OPEN INNOVATION MODEL IN THE KNOWLEDGE INTENSIVE BUSINESS SERVICES IN THE SLOVAK REPUBLIC[*]

Dana Benešová ¹, Viera Kubičková ², Miroslava Prváková ³

1,2,3 University of Economics in Bratislava, Faculty of Commerce, Department of Services and Tourism, Dolnozemská cesta 1, Bratislava, Slovak Republic

E-mails:¹ dana.benesova@euba.sk; ² viera.kubickova@euba.sk; ³ miroslava.prvakova@euba.sk

Abstract. Innovation and its management has been a current challenge for companies in the knowledge economy. Open innovation is a system that creates and uses synergies from sharing and collaboration. The digital economy and society support the emergence and functioning of open innovation systems. In the Slovak Republic´s environment, the management of innovations through an open mechanism is a perspective for the development of knowledge intensive business services (KIBS). These services are an important link in the value chain of the Slovak economy focused primarily on the automotive industry. The article deals with the creation of a model of open innovation in the environment of KIBS production in the Slovak Republic. Its elements and their classification are based on the results of the primary survey carried out by the Delphi method. The importance of individual elements thus reflects the priorities of innovation management of KIBS companies in the Slovak Republic. In the current theory, we do not find a model with these specifications. The presented model thus represents an original result supported by the primary research in a specific environment. The construction of the model identifies three building components of the open innovation mechanism: preparation and planning, implementation, evaluation of outputs and a value creation. They are complemented by factors, risks and effects. The model provides the possibility of measurement at the level of inputs and outputs.

---

1. Introduction

Innovations and its management have been a current issue for theory and practice. The reason is the effects of innovations, which, in the characteristics of the current economy, are a source of competitiveness of companies and national economies. The challenge for innovation management is therefore to set up a system that would support innovations, optimize the costs of their development and application, and generate synergistic effects. The Open Innovation Mechanism is a platform that accepts this challenge. At the same time, it reflects the conditions of the digital economy, within which the transfer of knowledge is accelerated and enables its sharing and cooperation of the subjects. According to Baur (2017), open innovation (OI) is nothing new, but it is currently gaining more acceptance and importance precisely because of digitalization. According to Trott and Hartmann (2009), the benefits and drivers of increased openness have been noted and discussed as early as the 1960s, especially in terms of mutual research and development (R&D) cooperation. The use of the term OI in relation to the growing trend of external cooperation was supported in particular by Chesbrough (2003), who expressed a modern view of open innovation and thus became the founder of this term. Several authors have been working on open innovation in the geographical territory of the V4 countries. Šmíd (2008) defines open innovation as a tool for sustainable business development. The authors Hvizdová and Máchal (2017), Knošková (2015), Vilčeková et al (2018) deal with the factors of knowledge transfer and cooperation of subjects in the mechanism of open innovation.

The topic of innovations in services and their management has a time lag in research compared to the same topic addressed in the conditions of production. This is also consistent with the thematic area of open innovation. According to Kubičková and Benešová (2011), the increased pressure on the performance of service producers is caused by increasing competition and growing trade in services. The need for service companies to make more efficient use of external ideas and technologies in their innovation activities is becoming increasingly desirable. The approach to open innovation according to Galati et al. (2012) may not be the same for all types of companies and in every industry. Each company is unique, with its own internal organization and specific internal dynamics and processes to which open innovation processes need to be adapted. This idea supports the effort to define open innovation and its mechanisms in the service production environment. The services sector is specific for its heterogeneity of activities. The production of services is affected by the specific characteristics of the services. It is therefore logical to accept differences in approaches to innovations and their management in services in terms of openness.

The article deals with the creation of a model of open innovation in the environment of knowledge-intensive production of services. The study presents a model of open innovation, which is constructed on the basis of the identification of factors, effects and risks of open innovation presented by several authors and models. Subsequently, it is adapted to the conditions of KIBS production in the Slovak Republic based on the application of the Delphi method. The method was applied by asking experts from the environment of innovation management in knowledge-intensive business services (KIBS) in the Slovak Republic. In current theory, we have not found a model with these specifications. The presented model thus represents an original result supported by the primary research in a specific environment.

1. Literature review

According to Metcalfe and Miles (2017), in the age of digitalization, companies that have an active approach to knowledge acquisition and can use it effectively will be among the first to provide better, faster and cheaper solutions than their competitors. The period of the Fourth Industrial Revolution is characterized by complete automation and digitalization processes with the use of electronics and information technologies in both production and services. According to Roblek et al. (2016), companies that want to move forward and be successful in the current competitive struggle must adapt their innovation processes to the conditions of the Fourth Industrial Revolution.

Currently, collaboration is not just about sharing knowledge about technology, it is also about sharing knowledge of the market, customers, or companies´own business models. Open innovation can be a response to changing market conditions and more specific customer needs. Chesbrough (2003) defines OI as the acquisition and provision of knowledge to accelerate internal innovations while expanding markets for the external use of internal innovations. Conceptually, it is a more distributed, more cooperative and decentralized approach to innovations, based on the fact that today's useful knowledge is widely distributed and society does not make full use of its resources if it innovates itself. The author also presents the effects for which it is advantageous to involve OI processes: achieving sustainable profitability, stable growth, personalization of services, focus on new business models, growing agility of companies and profit from the aspects of the Fourth Industrial Revolution. Through the OI mechanism, a company can reduce costs, speed up time for product and services launches, increase market differentiation and create new revenue streams. In terms of OI effects, we can consider effects in the areas of: consumer and customer, employee, business performance, product, partners and technology.

According to the author Durmaz (2013), OI is about creating a system in which ideas from customers, employees and other interested parties are openly projected. This system makes it possible to collect and develop ideas in cooperation with other actors, leading to continuous innovations. The term OI defines Kirschbaum (2005) as a cooperation between companies, individuals and public agencies to create innovative products and services. This process is also about sharing your risks and rewards. The definition is based on the belief that in a world of distributed knowledge, companies can no longer rely solely on in-house research, but rather on the benefits of innovations in cooperation with partners. Open access to innovations has brought significant benefits in many areas, including healthcare, IT, business services and public policy.

From the point of view of the effort to incorporate open innovation into the type of innovation based on the definition of several authors, we can state that this is a mechanism for creating innovation, not a type of innovation. An OI mechanism can result in innovation of a different type or kind.

