figure 3).

5. Conclusion and implications

5.1 Main findings

The research results confirmed the connection between the KB of the company and its innovation process and results. The main factors driving service innovation, depending on the KB, were identified as follows:

Figure 3 Convergence of ideas for new services in KIS



Source: Author's own creation

- product and the general strategy of the company;
- sources of ideas search for new services; and
- collaboration with clients.

The type of the KB affects the characteristics of the innovation process and the level of innovativeness of its outcomes:

1. The strategic behaviour, defined by the general management, can be formal or informal. Strategic behaviour delineates the strategic goals that the company aims to achieve, such as being innovative or maintaining a stable market position (Table 5). Companies with analytical KB mostly follow a formal strategy, companies with synthetic – use equally formal and informal strategies. Larger and more mature companies are more inclined to use formal strategies rather than SMEs. Companies with symbolic KB seem prefer relying on informal strategies with exceptions. Lastly, law company with the newly proposed interpretative KB in the research follows informal strategy, but this as well as in case with companies with synthetic KB can depend on the size and structure of the company.
2. Companies with analytical KB as a source of new ideas rely on the problems not studied in the past, appropriate for a research process. The process of new ideas search should be codified. Companies with synthetic KB mostly rely on internal knowledge of their employees as the main source of new ideas. Some as well copy ideas of their competitors or other KIBS companies. The process of new ideas search is mostly not codified. Companies with symbolic KB use the maximum variety in search of new ideas, from external (new services of companies of all sectors) to internal knowledge of their employees, in many times based on inspiration, to produce the personalised "made-to-order" product. The process is mainly not codified, but some companies use codified procedures to make it more repetitive. The process of new ideas search in law companies relying on interpretative KB is codified and defined by the procedures characteristic for the sector.
3. The offering strategy is influenced by relations with customers and translates into high or low personalisation of services:
    - analytical – low personalisation;
    - synthetic -medium/high;
    - symbolic – high; and
    - interpretative – high.

Such parameters as size, level of the structure maturity, organisational structure can affect the innovation process, but their connection with the KB is ambiguous and deserves further study. The two forces that affect the companies independently from the KB, studied in the research were geographical location of the company and time.

Knowledge results were compared according to the opinion of the interviewed responsible for the innovation process in their organisations. The main parameter was the intention of the structures to create more or less innovative products/services and their compliance to these plans.

Organisations with an analytical KB perform the innovation process based on codified scientific methods to solve problems not enough studied before. This approach is initially programmed to search for and produce new knowledge, which confirm the results of the study. Companies relying on synthetic and symbolic types of knowledge mostly plan the improvement of the performance of their services, such as speed and quality (Table 5). Companies with a synthetic KB rely substantially on previous experience and a tacit type of

knowledge. This type of approach tends to lead to improvement of previous services, resulting in moderately or not innovative results. This partly confirms the results of Pina and Tether (2016), which showed that companies with synthetic and symbolic KB tend to invest more in design rather than in R&D and consequently produce less innovative services. But, the present research results showed that these companies can produce innovative results if it is programmed in the general strategy or the process is influenced by analytical knowledge (Cases 3, 4, 7). Companies with a symbolic KB rely mostly on tacit knowledge, combining it with codified visual or textual sources. The results of this approach are affected by the subjective vision – the emotions or "inspiration" – of the creator of the service, which can produce different or new types of knowledge that may be innovative. This contradicts the results of Grillitsch *et al.* (2016) who found no influence of symbolic knowledge on innovation results. The requests of clients can affect the final result of the innovation process, as the clients can order varying degrees of products/services' newness. Companies with a symbolic KB depend substantially on clients' investment and develop services according to their orders. Legal firms follow a strict process on the basis of previous experience and codified procedures (Krupskaya and Pina, 2022). They can produce innovative results if their activity, through a trial or consultancy, can affect the final decisions of legal procedures, leading to a change in existing laws. This is usually a slow evolutionary process, depending on changes in society.

Basing on the research results presented in Table 5, it is possible to assume that organisations having a hybrid KB tend to create more innovative ideas if they are influenced by a more innovative KB, such as analytical (e.g. Case 3). This partially confirms previous research results (Grillitsch *et al.*, 2016). At the same time, the research results showed that different stages of the process can be affected by different types of knowledge; in such cases, it is possible to state that a company possesses a type of hybrid KB, in which a prevalent type of KB is supplemented by another type (Pina and Tether, 2016).

