OUTSOURCING OF R&D AND INNOVATION ACTIVITIES IN SMEs: EVIDENCE FROM SLOVENIA *

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ABSTRACT

This paper examines the outsourcing of research and development and of innovation activities in small and medium-sized companies (SMEs). As the results of these activities enable companies to achieve and sustain competitive advantage, it is crucial to manage them properly. As SMEs generally lack internal resources to perform R&D and innovation activities internally, is the outsourcing of these activities a viable solution for them? This paper examines the basic characteristics of outsourcing R&D and innovation activities in SMEs, based on a survey among Slovenian companies in the manufacturing and service industries. We tested five hypotheses. Empirical results show that one third of SMEs outsource R&D and innovation activities in different forms, and that small companies outsource these activities more often. The biggest share of SMEs partially outsources R&D and innovation activities, followed by SMEs that outsource all those activities, and by SMEs that perform R&D and innovate in co-operation with other firms. When comparing the type of R&D and innovation activities that are outsourced, the results show that SMEs mainly outsource experimental development, followed by basic research and applied research. However, they mostly outsource R&D and innovation activities to universities and independent research organisations and only occasionally to private organisations from industry and individual researchers.

Keywords: outsourcing, research and development, SMEs

JEL: L25, L26, O39

1. INTRODUCTION

To survive, companies have to renovate the way they do business and introduce innovation. The need for innovation is driven by four main factors (Cassiman, Veugelers, 2006). First, technological development forces companies to continually monitor technological changes and respond to them. The second factor is the rapid changes in customers' habits and needs, which drive companies' innovation in order to maintain or increase their sales. The third factor is competition between companies that forces companies to commit to research, development, and innovation. The last factor represents changes in the companies' environment, it is associated with all the other factors and combines them into a whole. Companies have several options for developing their products, abilities, production, marketing and organizational system (OECD, 2005). They can choose between internal development, development in co-operation with other companies, and the use of innovations developed by other companies.

The outsourcing of research and development (R&D) and innovation activities is important to study because in the past these activities were not outsourced often. However, in recent

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decades there has been a shift in outsourcing R&D (e.g. Mol, 2007; Leiblein, Miller, 2003), therefore it is important to study it. Implementation of R&D and innovation activities in co-operation with other companies is important for several reasons and because four forces lead the innovation revolution (Quinn, 2000). First, demand (on a national level) doubles every 14 to 16 years, thereby creating new markets that are interested in innovation. Second, the supply of scientists, technologists and other scientific professionals is high and access to them and their knowledge is simple. Third, interaction among different actors in the business environment is high because of the Internet and other information technologies. Fourth, political incentives (e.g. taxes and a reduction of trade restrictions) have led to greater economic activity.

In this paper we focus on the outsourcing of R&D and innovation activities from the outsourcer's point of view. Outsourcing is a widely accepted business tool for transferring a part of a company's business activities to another company to achieve different business goals. For the purpose of the paper we use a definition that explains outsourcing as cooperation between the outsourcer and the outsourcing provider. The outsourcer is a company that externally acquires particular services and/or products. The outsourcing provider is a company that performs those services and/or products for the outsourcer. Co-operation is based on an agreement that could be occasional, short, mid or long term.

In the past few years companies have increasingly been transferring the implementation of innovation to different market participants, from suppliers to consumers (Sawhney et al., 2003). In general, R&D and innovation activities can be implemented in two ways (Yaklef, 2005). The first is that R&D is organized and provided within a given company (Martin, Harris, 2000). The other way says that these activities are increasingly decentralized, flexible and outsourced to various partners or outsourcing providers (e.g. Thomke, Von Hippel, 2002; Chesbrough, 2003). This means companies can perform their R&D and innovation activities in several ways. On the one hand is completely internal implementation; on the other is the complete outsourcing of those activities. Between these two extremes several possible combinations exist for their implementation.

According to the European Innovation Scoreboard, Slovenian companies are among the innovation followers, but growth in their innovation performance is perceived. Additionally, the Statistical Office of the Republic of Slovenia has established that only half of Slovenian companies are innovative; of these, the dominant companies are from the manufacturing sector.

In this paper we investigate the outsourcing of R&D and innovation activities in Slovenian SMEs. The main research question of the paper is: to what extent and to which subjects do Slovenian SMEs outsource R&D and innovation activities (and what are the characteristics of such outsourcing)?

2. OUTSOURCING OF R&D AND INNOVATION ACTIVITIES

Increased competition, globalization of markets, and other emerging characteristics of the contemporary world have forced companies to use all their best resources and core competencies to exploit business opportunities and to succeed.

