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INNOVATION PROCESSES AND ENTREPRENEURIAL CULTURE FOR RADICAL INNOVATIONS

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Abstract

To survive and prosper, the organizations need to embed the processes and mechanisms to discover major technology and consumer trends and respond to them through new growth areas. Based on profound literature review providing insight into organizational factors that affect firms' ability to manage innovation this paper asks which innovation processes and entrepreneurial culture support radical innovations. The aim of the paper is to specify the company behaviour that leads to innovative outputs with high level of novelty in country specific context of Slovakia. We conducted two-stage empirical research in 2009 and 2014 mapping companies' approach to innovation management during the last 10 years. After surveying 102 firms in the first stage and 287 firms in the second stage we derive success factors for radical innovations. The findings demonstrate growing importance of corporate strategic orientation, highly developed innovation processes and parallel mechanisms for radical innovation, ability to manage internally and externally open innovation and support entrepreneurial culture. This study makes unique contribution to the understanding of innovation processes, organizational factors, and their significance and dynamics. It should attract managerial attention to recognize the importance of innovation management factors for building firm's innovation competency.

Keywords: innovation processes, radical innovations, entrepreneurial culture, innovation management, knowledge management,

JEL Classification: O30, M10.

Introduction

In recent decades, increasingly accelerated economic change has been taking place. The strong pace of technological development coincides with the advance of globalization resulting from integration of former communist countries in the capitalist economy, which has substantially increased competition, uncertainty and fragmentation of markets (Jaen and Liñán, 2013). Entrepreneurship is considered one of the most important factors contributing

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to economic development. It contributes to job creation, unlocks human potential and drives innovation (European Commission, 2003). In developed economies innovation is a central issue for the competitiveness of firms and countries. To achieve economic welfare companies and societies need radical innovations. The member states of European Union lag behind United States, South Korea and Japan. In a response to increased competition and globalization, the European Council argued for increased efforts to improve EU's performance in innovation. EIS – European Innovation Scoreboard and later IUS – Innovation Union Scoreboard launched by the European Commission measure how member states are performing in the area of innovation. A summary picture of innovation performance is provided by the Summary Innovation Index, a composite indicator obtained by an appropriate aggregation of the 25 indicators used for measuring innovation performance. Based on 2014 Summary Innovation Index, the EU Member States fall into four performance groups: innovation leaders, innovation followers, moderate innovators and modest innovators. Slovakia belongs to moderate innovators group, the performance of which is from 10% to 50% below EU27 average. Slovakia performs below the EU average for most indicators. Relative strengths are in sales share of new innovations, youth with upper secondary level education and international scientific co-publications. Relative large weaknesses are in non-EU doctorate students, license and patent revenues from abroad and PCT patent applications in societal challenges (IUS 2014). The measurement framework used in the Innovation Union Scoreboard distinguishes between 3 main types of indicators and 8 innovation dimensions. Among IUS innovation dimensions, Slovakia exhibits relatively larger weaknesses in “Linkages and entrepreneurship” and “Intellectual assets”. An area that needs particular attention is the overall perception of entrepreneur and entrepreneurial activities. The image of entrepreneur needs to have greater value (Trott, 2011) both in Slovakia and in EU 27.

The Innovation Union Scoreboard may be helpful to policymakers in deciding where to invest major resources, but its use for managers and entrepreneurs to improve innovation processes in order to create breakthrough innovations is limited. It does not reveal the company behaviour that leads to radical innovations. For this purpose we conducted an empirical research focused on factors that drive, at company level, the radical product innovation.

In the paper we explore theoretical sources and studies providing insight into entrepreneurship, intrapreneurship, innovation and organizational factors that affect firms' ability to manage innovation. That was the basis for formulation of the hypotheses and of the empirical survey based on a questionnaire. Our objective was to shed more light into company's behaviour and its development that leads to radical innovations. We conducted two-stage empirical research in 2009 and 2014 mapping companies' approach to innovation management during last 10 years. After surveying 102 firms in the first stage and 287 firms in the second stage we analysed the data, derived success factors for radical innovations with statistical relevance. We formulated conclusions and proposed suggestions for company managers and government to support entrepreneurship.