Table 1. Systematization of definitions of open innovation and identification of OI factors

Authors	Key elements of definition	Factors
Chesbrough (2003)	Knowledge transfer, cooperation	The degree of openness of the company's borders
Kearney (2008)	Cumulation of resources, partnership	Business model
Lazzarotti and Manzini (2009)	Cooperation	The level of cooperation
Tuomi (2009)	Sharing ideas	Availability and mobility of specialists
Dahlander and Gann (2010)	The process of exchanging and sharing innovations	Number and diversity of partners
Hilgers and Ihl (2010)	Knowledge transfer	Online environment
Wallin and Krogh (2010)	Creation and use of knowledge	Organizational structure of a company
Schweisfurth et al. (2011)	Integration of thoughts	Sharing culture
Galati et al. (2012)	Integration of innovative resources	Company culture
Lidegaard (2012)	Cooperation, shared use of innovative resources	Social openness
Piller (2012)	Integration of external knowledge	Technical openness
Durmaz (2013)	Cooperation	Interaction
Brant and Lohse (2014)	Integration of external knowledge	Motivation of individuals
Tidd (2014)	Resource sharing	Company motivation
Bengtsson et al. (2015)	Knowledge transfer	Transparency
Kirschbaum (2005)	Cooperation, risk sharing	Terms and conditions
Knošková (2015)	Cooperation	Protection of intellectual property
Oberhaus (2015)	Resource sharing	Business capacities
Dabic et al. (2016)	Cooperation and partnership	Sources of innovations
Greco et al. (2016)	Interaction	Knowledge management
Osorio et al. (2016)	Cooperation, interconnection of resources	Sources of knowledge and its availability
Hossain and Anees-ur-Rehman (2016)	Knowledge transfer	Management strategy
Zobel et al. (2016)	Transfer and exchange of knowledge	Innovation potential
Hvizdová and Máchal (2017)	Transfer and exchange of knowledge	Workforce qualification
Zapfl (2018)	Utilization of the innovative potential of the environment	Investments in R&D
		Creativity
		Cooperation

Source: author´s own, 2020

The above systematization of definitions of open innovation (Table 1) points to the application of different approaches and different understandings of this phenomenon. Chesbrough (2003) discusses knowledge flows, Tidd (2014), Dahlander and Gann (2010) identify open innovation as resources, which is a broader area. Others (Lazzarooti and Manzini, 2009) do not mention knowledge exchange in their definition, but instead they define it as a cooperation in which there are several partners doing something together. Cooperation is a common feature of explaining open innovation. The logical consequence of the cooperation is a grouping of partners, while the authors identify this group differently (Hossain, Anees-ur-Rehman, 2016; Wallin, Krogh, 2010; Greco et al., 2016; Tidd, 2014; Bengtsson et al., 2015; Chesbrough, 2003). The common element is the fact that the actors come from four areas: a company, individuals, private entities, public institutions. These are various departments in a company, employees, customers, clients, specialists, buyers, competitors, suppliers, universities, schools, research institutions, state and regional governing institutions, government, local communities, network and cluster partnerships, etc.

We understand open innovation as a process of sharing knowledge and other resources beyond the boundaries of the company/corporation as part of an open business model with a number of different actors with which the company/corporation cooperates. Open innovation is a mechanism enabling the use of synergistic effects from the sharing of innovation capacities of the participating actors, thus increasing the innovation potential of a company. Opening up the innovation process to partners has become a widely accepted path of innovations. In parallel with the growing research on open innovation, differences in the interpretation of the OI models have also developed. The basic point of differentiation is linked to the word "open," by which different scientists denote different degrees or dimensions of openness (Tynnhammar, 2017). According to Lazzarotti and Manzini (2009), the basic view of the application of OI in a company, which can be quantified, is an extent of openness to innovation. The extent of openness is a significant factor in the resulting effects of the mechanism of open innovation. According to the author Tynnhammar (2017) and his model, the extent is defined by the number of partners, the type of cooperation and cooperation in different parts of the process. More complex models focus on integrating and using ideas created outside and within a corporation in order to innovate. The defining feature of open innovation in this sense is the open business model.

The starting point for creating a model of open innovation in the environment of knowledge-intensive services in the Slovak Republic is the familiarity with the existing models and the determination of key elements for its construction with an emphasis on its functionality in a specific environment. A relatively extensive study of existing more or less complex efforts to model open innovation leads us to accept the following models of open innovation: the OI model focused on value creation (Aranha et al., 2015), the organizational model of OI (Salampasis, 2015), the model based on open innovation life cycle framework (Krause, Schutte, 2016), a model of the OI impact on a company's outputs (Farha, 2016). The models are not mutually exclusive, each author focuses on other aspects of an open innovation, as the purpose and focus of the model were partially different. The models differ mainly in the complexity of their application in practice, while the latter model integrates several already existing separate models into a common theoretical framework. An important finding is that the models have a built-in methodology for measuring open innovation and partly express the measurability of its effects. The question is the functionality of the models in terms of measurability of OI impacts, as they are, according to the several authors, too broad to be able to express them rigorously and quantitatively. The authors of the models express the possibility of measuring the effects of this mechanism only through the impacts on the overall performance of a company through key performance indicators.

The model focused on value creation and the one based on open innovation life cycle framework can be considered process-oriented, the other two as relationship-oriented. The models assume a partial ability to quantify and measure them, except for the conditions of the organizational model. Comparative analysis of the open innovation models is in table 2.

Table 2 Comparative analysis of the open innovation models

Title	Author	Characteristics	Measurability
The OI model focused on value creation	Aranha et al. (2015)	The functionality of open innovation is provided by an open business model that uses internal and external sources of knowledge and partnerships (independent variables) to create value (dependent variable). The process model.	✔
The organizational model of OI	Salampasis (2015)	Connectivity of three blocks: individual level, human resources management and organizational skills. An agile work environment is essential for the implementation of OI processes, which enables resiliency and flexibility of processes and also supports cooperation. The relational model.	**X**
The model based on OI life cycle framework	Krause and Schutte (2016)	The model consists of 18 factors and directs companies to implementation, performing and improving open innovations. The model consists of blocks: OI planning and preparation, OI application, OI measurement and evaluation, and OI enhancements. The process model.	✔
The model of OI impact on a company's outputs	Farha (2016)	The model measures the relationship between individual indicators and their impact on outputs in the form of inclination to innovation and company´s performance. It is based on 8 building blocks of open innovation: erosion factors, processes of open innovation, knowledge management, partnerships, organizational management, intellectual property, risks and benefits. These eight blocks are grouped into five indicators, which form a model of open innovation. The relational model.	✔

Source: author´s own

2. Methods

The aim of the article is to create a model of open innovation applicable in the environment of KIBS production in the Slovak Republic. The construction of the model was created on the basis of the acceptance of relevant model approaches and subsequently on the basis of the confrontation of the induced elements of the model with the professional environment. Using the chosen methodological procedure while constructing the model we answer the following research questions (RQ):

RQ1: What is the position of KIBS in the Slovak economy?