In general, innovation requires complex skills possessed only in a network of specialists. A decade ago Quinn (2000) underlined that strategic outsourcing of R&D and innovation activities and internal implementation of the latest technologies can lead to sustainable competitive advantages. Many SMEs have benefited from the opportunities outsourcers have offered in the development of new

products and services, since no internal R&D team in a company itself can predict, evaluate or take into account all the possible varieties of products or services. In order to survive and succeed in such an environment, external knowledge of the use of existing products and services is required as well as the development of new ideas and continual implementation of innovations. These attributes should lead companies to occupy significant positions in their respective industries (Quinn, 2000).

Transferring particular business activities to more specialized outsourcing providers enables innovative companies to reduce risk and produce products on a large scale. These changes have enabled companies to minimize fixed costs of production. Under such circumstances, outsourcing has become a useful business tool to focus scarce resources on core competencies that are related to fostering innovation (Andrade, Furtado, 2006). In today's environment, the most innovative companies cannot rely only on internal resources, but should develop their innovation ability to acquire knowledge created outside the company (Rigby, Zook, 2002). A company's environment represents a pool for gathering new knowledge and increasing the efficiency of internal R&D. However, companies tend to use a combination of internal and external knowledge, as it is a complementary activity (Cassiman, Veugelers, 2006). Therefore, apart from outsourcing R&D and innovation activities, companies must implement them internally (Chesbrough, 2003) to maintain and develop absorptive capacity, which represents a company's ability to apply acquired knowledge.

Among the reasons for outsourcing R&D and innovation activities are the development of new markets, the need for specific specialized knowledge, scarce resources, accelerating the process of introducing innovations, increasing the complexity of research and development, the uncertainty of results, high risks and high costs (Quinn, 2000; Howells, James, 2001; Grimpe, Kaiser, 2010). No company can innovate better on its own than several companies, suppliers and competitors. The outsourcer spreads the risk of failure to at least one provider. Additionally, with outsourcing it gains access to new people with different skills that are important in core business areas. They join the "global race for talents" (Lewin et al., 2009). With outsourcing, companies also facilitate entry into the market with new products or services.

The definition of R&D and innovation is broad and sometimes contradictory. For the purpose of our paper it is defined in the context of outsourcing. Research and development (R&D) activity includes three types of activities (Medvešek Miloševič, 2007): (1) basic research, (2) applied research, and (3) experimental development – development of applied solutions. Basic research is experimental or theoretical work whose primary goal is to gain new knowledge based on fundamental phenomena and observable facts, it is directed to search for new knowledge and universal knowledge. Applied research is also original investigation, which focuses on the acquisition of new knowledge, with an emphasis on a specific practical objective. Experimental development is the systematic use of knowledge generated by basic and applied research and practical experience aimed at producing new materials, products or devices, creating new processes, systems and services. Innovation includes new or significantly improved products, services and processes. Innovations include a series of scientific, technological, organizational, financial and commercial activities. The innovation must be new to the company, but not necessarily new to the market. It is not necessary that it is developed within the company. Innovation activities include the acquisition of machinery, equipment, software and licenses, engineering

and development, training, marketing, and research and development, conducted specifically for the development and/or implementation of product or process innovation (Medvešek Miloševič, 2007).

Empirical studies of R&D and innovation activity outsourcing is still limited in Slovenia. The Statistical Office conducted a survey of expenditure on innovation activities in the years 2004 to 2006 (SURS, 2008), which included the following types of costs: (a) internal costs of research and development, (b) external costs of research and development, (c) machinery and equipment, (d) external knowledge, (e) education, marketing innovation, and preparation for production/distribution. Internal costs represent approximately 29% of all costs, external costs for research and development represent 6.5%, cost of machinery and equipment 51%, costs of external knowledge about 2%, and the cost of education, marketing innovation, and preparation for production 11.5% of all costs. These results show that the outsourcing of R&D and innovation activities is present in companies; therefore an in-depth analysis is essential.

Based on the literature review we stated the following hypotheses:

Hypothesis 1: There are more companies that do not outsource R&D and innovation activities than those that do.

Hypothesis 2: Medium-sized companies outsource R&D and innovation activities more than small companies.

Hypothesis 3: Companies mostly outsource applied solutions and basic research the least.

Hypothesis 4: Companies mostly outsource R&D and innovation activities occasionally.

Hypothesis 5: Companies outsource to private companies from industry the most and to universities/faculties the least.

The hypotheses were tested on the sample of Slovenian SMEs from two industries, as explained below.

3. METHODOLOGY

In the empirical research, data were collected by a questionnaire and then analysed by standard quantitative business research methods. The quantitative approach was performed in several stages. First, an appropriate sample of companies was selected (this was done randomly from a list of SMEs from two industries – manufacturing and business services). Second, a measurement model was defined to measure R&D and innovation activities' outsourcing. Third, a questionnaire was prepared, and interviews were conducted. Fourth, empirical analysis with SPSS was made to test the hypotheses. Fifth, research results with confirmation/rejection of hypotheses were presented.

