

OPEN INNOVATION IN SLOVENIA: A COMPARATIVE ANALYSIS OF DIFFERENT FIRM SIZES

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ABSTRACT: *This article investigates the state of open innovation in Slovenia, using qualitative and quantitative research. Based on in-depth interviews with domestic and foreign experts in the field of open innovation, we identify the main advantages and reasons open innovation should be introduced in Slovenian companies, the main barriers that companies can encounter in the implementation of open innovation and suggestions for the successful development and implementation of the concept among Slovenian companies. A quantitative analysis of Slovenian companies shows that differences exist in implementing open innovation dimensions among micro, small, medium and large firms, as well as between manufacturing and service companies. We conclude by suggesting the steps to be taken to stimulate the development and implementation of open innovation in Slovenian companies, the implications for managers and policy-makers, as well as the limitations of our study, and future research.*

Key Words: *Open innovation, Large companies, SMEs, Manufacturing and service sector*

JEL Classification: O31, O32

1 INTRODUCTION

International competition, constantly changing environments and the rapid development of technology require adaptive and flexible responses from the companies facing such challenges (Eisenhardt & Tabrizi, 1995). While innovation itself is quite challenging, many once pioneering innovations rapidly become obsolete; therefore, companies must also innovate in the field of innovation itself (Selly Brown, 2003). Academics and business practitioners stress the importance of open innovation for sustaining competitive advantage in innovation and overall organizational performance. For example, Rogier van der Heide, Chief Design Officer of Philips Lighting (2011) once asserted, “Innovation doesn’t happen in a vacuum. You’re never alone. No one has the key just by himself.”

Open innovation was initially observed in large multinationals and high-tech sectors, as well as in more mature and traditional industries in the US (Chesbrough & Crowther,

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2006). Recently, trends towards more open ways of innovation have been also seen in European Union (EU) countries (Schroll & Mild, 2011). Despite the growing evidence of open innovation among European companies, there is a lack of studies related to open innovation regarding new member states of EU. Although they are trying to achieve equality with the old member states, some developmental differences remain between the two groups (Eurostat, 2011). The first gap in the literature thus concerns the investigation of the state of open innovation in the new member states of EU. Second, it is still not clear what the main reasons for the underdeveloped open innovation community in these countries are and how to stimulate the implementation of the concept.

In order to contribute to a better understanding of open innovation in new member states of EU, we have investigated the state of open innovation among Slovenian companies and suggested some proposals for stimulating open innovation practices. Despite the fact that Slovenia is a small transition economy, it is classified among innovation followers and outperforms most of the new member states of the EU (European Commission, 2013). Therefore, the findings of our research can also contribute to the development of open innovation in other new member states of the EU, as well as in candidate countries of the EU. Although some studies on open innovation in Slovenia already exist, they primarily focused on the high-tech sector (e.g. Rašković, Pustovrh, & Dakić, 2011) or analysed the supporting environment for open innovation (e.g. Krapež, Škerlavaj, & Groznik, 2012). The unique contribution of this study is the delivery of the first comparative analysis of the adoption of different open innovation activities by Slovenian firms, but we do not limit the study to certain industries or sizes. Moreover, we provide steps to be followed for the stimulation of the concept among Slovenian companies.

The paper proceeds as follows: we first summarize existing literature in the field of open innovation and outline the research questions. As a new member state, Slovenia is used as the case country in the investigation of open innovation, using both qualitative and quantitative research. We start with in-depth interviews with domestic and foreign experts in open innovation, with the aim of obtaining their opinions about the concept, its benefits and weaknesses, and their suggestions for the development of the concept in Slovenia. Furthermore, we carry out a quantitative analysis among Slovenian companies to identify the scope of their implementation of open innovation activities and the extent of their cooperation with different partners. Finally, we suggest some steps to be followed to stimulate the development and implementation of open innovation in Slovenian companies. We conclude with discussion of the implications, as well as the limitations of our study, and future research.

2 LITERATURE REVIEW AND RESEARCH QUESTIONS

2.1 The concept of open innovation

Open innovation has become one of the most frequently discussed concepts in innovation management (Chiaroni, Chiesa, & Frattini, 2010; Huizingh, 2011). It suggests that

companies should use a broad range of knowledge sources, including customers, suppliers, universities, national labs, consortia, consultants, start-ups (Chesbrough, 2003), spin-offs from large established firms, individual inventors (Chesbrough, 2006) as well as firms in unrelated industries, or even competitors (Wallin & von Krogh, 2010) to creatively exploit the firm's knowledge (Chesbrough, 2003). The open innovation approach assumes that links with external partners tend to complement rather than replace a firm's internal research and development (R&D) activities (Chesbrough, 2006; Lichtenthaler & Lichtenthaler, 2010; Tether & Tajar, 2008). The open innovation process also facilitates the processes of identifying new markets and exploiting those market opportunities that companies could not pursue within their current business model (Di Minin, Frattini, & Piccaluga, 2010). The need for the rapid development of new products and services with competitive prices requires companies to search for sources of ideas and innovations inside as well as outside their borders (Li & Kozhikode, 2009). Additionally, the meaning of successful technology transfer is also emphasised by increasing licencing activities, alliances and the outsourcing of R&D activities (Fabrizio, 2006).