1. Literature review

Entrepreneurship is perceived as an engine of socioeconomic growth and development (Hitt, Ireland, Camp and Sexton, 2001). Entrepreneurship involves identifying and exploiting opportunities in external environment. Seeking for opportunities and risk taking

reflects the basic characteristics of entrepreneurship. Today's rapidly changing and hypercompetitive business world requires strategic approach to entrepreneurship. Strategic entrepreneurship is the integration of entrepreneurial (opportunity-seeking) actions and strategic (advantage seeking) actions to entrepreneurial strategies that create wealth in changing environment (Genç, 2012; Hitt, Ireland, Camp and Sexton, 2001; Ireland, Hitt, and Sirmon, 2003). European Commission defines entrepreneurship as the "mind-set and process to develop economic activity by blending risk-taking, creativity and innovation with sound management within a new or an existing organization" (European Commission, 2003). Scholars have shown the tendency to divide entrepreneurship into two types according to the operating context. There are, firstly, individual entrepreneurs creating a new organization (traditional view) and secondly, corporate entrepreneurs (intrapreneurs) conducting entrepreneurial efforts within existing organizations and/or creating corporate ventures. Corporate entrepreneurship can be defined as the activities that an organization undertakes to enhance its product and process innovations, risk-taking and pro-active response to environmental forces (Castrogiovanni, Urbano and Loras, 2011). In our paper we will focus on corporate entrepreneurship and on entrepreneurial culture, an important dimension of strategic entrepreneurship. Entrepreneurial culture includes risk taking, tolerating failures, operating in an uncertain environment, competing in complexity, seeking for opportunities, flexibility, creating the ambiance that fosters innovation (Hamel, 2002; Thomke, 2003; Genç, 2012). Other strategic entrepreneurship domains include external networks and alliances, organizational learning and knowledge management, corporate venturing and internationalization (Genç, 2012; Hitt, Ireland, Camp and Sexton, 2001, Tantau, 2011).

Concepts of entrepreneurship, intrapreneurship and innovation are mutually inclusive. Entrepreneur in knowledge economy should pro-actively pursue innovation to survive in circumstances of constant change. Innovation is complex issue and involves management of variety different factors. In economic literature there are numerous studies on the variables that have a significant impact on competitiveness, innovation and value for their company and the customer (Christensen and Raynor, 2003; Hollanders and Van Cruysen, 2008). Success factors of innovative companies can differ. Higgins and McAllaster (2002) state, that the real key contributor to innovation is the management of shared values and organizational culture. Outstanding organizational performance results from strongly held shared values and that it is organizational values that drive business and reduce contra productive behaviour (Zhang, Austin, Glass and Mills, 2008). Organization's ability to learn from experience and analysis plays important role.

On the basis of a systematic theoretical analysis Smith, Busi, Ball and van der Meer (2008) specified nine organizational factors that affect companies' ability to manage innovation, regardless of their geographic presence and identified relationships between them: (1) *Technology* that is often considered as innovation output was considered as an influencing factor of innovation. (2) *Innovation process* which affects the development of new initiatives, the selection and evaluation mechanisms and implementation of innovation. (3) *Corporate strategy* which includes aspects of the overall company strategy and innovation strategy, defining the mission and business objectives and strategic decision making. (4) *Organizational structure* represents the configuration of the organization and affects the ability to manage innovation. (5) *Organizational culture* affects the values recognized in the organization and affects cooperation, communication and relationship with risk taking. (6) *Employees* as a factor associated with personal characteristics affecting

incentives for innovation. (7) *Resources*, human, financial, and material, influence the innovative capacity of the organization. (8) *Knowledge management*, which includes aspects of using internal and external knowledge in innovation management. It takes into account the organization's ability to learn from other companies, customers, suppliers, technology monitoring, internal R&D and networking. Maintaining an organization's knowledge base involves patenting, licensing and contract research (Trott, 2011). (9) *Management style and leadership* as a factor that is related to personal characteristics of management, management style and way of motivating employees to innovate.

Until the end of last century, organizations generally followed a closed innovation paradigm for their R&D activities, according to which innovation was both internally generated and exploited. Improving collaboration with universities companies could capitalize on academic research and thus move beyond incremental innovations to radical innovations (Pamfilie, Giusca and Bumbac, 2014). Emergence of new factors as the increasing availability and mobility of skilled employees, creation of venture capital markets, the novel opportunities to externally exploit unused ideas, the emergence of new technologies that allow collaboration of distant geographic areas and the presence of capable suppliers started to erode the benefits of closed innovation paradigm. This trend is reflected into the rise of open innovation paradigm, whose main logic is that valuable ideas can come from inside or outside the company as well (Garavelli, Messeni Petruzzelli, Natalicchio and Vanhaverbeke, 2013). According to Mortara and Minshall (2011), there are many ways to implement open innovation depending on (1) innovation needs, (2) the timing of implementation and (3) the organizational culture. Organizational culture of the firm can overrule other implementation drivers. Despite the need for ambidexterity, firms with strong tradition of closed innovation focused on inbound activities only. Companies with more extroverted culture implemented both inbound and outbound activities.

