The Influence of Financial Sourcing and Collaboration on Innovative Company Performance: A Comparison of Czech, Slovak, Estonian, Lithuanian, Romanian, Croatian, Slovenian, and Hungarian Case Studies

Viktor Prokop, Jan Stejskal, and Petr Hajek

Abstract Many authors emphasize that regions are key elements and political tools for economic growth and that regional competitiveness significantly shapes entrepreneurial behavior, and also say, that high-tech firms choose their location based on their assessment of regional competitiveness (productivity, innovations) and that highly innovative firms settle in highly competitive regions. Scholars analyze the knowledge spillovers and their impact on firms' productivity, demand and successful implementation of product and process innovations. Other scholars suggest that for economic growth promotion it is necessary to take actions to support the creation and dissemination of knowledge, to support research and development activities, investment in appropriate infrastructure and communication technology. Therefore, the significance of innovation is today more and more frequently emphasized as a key engine for regional growth, standard of living and international competitiveness. The goal of this chapter is to provide an analysis and evaluate the influence of selected drivers—determinants of the knowledge economy on the selected output—turnover from innovated production and provide some practical implications for policy makers not only in selected countries. The analysis will be conducted by using a multiple linear regression models constructed by the authors. Results show that determinants of innovation activities vary across countries and, separately, influence innovation activities less than in combination with each other. These findings confirm previous studies on the general shift towards a knowledge economy and the importance of factors such as knowledge, innovation and cooperation with different partners that allow the creation of synergies and spillover effects.

V. Prokop (✉) · J. Stejskal · P. Hajek
Faculty of Economics and Administration, University of Pardubice, Pardubice, Czech Republic
e-mail: viktor.prokop@upce.cz; jan.stejskal@upce.cz; petr.hajek@upce.cz

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1 Introduction

Currently, competitiveness is a topic that is frequently discussed and dealt with in economic analysis. This applies not only to individual companies or sectors but also to regions by whatever definition. Competitiveness is an entity's ability to be successful in a competitive environment so that its goals are achieved to the greatest possible extent (and in the most effective way). In fact, competitiveness is considered to be one of the most significant determinants of economic development; gradual increase of this determinant results to the fulfillment of objectives of regional policy and to the growth of welfare, quality of life and long-term economic development (Amin 1999; Prokop and Stejskal 2015b). Companies must respond dynamically to adapt to the situation on international markets. They must change production processes and find new resources for the needs of innovative production. These consist of valuable knowledge and skills that complement their own capabilities. Firms must dramatically change their innovative activities as well as company strategy and the company's access to innovations (Autio et al. 2014). Similarly, entrepreneurs must understand that firms are part of an innovative environment where individual entities affect others. This innovative environment plays an important role in the innovation process at the firm level (Stejskal and Hajek 2012). Knowledge, spillover effects, cooperation, and complex R&D have become the new production factors in this third phase. These factors, mainly cooperation activities with other firms or institutions, open up opportunities for accessing complementary technological resources (such as skill sharing), which can contribute to faster innovation development, improved market access, economies of scale and scope, cost sharing, and risk spreading (De Faria et al. 2010).

There are many methods of achieving maximum effectiveness. On one hand, they are dependent on the type of entity in question, but they are also influenced by the environment and the conditions of the economic system surrounding the competing entities. Sources of competitive advantage also continue to develop within the current globalized system; therefore, researchers also try to discover the most effective possible way to increase competitiveness both for economic entities and regions (and, thus, for the entire economy). Thanks to globalization and technological progress, methods of communication, the Internet and IT technology are important production factors that often play a key role in achieving competitiveness (Chen et al. 2004). More and more often, these results in progress towards a knowledge economy, in which knowledge represents an important national, regional or company asset that creates a source of competitive advantages (McAleer and Slottje 2005). Each entity's economic potential is determined by its ability to create, use and share knowledge (Malecki 2000).

Knowledge and the ability to transform it into innovation are becoming the foundation for individual regional and national economic systems. These often try to support the creation, acquisition and transfer of knowledge—both financially and non-financially. In this way, the economy often becomes dependent or based on knowledge. Regarding each government's limited financial possibilities, the

question arises as to the effectiveness of such attempts (and support for such attempts) to create and develop a knowledge economy. There are no standard, generally recognized methods that are able to determine to what degree an economy is based on knowledge (Kitson et al. 2004). Various studies argue about whether economies' knowledge base is measurable or how to measure a knowledge economy's outputs, which are necessary for different types of economic analysis (Leydesdorff et al. 2006). That is why it can be very difficult to evaluate the effects of each driver (determinant) in innovation environment. Typical examples are the effects of the soft determinants—for example the level of cooperation. The second determinant what is difficult to evaluate, is the public support, i.e. financial resources to support collaboration and knowledge transfer, acquisition and application in practice. Very often the (mainly the support from the EU budget and national budgets are applied).