The first practical occurrences of open innovation processes can be seen in the 1920s, with the case of Columbia Steel employing an open pattern of cooperation with equipment suppliers (Aylen, 2009). Presently, open innovation is seen in almost all industries and organisations (Chesbrough & Crowther, 2006). More recent practices of open innovation can be observed in the biopharmaceutical industry (Bianchi, Cavaliere, Chiaroni, Frattini, & Chiesa, 2011; Langvardt, 2010), the food industry (Sarkar & Costa, 2008), the automotive industry (Di Minin et al., 2010), open source software (von Krogh, Spaeth, & Lakhani, 2003; West, 2003; West & Gallagher, 2006), the digital amplifier industry (Christensen, Olesen, & Kjar, 2005), and different multinational firms, such as Procter & Gamble (Dodgson, Gann, & Salter, 2006; Huston & Sakkab, 2006), Apple, Nintendo (Pontiskoski & Asakawa, 2009), Nokia (Dittrich & Duysters, 2007; Pontiskoski & Asakawa, 2009), Dell (Di Gangi & Wasko, 2009), Deutsche Telekom (Rohrbeck, Holzle, & Gemunden, 2009) and the materials company DMS (Kirschbaum, 2005).

2.2 Open innovation in SMEs

Although first open innovation occurrences described by Chesbrough (2003) perceive open innovation from the point of view of large, established companies, research is increasingly analysing open innovation in the context of smaller organizations. The first quantitative study exploring the incidence and trends of open innovation in SMEs was provided by van de Vrande, de Jong, Vanhaverbeke, and de Rochemont (2009), who indicated that open innovation activities are increasingly practiced by smaller competitors. This research also identified the main reasons for implementing open innovation by SMEs that are market-related: to serve customers' needs, to open up new markets, to secure revenues and to maintain growth. Lee, Park, Yoon, and Park (2010) support the practices of open innovation in SMEs and emphasize the importance of

intermediate organization in facilitating their innovation capabilities. Finally, Parida, Westerberg, and Frishammar (2012) show that the adoption and utilization of open innovation activities have a positive influence on the innovative performance of SMEs. They state that by performing technology scouting, vertical and horizontal technology collaboration and technology sourcing, SMEs can partly overcome any disadvantages of their small size and perform innovation better than if all innovative activities were done in-house.

2.3 Research questions

The aim of our study is to evaluate the overall state of open innovation in Slovenia, especially a comparison of the implementation of open innovation by Slovenian companies (regarding their size and industry). Previous research revealed that there are differences in implementing open innovation between small and large firms, with larger firms more frequently adopting open innovation activities, whereas there is no significant difference between industries (van de Vrande et al., 2009). The first aim of this study is to identify the reasons open innovation is beneficial for Slovenian companies. Our first set of research questions thus investigates the following reasons:

Research question 1a: What are the main advantages and reasons for the implementation of open innovation?

Research question 1b: How can open innovation best be implemented?

Research question 1c: Which obstacles can companies encounter in the implementation of open innovation?

The second set of research questions relates to the actual implementation of open innovation by Slovenian companies. Prior studies related to the state of open innovation in Slovenia revealed that over 50% of Slovenian firms develop innovation based on solely internal knowledge, which indicates a high level of “innovation closedness” of these firms (Rašković et al., 2011). However, the beginnings of open innovation can be seen in collaboration with different partners, with the most influential source of information when developing new ideas by Slovenian firms being customers and suppliers, followed by research institutions (Krapež et al., 2012; Rašković et al., 2011). The second set of questions refers to executional characteristics of open innovation process:

Research question 2: With whom do Slovenian companies collaborate the most when acquiring new know-how/technologies?

Research question 2a: Are there any differences in collaboration with different partners regarding a firm’s size?

Research question 2b: Are there any differences in collaboration with different partners regarding a firm’s business sector?

The third set of research questions explores the actual implementation of different open innovation activities by Slovenian firms and the potential differences between the groups

(regarding their size and industry). van de Vrande et al. (2009) reveals that SMEs often involve their customers in innovation processes and acquire new knowledge by external networking, whereas outward and inward intellectual property (IP) licensing, venturing activities and external participations are practiced only by a minority of SMEs. The authors also identified one difference between the manufacturing and service sectors: manufacturing firms are more actively involved in the outsourcing of R&D and the out-licensing of IP. Our third set of research questions is as follows:

Research question 3: Which open innovation dimension is most commonly used among Slovenian companies?

Research question 3a: Are there any differences in the implementation of open innovation dimensions among Slovenian companies regarding their size?

Research question 3b: Are there any differences in the implementation of open innovation dimensions among Slovenian companies regarding their business sector?

According to Krapež et al. (2012), Slovenia has been developing support mechanisms to create a friendlier business environment for open innovation. Therefore, we wanted to identify the main reasons for the underdeveloped open innovation community in Slovenia, and ways to facilitate the development of this community. Our final research questions are thus:

Research question 4: What are the main reasons for the underdeveloped open innovation community in Slovenia?

Research question 5: How can the development of open innovation among Slovenian companies be stimulated?

We used two different methodological approaches in examining our research questions. The first part of our research comprises structured interviews with six domestic and foreign experts in the field of open innovation; the second part presents quantitative research among Slovenian companies. The main advantage of integrating qualitative research with survey research is to increase the quality of the survey instrument, whereas the qualitative approach contributes to understanding the studied concept from the perspective of individuals (Bamberger, 2000).