In the empirical survey (Bradač, 2009) there were 158 Slovenian SMEs (according to the number of employees) in the manufacturing and services industries, from which we obtained 151 valid responses for the field of outsourcing research and development and innovation activities. Given the number of employees per company, 21% of the companies were medium sized (50 to 249 employees) and 79% were small (10 to 49 employees).

4. FINDINGS OF R&D AND INNOVATION ACTIVITIES OUTSOURCING IN SMEs

To be able to make an in-depth analysis of the outsourcing of research and development and innovation activities, we first had to establish whether companies outsourced those activities. Respondents had four options to

choose from with regard to outsourcing R&D and innovation activities and in which way:

1. That they do not outsource R&D and innovation activities
2. That they outsource R&D and innovation activities partially
3. That they outsource R&D and innovation activities totally
4. That they provide R&D and innovation activities in cooperation with outsourcing providers.

The results in Table 4.1. show that almost 32% of respondents outsource R&D and innovation activities in different ways, while 68% of them do not outsource those activities. However, 21% of those that outsource R&D and innovation activities do it partially, 7% totally outsource R&D and innovation activities and 7% of them provide R&D and innovation activities in cooperation with the outsourcing provider.

Table 4.1. Share of companies that outsource R&D and innovation activities in different ways

	Frequency	Percent
Do not outsource R&D and innovation activities	103	68.2
Do outsource R&D and innovation activities	48	31.8
- *partially*	32	21.2
- *totally*	11	7.3
- *co-operatively*	5	3.3
Total	151	100

Based on the results analysed above we can confirm *Hypothesis 1* that more companies do not outsource R&D and innovation activities than those that do.

Table 4.2. and Table 4.3. provide the results of analysing differences in outsourcing R&D and innovation activities between small and medium-sized companies.

Table 4.2. Number of small and medium-sized companies that outsource R&D and innovation activities

Size group	N	Mean	Std. Deviation	Std. Error Mean
Small companies	35	2.51	0.742	0.126
Medium-sized companies	13	2.23	0.439	0.122

Table 4.3. Differences in outsourcing R&D and innovation activities between small and medium-sized companies

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Differences in outsourcing R&D and innovation activities between small and medium-sized companies	7.75	0.008	1.62	36.53	0.05	0.28	0.17	-0.07	0.64

Among companies that outsource R&D and innovation activities, 73% are small companies and 27% medium-sized companies. The results show with statistical significance (p=0.05) that small companies outsource R&D and innovation activities more than medium-sized companies. According to these results *Hypothesis 2* is rejected.

Among companies that do outsource R&D and innovation activities we try to establish the types of activities that are outsourced. These were divided into three groups according to the definition of the Slovenian Statistical Office (SURS, 2007):

- Basic research: Basic research is experimental or theoretical work

undertaken primarily to acquire new knowledge of the foundations of phenomena and observable facts.

- Applied research: Applied research is original research geared primarily to the practical aim or objective. This may include industrial research.
- Experimental development–development of applied solutions: These include activities of planning and development of various new or improved products and services.

Results of outsourced types of R&D and innovation activities are shown in Table 4.4. Each respondent was able to select more types of outsourced activities; therefore, the cumulative is more than 100%. Companies mostly outsource development of applied solutions, which are part of innovation activities. Among R&D activities are basic research (33.3%), which is outsourced more often than applied research (27.1%).

Table 4.4. Types of outsourced R&D and innovation activities

Type of R&D and innovation activities	Frequency	Percentage of all that outsource R&D and innovation activities (n=48)
Basic research	16	33.3
Applied research	13	27.1
Experimental development	34	70.8
Do not know a type	8	16.7

According to the results in Table 4.4. we can confirm *Hypothesis 3* only partially, because in the sample, companies mostly outsourced the development of applied solutions, but basic research is not outsourced, at least as stated in the Hypothesis 3.

To establish what the characteristics of outsourcing R&D and innovation activities are, we examined the frequency of outsourcing R&D and innovation activities on a four-stage scale:

- Occasionally (only when there was a need for R&D and innovation activities in the company)
- Short-term (co-operation less than 1 year)
- Mid-term (co-operation 1 to 3 years)
- Long-term (co-operation more than 3 years).

As shown in Table 4.5., companies mostly outsource R&D and innovation activities occasionally and least on a long-term basis. Such a result was expected, because SMEs search for additional resources only when a company needs them or when the market demands it. Therefore, *Hypothesis 4* can be confirmed, that SMEs mostly outsource R&D and innovation activities occasionally.

Table 4.5. Frequency of outsourced R&D and innovation activities

Type of R&D and innovation activities	Occasionally	Short-term	Mid-term	Long-term
Basic research	5	4	2	6
Applied research	5	3	2	3
Experimental development	19	4	2	9
Do not know a type	6	0	1	0
Total	35	11	7	18

R&D and innovation activities can be provided by different types of organisations or individuals. In the survey we defined four different providers of R&D and innovation activities:

- University/faculty
- Public or private independent research organisation
- Other private companies (from industry)

- Individual researchers.