RQ2: Which factors of open innovation are the key ones in the conditions of KIBS in the Slovak Republic?

RQ3: Which risks are the most significant for the process of organizational innovation in KIBS in the Slovak Republic?

RQ4: What effects are created by the implementation of open innovation in KIBS in the Slovak Republic?

The starting information for the creation of the model is the position of KIBS in the Slovak economy as a relevant environment. Data from the Statistical Office of the Slovak Republic and Eurostat were used to identify the position of KIBS in the Slovak Republic. The selected indicators are gross domestic product, employment and labor productivity.

The construction of the model itself is based on the source analysis, existing OI models and the results of the Delphi method. By analyzing the relevant sources, we identified 81 key elements of OI. The key elements included the items: factor, risk, effect. After analysis of OI models, 125 key elements were identified. After combining the two above mentioned sources, a knowledge base with 206 key elements was created. This number represented a comprehensive range of identified factors, risks and effects, with the scale including term overlaps and content relatedness of the defined elements. Subsequently, we proceeded to narrow the scale on the principle

of term and content relatedness of concepts. The reduced database contained 52 key elements, which were divided into 3 logical units - building blocks of the OI model: the preparation and planning, the implementation, the evaluation of outputs and the value creation. Within the first block (planning and preparation for OI), based on the analysis of the sources, 4 main factors had been identified, which were further defined by means of subfactors. In the second block of OI (implementation of OI), the analysis of the sources had identified the process of open innovation, which can be applied in 3 ways, and then the main risks arising from these processes were identified. The third building block of OI (evaluation of outputs and value creation) was characterized by the effects resulting from the application of the OI mechanism for the company.

Through the application of the Delphi method, the degree of influence of factors, risks and effects on the application of the proposed conceptual model in the KIBS environment in the Slovak Republic was identified. The Delphi method was chosen for this qualitative survey by inquiring the experts. The conditions for the selection of the experts and the areas of their expertise were very specific, which significantly narrowed the circle of potential experts in Slovakia. 16 experts were contacted and 12 of them answered. The addressed experts (Table 4) worked for more than 3 years in an open innovation environment in KIBS.

The qualitative survey was conducted in the period of 7 - 20 January, 2020 in the form of an online questionnaire, created through Google forms. The questionnaire consisted of 19 questions, of which 3 were identification ones, 7 were open questions and 9 were closed. The closed questions consisted of the evaluation of the degree of influence of the selected factors, risks and effects in the form of the Likert scale (5 - the highest level of importance, 1 - the lowest level of importance) on the application of OI in KIBS in the Slovak Republic. Each evaluation was followed by an open question with the opportunity to express their views. Data processing was performed by calculating the average and median for the individual OI indicators. The average was used to determine the order of the factors, risks and effects. As stated by Egerová and Mužík (2010), if the average is equal to or lower than 3, then the given indicator is not important. If the average is higher than 3, the indicator is very important, and if its value is higher than 4, the indicator is the key one. The average was rounded to two decimal places. To identify the order of the subfactors, risks and effects, a scale of importance was assigned with the assigned significance (Table 3). The median was further used as an indicator of group opinion (Egerová and Mužík, 2010). After the evaluation, the resulting order as well as the median values were resent to the experts for verification and possible modification of the original answers. This verification took place in the period of 10 - 24 February, 2020 in the form of an online questionnaire created via Google forms. After obtaining feedback, the comments were incorporated and subsequently a draft conceptual model of the application of open innovation in the KIBS environment in the Slovak Republic was created, whose subfactors, risks and effects had a median value greater than or equal to 4 after the evaluation.

Table 3. Scale of the degree of influence of the factors (together with the sub-factors), risks and effects on the application of OI in KIBS

Scale of the degree of influence	Significance
1 – 2,4 (including)	insignificant
2,5 – 3,5(including)	less significant
3,6 – 4,4 (including)	significant
4,5 – 5 (including)	the key one

Source: the authors' own

Table 4 Information on the respondents - experts from the KIBS environment in the Slovak Republic

Position and department of the expert	Number of years of the expert´s experience	Number of employees in the relevant company	Activity of the company according to the categorization of economic activities SK NACE Rev. 2	Number of the experts-respondents
CPO (Chief People Officer),top management	7 and more	50- 100	Section J - 62.09 Other information technology and computer services	1
CEO (Chief Executive Officer),top management	3 - 5	50-100	Section J - 62.09 Other information technology and computer services	1
Senior manager, department of Customer-Specific Development	7 and more	101-150	Section J - 62.09 Other information technology and computer services	2
Senior manager, department of Cyber Security	3 - 5	101-150	Section J - 62.09 Other information technology and computer services	2
CEO (Chief Executive Officer), top management	5 - 7	up to 50	Section M - 70.22 Business and management consulting services	1
Senior manager, Department of Business Management	5 - 7	up to 50	Section M - 70.22 Business and management consulting services	2
Senior manager, Advisory Department	7 a viac	151-200	Section M - 69.2 Accounting, bookkeeping and auditing activities; tax consultancy	1
Senior manager, Human Resources Department	3 – 5	151-200	Section M - 69.2 Accounting, bookkeeping and auditing activities; tax consultancy	2

Source: the authors' own.

3. Results and discussion

RQ 1: What is the position of KIBS in the Slovak economy?
In the conditions of knowledge-based economy, the production of knowledge intensive services is a characteristic feature of advanced economies. KIBS are gaining a unique position, satisfying intermediate demand and thus directly influencing the promotion of innovation throughout the whole economy. One of the first definitions of the term KIBS is linked to Davis and Botkin, 1994. Their definition consisted of a common characteristic of companies with high level use of knowledge. In the economic activities, KIBS are represented by sections J - information and communication services, M - professional, scientific and technical activities (excluding division M 75) and divisions N 78 - job placement, N 80 - security and investigation services. According to Nählinder (2005), KIBS are services and business operations that are highly dependent on expertise. As a result, their employment structures are shaped for the benefit of scientists, engineers and other professionals. Their

importance in the Slovak economy is supported by a strong customer base of the automotive, electrical and engineering industries, whose competitiveness is also conditioned by quality service deliveries.