3 STUDY 1: SETTING THE CONTEXT

The broad assessment of the state of open innovation in Slovenia and partial proposals for its further development are obtained through qualitative research technique. The main aim of the in-depth interviews was to obtain feedback on the concept of open innovation from experts in the field. The interviewees answered questions related to the main advantages and reasons open innovation should be introduced to Slovenian companies, the main barriers that companies can encounter during the implementation of open innovation, and their suggestions for the successful development and implementation of the concept among Slovenian companies.

3.1 Approach

Six in-depth interviews with domestic and foreign experts in the field of open innovation were conducted. Different groups of experts were chosen as respondents in order to capture several viewpoints of the concept. The academic aspect was covered by interviewing a professor conducting research in the field of open innovation, while the director of consultancy firm active in the field of open innovation, a representative of a supporting environment involved in European projects related to open innovation, and the head of business excellence development of a Slovenian company implementing open innovation provided the business practitioners' view. We also selected two foreign experts in the field (directors of consultancy firms from the UK and Italy) who have been active in the area of open innovation for many years and are familiar with the Slovenian environment.

The interviews were carried out in May 2010 and took approximately one hour per respondent. The interviews were semi-structured, allowing open conversation about the topic. However, the basic set of questions that enabled cross-analysis of answers was as follows: As a starting point, we wanted to identify main motivation for introducing open innovation. The interview proceeded with querying the most appropriate ways of introducing the concept in the business, the key elements in initiating it and the essential elements that companies should give most attention to. We were interested in respondents' opinions about the most appropriate way to introduce open innovation, as well as how to extend it as part of the established way of innovating in the firm. Respondents also addressed questions about main obstacles that companies may encounter during the introduction of the concept. The interview concluded with suggestions for the stimulation and implementation of open innovation in Slovenia. In the forthcoming subsections, we present a summary of the respondents' statements and reflections.

3.2 Results

3.2.1 *Motivation for implementation of open innovation*

From the perspective of the interviewees, the main advantage of open innovation is the possibility of accessing a wide range of knowledge from different sources. "The integration of suppliers and end users in the early process of innovation give the company the ability to identify their needs, aspirations and potential new solutions" (Briški, 2010). Additionally, the concept of open innovation provides a set of skills from many people who would otherwise be difficult to reach. Companies operating with open innovation can enter the market faster, can better exploit internal resources and create more integrated solutions. Open innovation enables wider, faster and better usability of technology, as well as better transfers in practice, which in turn leads to better performance of the company. Moreover, the concept can also contribute to cost reduction since part of the necessary production can be obtained externally and thus reduce the costs of their own development (in terms of both financial and human resources). Competitive advantage and higher chances of entering international markets were also mentioned as key

reasons for bringing open innovation to the company. "In today's era of the internet and advanced technology, it is extremely difficult to maintain professional secrecy; therefore, the importance of quick entering to the market is rapidly growing, which can be achieved by the new way of innovation" (Ollivere, 2010).

3.2.2 Ways of successful implementation of open innovation practices

"Open innovation requires implementation at all levels of the company. The practice should be part of the overall business model, and it should not be isolated in the R&D department of a company" (di Anselmo, 2010). Implementation at all levels within the company "[...] requires a team of people who understand the processes and discipline of innovation and are willing to maintain an open dialogue as well as a business model in which participants feel relaxed, develop their thoughts and ideas and see the achievements of their goals in the work they are doing" (Bulc, 2010). The R&D department should include employees who are familiar with the technology of the anticipated product and know how to find potential partners, as well as how to cooperate with them and serve as a bridge between them and the company. "Successful development requires research, but not always on the principle of "research and development", but increasingly on the principle of "cooperation and development" (Mulej, 2010).

The most appropriate way of implementing open innovation practices is sequential. "External environments can be included in the R&D activities through cooperation with various research institutions, universities, companies [...] which have specific knowledge and cutting-edge research results" (Briški, 2010). However, "a company must not forget its internal communication between departments, functions, or between developers, customers and suppliers. The company must introduce the concept of open innovation in all departments and business processes, and must constantly search for and evaluate new ideas" (Ollivere, 2010).

3.2.3 Main obstacles to the implementation of open innovation practices

According to interviewees, the main obstacles to the implementation of open innovation are employee resistance (mainly due to a lack of understanding what open innovation is), a vertical organizational structure, cultural issues and problems related to different partnerships (lack of understanding of each other, different cultures and different modes of thinking). "Additional problems can be raised by employees, who are stimulated to think in creative and innovative ways" (Briški, 2010). "Employees in R&D departments generally oppose sharing or pooling of IP, [...] believing that their technology is the best and requires no further development. Moreover, financial directors are not keen to invest extra money into research" (Ollivere, 2010).

Another dilemma of implementing open innovation involves IP protection. The aim of open innovation should be creating additional revenue rather than protecting itself from

competitors' access. The company must clearly distinguish between its business secrets, which deliver a substantial competitive advantage, and the technology and innovation that they want to quickly develop and market and/or require additional assistance and expertise for further development.