5.2 Theoretical implications

The research filled the gap in the lack of deep empirical study of innovation processes in companies with different KB (Pina and Tether, 2016; Biemans *et al.*, 2016; Storey *et al.*, 2016). It confirmed on empirical basis in different KIS in different locations the connection between the KB, its innovation process and the level of innovativeness of the final results. The research described the influence of the KB on the forces affecting innovation processes.

The empirical results showed that companies with all KB tend to formulate plans for the innovation. They can be formal or informal, depending on strategic plans of the management or drawn on the tactical situation of the company, but most companies develop a goal for the innovation process. The KB affects whether its formal or informal, explicitly formulated in advance or kept in mind by the managers. That was not stressed in the previous literature. The research results showed that KB has a big influence on the service/product strategy of the company, resulting in low or highly personalised services/products. Personalisation of services determines the level of collaboration with the clients, starting from low in companies with analytical KB, to medium-high in synthetic, to extremely high in symbolic and interpretative. In the companies with symbolic and interpretative KB, the innovation process does not start without the order of the client and his investment.

Research results systemised and identified in a more precise way the sources of new ideas for companies with different KB. They described how the search of new knowledge is divided between external and internal sources, and which sources are prevailing in companies with a certain KB.

Lastly, the research results showed that the level of innovativeness of the services as well depend on the KB. They confirmed the results of previous studies that companies with

analytical KB produce more innovative results. While the results of previous studies did not show the agreement on the level of innovativeness in companies with synthetic and symbolic KB, the results of the present study showed that companies with synthetic KB can produce innovative results that change the market if the managers set this objective in the general and product strategy, while in general, companies with synthetic KB tend to apply innovative solution for process improvement. Companies with symbolic KB can produce innovative results but are limited by the clients' investment and their desires in the innovation results. They can develop innovative solutions if requested by their clients and through creative inspirations of their employees. The more creative service the company develops, the more innovative it can be.

The study also indicated that innovation processes should be viewed as dynamic, changing depending on projects and through time. The processes are affected by interconnected multiple factors. External sources of new knowledge complement internal ones, strategic goals can be influenced by the tactical reaction on the market or by financial situations.

5.3 Practical implications

Literature analysis showed that every company should consider its particular characteristics for developing its own innovation process (Jaakkola and Hallin, 2018; Pina and Tether, 2016; Chichkanov *et al.*, 2021). Knowledge-based economy challenges companies to adapt their innovation processes. To identify and respond to emerging opportunities in a continuous changing environment, companies should develop "strategic flexibility" to develop new products by means of "sensing, seizing and reconfiguring activities" (Ahmadi and Osman, 2020, p. 84).

This research can help KIS organisations understand which models exist for the search and development of innovative ideas. Companies that are forced to change, diversify or expand their services can use the developed classification of sources for new knowledge search.

Following the investigated classifications, organisations can classify themselves according to the dominant KB, and consequently, choose the right strategy for developing innovative services. For example, if the company applying synthetic KB aims at developing more innovative services it can introduce analytical KB in new ideas search process based on codified sources and analytical approach, or applying the knowledge on the needs of its clients, introduce services that combine personalisation and newness in the market. If the company, applying basically symbolic KB, aims at developing more innovative services, it can start to search for new ideas more in external sources (companies of other KIS or different sectors) to expand its knowledge and apply the knowledge of its clients to elaborate it with the creative approach of its employees.

Taking as a template the proposed developed model, companies could personalise the model, taking into consideration their particular characteristics, location and changes over time affecting their activity. Basing on the experience of the investigated cases, managers can learn to benefit from obstacles in innovation processes, transforming them into incentives to overcome and find new approach to products/services innovation.

The description of successful innovation processes and results in several leading companies presented in the study may help other companies in identifying knowledge-integration practices to improve performance and innovation processes.

5.4 Limitations and future research

Further research, based on a larger number of companies is needed to confirm the results of this research. It is necessary to investigate other parameters such as size, level of maturity, corporate governance and companies' structure in their affection on the innovation processes and results. The influence of national institutional landscapes on innovation

processes deserves further detailed exploration. Further detailed investigation should be devoted to investment strategies in KIS projects in relation with the KB and the knowledge strategy of the company.

Further research is needed to find more parameters affecting the innovation processes in KIS. In the research, only one model was proposed to describe this process. Other models that include more parameters and base on a larger number of companies could describe the process in a more detailed way. The description of innovation process in dynamics, a model that could develop with time is one of the challenges in the topic.

To create a universal model of all the forces over time in KIS is a challenging task. Multiple parameters arriving from both quantitative and qualitative studies should be taken into consideration. A model could have space for continuous addition of new forces that could appear due to evolutionary changes on the market and in the society in general.

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