

Knowledge and Innovation Performance in Czech Firms: The Influence of Decision-Making Structure

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Abstract: There are plenty of factors that influence a company's innovation performance. They include, for example, the firm's strategy, organizational culture, size, and availability of resources. Besides these factors, a lot depends on the firm's leadership, attitude towards innovation, experience, and knowledge. The influence of external knowledge, like patents and inventions from other businesses, has been studied by researchers many times. However, previous scientific publications contain mixed evidence on the impact of external knowledge on a firm's innovation performance. Many of them defined separate factors, like innovation orientation or knowledge sources, as influential for the firm's innovativeness. However, not enough studies were made on firms' decision-making structure. Scholars suggested that decentralized companies are more likely to experiment in their innovation activities than centralized ones. We aim to determine the role of the decision-making structure in innovation performance by gaining external knowledge among firms in the Czech Republic. We contribute to the existing literature by distinguishing the firms by their legal statuses (sole proprietorship, partnership, shareholding company) and the presence/absence of a supervisory board. Our research is done by applying a quantitative method with empirical data. We use multiple linear regression and SPSS software to determine the influence of external knowledge acquisition and other related factors (R&D inside and outside the firm, age, size) on innovation performance, with decision-making structure indicators included. We divide innovations into process and product ones. The study uses the World Bank Enterprise Survey data for the Czech Republic. The results of this paper present important outcomes for practitioners. They will prompt more efficient innovation strategies for firms, depending on their management type.

Keywords: External knowledge, Innovation performance, Decision-making structure, Czech firms, Product innovations, Process innovations

1. Introduction

Innovations are very important for the development of businesses, as well as for triggering their competitive advantage and achieving economies of scale (Prokop, Kotkova Striteska & Stejskal, 2021). Competition in many areas leaves no other choice for companies except to innovate if they want to stay afloat (Williams, 1992). There are many determinants that influence the innovation process in the companies. External knowledge, which companies acquire to complement the existing internal knowledge in the company, represents one of the most influential groups (Belderbos et al., 2004; Prokop & Stejskal, 2019). It is clear because firms cannot solely rely on their technologies and knowledge. To stay competitive, firms must acquire knowledge from the outside. As Chesbrough states (for example, Chesbrough, 2012), "not all smart people work for us, and not all smart ideas originate in our company". Therefore, external knowledge is one of the main components that help companies introduce new products and services, as many researchers emphasize (Cassiman and Veugelers, 2006; Trantopoulos et al., 2017; Stejskal et al., 2018). One of the options for how external knowledge can be obtained is a collaboration with other firms (Das and Teng, 2000). However, there are also other ways. R&D activities, expansion to foreign markets, education of employees, and investments from the outside are often cited as the most influential factors for innovation. (Ehrenberger et al., 2015; Lin, J.Y., Yang, C.H., 2020).

Many researchers previously studied the influence of external knowledge on innovation. Regarding examples, Duong et al. (2022) studied whether family or non-family firms use external knowledge more effectively in Belgium. Yu and Lee (2017) found that collaboration with research organizations positively influences the innovativeness of companies in Korea. Concerning the country of our study, Ehrenberger et al. (2015) were looking for factors influencing innovation in small and medium enterprises in the Czech Republic. It's an important observation as research organizations are among the main sources of external knowledge for businesses. Yu and Lee (2017) defined that a firm's innovation orientation, age, and size significantly impact innovation performance. Larger and older firms have better abilities to use external collaboration to increase innovation performance. Authors also suggest differentiation by the decision-making structure of the company to test the effect of research collaboration on innovation performance, based on the conclusions of Jansen et al. (2005), who came to the conclusion that less decentralized companies are more likely to explore and implement innovations than centralized ones.

Numerous researchers tested the influence of the organizational structure of the company on innovativeness (Cosh et al., 2012; Yang et al., 2015; Sari et al., 2022). As previous studies showed, the influence of the decision-making structure on innovations in companies is not obvious (Yang et al., 2015; Sari et al., 2022). Also, there are discussions on the significance of external knowledge in the company's innovation process depending on the company's characteristics (Trantopoulos et al., 2017; Duong et al., 2022). It motivates us to find out whether the acquisition of external knowledge is an influential factor in the company's innovation performance and define which conditions facilitate the efficient use of external knowledge.

Summing up, *the first aim of this study is to test whether the acquisition of external knowledge is an influential factor for innovation performance in Czech companies. The second aim is to determine if the decision-making structure of Czech companies matters when it comes to the acquisition of external knowledge for innovation.* Our research delivers important results that will help to better understand the nature of external knowledge acquisition by companies by adding valuable distinctions between firms of different legal statuses and decision-making structures. A firm's management structure may speed up or slow down processes inside the firm, including the innovation processes. We test the effectiveness. It will allow us to define more precisely the main factors that influence the effectiveness of external knowledge acquisition.