2. Research objectives and methodology

The paper studies innovation processes and entrepreneurial culture driving radical innovations at company level in Slovakia. Based on profound literature review and country innovation performance analysis, our first objective was to specify the company behaviour and its development that leads to innovative outputs with high level of novelty in country specific context of Slovakia. The second objective of the study was to assess factors that drive radical innovation and suggest improvements to stimulate entrepreneurial culture and corporate entrepreneurship in changing environment.

To identify structural relationships between radical product innovations and company behaviour we conducted two-stage empirical survey in companies in Slovakia. The research was conducted in 2009 and in 2014. The structured questionnaire was based on the OECD recommendations for conducting innovation surveys (OECD and Eurostat, 2005) and literature review, mainly Tidd, Bessant and Pavitt (2007). The questionnaire consisted of innovation audit focused on innovation processes, overall strategy, supporting organization for radical innovations, internal and external openness, and knowledge management.

The research in the first stage in 2009 involved 102 companies, of which 42.2% were small enterprises with number of employees from 1 to 49, 33.3% were medium-sized enterprises with number of employees from 50 to 249 and 24.5% of the total sample consisted of large enterprises with more than 250 employees. Of all enterprises 62.7% were owned by Slovak

capital, 23.5% by foreign capital and in 13.7% of cases the ownership was mixed. We analysed new product introductions on the market in the period of five years from 2004 to 2008.

The research in the second stage in 2014 involved 287 companies, of which 45.3% were small enterprises with number of employees 1 to 49, 27.18% were medium-sized enterprises with number of employees from 50 to 249 and 27.53% of the total sample consisted of large enterprises with more than 250 employees. Of all enterprises 63.07% were owned by Slovak capital, 24.74% by foreign capital and in 12.2% of cases the ownership was mixed. We analysed new product introductions on the market in the period of five years from 2009 to 2013.

For the purpose of this study we introduced following hypotheses.

Based on the findings of Innovation Union Scoreboard, Slovakia belongs to moderate innovators with below average performance (IUS, 2014). We expect that foreign ownership will improve innovation performance in firms active in Slovakia.

H1: New product introduction with high level of novelty is positively influenced by foreign ownership.

Tidd, Bessant and Pavitt (2007) introduce innovation processes that represent company approach to innovation from no importance (1st level) to highly developed and efficient systems (4th level). Innovative projects with high levels of risk require different ways of managing from incremental product innovations and require the creation of a separate space (5th level) (Benner and Tushman, 2003; Hamel, 2002; Christensen and Raynor, 2003; Pandey and Sharma, 2009). Innovative companies are not only those who produce innovative products, but also those who know how to modify the formal product development process in order to come to an acceleration of change (Ettlie and Elsenbach, 2007).

H2: New product introduction with high level of novelty is positively influenced by (a) using formalized innovation processes, (b) highly developed and efficient systems for new product development including technology and market trends evaluation, (c) alternative and parallel process for radical innovation that is not in line with common procedures.

Shared vision and the will to innovate are important building blocks of innovation endeavour. Communication of defined mission, vision and values to the employees is the next step in deploying strategic initiative into the organization (Hamel, 2002; Smith, Busi, Ball and van der Meer, 2008). Clear link between innovation projects and overall company strategy is considered important for innovation implementation, as well as changing the innovation strategy in accordance with the changes of external environment. Ability to change innovation strategy in changing circumstances is positive signal for dynamic company competence to react to changing environments introducing new products (Tidd, Bessant and Pavitt, 2007).

H3: Corporate strategy which includes aspects of (a) defining the overall company strategy and (b) innovation strategy, (c) defining the mission and business objectives and strategic decision making has positive correlation with new product introduction with high level of novelty.

In the conditions of knowledge economy open innovation approach is being adopted by increasing number of companies. The literature on open innovation observes that many

firms have opened up their boundaries and strive for variety of open innovation activities to improve their innovation processes through exchange with the external environment (Dabrowska, Fiegenbaum and Kutvonen, 2013; Kubičková and Benešová, 2011). The research has found that open innovation increases product development, innovative performance, and chances for market success (Chesbrough, Vanhaverbeke and West, 2006; Leiponen and Helfat, 2010). There are several concepts and classification of open innovation and extensive review of positive and negative sides. Lichtenthaler (2011) defined open innovation as systematically performing knowledge exploration, retention, and exploitation inside and outside an organization's boundaries throughout the innovation process. Recent developments in both communication infrastructure (powerful interactive web systems) and wider external culture of sharing and social networking have opened up new possibilities of broader involvement in innovation (Ramaswamy, 2009; van Zyl, 2009).