In 2018, KIBS accounted for 13.3% of total GDP in the Slovak Republic, and information and communication services accounted for 4.2% of GDP. They accounted for 13.4% of total employment and information and communication services for 2.9% (Statistical Office of the Slovak Republic, 2020). According to the statistical availability, GDP and employment in KIBS include the performances of sections J, M and N. In the period of 2008-2017, the volume of GDP in the Slovak Republic, created in sections J and M together, increased, while in 2007 it amounted to 5211.5 mil. EUR and in 2017 7933.0 mil. EUR. The decrease in this indicator was recorded only in 2013. This volume was the lowest among the V4 countries, but the growth rate was higher in the Slovak Republic than in Czechia and Hungary. The average annual GDP growth rate in KIBS in the Slovak Republic was 4.8% in the period under review (European Commission, 2020). The dynamics of the development of KIBS in the Slovak Republic suggests their relatively significant impact on the Slovak economy. At the same time, their influence is also strengthened by the ability of KIBS products to transform innovations into buyer entities and to improve value chains in the Slovak economy.
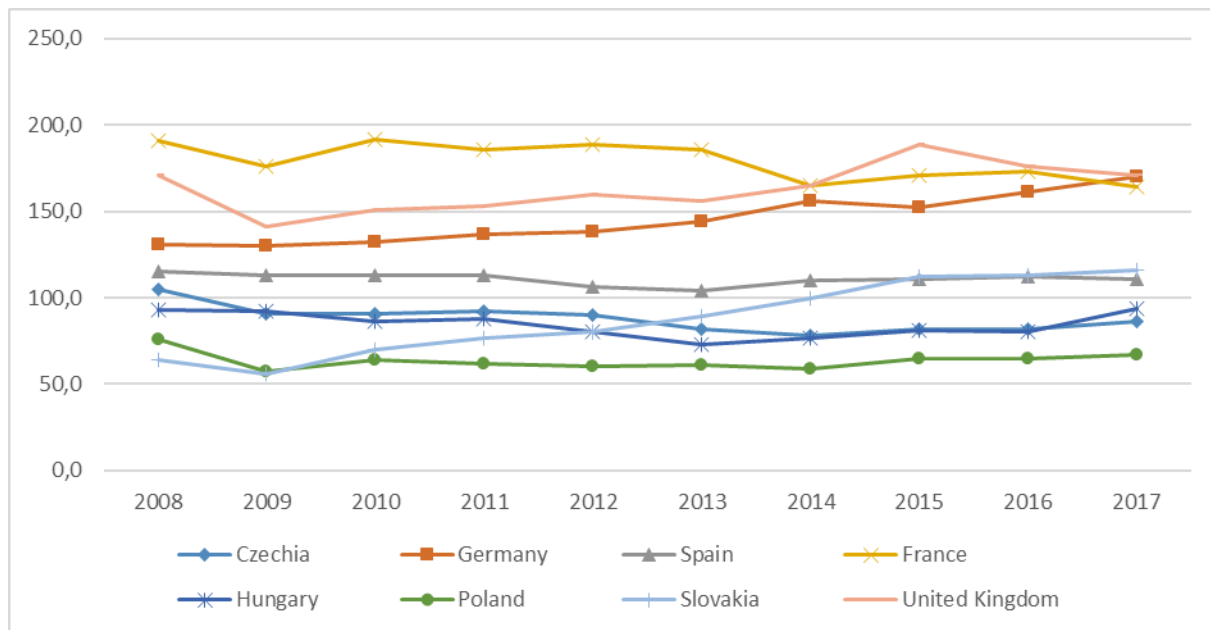
Fig. 1. Labour productivity in KIBS (thousands of EUR)

Source: author´s own based on the Eurostat database

A comparison of the achieved labor productivity in KIBS (expressed as sales per employee) and its development in the years of 2008 - 2017 in the selected countries suggests that KIBS productivity in the Slovak Republic increased and it is the highest in the V4 countries at the end of the period under review, reaching the labor productivity level achieved in Spain (Fig. 1). Support for increasing performance in KIBS in the Slovak Republic is a challenge for the area of innovations and their management. Therefore, we chose the KIBS production environment as a relevant environment for creating an open innovation.

RQ 2: Which factors of open innovation are the key ones in the conditions of KIBS in the Slovak Republic?

Based on the analysis of the sources on the subject, we defined four key factors - company culture, organizational structure, business model and organizational readiness, as those influencing the implementation and the process of open innovation (OI) in companies mostly.

We relied on the several authors (Chesbrough 2003; Tuomi 2009; Wallin and Krogh 2010; Galati et al. 2012; Zobel et al. 2016; Hvizdová and Máchal 2017; Zapfl 2018), who identified company culture as an important factor creating a satisfactory or unsatisfactory background for the application of OI. However, when implementing open innovation processes, it is important that the company culture, when communicated by it externally, reflects the real situation within the organization. By testing through the subfactors creating the company culture of the KIBS companies in the Slovak Republic (Table 5), we found that the key subfactors with the highest impact on the use of open innovation are: motivation, cooperation, freedom of expression, leadership style, dialogues and employee training within the organization. Very important subfactors are also respect for diversity, acquisition and retention of talents, mutual internal dynamics, creativity, organizational support and trust.

Table 5 The influence of the key factors of open innovation in the KIBS conditions in the Slovak Republic

Evaluation of the influence of the company culture factor on open innovation through the subfactors							
Subfactor	Motivation	Cooperation	Freedom of expression	Leadership style	Dialogues	Education	Respect for diversity	Acquisition and retention of talents
Mean	5	4,75	4,75	4,5	4,25	4,25	4	4
Median	5	5	5	4,5	4,5	4,5	4	4
Subfactor	Internal dynamics	Collectivity	Creativity	Organisational support	Trust	Fair play	Development	Intellectual potential
Mean	3,75	3,5	3,75	3,75	3,75	3,25	3,25	3
Median	4	3,5	4	4	4	3	3	3
Evaluation of the impact of the organizational structure factor on open innovation through the subfactors							
Subfactor	Top management	Human resources management	Research and development	Knowledge management	Intellectual property management	Sales department	Marketing department	Financial department
Mean	5	4,5	3,75	3	2,5	2,25	2	1,75
Median	5	4,5	4	3	2,5	2	2	2
Evaluation of the impact of the business model factor on open innovation through the subfactors							
Subfactor	Open innovation environment of the company	Intensive cooperation in the company	Mixed financial resources	Interactions in the ecosystem	Open process of innovation development	Creating an open innovation community	Creating an open innovation ecosystem	Large number and diversity of partners
Mean	4,25	4,25	4,25	4	4	3,5	3,5	3
Median	4,5	4,5	4,5	4	4	3	3	3
Evaluation of the impact of the factor of organizational readiness of the company on open innovation through the subfactors							
Subfactor	Strategic orientation	Qualified workforce	Open innovation processes	Findings on open innovation	Internet and online environment			
Mean	4,75	4,5	4,25	3,75	3,25			
Median	5	4,5	4,5	4	3			