Therefore, the goal of this chapter is to provide an analysis and evaluate the influence of selected drivers—determinants of the knowledge economy on the selected output—turnover from innovated production and provide some practical implications for policy makers not only in selected countries. The analysis will be conducted by using a multiple linear regression models constructed by the authors.

The remainder of this chapter is divided in the following way. The first two sections are focused on the knowledge economy and the determinants of environment what lead to innovations. The third section describes the methodology, analysis and results. The last section comprises the research's concluding evaluations and provides practical implications for policy makers.

2 The Innovation Environment and the Drivers[1]

Economic development and the gradual improvement of the living conditions in a country and its regions is a basic long-term strategic goal (Safiullin et al. 2012; Pachura and Hájek 2013). Many authors emphasize that regions are key elements and political tools for economic growth and that regional competitiveness significantly shapes entrepreneurial behavior, and also say, that high-tech firms choose their location based on their assessment of regional competitiveness (productivity, innovations) and that highly innovative firms settle in highly competitive regions (Boschma 2004; Annoni and Kozovska 2010; Prokop and Stejskal 2015a). This leads to the attempt by regional governments to look for the most effective possible ways to increase their regional competitiveness—i.e., one of the main engines for the region's growth (Snieska and Bruneckienė 2009; Stejskal and Hajek 2012). A number of factors influence the success of these attempts.

One of these is knowledge, which has been an increasingly significant production factor as of the start of the twenty-first century (Malecki 2000). This fact is supported

[1] Adopted from Prokop et al. (2017)

by a number of studies investigating the connection between the increase in regional competitiveness and knowledge (Audretsch et al. 2012; Kwiek 2012; Sum and Jessop 2013; Camagni and Capello 2013). Knowledge undoubtedly represents a new source of economic growth; however, from the economic perspective, utilizing knowledge is not a new issue (Snieska and Bruneckienė 2009). Around 1911, Schumpeter had already come up with the idea of using knowledge and its combinations as a foundation for innovative activities and entrepreneurship and we can see a shift from material and capital inputs to the input information, respectively knowledge (Cooke and Leydesdorff 2006; Hajek and Stejskal 2015). The number of scholars analyzes the knowledge spillovers and their impact on firms' productivity, demand and successful implementation of product and process innovations. Other scholars suggest that for economic growth promotion it is necessary to take actions to support the creation and dissemination of knowledge, to support research and development activities, investment in appropriate infrastructure and communication technology. Therefore, the significance of innovation is today more and more frequently emphasized as a key engine for regional growth, standard of living and international competitiveness (Acs et al. 2002a). The role of knowledge and its ties to innovation and economic performance continues to be more frequently analyzed (Shapira et al. 2006). It is clear that it is no longer possible to attain economic growth in the same ways as in the past, i.e., by hiring an ever greater number of workers as an input resource or by increasing consumer demand (Pulic 1998; Chen et al. 2004). Therefore, individual economic entities must seek new ways of keeping up with the competition and coping with the tempo of quick changes (Stejskal and Hajek 2015). New, economically useful knowledge that leads to the creation of innovation (product or process) therefore plays a significant role in (i) achieving economic growth; (ii) international trade; and (iii) regional development (Acs et al. 2002b).

The efforts to save the resources during the innovation production (product, service and process or marketing innovations), the accelerating their entry into the market and the gaining a competitive advantage in a globalized economy, these all lead to massive use of the second determinant of the innovation environment. The cooperation is this second determinant (Lee et al. 2012; Fitjar and Rodríguez-Pose 2013). A common platform of cooperation is a variant of the (quadruple) triple helix (Leydesdorff 2012). It is proven in many studies that cooperation (in all its forms: cooperation only within the enterprise or business networks; collaboration with universities and research institutions, and broad platform for industry-university-government cooperation) contributes to the formation of innovations, it accelerates and cheapens the all processes (Lee et al. 2012; Fitjar and Rodríguez-Pose 2013; Schilling 2015). However, there has been intensive cooperation; many conditions in the economic environment must be fulfilled (e.g. generally positive business atmosphere, trust or creation of the appropriate incentives for development of cooperation at various levels). Due to globalization, it is not necessary to think about collaboration just on a regional level or platform (Conrad et al. 2014). On the other hand, studies point to the fact that the level of trust with the increasing distance of the cooperating entities is decreased (Connell et al. 2014).