H4: New product introduction with high level of novelty is positively influenced by (a) internal openness of the company, that is internal collaboration and knowledge sharing by means of internal innovation network and (b) external openness of the company that is external collaboration by means of external innovation network.

Knowledge management becomes primary role of managers in learning organization. It includes aspects of using internal and external knowledge in innovation management (Smith, Busi, Ball and van der Meer, 2008). Knowledge management takes into account the organization's ability to learn from other companies, customers, suppliers, technology monitoring, internal R&D and networking. Maintaining an organization's knowledge base involves patenting, licensing and contract research (Trott, 2008). Open innovation is changing the culture across firms that are assigning increased importance to IPR – intellectual property rights in favour to more controlling approach to IPR (Mortara and Minshall 2011).

H5: Knowledge management factors represented by (a) Intellectual Property Rights (IPR) protection and (b) use of IPR of others differentiate radical innovators from incremental.

Collected data were processed by the statistical program Statgraphics. Main characteristics were obtained arranging the collected data into frequency tables. To test the hypotheses that we posed in terms of research set, we used data analysis by cross-tabulation. We developed the factors that differentiate innovators with new to the world products from others analysing their behaviour by means of cross-tabulation and frequency tables. We examined the statistically relevant relationship between variables by the test of fit – chi-square test – applied to the cross-tabulation. Hypothesis tests were run to determine whether or not to reject the idea that row and column variables are independent. If the probability value is greater than or equal to 0.05, we cannot reject the hypothesis that rows and columns are independent at the 95.0% confidence level. We derived factors that differentiate radical innovators from others and examined statistical significance of relationship.

3. Results and discussion

We surveyed innovation processes and entrepreneurial culture in firms active in Slovakia. Based on the results of the surveys we developed the factors that differentiate radical innovators from incremental in two consecutive stages. The results of the first stage from 2009 (mapping years from 2004 till 2008) show that 8.9% companies introduced new to the world product, 42.2% product new to the market and 41.3% product new to the firm. The

results of the second stage from 2014 (mapping years from 2009 till 2013) show that 14.6% of all companies introduced product new to the world, 34.8% product new to the market and 48.2% product new to the firm. New to the world products were introduced mostly by foreign companies.

H1: New product introduction with high level of novelty is positively influenced by foreign ownership was confirmed.

Cross-tabulation indicating association of firms with new to the world products with Slovak, foreign or mixed ownership is shown in table no. 1.

Table no. 1: Cross-tabulation for new to the world products association with firm ownership in 2014 research stage

	Firms with New to the world products	Firms Without New to the world products	Data not available	Row Total
Slovak ownership	12	167	2	181
	4.18%	58.19%	0.70%	63.07%
Foreign ownership	21	44	6	71
	7.32%	15.33%	2.09%	24.74%
Mixed ownership	9	26	0	35
	3.14%	9.06%	0.00%	12.20%
Column Total	42	237	8	287
	14.63%	82.58%	2.79%	100.00%

We examined interdependence between the variables applying test of fit – chi-square test to the cross-tabulation. As we can see from the table no. 2 this resulted in overall chi-square value 38.676 with 4 degrees of freedom (df) and probability 0.0000.

Table no. 2: Tests of Independence

<i>Test</i>	<i>Statistic</i>	<i>Df</i>	<i>P-Value</i>
Chi-Square	38.676	4	0.0000

A probability of 0.05 or smaller means we can be at least 95 per cent certain that the association between two variables could not have occurred by chance factors alone. Owing to statistical rounding of numbers a probability of 0.0000 does not mean zero, but it is less than 0.0001. We therefore concluded that relationship between new to the world products and firm ownership cannot be explained by chance factors alone.

Innovation processes

The analysis of responses received from the firms, revealed deployment of *innovation processes* used in firms in both stages (table no. 3). Four levels of innovation processes indicate the importance that the company assigns to innovation activities. Fifth level innovation process identifies companies that create specific processes and procedures for radical innovations. Fifth level innovation process is not mutually exclusive with other processes.

From the results we can see a progress in implementation of higher level innovation processes by firms in 2014 stage vs. 2009 stage. In both 2009 and 2014 research stages we found out that radical innovations on new to the world level correlate with 4th level innovation processes and 5th levels innovation processes.