The rest of the paper is organized as follows: Section 2 contains an overview of the literature with the innovation theories and studies that mention the effect of external knowledge and other factors on innovation. Section 3 contains data and methodology description. Next, we present the results and their discussion in Section 4. In the last part, we conclude our paper, including a summary of contributions and suggestions for future research.

2. Hypothesis Development and Literature Review

External knowledge is usually defined as all the know-how, patents, and inventions obtained by a company outside its borders, including from other businesses and organizations (Loree et al., 2011). In this study, we therefore understand external knowledge as patents, know-how, inventions, and other types of knowledge acquired from other businesses and organizations. This understanding reflects the definition by the World Bank Enterprise Survey that we use as our data source. Several scientists proved the important role of external knowledge in the innovation processes in enterprises. Laursen and Salter (2006) found proof that the implication of external knowledge has a positive impact on innovations in the UK manufacturing industry. Ahuja and Katila (2001) noticed the same link for the leading world's chemical enterprises, and Un et al. (2010) discovered the positive influence of R&D collaboration on product innovation. Ben Arfi et al. (2018) discovered that the positive impact of knowledge on green innovation in firms depends on a combination of internal and external sources of knowledge. Chatterji and Fabrizio (2014) define that not only other firms and universities may be the sources of external knowledge but also the customers. And the acquisition of user experience positively influences product innovation in the medical industry. The mentioned research outcomes lead to the formulation of our first hypothesis when we examine if such factor as external knowledge is important in the innovation process. Here, we understand the innovation process as the introduction of innovation of two types (product or process). Moreover, we will use internal R&D activities and R&D activities with contractors as additional independent variables (described below).

H1: Acquisition of external knowledge positively affects the implementation of product and process innovations by enterprises.

This type of analysis is highly relevant to our chosen territory, i.e., the Czech Republic, which belongs to the group of Central and Eastern Europe (CEE). CEE countries are generally understood as countries where innovative firms often depend on external knowledge and technology (see, for example, Prokop, Stejskal, Klimova & Zitek, 2021). Moreover, against policymakers' expectations, these countries do not grow based on research-driven innovation (Radošević, 2017).

As Jansen et al. (2005) and Yu and Lee (2017) suggested, decentralized companies are more willing to explore and implement new technologies. However, Yu and Lee (2017) mentioned that there is still a gap in understanding how the decision-making structure of the firm may influence its innovation activities and suggested this direction for future research. Decentralized companies are more willing to innovate, as evidenced by Cosh et al. (2012) for UK firms. The role of the supervisory board in the innovativeness of the firm, by which we differentiate the firms, was studied by Jasinski (2019). Yang et al. (2015) discovered that the interconnection between centralization and innovation performance in Chinese companies depends on the information flow inside the company and the motivation of workers. This study is close to our research, as it also deals with knowledge as an influential factor in innovation performance and divides companies by their decision-making

structure. Sari et al. (2022) proved the positive influence of the time in power of the supervisory board on innovation performance in Indonesia. However, there is still a lack of studies that would directly test the influence of organizational structure on innovativeness (as suggested by Jansen et al. (2005) and Yu and Lee (2017)). From here, we formulate our second hypothesis.

H2: Less centralized companies (with supervisory boards, those that have market shares) are better at exploiting external knowledge to create innovations.

Except for the primary independent variable, we also investigate the influence of other related indicators on innovation performance, namely R&D activities inside and outside the firm. These variables were used, in particular, by Ehrenberger et al. (2015) and Prokop et al. (2021). Ehrenberger et al. (2015) found R&D activities inside the firm as the most significant contributor to innovations among SMEs in the Czech Republic. Prokop et al. (2021) used many different components of internal and external R&D and knowledge to test their influence on companies' innovation performance in Central and Eastern Europe. Authors concluded that firms in catching-up CEE countries depend more on internal than external sources of knowledge and R&D in general, despite the increasing role of the foreign knowledge. We use the internal and external R&D variables to test whether they are influential, alongside the external knowledge variable.

We include age and size as control variables for our analysis. Yu and Lee (2017) found that older and larger firms benefit more from getting outside knowledge. According to Penrose and Penrose (2009), older firms tend to accumulate more resources, allowing them to support innovations to a greater extent. The opposite result, however, was found by Huergo and Jaumandreu (2004) for Spanish firms. Ettlie and Rubenstein (1987) proved that larger firms are more likely to introduce innovations than smaller ones. Sari et al. (2022) found the negative influence of the company's size on innovativeness. We seek to approve or disapprove the results of the studies mentioned above.