Many studies highlight the fact that effective collaboration requires the creating of favorable business environment, adequate incentives to innovation processes and helpful attitude from the public sector (Kaihua and Mingting 2014; Wang et al. 2016). A common characteristic of the listed drivers is the public support, which can help to create the above mentioned environment, and initiate the cooperation on the (initially the mostly) regional level (De Blasio et al. 2015). The practice shows that public support providing to foster innovation is not very effective. Often, businesses are investing own funds in own R&D activities; respectively they invest the internal money to innovative collaboration (Bronzini and Iachini 2014). The second option is to purchase knowledge or whole innovation in the market by other economic subject, which is also financed from internal funds. Given the EU's interest to maximize the production of innovations and innovative products on its territory, there are many grants in this area and to various entities (including businesses, public sector organizations, knowledge-based sectors, as well as other support organizations and agencies). Condition for the disbursement of European funds is often the co-financing from national and internal funds. The evaluating the effectiveness of this public support is very problematic as evidenced by numerous studies (Zúñiga-Vicente et al. 2014; De Blasio et al. 2015). There are many obstacles for detailed analysis, for example missing micro data, very long period between using money and the innovation birth, missing output criterion and very of the un-measurable quality etc. (Czarnitzki and Lopes-Bento 2013). There are many studies that demonstrate the positive effects of public funding, but some authors are critical and the effectiveness of public subsidies is evaluated as inadequate (Antonioli et al. 2014).

Many mentioned studies show that in various countries the situation is different. Often the settings of financing terms, bureaucracy procedures or the existence of different legal barriers are different. Our previous research (e. g. Prokop and Stejskal 2016a, b) shows that many of the drivers of innovation environments operate independently and influence positively the outcome of the innovation process. On the other hand, the effects what are generated from the combination of different drivers were detected and analyzed. But there is no international comparative study that would analyze the combination of drivers and compared the situation internationally.

3 Data and Methodology

Data for the analyses were obtained from the Community Innovation Survey for 2010–2012. The Community Innovation Survey (CIS) is a harmonized questionnaire, which is part of the EU's science and technology statistics; it is carried out every 2 years by the EU member states and a number of ESS member countries. For our analysis, we created original multiple linear regression models that are commonly used for these kinds of analyses (e.g. Nieto and Quevedo 2005; Chen and Huang 2009; Bishop et al. 2011—logistic regression; Schneider and Spieth 2013—multiple linear regression) and therefore we suppose these models sufficient. We investigate

the relationship between one dependent variable, represented by the % of turnover in new or improved products introduced during 2010–2012 (new to the market), and a number of selected independent variables (innovation activity determinants, see Table 1). In total, we analyzed 10,804 enterprises from 8 countries (see Table 2) from the manufacturing industries (NACE Categories 10–33).

Regression models take the general form as follows (Chatterjee and Hadi 2013):

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n + \varepsilon \quad (1)$$

where:

y is a dependent variable;
$x_1, x_2 \ldots x_n$ are independent variables;
ε is an error term that accounts for the variability in y that cannot be explained by the linear effect of the n independent variables;

Table 1 Independent variables

Financing	Cooperation	Innovation	Firm activities	Other
Public funding from local or regional authorities (FUNLOC)	Government or public research institutes (CO_GOV)	Introduced a new or significantly improved product into the market (INN_G)	Merge with or take over another enterprise (ENMRG)	The largest market in terms of turnover between 2010–2012 (LARMAR)
Public funding from the central government (FUNGMT)	Other enterprises within an enterprise group (CO_GP)	Introduced a new or significantly improved service into the market (INN_S)	Sell, close, or outsource some of the company's tasks or functions (ENOUT)	Participation in a group of enterprises (GP)
Public financial support from the EU (FUNEU)	Suppliers of equipment, materials, components, or software (CO_SUP)	Introduced a new or significantly improved process into the market: method of production; logistic, delivery, or distribution system; supporting activities (INN_P)	Establish new subsidiaries in [home country] or in other European countries (ENNWEUR)	
	Clients or customers (CO_CUS)		Establish new subsidiaries outside Europe (ENNWOTH)	
	Universities or other higher education institutions (CO_UNI)			