Table no. 3: Innovation processes used by firms in Slovakia in 2009 and 2014 research stages

Innovation processes characteristics	2009	2014
1 st level – company does not put any importance to innovations, it does not innovate or innovates very rarely	10.7%	3.5%
2 nd level – company innovates occasionally without formal process	28.4%	11.1%
3 rd level – company understands importance of innovation, formal innovation processes are implemented, but there is room for improvement	23.7%	41.1%
4 th level – company has implemented highly developed and efficient systems for new product development including technology and market trends evaluation	37.2%	44.3%
5 th level – company has implemented alternative and parallel process for radical innovation that is not in line with common procedures	28.4%	34.1%

H2: New product introduction with high level of novelty is positively influenced by (a) using formalized innovation processes, (b) highly developed and efficient systems for new product development including technology and market trends evaluation, (c) alternative and parallel process for radical innovation that is not in line with common procedures was confirmed just for (b) highly developed and efficient systems for new product development with technology and market trends evaluation and for (c) alternative and parallel process for radical innovation that is not in line with common procedures.

Corporate strategy factors

Corporate strategy factors have important influence on company innovation. We examined company mission, vision and values, communicating mission, vision and values to employees, innovation strategy, the link of innovation activities with overall company strategy and flexibility of innovation strategy. Corporate strategy factors embedment in firms in 2009 and 2014 research stages are presented in figure no. 1. They show growing implementation in time.

In our findings in 2009, there were no strategic factors that would differentiate radical innovators from others. Based on the analysis of cross-tabulations in 2014 research stage we found several differentiating factors for radical innovators. Defining innovation strategy and linking innovation projects to overall strategy were differentiating factors found in radical innovators behaviour. Company vision, mission and values were broadly implemented and communicated in nearly all companies so they did not have differentiating character.

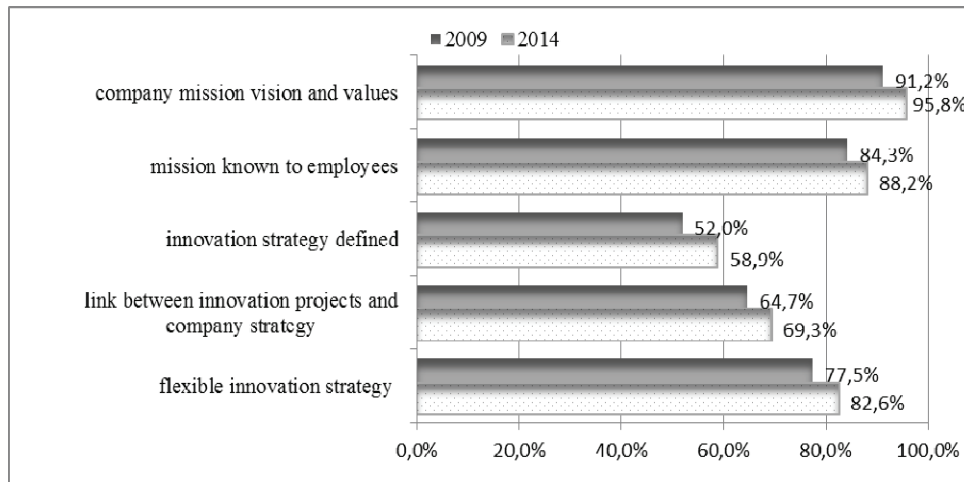


Figure no. 1: Strategic factors implementation

H3: Corporate strategy which includes aspects of (a) defining the overall company strategy and (b) innovation strategy, (c) defining the mission and business objectives and (d) linking innovation projects to overall company strategy has positive correlation with new product introduction with high level of novelty was confirmed just partly. It was not confirmed in 2009 research stage. In 2014 research stage it was confirmed for (b) defining innovation strategy and for (d) linking innovation projects to overall company strategy showed radical innovation results.

Supporting organization for radical innovation

Regardless of how well the organization developed systems for the identification and development of new products, these systems would not work well, if good organizational context is not created and organizational structure supporting innovation is missing. As identified by Christensen and Raynor (2003) very important factor for the ability to manage radical innovation is a company's ability to use ideas that do not fit into its business by providing licenses or spin-offs into a new business. Another important factor is the rapid experimentation, try and learn approach to explore new directions in technology and markets (Hamel, 2002; Christensen and Raynor 2003; Thomke, 2003).