3.2.4 The main reasons for the underdeveloped open innovation community in Slovenia

The main reasons for the poor representation of open innovation among Slovenian companies are, in the opinions of the respondents, the philosophies of these companies, which are very closed and conservative. Additionally, Slovenian companies are primarily focused on the domestic market. Interviewees also commented that Slovene companies fear operating openly, lack ideas and knowledge of innovation and innovation processes, and lack the knowledge for effective management and moderation of such teams. In their view, Slovenian companies are not able to identify in which areas it makes sense to work with external partners. Moreover, they stated that Slovenian companies are not familiar with open innovation practices. Therefore, additional problems also arise in the implementation of the practice, since they are not acquainted with the most appropriate tools and strategies for such introductions in their business.

3.2.5 How to facilitate adoption of open innovation practices in Slovenian companies

The final discussion of the interview included a question about the adoption of open innovation in Slovenian companies. Interviewees suggested several steps for implementing open innovation. "It should start with the education and awareness of new generations of students with entrepreneurship, market orientation, and open innovation" (di Anselmo, 2010). Companies have to first become well acquainted with open innovation practices, after which they can start to create a network of partners with whom they want to cooperate. The foreign interlocutors suggested presentations of good practices from abroad, which will show the positive impact of open innovation on firm performance.

In their view, companies have to specialize and focus on their core competencies and find partners and contractors in the areas in which they lack knowledge or have higher costs of production. "It is crucial to connect larger firms with smaller enterprises as the latter often develop inventions that the former are looking for. In this way, both partners are in advantage — small businesses are lacking the financial resources, the right equipment and facilities [...] large companies can more quickly access the market with already developed technology required for their final product. The mutual benefit is the increased flow of knowledge, ideas, creative concepts and development of new products and services for market needs" (Rangus, 2010).

4 STUDY 2: THE STATE OF OPEN INNOVATION AMONG SLOVENIAN COMPANIES

We also conducted a survey among Slovene companies to better understand the state of the art of open innovation. Specifically, we aimed to examine the implementation of different open innovation activities by Slovenian companies and the extent of their cooperation with different partners.

4.1 Methodology

The questions used in this research are part of a larger empirical survey. We randomly selected 2,000 Slovenian manufacturing and service firms from the Business Directory of the Republic of Slovenia (PIRS) and emailed a survey to top executives of these firms in September 2012. We researched companies of different sizes and sectors (e.g. manufacturing, electricity, gas, steam and air conditioning supply, construction, information and communication, professional, scientific and technical activities, etc.). After sending two reminders (one after a week and the second one after three weeks), we received 340 responses (17% response rate). We compared the means of the first 25% of responses to the means of the last 25% of responses and found no significant differences. Two questionnaires had more than 25% of data missing; therefore, we excluded them from the analysis. All other missing values were replaced by using the expectation-maximisation method of imputation. The composition of the sample is presented in Table 1.

Table 1: *Sample composition*

Sample size (number of firms)	338
Distribution of firms by size (number of employees)	
Micro (0–9 employees)	26%
Small (10–49 employees)	39%
Medium (50–249 employees)	23%
Large (more than 249 employees)	12%
Distribution of firms by industry	
Manufacturing	53%
Service	47%

We measured different open innovation activities based on the description provided by van de Vrande et al. (2009) defining technology exploration as a firm's activities of acquiring outside technology and know-how and being comprised of external participation, inward IP licensing, external networking, outsourcing R&D, and customer involvement. In contrast, the aim of technology exploitation is to better profit from internal knowledge; it consists of venturing, outward IP licensing and employee involvement. Since micro and small firms find venturing activities difficult to implement, we included a question related to pre-venturing activity instead. Respondents evaluated agreement/disagreement with each statement on a 7-point Likert scale. External networking was measured with the specification of frequency of cooperation with different partners

(with an aim to acquire new know-how/technology) on a 7-point Likert scale (1 = never, 7 = always). The complete list of questions is presented in Appendix 1.

The Kruskal-Wallis and Mann-Whitey U tests were used for the identification of statistically significant differences of implementation of the open innovation dimensions among different groups of companies (regarding their size and industry).

4.2 Results

The results revealed that the most commonly used open innovation activity (regardless of firm's size or industry) is customer involvement, followed by employee involvement and pre-venturing activities. Companies most frequently collaborate with customers and suppliers. Analyses related to groups' comparison are presented in the following subsections.

4.2.1 Open innovation and firm's size

Table 2 shows that there are differences regarding the implementation of different open innovation activities among micro, small, medium and large companies, with large companies more involved in open innovation activities in most cases. An exception is outward IP licensing for which the results suggest that the smaller the company is, the more outward IP licensing is carried out. However, there are only three statistically significant differences among the groups, the first of which is connected to outsourcing R&D from knowledge institutions, with larger firms being the most involved in these services. The second statistically significant difference is related to the inward IP licensing between micro, small and large companies, with larger companies being more frequently involved in these activities. The third statistically significant difference appeared in pre-venturing activities among micro and all other groups of firms, with micro firms being the least involved in these activities.

Table 2: Differences in implementation of open innovation regarding a firm's size

	Micro		Small		Medium		Large		Kruskal-Wallis	
	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Chi-Square	Asymp. Sig.
Customer involvement	6.00	5.94	7.00	6.18	7.00	6.18	6.50	6.30	3.729	.292
External participation	5.00	4.19	5.00	4.49	5.00	4.79	5.00	4.90	6.298	.098
Outsourcing R&D	2.00a	2.62	2.00a	2.65	4.00b	3.36	4.00c	4.20	35.398	.001
Inward IP	3.00a	3.10	3.00a	3.10	3.00ab	3.35	4.00b	3.97	8.117	.044
Pre-venturing	5.00a	4.77	6.00b	5.39	6.00b	5.70	6.00b	5.64	16.336	.001
Outward IP	4.38	4.22	4.00	4.21	4.00	4.04	4.00	3.81	1.297	.730
Employee involvement	6.00	5.40	6.00	5.62	6.00	5.54	6.00	6.00	6.566	.087

Statistically significant at $P < 0.05$.