Source: authors' own processing of survey results, 2020

The open innovation factor "organizational structure" is the way in which a company communicates, shares responsibilities and adapts to change. According to several authors (Kearney, 2008; Schweisfurth et al. 2011; Piller, 2012; Durmaz, 2013; Hvizdová and Máchal, 2017), the division of powers and responsibilities within a company has an impact on the overall application of open innovation processes and thus on the company's relationship with the external environment. . The key subfactors reflecting the „organizational structure" factor in KIBS companies in the Slovak Republic are top management and human resources, which the company has at its disposal and manages. The top management of the company makes decisions of a strategic nature that affect the degree of implementation of OI, human resource management plays an important role in managing the optimal exchange of knowledge from employees to the management of the company and vice versa. A very important subfactor is also research and development carried out within the company as well as in cooperation with external partners.

Based on many authors (Chesbrough, 2003; Durmaz, 2013; Brant and Lohse, 2014; Knošková 2015; Dabic et al., 2016; Greco et al., 2016; Osorio et al., 2016; Zapfl 2018 and others) an important factor of OI is the business model focused on openness in the application of innovation processes.

Openness within the business model means in particular the ability of the company to open up when exchanging knowledge and other resources (human, financial, material and others). Openness also applies to a large extent to cooperation, which must be effective both within the company and beyond its borders, implemented interactively in the innovation ecosystem. Millard (2018) defines an innovation ecosystem as a complex of communities, organisms and its subsistence environment functioning as an ecological unit. The innovation ecosystem consists of actors such as universities, governments, corporations, businesses, private investors, foundations and others. Each of them plays an important role in creating the value chain of the ecosystem by turning new ideas into reality through cooperation, the provision of open accesses or financial investments. The results of the survey show that the key subfactors of the business model in KIBS companies in the Slovak Republic are an open innovative business environment, intensive cooperation in the company and interactions in the ecosystem. Very important sub-factors include the use of mixed financial resources and the open process of innovation development.

According to numerous authors, a significant factor in the application of OI is the organizational readiness of the company. Open innovation is not a one-off tool, given that the effects of the application of OI have a long-term effect, it is therefore heterogeneous in time and a strategic tool. Open innovation is based on the high qualification of human resources, but also on human abilities to cooperate, accept external sources of knowledge, or offer their knowledge for external use. The results of the survey indicate that the key subfactors of the organizational readiness of KIBS companies in the Slovak Republic are the strategic orientation towards innovation openness, a qualified workforce and the processes of development of open innovation processes. A very important subfactor is also the knowledge about OI, which company management and employees have at their disposal, permanently share and further develop.

RQ 3: Which risks are the most significant for the process of organizational innovation in KIBS in the Slovak Republic?
Based on the findings of several authors, for example, according to West and Bogers (2017), Chesbrough, Euchner (2011), there are two types of OI processes: inside-out and outside-in. The authors Dahlander and Gann (2010) add a third, coupled process, to the two existing processes. The types vary depending on the flow of knowledge, with the coupled process linking these flows. The type of OI affects the mechanism of OI, its results but also the risks.

Make your research more visible, join the Twitter account of ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES: @Entrepr69728810

Table 6. The evaluation of the importance of the risks of open innovation in the conditions of KIBS in the Slovak Republic

	The evaluation of the importance of the risks of open innovation						
Risks	Limited ability to develop and use intercompany relations	Limited ability to use external knowledge	Knowledge flow management	Increasing the complexity of processes resulting from cooperation with external parties	Development limitation of the internal skills and key technological competencies	Increase of the dependence on external technology providers	Limited ability to provide internal knowledge for external needs
Mean	4,25	4	4	3,5	3,25	3	2,75
Median	4	4	4	3,5	3,5	3	3

Source: authors' own processing of survey results, 2020

Not all risks arising from the application of OI can be accurately predicted, but it is generally possible to identify the most frequent risks. By testing the risks in the survey, we specified the most important and critical risks of the application of OI in KIBS companies in the Slovak Republic (Table 6), which are limited ability to develop and use intercompany relations, limited ability to use external knowledge and limited ability to manage knowledge flow. The ability of management and employees to share new knowledge or resources, cooperate with external partners, apply knowledge management in the business processes are the basic principles of open innovation, the absence of which threatens the success of OI implementation. The identification of the status of business processes and the preparatory phase of the application of OI is therefore crucial for the companies.

RQ4: What effects are created by the implementation of open innovation in KIBS in the Slovak Republic?
With the open innovation processes, many positive effects are created, it is necessary to define the goal that the company wants to achieve by applying OI. Based on this, the company can use the decision-making process to determine the scope of the project, the number and nature of the partners, the purpose of using open innovation, the risks of open innovation and others. It will answer the question of whether the implementation of open innovation is the best tool to achieve the goal, to gain competitive advantage and what other effects it can bring to the company.

Table 7. The evaluation of the importance of the effects of open innovation in the conditions of KIBS in the Slovak Republic

	The evaluation of the importance of the effects of open innovation						
Effects	Competitive advantage	New revenue streams	New products and services	Improving customer relationships	Cost reduction	Strengthening relations with employees	Improving financial performance	Improving management skills
Mean	5	5	5	4	4	3,75	3,75	3,5
Median	5	5	5	4	4	4	4	3,5

Source: authors' own processing of survey results, 2020

The results of the survey indicate the key effects of open innovation in the conditions of KIBS in the Slovak Republic (Table 7), which are gaining a competitive advantage, generating the new revenues and creation of new products and services. Respondents consider the improvement of relations with customers, employees and partners, the reduction of production costs and the improvement of the company's financial performance to be very important effects.

Discussion

The OI model in KIBS in the Slovak Republic (Fig. 2) was compiled primarily from internal factors of open innovation and is focused on the business processes. The basis of the model is based on the Model based on OI life cycle framework (Krause and Schutte, 2016) and the Organizational Model of OI (Salampasis, 2015), as the application of open innovation itself depends, according to the several authors, mainly on the organizational structure of a company and its culture, which is based on the principle of cooperation.