We examined the factors that are important for building the competence to innovate in a discontinuity. Company support for radical innovation is crucial when disruptive changes occur and important knowledge sources are located outside the firm. Supporting organization was specified by wiliness to use open innovation where part of the innovation process takes place outside the boundaries of the firm, implementation of parallel processes for radical innovation along with processes for incremental innovation, ability to experiment, ability to evaluate changes in technologies and markets and to sell or spin-off those projects that do not fit to company strategic orientation (figure no. 2).

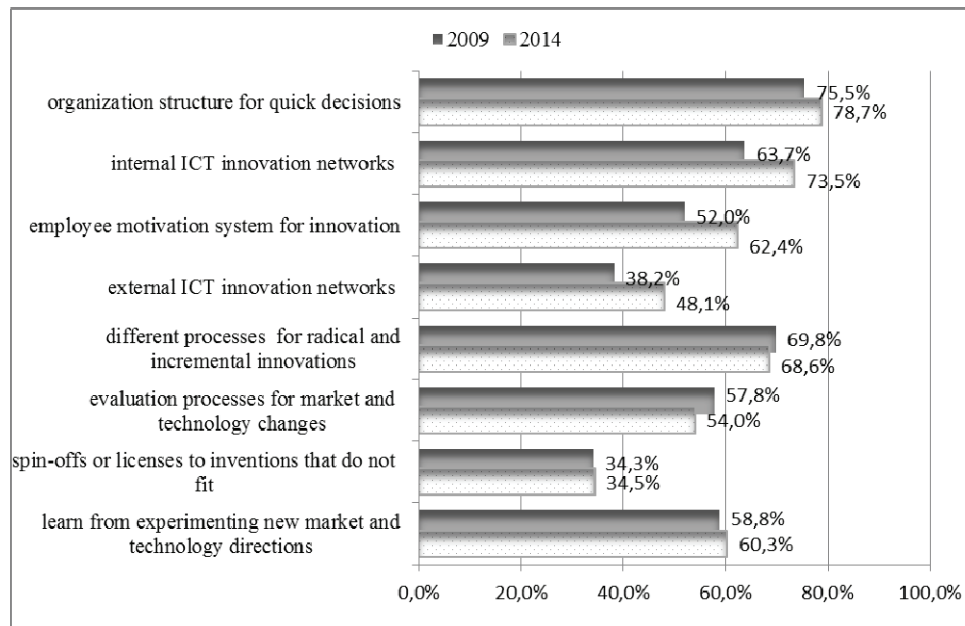


Figure no. 2: Supporting organization for radical innovation

In 2009 research stage we have not identified any differentiating factors between radical and incremental innovators in supporting organization with statistical relevance. In 2014 research stage factors that differentiate radical innovators that introduce new to the world products from others are internal cooperation using ICT network for innovation, specific processes for radical innovations that are different from processes for incremental innovations, evaluation processes for technology and market changes, external cooperation using ICT network for innovation, creating spin-offs or selling projects that do not fit corporate strategy.

Internally and externally open innovations

The adoption of the open innovation approach in which organizations make use of internal and external resources to drive their innovation processes is considered as a way to enhance innovation capabilities (Mortara and Minshall, 2011).

In our 2009 research stage radical innovators were differentiated from incremental innovators by systematic use of internal research and development in new product idea creation. Significant relation was demonstrated between radical innovators and a systematic use of universities and research institutions as a source of new product ideas. In 2014 research stage importance of open approach to radical innovation has grown. Multidisciplinary approach of radical innovators was supported by systematic use of internal research and development, marketing & sales, production, customer service, and logistic, procurement & distribution in creating new product ideas with statistical relevance. Cooperation with universities and other external research institutions in 2014 research stage even decreased from 8.8% in the 2009 research stage to 3.9% in 2014 research stage, but

their support was occasionally used by 54.7% radical innovators. Systematic use of consumers and customers is a differentiating factor in the development of new to the world products.

H4: New product introduction with high level of novelty is positively influenced by (a) internal openness of the company, that is internal collaboration and knowledge sharing by means of internal innovation network and (b) external openness of the company that is external collaboration by means of external innovation network was not confirmed in 2009 research stage but it was confirmed in 2014 research stage when internally and externally open innovation processes resulted in new to the world products.

Knowledge management

Knowledge management becomes primary role of managers in learning organization. Miklošik, Hvizdová and Žák (2012) demonstrate causal relationship between the implementation of the principles of knowledge management and innovation capacity of the company. Knowledge management can thus be described as a significant determinant of sustainable competitiveness. It is important to manage the process in an explicit form. Learning from other organizations is widely used approach while IPR protection and passive use is much less frequent in Slovakia (figure no. 3).