External networking was measured via collaboration with different partners. The results in Table 3 support the abovementioned outcomes with larger companies more actively involved in collaboration with different partners than smaller companies. There are three statistically significant differences among the groups. Such a difference related to collaboration with knowledge institutions is seen between the groups of micro and small companies and medium and large companies, whereas the larger the company is, the more it collaborates with knowledge institutions.

The second statistically significant difference among the groups is related to collaboration with consultancy companies. Micro companies collaborate with them statistically significantly less frequently than medium and large companies do. Furthermore, small companies collaborate with consultancy firms statistically significantly less than large companies do. Moreover, a statistically significant difference also appeared in relation to cooperation with high-tech start-ups: micro and small companies collaborate with these kinds of companies less frequently than large firms do.

Table 3: *Differences in cooperation with different partners regarding a firm's size*

	Micro		Small		Medium		Large		Kruskal-Wallis	
	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Square	Chi-Asymp. Sig.
Customers	6.00	5.37	6.00	5.50	6.00	5.70	6.00	5.83	5.525	.137
Suppliers	5.00	5.15	6.00	5.29	6.00	5.40	6.00	5.61	4.078	.253
Knowledge institutions*	4.00a	3.72	4.00a	3.77	5.00b	4.54	6.00c	5.20	32.253	.000
Consultancy companies	3.00a	2.91	3.00ab	3.20	4.00bc	3.65	4.00c	3.95	16.870	.001
Competitors	3.00	3.16	3.00	2.89	3.00	2.99	3.00	3.09	1.993	.574
Companies engaged in activities different from yours	4.00	3.98	4.00	3.80	4.00	3.86	4.00	3.95	1.009	.799
High-tech start-ups	2.00a	2.66	2.00a	2.53	3.00ab	2.78	3.00b	3.33	10.839	.013
Creative individuals	4.00	4.18	4.00	4.25	4.00	4.00	4.00	4.00	2.326	.508

*Such as universities, faculties, institutes, laboratories, etc.
Statistically significant at $P < 0.05$.

4.2.2 Open innovation and a firm's business sector

Although previous empirical results suggest that there are minor differences regarding a firm's business sector, we identified quite a few differences in the manufacturing and service sectors. These two groups were statistically significantly differentiated in the implementation of more than half of the open innovation activities (Table 4). Surprisingly, the results reveal that service firms are more frequently involved in most open innovation activities. Service firms are statistically significantly more often engaged in external participation, pre-venturing, outward IP licensing and employee involve-

ment. This may be due to the fact that the majority of the surveyed service companies belong to high-tech sector, whereas most manufacturing companies are in the low-tech sector.

Table 4: *Differences in implementation of open innovation regarding a firm's business sector*

	Manufacturing		Service		Mann-Whitney U	Asymp. Sig. (2-tailed)
	Median	Mean	Median	Mean		
Customer involvement	7.00	6.14	7.00	6.13	14070.500	.844
Internal participation	5.00	4.34	5.00	4.75	12347.000	.033
Outsourcing R&D	3.00	3.06	3.00	2.91	13464.500	.384
Inward IP	3.00	3.12	4.00	3.42	12981.500	.156
Pre-venturing	6.00	5.18	6.00	5.49	12619.000	.064
Outward IP	4.00	3.82	5.00	4.47	11311.000	.001
Employee involvement	6.00	5.40	6.00	5.80	11686.500	.003

Statistically significant at $P < 0.05$.

Service companies collaborate more with more of the listed partners (Table 5) while a statistically significant difference is related to collaboration with competitors, with companies engaged in activities different from theirs, with high-tech start-ups and with creative individuals.

Table 5: *Differences in cooperation with different partners regarding firm's size*

	Manufacturing		Service		Mann-Whitney U	Asymp. Sig. (2-tailed)
	Median	Mean	Median	Mean		
Customers	6.00	5.57	6.00	5.53	14067.500	.850
Suppliers	5.47	5.33	5.00	5.31	14037.000	.825
Knowledge institutions*	4.00	4.08	4.00	4.13	13937.000	.740
Consultancy companies	3.00	3.19	4.00	3.45	12885.500	.127
Competitors	3.00	2.82	3.00	3.21	11846.000	.006
Companies engaged in activities different from yours	4.00	3.69	4.00	4.09	11814.000	.005
High-tech start-ups	2.00	2.56	3.00	2.89	12642.500	.069
Creative individuals	4.00	3.87	5.00	4.46	10782.000	.000

*Such as universities, faculties, institutes, laboratories, etc.

Statistically significant at $P < 0.05$.

The summary of the results related to specific research question is presented in Appendix 2.