Legend: The % of total turnover in 2012 was used to determine expenditures

Table 2 Number of companies analyzed in selected countries

Country	Number of companies
Czech Republic	3110
Hungary	2799
Slovak Republic	870
Romania	3982
Croatia	1280
Slovenia	918
Estonia	921
Lithuania	906

Source: Authors' own calculations

$\beta_1, \beta_2 \ldots \beta_n$, called the regression parameters or coefficients, are unknown constants to be determined (estimated) from the data.

Verification of whether the data from the CIS were correlated was conducted using Spearman's test. Spearman's coefficient (r_s) measures the strength of the linear relationship between each two variables when the values of each variable are rank-ordered from 1 to N, where N represents the number of pairs of values (the N cases of each variable are assigned integer values from 1 to N inclusive, and no two cases share the same value). The difference between ranks for each case is represented by d_i. The general formula for Spearman's rank correlation coefficient takes the general form as follows (Weinberg and Abramowitz 2002; Borradaile 2013):

$$r_s = 1 - \frac{6\sum d_i^2}{N^3 - N} \tag{2}$$

The values of Spearman's test rejected the hypothesis that the data are correlated with a level of significance at $p < 0.05$. Moreover, we also tested the collinearity among the independent variables by using Variance Inflation Factor (VIF) for each regression model (country). Multicollinearity was not observed in any of the models (VIF < 5).

All calculations were made using the statistical software STATISTICA (StatSoft Inc. 2011). After fulfilling the first prerequisite (uncorrelated data) and the rejection of multicollinearity in the model, the analysis itself was conducted.

4 Drivers of Innovative Activities Analysis

For every country, we created 8 models (M1–M8) analyzing the influence of selected variables (Table 1) and the creation of spillover effects. Firstly, we analyzed the relationship between each of the independent variables (the determinants of innovative activities) and the target (dependent) variable (the growth of turnover from innovated products between 2010–2012). This is presented in model M1. Most

of the determinants of innovation activities differ within countries and most of these determinants do not influence the innovation activities separately. There are number of studies that analyze the spatial distribution of innovative activities and the role of technological spillovers in the process of knowledge creation and diffusion across firms, regions, and countries (e.g., Moreno et al. 2005; Cabrer-Borras and Serrano-Domingo 2007; Lee et al. 2015). For example, Fritsch and Franke (2004) investigated the impact of knowledge spillovers and R&D cooperation on innovation activities in German regions; Andersson and Ejermo (2005) showed that there is a positive relationship between the innovativeness of a corporation and its accessibility to university researchers in Sweden; and Dahl (2002) and Engelstoft et al. (2006) analyzed knowledge flows within clusters in Denmark with respect to spillover effects as a positive technological externality.

Therefore, we subsequently analyzed how the addition of variables and their interactions could influence the strength of models. We created other advanced models (M2–M8) that analyzed influence of public funding and cooperation on dependent variable. We analyzed influence of combinations between public financing and cooperation within groups of companies (M2), cooperation with suppliers (M3), cooperation with customers (M4), cooperation with universities (M5), cooperation with government or public research institutes (M6). We also analyzed influence of combinations between cooperation with universities and other cooperation partners (M7) and influence of combinations between cooperation with government or public research institutes and other cooperation partners (M8). All results (for all selected countries) are shown in following Sects. 4.1–4.8.

4.1 Romania

In Romania, spillover effects rarely occurred because of a lack of innovative background and facilities. The results in Table 3 show that the majority of the research results are not significant. We assume that there are other factors that affect the output variable than those examined in this study. The most significant determinant of innovative activities in Romanian companies seems to be collaboration. It is apparent from the various models that the companies working together with their suppliers (on a regular supplier-customer base) positively influenced their innovation outcomes. Surprisingly, it was found that collaborating with customers did not lead to changes that would positively affect any subsequent levels of revenue from innovation. Romanian businesses also collaborated with public research organisations. Collaboration with them also positively influenced the innovation outputs and, consequently, innovation revenue.

Examining the combination of the effects of the selected variables does not yield any results. No form of public support acts sufficiently strongly on innovation activities and does not affect the output variable significantly. No significant (and positive) effect of collaboration or public funding of innovative activities was revealed.