In 2009 research stage we identified active and passive use of IPR as differentiating factor between radical and incremental innovators. In 2014 research stage use of IPR has grown. 83.3% of radical innovators with new to the world products use active protection of their intellectual property and 50.0% use licences for using intellectual property of others in their products. Active and passive IPR protection is differentiating factor between innovators introducing new to the world products and incremental innovators.

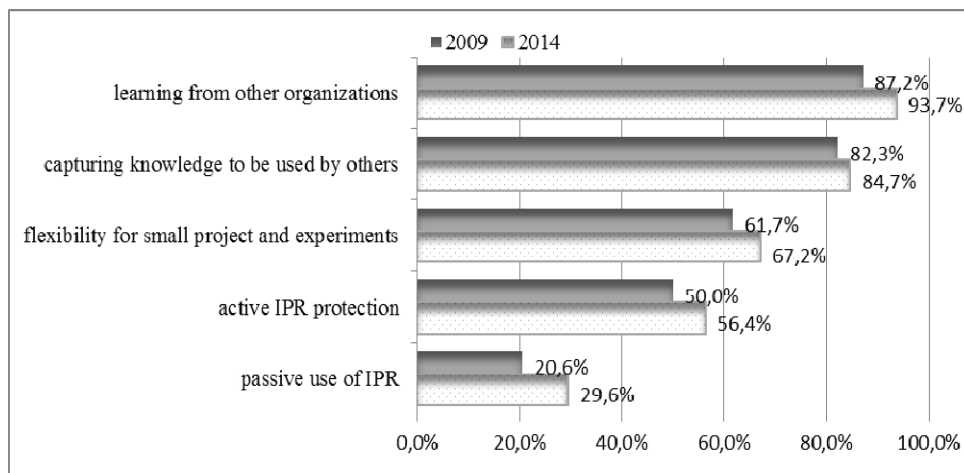


Figure no. 3: Knowledge management factors

Knowledge and technology transfer, ability to use unused patents and industrial designs of other firms supports introduction of radical innovations on the market. One of the major innovation performance weaknesses of Slovakia has been very low patenting. The main

cause of this situation is the lack of financial support from the state. Flexibility for implementing small projects and experiments with quick feedback became differentiating factor for radical innovators.

H5: Knowledge management factors represented by (a) Intellectual Property Rights (IPR) protection and (b) use of IPR of others differentiate radical innovators from incremental was confirmed in 2009 and 2014 research stage.

Based on the results of 2009 and 2014 research stages we developed factors that differentiate radical innovators from incremental with statistical relevance (Table no. 4).

Table no. 4: Factors that drive radical innovation at company level in 2009 and 2014

	2009	2014
Innovation processes		
4 th level –highly developed and efficient systems for new product development including technology and market trends evaluation	p=0.0092	p=0.0288
5 th level –alternative and parallel process for radical innovation that is not in line with common procedures	p=0.0116	p=0.0391
Corporate strategy factors		
Defining innovation strategy	-	p=0.0185
Link between innovation projects and overall company strategy	-	p=0.0014
Supporting organization for radical innovation		
Internal cooperation using ICT network for innovation	-	p=0.0042
Specific processes for radical innovations that are different from processes for incremental innovations	-	p=0.0000
Evaluation processes for technology and market changes	-	p=0.0116
External cooperation using ICT network for innovation	-	p=0.0000
Creating spin-offs or selling projects that do not fit corporate strategy	-	p=0.0010
Internally and externally open innovation with systematic involvement		
Internal research and development	p=0.0022	p=0.0000
Marketing and sales	-	p=0.0006
Production	-	p=0.0001
Customer service	-	p=0.0058
Logistic, procurement and distribution	p=0.0020	p=0.0003
External research institutions	p=0.0366	-
Consumers and customers	-	p=0.0369
Knowledge management		
Active Intellectual property rights protection	p=0.0218	p=0.0007
Passive use of Intellectual property rights of others	p=0.0301	p=0.0393
Flexibility for implementing small projects and experiments with quick feedback	-	p=0.0258

Radical innovators use efficient innovation systems for new product development including technology and market trends evaluation, and they apply specific processes for radical innovation. Entrepreneurial culture of radical innovators evolves to higher flexibility for small projects, quick experimenting and feedback, seeking for opportunities examining new

technology and market trends, creating the ambiance that fosters radical innovation. There is still space for improvement in risk taking, tolerating failures, operating in an uncertain environment, and competing in complexity.