3. Methods and Data

3.1 Methods and Description of Data

We applied multiple linear regression and used SPSS software to get our results. This software was, in particular, used by Torres de Oliveira et al. (2022) for their research on the influence of external knowledge on innovations. Our data is divided into two and three groups based on the presence of the supervisory board and legal status, respectively. As a data source for our paper, we used the World Bank Enterprise Survey for the year 2019. The survey contains data on enterprises, including information about innovation performance, external knowledge acquisition, and on size and age of companies. In total, we included all the inputs except those with missing values – the data for 499 Czech companies. We differentiate the companies by two criteria described as decision-making structure: legal status (shareholding with traded shares, shareholding with non-traded shares, sole proprietorship) and presence/absence of the supervisory board. We follow the suggestions of Jansen (2005) and Yu and Lee (2017).

3.2 Dependent, Independent, and Control Variables

We have two dependent variables, product and process innovations. These two types of innovations are the most widespread, and both are mentioned in the World Bank Enterprise Survey. Duong et al. (2022) concentrated solely on product innovations, following the works of De Massis et al. (2015) and Ettlie and Rubenstein (1987).

We include two other independent variables, namely R&D activities inside the firm and R&D activities contracted with other companies. These indicators show whether the firm spent any resources on the research activities in the firm itself or agreed on the research with outside contractors. These variables were used by Ehrenberger et al. (2015), who found R&D activities inside the firm as the most significant factor for innovations in Czech companies. The age and size of the firm are used as control variables, based on a paper by Yu and Lee (2017). We described all our variables in Table 1. We sort firms by size according to the European Commission classification: small enterprises are those having less than 50 employees, medium-sized enterprises have from 50 to 250, and large are those counting more than 250.

Table 1: Description of Variables

Variable	Type	Description	Categories
Acquisition of external knowledge	Independent	Over the last three years, did this establishment spend on the acquisition of external knowledge?	1 = yes; 2 = no
R&D inside the company	Independent	Over the last three years, did this establishment spend on research and development activities within the establishment?	1 = yes; 2 = no
R&D with contractors	Independent	Over the last three years, did this establishment spend on research and development activities contracted with other companies?	1 = yes; 2 = no
Product innovations	Dependent	During the last three years, has this establishment introduced new or improved products or services?	1 = yes; 2 = no
Process innovations	Dependent	During the last three years, has this establishment introduced any new or improved processes?	1 = yes; 2 = no
Age	Control	In what year did this establishment begin operations? (2019-year)	1 = 0–10; 2 = 10–20; 3 = 20–30; 4 = more than 30.
Size	Control	At the end of the fiscal year, how many permanent, full-time individuals worked in this establishment?	1 = 0-50; 2 = 51-250; 3 = more than 250.

4. Results and Discussion

We divide our results into two parts. The first part is for differentiation by legal status (Table 2), the second part is for division by the presence/absence of the supervisory board (Table 3). We also divide results based on the dependent variable, whether it is product or process innovations.

Table 2. Results of Regression for Different Legal Status

Product innovations						
	Traded shares		Non-traded shares		Sole proprietorship	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
External knowledge	0.500	0.064	0.112	0.089	0.285	0.274
R&D inside	0.068	0.762	0.223	0.000***	0.468	0.003**
R&D contract	-0.081	0.785	0.113	0.114	-0.005	0.979
Age	0.004	0.975	0.014	0.605	0.051	0.425
Size	-0.040	0.793	-0.067	0.064	-0.074	0.469
Process innovations						
External knowledge	-0.015	0.958	0.085	0.173	-0.032	0.868
R&D inside	-0.088	0.716	0.080	0.105	0.440	0.000***
R&D contract	0.132	0.679	0.208	0.002**	0.318	0.032*
Age	-0.149	0.248	-0.046	0.084	-0.071	0.143
Size	0.080	0.623	-0.075	0.027*	0.048	0.532

Significance: * - 0.05 ** - 0.01 *** - 0.001

Results in Table 2, for differentiation in legal status, show the outcome opposite to the expected. Surprisingly, in cases of both types of innovation, external knowledge doesn't have an influence in the case of any type of legal status of a business. External knowledge, or any other factor, does not influence product or process innovations in less centralized companies, those with shares traded on the market. Therefore, we conclude that such factor as the company's legal status doesn't impact the connection between the acquisition of external knowledge and innovations. Such an outcome contradicts the outcomes discovered in studies of Yu and Lee (2017) and Jansen et al. (2005), who suggested research on decision-making structure and innovations and claimed that less centralized companies are more willing to explore and innovate, respectively. Though, the outcome could correspond to the results of Inkinen et al. (2015), who find other characteristics of a company's management, such as strategic management practices, essential for a company's innovation performance. By contrast, we confirmed that R&D activities have a high impact on innovations, and what is remarkable is more in centralized types of proprietorship than decentralized ones. The most influential among all factors turned out to be the R&D activities inside the company, and it had influence in half of the cases and with high significance. This result is in line with Ehrenberger et al. (2015), in whose study, R&D activities inside the firm were found to be the most influential factor in Czech SMEs. Regarding control variables, size was proved to have an influence only in one of the three cases, and this influence was negative. The same result was achieved in the study of Sari et al. (2022) for Indonesian companies.