5 DISCUSSION

Although open innovation has received substantial attention in recent years, the research mostly builds on the evidence of how open innovation is adopted in the most developed part of the world (e.g. USA, old member states of EU) while research on open innovation in other EU countries (new member states of the EU) is practically non-existent. The purpose of this study is to contribute to the body of knowledge examining open innovation practices in organizations, by focusing specific attention on open innovation practices in Slovenian companies. Some preliminary evidence on the state of open innovation in Slovenia among high-tech companies has already been presented by Rašković et al. (2011), who showed that most of these companies are still more inclined to “closed” innovation. Krapež et al. (2012) focused exclusively on the Slovenian companies that innovate openly by cooperating with external partners, and found that Slovenia has been developing a friendlier business environment for open innovation. We contribute to the research to this body of literature by providing a comparative analysis on the adoption of different open innovation practices by Slovenian firms. One specific advantage of our research framework is that we do not limit it to certain industries or company sizes. Based on our insights, we have developed some recommendations for facilitating the implementation of open innovation.

Our results suggest that there are differences regarding the implementation of open innovation dimensions in relation to firm’s size, with larger companies more involved in open innovation activities, which is in line with the previous results on open innovation (e.g. van de Vrande et al., 2009). An interesting difference (although not statistically significant) appeared in relation to outward IP licensing, which showed that smaller companies are more inclined to selling and/or licensing of their IP. This may be related to the fact that smaller companies often develop product/services that are intermediary components of final products/services developed by another company. Indeed, this is aligned with the statistically significant finding that larger companies more frequently buy and/or license-in IP from other companies. The second statistically significant difference is related to pre-venturing activities, which are the least commonly used by micro companies. When developing the final product/service, micro firms are probably the least inclined to share the profit with other firms only for launching products/services on the market. Statistically significant differences in collaboration with different partners (regarding the firm’s size) is shown in collaboration with knowledge institutions, in collaboration with consultancy firms and collaboration with start-ups, with larger firms more actively involved in these kinds of collaborations. The main reason may be connected to the financial resources supporting the collaborations. Larger companies can easily afford to pay for consultancy services or joint R&D development with knowledge institutions and/or high-tech start-ups, which is also evident from the statistically significant difference in outsourcing R&D from knowledge institutions (with larger firms most frequently using these services).

A comparative analysis among manufacturing and service industry revealed that service firms more frequently carry out most open innovation dimensions. However, we believe the results are influenced by the characteristics of the sample, since most high-tech companies in the sample belong to service sector. This is congruent with the findings of Raškovič et al. (2011) in which 91.25% of the analysed high-tech companies belonged to service sector. Service firms collaborate more with competitors in a statistically significant manner, with companies engaged in activities different from theirs, with high-tech start-ups and with creative individuals. More frequent collaboration with competitors may be due to the fact that service outcomes are difficult to protect; therefore, these companies avoid IP protection problems. Since these companies develop high-tech services, they often lack knowledge related to technology or knowledge that is beyond their domain. It seems that companies tend to remedy this gap of knowledge by collaborating with high-tech start-ups or companies engaged in activities other than theirs. Creative individuals can help them with the identification of potential future service solutions or the creation of the service image.

Drawing on previous work on open innovation in Slovenia and our study, we provide some proposals for facilitating the practice among Slovenian companies, which are gathered into three steps and presented in Figure 1.

The first step is related to the raising awareness regarding open innovation practices and its benefits. Successful understanding and learning new ways of innovation requires the organization of workshops and trainings on the topic of open innovation, where companies can become aware of the importance of the concept, its advantages, and benefits. On the basis of good practices from abroad, the progress and positive change in companies that have successfully introduced the concept can be presented, followed by the directions and possible ways of introducing the concept in business.

The second step relates to the introduction and implementation of open innovation, whereas the main changes are required in the organizational structure and culture of Slovenian companies. The starting points are changes in the mentality and understanding of management, since misunderstanding and scepticism about the new concept by the principal management at the outset leads to failure. Therefore, new ways of managing and rewarding are needed for the successful implementation of open innovation. This is followed by a mental shift of all employees, which is necessary to stimulate creative and unconventional thinking. These first two steps can be carried out with the help of experienced (foreign) trainers/mentors.

The decision to switch from closed to open innovation is made by the company itself, but the state can play an important role with direct and indirect financial incentives, and initiatives. Therefore, a successful implementation of open innovation by Slovenian companies also requires support from the state, which should be applied to different types and developmental situations of the industries, which represents the third step in the proposed model of facilitating open innovation.