Other strategic entrepreneurship domains that include external and internal networks and alliances, organizational learning and knowledge management, corporate venturing and internationalization (Genç, 2012; Christensen, 2004; Hitt, Ireland, Camp and Sexton, 2001, Tantau, 2011) have gone through changes. Radical innovators started to link their innovation projects closer to their corporate strategy and define their innovation strategy. Open innovation both in- and out bound holds great importance and growing potential in creating radically new products. In 2009, involvement of internal research and development was the only differentiating factor for radical innovators. In 2014, radical innovators involved also marketing and sales, production, customer service, logistics, distribution and procurement functions into internally open exploration in addition to research and development personnel. The nature of external openness has changed too. Systematic cooperation of firms with external research institutions and universities was very low in 2009 research stage. It went even lower in 2014 research stage, most probably due to the cost cuts during crisis. Cooperation with research institutions was substituted with customers and consumers involved in new product creation. Multidisciplinary approach in radical innovation grew considerably. Inbound openness – acquiring and sourcing has been supplemented by outbound openness – selling and revealing innovation projects that do not fit strategic focus of the firm and creating spin-offs that differentiate radical innovators from incremental.

In order to keep up with technological pace, firms increasingly stop limiting themselves to only use technology developed in house. Intellectual property rights protection and ability to use unused patents of other entities remains differentiating factor of radical innovators in the first and second stage of research. Growing trend in IPR protection within radical innovators in Slovakia can be identified. Unfortunately, overall level of protecting intellectual property by patents, designs and trade marks at Community level in Slovakia is far below EU average.

Conclusions

This paper makes unique contribution to the understanding of factors that drive radical innovations at company level and contribute to corporate entrepreneurship. Overall, it has been shown that radical innovators in Slovakia open up their borders for exploration and exploitation, build external and internal networks, use highly developed innovation processes, link their innovation projects to company strategy and, actively use IPR. Their entrepreneurial culture fosters flexibility, quick experimenting, seeking for new opportunities and creating space for radical innovations.

To survive and prosper in changing conditions and growing global competition, innovation performance in Slovakia has to be improved. The suggestions for company managers that may be derived from this paper are building entrepreneurial culture focused on risk taking, creating space for discovery of new technology and market trends, quick experimenting, tolerating failures and opening innovation both internally and externally. Firms in Slovakia use external research institutions and universities in very low and even declining extend.

Our suggestion is to build partnerships, alliances and clusters of firms and universities to involve universities in open innovation processes in much higher extend.

Slovakia has proven innovative potential. There are a number of small and medium-sized, high-growth companies with the potential to become a leader in a particular area of business. It is necessary to stimulate and support their growth. Our next suggestion is governmental support to organizations with radical innovations to fund their intellectual property by international and Community patent applications, support and co-finance the introduction of ISO standards in small and medium-sized enterprises, create and promote entrepreneurial culture in broad society, change the cooperation between the public and private sector, notably through innovation partnerships, introduce a program to support participation in international projects and EU programs, sign international agreements on cooperation in science, technology and innovation, create an internal market for skills, patents, venture capital, support the rapid implementation of ideas to market, support entrepreneurship education at all levels.

Our study should attract managerial attention in recognizing the importance of innovation management factors for building firm's innovation competency and entrepreneurial culture to enhance entrepreneurship.

The results are useful for the academic sphere as the study reinforces the theory on open innovations (Lichtenhaler 2011; Chesbrough, Vanhaverbeke and West, 2006), reveals the importance of internal and external openness in innovation processes, and role of entrepreneurial culture.

The study may suffer from the limitations that should be acknowledged. Some limitations of the study include sample size inconsistency. The sample in 2014 is different from the sample in 2009 which may influence statistical relevance of analysed data. Differences in factors may partly result from sample specificity. We experience lack of data on economic impact of product innovations on firms' turnover and profit. In the research, management point of view is represented, which may differ from employees' perception mainly in area of organizational values, mission, and vision deployment and motivation for creating innovations in the firm. We can assume that questioning organizational values deployment and motivation systems to employees would change the positive picture.

Future development of the research can address the ability of radical innovations to transform industrial landscape. It is often argued that incumbent organizations suffer in the face of radical innovations due to the commitments to their current value networks and new entrants succeed (Benner, 2010; Christensen, 2006; Rothaermel and Hill, 2005). Ansari and Krop (2012) challenge this opinion and create framework for understanding incumbent challenger dynamics. Quantitative analysis on the performance of traditional incumbent companies in needed to develop survival profile in circumstances of radical change.

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