Table 3: Results of Regression for Present/Absent Supervisory Board

Product innovations				
	Present		Absent	
	Coefficient	p-value	Coefficient	p-value
External knowledge	0.298	0.008**	0.094	0.188
R&D inside	0.274	0.003**	0.233	0.000***
R&D contract	0.067	0.576	0.103	0.175
Age	0.066	0.211	0.012	0.667
Size	-0.143	0.024	-0.045	0.255
Process innovations				
External knowledge	0.164	0.171	0.063	0.320
R&D inside	-0.079	0.424	0.175	0.000***
R&D contract	0.218	0.095	0.205	0.002**
Age	-0.005	0.933	-0.062	0.014*
Size	-0.054	0.429	-0.064	0.070

Significance: * - 0.05 ** - 0.01 *** - 0.001

Our results in Table 3 show that the acquisition of external knowledge has an impact only on product innovations in companies where the supervisory board is present. It partially proves hypothesis number two, which says that less centralized companies are better at innovation implementation. But, what is more important, hypothesis number one is proven here, as less centralized companies (with supervisory boards) have an impact of external knowledge on product innovations, while more centralized (without supervisory boards) - don't. These results are in line with the conclusions of Duong et al. (2022), who found that in certain types of firms, external knowledge has a positive impact on product innovations, and with the research of Jansen et al. (2005), who suggested that less centralized companies are better at using the external knowledge for innovations. Hypothesis number one is proven only in the case of product innovations, which corresponds to the results of Kobarg et al. (2019), where product innovations were studied.

Besides that, a valuable outcome is that in the case of more centralized management (non-traded shares, sole proprietorship), such factors as internal/external R&D activities have more impact in the case of process innovations than in companies with the less centralized type of management. Such results match the conclusions of Un et al. (2010) and Ehrenberger et al. (2015), who proved the significant influence of R&D activities on

companies' innovations. Nevertheless, Un et al. (2010) had such results for product innovations, and the authors explained it by a wise choice of collaborators outside the companies. Ehrenberger et al. (2015) also noticed the influence of size on the intensity of R&D activities inside the firm, as bigger companies tend to have them more. The control variables didn't turn out to be substantial in this case, as well as in the previous test. Age is significant only in process innovations when the supervisory board is absent.

5. Conclusions

In our study, we tested the role of external knowledge in creating innovations in Czech companies. We used a sample of 499 enterprises from different industries of different ages and sizes. The study resulted in several repercussions. First, no effect of separation by legal status was found. Our hypothesis that companies with decentralized structures are better at using external knowledge was unconfirmed. In this instance, other independent variables, namely expenditure on R&D activities, had an influence on both types of innovations. The unexpected part is that the influence is stronger when the company's structure is more centralized. This result contradicts our hypothesis assumption.

Nevertheless, the hypothesis on the effect of decision-making structure was proved after testing it for the supervisory board variable. However, this suggestion was confirmed only for product innovations. Control variables didn't have the expected influence. The most important outcome of our study is that the acquisition of external knowledge has a positive impact on product innovations in companies with supervisory boards. It proves the second and partially the first hypotheses of our study. External knowledge has more influence on innovation performance in less centralized companies than in more centralized ones. Such an outcome is in line with the results of Duong et al. (2022), who proved that efficiency in using external knowledge for product innovations depends on the internal characteristics of the firm.

The findings of our study are potentially beneficial for further research in the field. They show that the legal status of the firm is insignificant for the innovations using external knowledge. They also show that the presence of the supervisory board and the firm's age and size have limited influence on the company's innovations. Based on this information, researchers can define more precise aims of their studies.

Our study has certain limitations. Our outcomes are bounded by the availability of data from the World Bank. Also, we tested the influence of independent variables only in one country. In further research, more countries could be included in the analysis, for example, other countries from CEE. Moreover, other characteristics of the firm, like sector or environmental orientation, could be tested if a wider variety of data is available. Our results could also be supported in the future using more variables and a mix-method approach combining, for example, other methods, such as partial least squares structural equation modeling and fuzzy-set qualitative comparative analysis (see, for example, Prokop & Hajek, 2023).

Acknowledgement

This paper was supported by grant No. SGS_2023_011 from the University of Pardubice Student Grant Competition.

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