According to the several authors, the open business model is a basic factor that should be part of all OI models. Within the last, third building block in the model, the basic factors were identified mainly from the Model of OI impact on a company's outputs (Farha, 2016) and supplemented by knowledge from the OI model focused on value creation (Aranha el al., 2015).

The model design therefore consists of the several previous models. Figure 1 graphically expresses the design of the Model of OI application in KIBS in the Slovak Republic.

The model consists of 3 building blocks, the first (planning and preparation for OI) is further divided into the factors: organizational readiness, company culture, organizational structure and open business model. These factors are supplemented by other subfactors that characterize them in more detail.
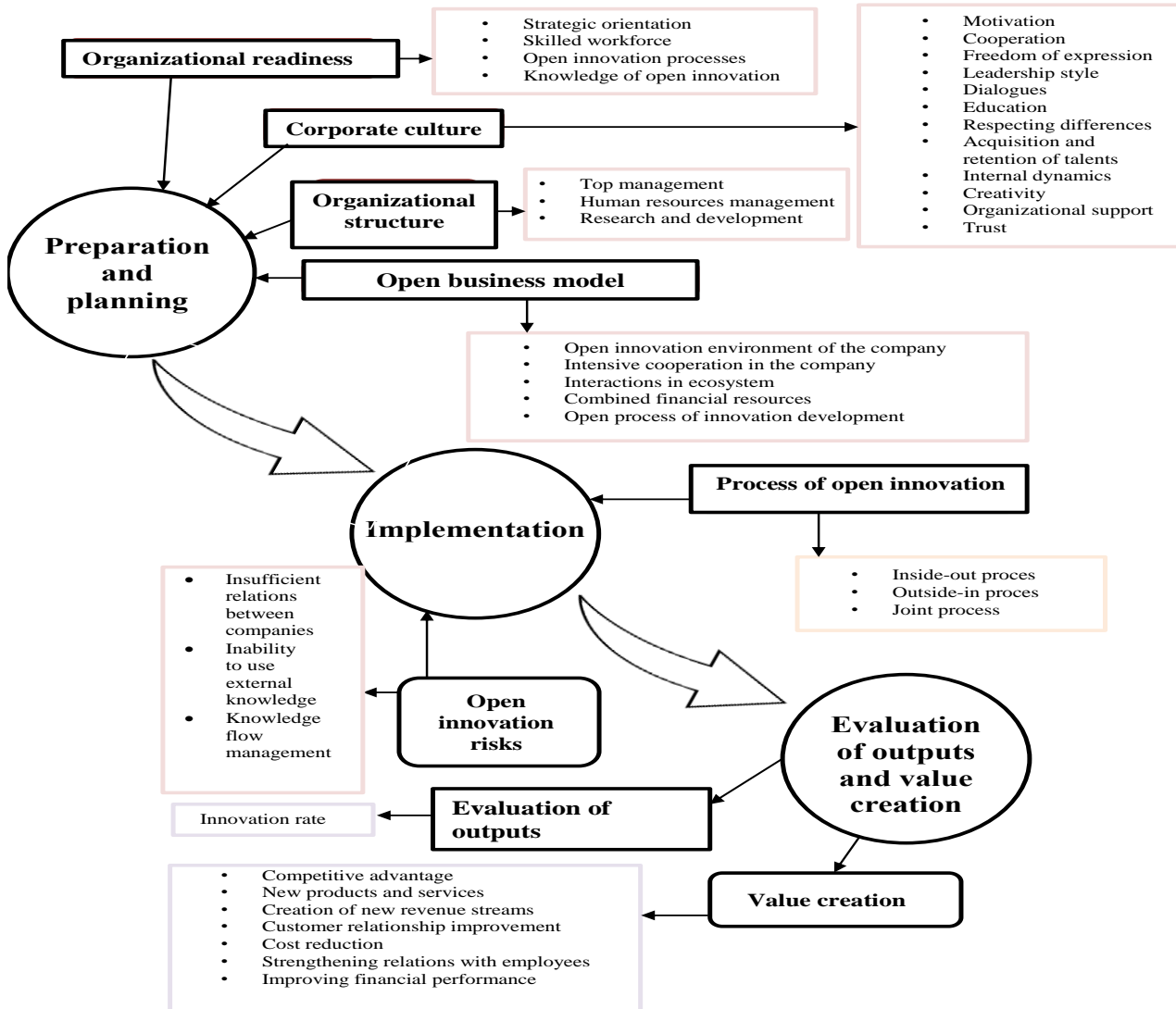
Fig. 2. The model of open innovation in KIBS in the Slovak Republic

Source: authors' own, 2020

The second building block (implementation of OI) is divided into the OI processes and the risks arising from these processes. The last, third building block of the model is divided into evaluation of outputs and value creation. This model makes it possible to express the innovative potential of the mechanism. This is expressed by the inputs to the open innovation mechanism through the evaluation and/or quantification of the proposed sub-factors listed under the "preparation and planning" building block. The effective use of the inputs of the open innovation mechanism is influenced by the way it is implemented, while the correct choice of a specific method affects the risks of OI. The model allows to measure the effects from the implementation of OI in KIBS. The

1353

priority output of the OI system is the innovativeness of the subject expressed in the model by the level of innovation. Other measurable effects are aimed at creating value for the KIBS entity applying OI.

Value creation for a company is reflected in the sphere of its market position, product competitiveness, financial income and financial performance, customer relations, cost reduction and employee relations.

Conclusion

The position of KIBS in the Slovak economy can be described as significant not only with regard to the achieved economic performance and their dynamics, but also due to their function of transferring innovations to the value chains of production of the key sectors of the Slovak economy. The requirement of quality, availability and innovation of KIBS products in the Slovak Republic is an important condition for satisfying the intermediate demand of industrial companies in the Slovak Republic. Support for increasing the quality and performance of KIBS in the Slovak Republic is a challenge for the area of innovations and their management. The solution to the issue of open innovation systems is therefore very topical for the KIBS production environment in the Slovak Republic. We understand open innovation as a process of sharing knowledge and other resources beyond the boundaries of the company/corporation as part of an open business model with a number of different actors with which the company/ corporation cooperates. Open innovation is a mechanism enabling the use of synergistic effects from the sharing of innovation capacities of the participating actors, thus increasing the innovation potential of the company.