As the respondents had a possibility to choose all types of organisations that they outsource to, the sum is more than 100%. Table 4.6. represents the frequency of outsourcing R&D and innovation activities out of all those that outsource those activities (n=48). The results show that companies mostly outsource to other private organisations (almost 44%) that can be from the same industry as the outsourcers or from other industries. Companies outsource the least to individual researchers (31%), but differences among each type are small. According to the results H*ypothesis 5* can be confirmed partially. We confirmed that companies mainly outsource to private organisations, but we could not confirm the thesis that they are outsourcing to universities/faculties the least.

Table 4.6. Frequency of outsourced R&D and innovation activities by type of outsourcing provider

Type of R&D and innovation activities	Frequency	of all that outsource R&D and innovation activities
University/faculty	18	37.5
Public or private independent research organisation	18	37.5
Other private organisation (from industry)	21	43.8
Individual researchers	15	31.3
Do not know	3	6.3

To gain a deeper insight into the frequency of outsourcing R&D and innovation activities to four groups of organisation we analysed them also by type of activities, which is represented in Table 4.7.

Table 4.7. Frequency of outsourcing R&D and innovation activities by type of activity and type of outsourcing provider

Type of R&D and innovation activities	University	Public or private independent research organisation	Other private organisation (from industry)	Individual researchers	Do not know
Basic research	7	7	10	4	0
Applied research	7	8	5	4	0
Development of applied solutions	13	13	16	11	1
Do not know a type	3	1	2	3	2
Total	30	29	33	22	3

The results of outsourcing R&D and innovation activities to different organizations and individuals show that the respondents outsourced all types of activities. However, basic research and applied solutions were mostly outsourced to private organizations while applied research was outsourced to independent research organisations.

5. CONCLUSIONS

In the paper we analysed characteristics of outsourcing R&D and innovation activities among SMEs in Slovenia. Based on the literature survey it was established that in the past, companies mainly used internal resources to provide R&D and innovation activities. However, in the past two decades a major shift to other forms of implementation of these activities has taken place. Companies started to acquire R&D and innovation activities in the market or perform them jointly in co-operation with other companies.

In the empirical part of the paper we tested five hypotheses on specific characteristics of R&D and innovation activities outsourcing. We could confirm two hypotheses, two were confirmed partially, and one was rejected. This is represented in Table 5.1.

Table 5.1. Results of testing hypotheses

Hypothesis	Confirmed/ rejected
H1: There are more companies that do not outsource R&D and innovation activities than those that do.	Confirmed
H2: Medium-sized companies outsource R&D and innovation activities more than small companies.	Rejected
H3: Companies outsource applied solutions the most and basic research the least.	Partially confirmed
H4: Companies mostly outsource R&D and innovation activities occasionally.	Confirmed
H5: Companies outsource to private companies from industry the most and to universities/faculties the least.	Partially confirmed

We found that approximately one third (31.8%) of companies outsource R&D and innovation activities in different forms (totally, partially or in co-operation). A comparison of two groups of companies, i.e. small and medium-sized, showed that statistically significant small companies outsource R&D and innovation activities more than medium-sized companies.

Second, several types of R&D and innovation activities exist. In the survey we examined three groups, namely basic research, applied research, and experimental development. Results show that 71% of companies (that do outsource R&D and innovation activities) outsource experimental development, 27% outsource applied research and 33% of them basic research.

Third, when considering the time element in outsourcing co-operation, a company can outsource a particular activity occasionally (only when it is needed), short term, mid-term or long term. In the survey, most of the companies outsource R&D and innovation activities occasionally, followed by long-term outsourcing and mid-term the least.

Fourth, companies can outsource their activities to different types of organisations. In the survey, there were four predefined groups of organisations (university/faculty, public or private independent research organisation, other private organisation from industry, and individual researchers). The majority of them outsourced to private organisations from industry and at least to individual researchers.

With our analysis of outsourcing R&D and innovation activities we established a basic insight into this research area. However, further research is needed to establish a broader picture of outsourcing those activities in SMEs. One possibility is to examine more than two industries; the other is to examine more characteristics of outsourcing; while the third is to analyse certain characteristics of outsourcing R&D and innovation activities more deeply. Because no longitudinal data were available, we could not investigate the important issue of whether companies that outsource R&D and innovation activities perform better in the long run than those that do not. In any case, the conclusion is that like large companies, SMEs also have to innovate and have access to the most valuable resources – talent and creativity – for long-term success. If they do not have enough of these resources within the company they have to find it on the market. The strategic outsourcing is an appropriate tool for that.

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