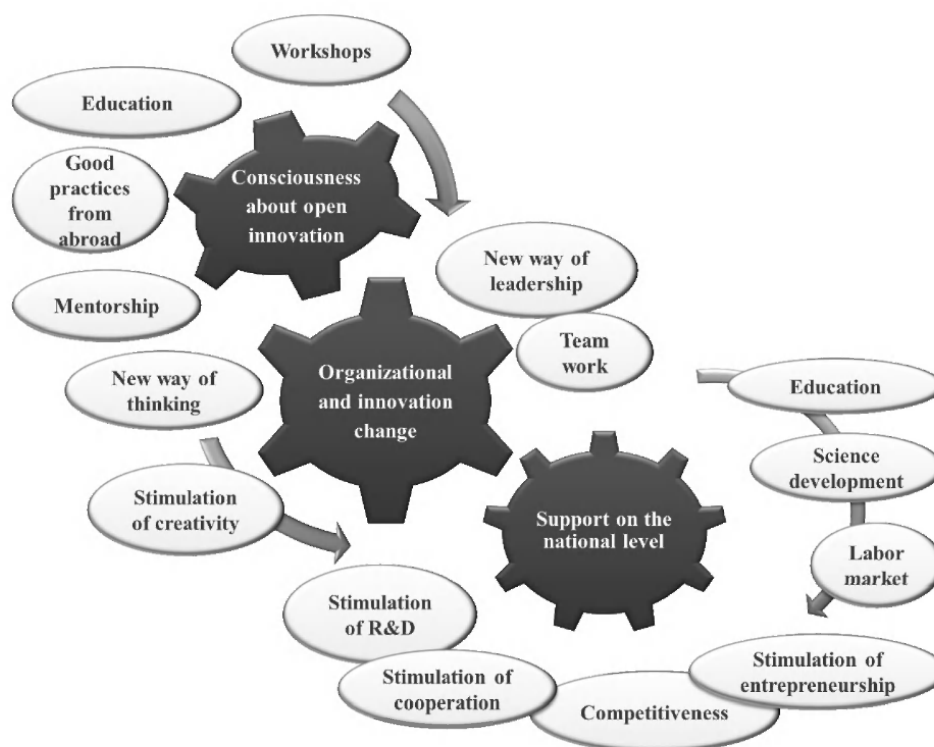


Figure 1: *Perspective of open innovation in Slovenia*

6 IMPLICATIONS, LIMITATIONS AND FUTURE RESEARCH

Many high-tech European and US companies practice open innovation extensively, while open innovation activities are not that common in new member states of the EU, and specifically in Slovenia. There are many possible reasons for the low adoption of open innovation practices in companies, amongst which most likely concern fear of a “hostile” takeover of ideas or already developed technologies, lack of knowledge about the practice, and cultural specificities of Slovenian entrepreneurs. The results of this study show that there have been some initial bursts of activities in the field of open innovation among Slovenian companies, but they require strong stimulation to become genuine open innovators.

We believe this study makes several theoretical and practical contributions. From a theoretical perspective, the paper contributes to the literature in the field of the state of open innovation in European countries that are lagging behind the most developed countries of the world. From a practical point of view, the open innovation perspective can help Slovenian managers in adopting this important practice and policy makers in facilitating open innovation. Additionally, the proposed steps for the facilitating of the

implementation of open innovation are a good starting point for the development of the concept in other less developed European countries.

6.1 Implications for managers

Our results indicate that Slovenian companies are beginning to introduce some aspects of open innovation. Although the existing evidence suggests that any of the open innovation activities may improve firm's performance, each activity can influence the performance outcomes differently (Parida et al., 2012); therefore, a company should approach open innovation as a whole to profit the most from the concept. Additionally, the steps recommended for the implementation of open innovation stress the importance of management and its understanding of the concept. Managers should be aware that delegation in open innovation shifts to co-ordination, the harmonization of ideas and teamwork, the encouragement of creative proposals and ideas, and the development of innovative solutions in which all employees within the company, as well as external partners should be included. Moreover managers should stimulate the creative and unconventional thinking of employees and reward them for finding useful ideas outside the firm's boundaries. Managers should create an environment in which corporate culture, value and reward systems as well as human resources support the development and implementation of open innovation (Krapež et al., 2012).

6.2 Implications for policy makers

The results from Rašković and Pustovrh (2010) indicated that the main barriers that hinder innovation performance of Slovenian companies concern accessing financial resources, tax law and efficiency of market labour. Similarly, Krapež et al. (2012) stressed the importance of supportive business environment, but not exclusively based on governmental financial support, but should also include changes in legislation, tax system, administrative procedures, infrastructure and funding opportunities. Policy makers may want to follow the suggestions provided by de Jong, Vanhaverbeke and Chesbrough (2008), who identified seven areas of legislation that require certain changes to ensure the positive development of open innovation, and apply them to the need of Slovenian companies. Subscribing to the proposals of the Slovenian studies, our findings also emphasize the importance of the help of regional policy makers (especially for smaller companies) in stimulating the incentives in the form of workshops and training programs if possible with the help of foreign mentors. This coincides with the suggestion of de Jong, Kalvet and Vanhaverbeke (2010), who state that policies have to support the networking skills of the companies, which can be reached by improving their knowledge and competences in these areas, by delivering information and by presenting already-established open innovation models and best practices. They suggest tailor-made services moderated by experts with the knowledge and skills in the field of open innovation, as well as the facilitation of go-betweeners, who are matchmakers bringing different partners together.

6.3 Limitations and future research

As with any research, also this study has several limitations. Firstly, limitations related to the in-depth interviews include potential selection bias: it was very difficult to find experts from Slovenia in this field and motivate them to participate in the study. Therefore, we included foreign experts who have wide knowledge and extensive experience in the field of open innovation. Limitations could also be related to the nature of the questions of the interview, since they could include additional and more detailed questions. In addition, the obtained results are based on responses from a relatively small number of interviewees. Future studies would thus contribute by extending the pool of interviewees and questions included in the qualitative research. The main limitation of the quantitative study is the use of a proxy measure for open innovation. All the dimensions of open innovation, except external networking, were based on one question. The use of a more sophisticated and statistically valid and reliable measure could provide more accurate results. Therefore, further analyses examining specific elements of different open innovation dimensions in Slovenian companies are needed to support our findings. Hence, it would be interesting to conceptualize and validate a general scale for open innovation, which would provide foundations for better quantitative analysis between open innovation and other organizational variables and enhance the understanding of different context dependencies and interactions (Huizingh, 2011). A common measurement for open innovation would therefore enable better cross-industry and cross-country analyses, as well as the identification of moderating and mediating effects on the relationship between open innovation and a firm's performance. From the practical point of view, the analyses based on common open innovation measurements would enable managers to understand how to enhance the open innovation outcomes and to know which determinants at the organizational as well as broader level influence the business success. An interesting study would also be an examination of the most appropriate proportion of open and closed businesses. Since the balance between open and closed innovation in diverse firms is very different, it would be worth exploring the key factors that affect the balance and thereby create a universal formula that would assist in determining the extent to which it makes sense to open a firm's innovation process. Finally, future research should focus on the influence of various national governmental policies that stimulate open innovation in organizations (Herstad, Bloch, Ebersberger, & van de Velde, 2010).