The study presents a model of open innovation, which is constructed on the basis of the identification of the factors, effects and risks of open innovation presented by the several authors and models. Subsequently, it is adapted to the conditions of KIBS production in the Slovak Republic based on the application of the Delphi method. The method was applied by asking experts from the environment of innovation management in knowledge-intensive business services (KIBS) in the Slovak Republic. The mentioned model is thus a functional tool for evaluating the innovation potential of a company operating in a relevant environment and a tool for evaluating the outputs of the OI mechanism applied in a given company.

The application of the presented OI model allows to achieve positive effects for the company producing KIBS. It is also important to realize that the impacts of the OI mechanism effects in KIBS will be notable for the relevant business environment. These are the schools, universities, businesses, public institutions and research institutions that enter into the processes of sharing not only the resources but also the effects as part of the functioning of the open innovation mechanism with KIBS company. This creates synergistic effects that can be identified not only in the KIBS environment, but also in other economic and social areas. The application of the model may be limited by the capital background of the company and its origin. Companies with multinational operations are subject to the management practices created by the parent company. These practices can accept other key elements of the open innovation mechanism that are functional in the environment of the parent company's economic and social conditions. Thus, the application of the proposed model within multinational corporations may not be accepted.

The specific application of the key elements of the OI KIBS model in the Slovak Republic is further dependent on the selection of indicators enabling accurate quantification of inputs (subfactors) and outputs (effects). This process is unique to a specific company/corporation. Further applied research in this area should be aimed at identifying specific indicators for a defined entity. At the same time, it is important to deal with the identification of barriers and critical points before applying the model in the specific conditions of the selected entity. The success of the application of the OI model in KIBS in the Slovak Republic may be influenced by the company's

Make your research more visible, join the Twitter account of ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES: @Entrepr69728810

innovation capacity, strategic priorities, company culture, organizational readiness, cooperation ability, innovative maturity, expectations, management style, level of ICT use, communication skills and financial resources.

References

ARANHA, A., GARCIA, N.A.P., CORRÊA, G. (2015). Open Innovation and Business Model: A Brazilian Company Case Study. Journal of Technology Management & Innovation, 10(4) http://dx.doi.org/10.4067/S0718-27242015000400010

BAUR, P. (2017). The Advance of Open Innovation. https://news.sap.com/2017/04/henry-chesbrough-interview-advance-of-open-innovation/

BENSTSSON, B., LAZZAROTTI, V., LAKEMOND, N., MANZINI, R. (2015). Open to a Select Few? Matching Partners and Knowledge Content for Open Innovation Performance. Creativity and Innovation Management. 24(1), http://dx.doi.org/10.1111/caim.12098

BRANT, J. LOHSE, S. (2014). The Open Innovation Model. Paris. International Chamber of Commerce. 28 p. https://www.iccwbo.be/wp-content/uploads/2012/03/20140325-The-Open-Innovation-Model.pdf

DABIC, M., BASIC, M., VLAJČIĆ, D. (2016). Introduction to the Open Innovation Paradigm. LUT Scientific and Expertise Publications. 113-162. https://www.researchgate.net/publication/316526811_Introduction_to_the_Open_Innovation_Paradigm

DAHALANDER, L. GANN, D. M. (2010). How open is innovation? Research Policy, 39(6), 699-709. http://dx.doi.org/10.1016/j.respol.2010.01.013

DAVIS, S. BOTKIN, J. (1994). The Coming of Knowledge-Based Business. Harvard Business Review, (9-10), https://hbr.org/1994/09/the-coming-of-knowledge-based-business

DURMAZ, L. (2013). Open Innovation – Definition and Benefits. http://imblog.ideaglow.com/open-innovation-definition-benefits/

EGEROVÁ, D., MUŽÍK, J. (2010). Aplikace metody Delphi při expertním stanovení faktorů ovlivňujících efektivnost e-learningu ve vzdělávání pracovníků v malých a středních podnicích (Application of the Delphi method in the expert determination of factors influencing the effectiveness of e-learning in the education of employees in small and medium-sized enterprises). E+M Economics & Mmanagement, 10(2), 137-152, www.ekonomie-management.cz/download/1331826760_1072/13_egerova.pdf

EUROPEAN COMMISSION. (2020). Eurostat database. Available 2020-04-28 at https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

FARHA, S. (2016). Open Innovation Practices in the Professional Services Industry. Université de Montréal, p. 471. https://publications.polymtl.ca/2458/1/2016_ShadiFarha.pdf

GALATI, G., BIGLIARDI, B., DORMIO, A.I. (2012). The adoption of open innovation within the telecommunication industry. European Journal of Innovation Management, 15(1), 27-54. http://dx.doi.org/10.1108/14601061211192825

Make your research more visible, join the Twitter account of ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES: @Entrepr69728810

GRECO, G., GRIMALDI, M., CRICELLI, L. (2016). An analysis of the open innovation effect on firm performance. European Management Journal, 34(5), 501-516. http://dx.doi.org/10.1016/j.emj.2016.02.008

HILGERS, D. IHL, CH. (2010). Citizensourcing: Applying the Concept of Open Innovation to the Public Sector. International Journal of Public Participation, 4(1), 67-88, https://pdfs.semanticscholar.org/027e/28e33c592adc746c5ba4b77e8ca14fc1cd75.pdf

HOSSAIN, M. ANEES-UR-REHMAN, M. (2016). Open innovation: an analysis of twelve years of research. Strategic Outsourcing An International Journal, 9(1), 22-37. http://dx.doi.org/10.1108/SO-09-2015-0022

HVIZDOVÁ, E. MÁCHAL, P. (2017). Vplyv manažmentu ľudských zdrojov na otvorené podnikové inovácie – perspektíva projektového manažmentu (The impact of human resource management on open business innovation - the perspective of project management). Ekonomika Management Inovace, 9 (3), 39-48. http://emijournal.cz/wp-content/uploads/2017/12/04_vplyv-manažmentu-ludských-zdrojov.pdf

CHESBROUGH, H. (2003). The Logic of Open Innovation: Managing Intellectual Property. California Management Review, 45(3), 33-58, https://doi.org/10.1177/000812560304500301

CHESBROUGH, H., EUCHNER, J. (2011). The Evolution of Open Innovation: An Interview with Henry Chesbrough, Research-Technology Management, 54:5, 13-18. http://dx.doi.org/10.5437/08956308X5405003

KEANREY, A. T. (2008). What are the innovation management tools. Available 2019-07-01 at https://www.researchgate.net/profile/Faris_Alshubiri/post/What_are_the_innovation_management_tools/attachment/59d6265b79197b8077984a75/AS%3A321868731486208%401453750893367/download/6.pdf

Kirschbaum, R. (2005). Open Innovation In Practice, Research-Technology Management, 48(4), 24-28. http://dx.doi.org/10.1080/08956308.2005.11657321

KNOŠKOVÁ, Ľ. (2015). Riadenie inovačných procesov (Management of innovation processes). 1. vyd. Bratislava: Vydavateľstvo EKONÓM, 2015. p.123.