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APPENDIX 1: OPEN INNOVATION DIMENSIONS

(7-point Likert scale: 1 = strongly disagree; 7 = strongly agree)

CUSTOMER INVOLVEMENT: Customers/end users are usually involved in the process of new product/service development.

EXTERNAL NETWORKING: In order to acquire new know-how/technology, we are willing to invest in a new company.

OUTSOURCING R&D: We acquire new know-how/technology through research and development services provided by knowledge institutions such as universities, faculties, institutes, laboratories, etc.

INWARD IP LICENSING: To ensure successful development of new products/services, we usually buy the intellectual property of other companies.

PRE-VENTURING: When launching our own new products/services on the market, we cooperate with external partners.

OUTWARD IP LICENSING: We are willing to sell part of our intellectual property (e.g. patent, trademark).

EMPLOYEE INVOLVEMENT: In our company, we actively encourage communication among unrelated groups of employees in the company.

EXTERNAL NETWORKING - Collaboration with different partners (7-point Likert scale: 1 = never, 7 = always)

In order to acquire new know-how/ technology we cooperate with:

- ...our customers
- ...our suppliers
- ...knowledge institutions such as universities, faculties, institutes, laboratories
- ...consultancy companies
- ...our competitors
- ...companies engaged in activities different from ours
- ...high-tech start-up companies
- ...creative individuals

APPENDIX 2: SUMMARY OF THE RESULTS RELATED TO RESEARCH QUESTIONS

No.	Research question	Results
RQ1a	What are the main advantages and reasons for the implementation of open innovation?	The possibility of accessing a wide range of knowledge from different sources, faster entrance to the market, better usability of technology, better exploitation of internal resources, creation of more integrated solutions, cost reduction, maintenance of competitive advantage and the possibility of entering the international market.
RQ1b	How can open innovation best be implemented?	The concept should be part of the overall business model and implemented at all levels within the company. This requires a team of people who understand the processes and discipline of innovation and are willing to maintain an open dialogue. Business executives have to be familiar with the concept and understand it.
RQ1c	Which obstacles can companies encounter in the implementation of open innovation?	Employee resistance, a lack of understanding and a lack of knowledge about open innovation, a vertical organizational structure, cultural issues and problems related to different partnerships (lack of understanding of each other, different cultures and different modes of thinking), IP protection.
RQ2	With whom do Slovenian companies collaborate the most when acquiring new know-how/technologies?	Companies most frequently collaborate with customers and suppliers.
RQ2a	Are there any differences in collaboration with different partners regarding a firm's size?	Large and medium sized companies collaborate more with knowledge institutions than small and micro firms. Large companies collaborate more with knowledge institutions than medium companies. Micro companies collaborate with consultancy companies less than medium and large companies. Small companies collaborate with consultancy firms less than large companies. Micro and small companies collaborate with high-tech start-ups less frequently than large firms.
RQ2b	Are there any differences in collaboration with different partners regarding a firm's business sector?	Service companies collaborate more with competitors, with companies engaged in activities different from theirs, with high-tech start-ups and with creative individuals.
RQ3	Which open innovation dimension is most commonly used among Slovenian companies?	Most commonly used open innovation dimension is customer involvement, followed by employee involvement and pre-venturing activities.
RQ3a	Are there any differences in the implementation of open innovation dimensions among Slovenian companies regarding their size?	Larger firms most frequently use outsourcing R&D from knowledge institutions. Larger companies are more frequently involved in inward IP licensing as small and micro firms. Micro firms are the least involved in pre-venturing activities.
RQ3b	Are there any differences in the implementation of open innovation dimensions among Slovenian companies regarding their business sector?	Service firms are more often engaged in external participation, pre-venturing, outward IP licensing and employee involvement.

RQ4	What are the main reasons for the underdeveloped open innovation community in Slovenia?	The philosophies of Slovenian companies, which are very closed and conservative. Slovenian companies are primarily focused on the domestic market, they fear operating openly, have a lack of ideas, knowledge of innovation and innovation processes, and they lack the knowledge for effective management and moderation of such teams. They are not familiar with the concept of open innovation. Additional problems also arise at the implementation of the concept, since they are not acquainted with the most appropriate tools and strategies for introduction in their business.
RQ5	How can the development of open innovation among Slovenian companies be stimulated?	Companies have to first become well acquainted with the concept of open innovation, after which they will start to create a network of partners with whom they want to cooperate; they will have to inspire respect in them, as well as be interested in participating, and then find the areas of common operation. Foreign interlocutors suggested presentations of good practices from abroad, which will show the positive impact of open innovation on firm performance.

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