KRAUSE, W. SCHUTTE, C. (2016). Developing design propositions for an open innovation approach for SMEs. South African Journal of Industrial Engineering, 27(3), http://dx.doi.org/10.7166/27-3-1625

KUBIČKOVÁ, V. – BENEŠOVÁ, D. (2011). Character and innovation activity intensity in services in the Slovak Republic and its economic importance. Journal of Economics, 59(4), 412–427, https://www.sav.sk/index.php?lang=en&doc=journal-list&part=article_response_page&journal_article_no=6704

LAZZAROTTI, V. – MANZINI, R. (2009). Different Models of OI: A Theoretical Framework and An Empirical Study. International Journal of Innovation Management, 13(4), 615-636, https://doi.org/10.1142/S1363919609002443

LIDEGAARDA, S. (2012). Social Media for Corporate Innovators & Entrepreneurs: Add Power to Your Innovation Efforts. Available 2019-07-02 at http://www.tinno.com.br/wp-content/uploads/2013/01/Social-Media-for-Corporate-Innovators-and-Entrepreneurs.pdf

METCALFE, J. S. MILES, I. (2000). Innovation Systems in the Service Economy: Measurement and Case Study Analysis. 1. edition New York: Springer Science+Business Media New York, p. 339.

MILLARD, J. (2018). Open governance systems: Doing more with more. Government Information Quarterly, 35(4), 577-587. https://doi.org/10.1016/j.giq.2015.08.003

NÄHLINDER, J. (2005). Innovation and Employment in Services: The case of Knowledge Intensive Business Services in Sweden. Dissertation Thesis, Linköping University. http://liu.diva-portal.org/smash/get/diva2:20573/

OBERHAUS, D. (2015). Open Innovation Definiton. https://www.innoget.com/open-innovation-definition

OSORIO, A.E., OZKAZANC-PAN, B., JIANG, C., JAVADIAN, G., GUO, G., DUTTA, D.K., GUPTA, V.K. (2016). Classics in entrepreneurship research: Enduring insights, future promises. New England Journal of Entrepreneurship, 19(1), 7-23. https://doi.org/10.1108/NEJE-19-01-2016-B001

Make your research more visible, join the Twitter account of ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES: @Entrepr69728810

PILLER, F. (2012). Global solutions, local failure - overcoming barriers implementing open innovation. https://www.mixprize.org/hack/global-solutions-local-failure-overcoming-barriers-implementing-open-innovation/

ROBLEK, V., MEŠKO, M., KRAPEŽ, A. (2016). A Complex View of Industry 4.0. SAGE open, 6(2), https://doi.org/10.1177/2158244016653987

SALAMPASIS, D., (2015). Trust Embedded Open Innovation: Human-Centricity in the Financial Industry. Dissertation Thesis, Lappeenranta University of Technology, https://lutpub.lut.fi/bitstream/handle/10024/117308/Salampasis%20A4.pdf?sequence=2

SCHWEISFURTH, S., RAASCH, K., HERSTATT, C. (2011). Free revealing in open innovation: A comparison of different models and their benefits for companies. International Journal of Product Development, 13(2), 95–118. https://doi.org/10.1504/IJPD.2011.038867

ŠMÍD, J. (2008). Otvorené inovácia. http://www.nanosvet.sk/_paper/otvorena_inovacia.pdf

ŠTATISTICKÝ ÚRAD SLOVENSKEJ REPUBLIKY (2020). Verejná databáza údajov STATdat (.
Public database STATdat) http://statdat.statistics.sk/cognosext/cgi-bin/cognos.cgi?b_action=xts.run&m=portal/cc.xts&gohome=

TIDD, J. (2014). Open Innovation Management Research and Practice. Imperial College Press: London, UK, https://www.researchgate.net/publication/285734571_Open_Innovation_Management_Research_and_Practice

TROTT, P. HARTMANN, D. (2009). Why Open Innovation is Old Wine in New Bottles. International Journal of Innovation Management, 13(4), 715–736, http://enterrasolutions.com/media/docs/2013/02/1.pdf

TUOMI, I. 2009. Theories of Open Innovation.
http://www.meaningprocessing.com/personalPages/tuomi/articles/TheoriesOfOpenInnovation.pdf

TYNNHAMMAR, M. (2017). Open Innovationandits definitions. XXVIII ISPIM Innovation Conference. In Proceedings of the Innovation Symphony, Vienna, Austria, 18–21 June 2017. https://www.diva-portal.org/smash/get/diva2:1133607/FULLTEXT01.pdf

VILČEKOVÁ, L., MUCHA, B., PERÁČEK, T., STRÁŽOVSKÁ, Ľ. (2018). *Selected issues of family business in selected countries with emphasis on the Slovak Republic.* Proceedings of the 31st International Business Information Management Association Conference, IBIMA 2018: Innovation Management and Education Excellence through Vision 2020, 2500-2509

WALLIN, W.M. KROGH, V.G. (2010). Organizing for Open Innovation: Focus on the Integration of Knowledge. Organizational Dynamics, 39(2), 145–154, https://doi.org/10.1016/j.orgdyn.2010.01.010

West, J., Bogers, M. (2017) Open innovation: current status and research opportunities, Innovation, 19(1), 43-50. https://doi.org/10.1080/14479338.2016.1258995

ZAPFL, D. (2018). Open Innovation vs. Closed Innovation. Available 2019-07-16 at https://www.lead-innovation.com/english-blog/open-innovation-vs.-closed-innovation

ZOBEL, A. et al. (2016). The open innovation research landscape: established perspectives and emerging themes across different levels of analysis. Industry and Innovation, 24(1), 8-40, https://doi.org/10.1080/13662716.2016.1240068

Make your research more visible, join the Twitter account of ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES: @Entrepr69728810

Dana BENEŠOVÁ
ORCHID ID: https://orcid.org/0000-0002-9336-7447

Viera KUBIČKOVA
ORCHID ID: https://orcid.org/0000-0001-6129-2471

Miroslava PRVÁKOVÁ
ORCHID ID: https://orcid.org/0000-0002-5214-8395