Table 3 Romania

	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	0.219	0.208*	0.157	0.165	0.224**	0.218**	0.197*	0.223**
GP	−0.012	−0.012	−0.013	−0.013	−0.012	−0.013	−0.012	−0.012
LARMAR	−0.010	−0.011	−0.012	−0.012	−0.010	−0.010	−0.011	−0.012
FUNLOC	−0.076	−0.075	−0.016	−0.020	−0.077	−0.072	−0.078	−0.074
FUNGMT	−0.014	−0.014	−0.015	−0.027	−0.010	−0.019	−0.016	−0.017
FUNEU	−0.033	−0.021	−0.029	−0.030	−0.036	−0.030	−0.034	−0.035
CO_GP	−0.008	0.003	−0.005	−0.010	−0.008	−0.007	−0.005	−0.014
CO_SUP	0.050	0.050**	0.164**	0.045*	0.051**	0.047	0.029	0.050**
CO_CUS	−0.066	−0.064***	−0.071***	0.022	−0.066***	−0.065	−0.084**	−0.077***
CO_UNI	0.001	−0.002	0.004	0.008	0.001	−0.006	0.021	0.003
CO_GOV	0.042	0.041*	0.043*	0.043*	0.043*	0.034	0.034	0.033
ENMRG	0.046	0.046	0.046	0.050	0.045	0.050	0.051	0.049
ENOUT	0.004	0.005	0.005	0.006	0.004	0.008	0.005	0.008
ENWEUR	0.046	0.046	0.047	0.045	0.046	0.038	0.036	0.023
ENNWOTH	0.074	0.074	0.072	0.069	0.073	0.065	0.067	0.079
INN_GOOD	−0.001	−0.001	−0.001	−0.001	−0.0001	0.001	−0.002	0.001
INN_SERV.	−0.022	−0.022	−0.023	−0.020	−0.022	−0.021	−0.019	−0.020
INN_PROC.	−0.006	−0.005	−0.006	−0.006	−0.006	−0.008	−0.009	−0.007
FUNLOC*CO_GP		0.000						
FUNGMT*CO_GP		0.001						
FUNEU*CO_GP		−0.015						
FUNLOC*CO_SUP			−0.120*					
FUNGMT*CO_SUP			0.004					
FUNEU*CO_SUP			0.001					
FUNLOC*CO_CUS				−0.114				

(continued)

Table 3 (continued)

	M1	M2	M3	M4	M5	M6	M7	M8
FUNGMT*CO_CUS				0.035				
FUNEU*CO_CUS				−0.001				
FUNLOC*CO_UNI					0.000			
FUNGMT*CO_UNI					−0.008			
FUNEU*CO_UNI					0.005			
FUNLOC*CO_GOV						0.000		
FUNGMT*CO_GOV						0.036		
FUNEU*CO_GOV						−0.008		
CO_UNI*CO_GP							−0.012	
CO_UNI*CO_CUS							0.028	
CO_UNI*CO_SUP							0.032	
CO_UNI*CO_GOV							0.014	
CO_GOV*CO_GP								0.013
CO_GOV*CO_CUS								0.029
CO_GOV*CO_SUP								−0.016
CO_GOV*CO_UNI								0.008
R2	0.081	0.081	0.090	0.097	0.081	0.088	0.094	0.088

***sig. at $p < 0.01$; **sig. at $p < 0.05$; *sig. at $p < 0.1$

Romania is a typical example of a country where there is an innovation paradox. In this country, a background for innovation is missing, and the country faces obstacles in elements of its environment (e.g., insufficient infrastructure). Therefore, determinants of innovative activities are not able to influence the growth of turnover from innovation even if they were provided with sufficient public funds. The country struggles with a lack of absorption capacity but may also be hampered by a lack of demand for innovation outputs (from both enterprises and research organizations). Therefore, we strongly suggest coordinating public policies, building sufficient infrastructure in the country, supporting the identification of innovative needs and the demand for innovation outputs, and helping promote trust among organizations.

4.2 Croatia

The results in Table 4 show that the determinants of innovative activities examined (acting alone) do not affect innovation outcomes and subsequent revenue from innovation in a significant way. The only positive result was revealed in the co-innovation of a group of companies (CO_GP). Here, in all examined models and variants of cross-determinants, positive results have appeared. Similarly, it is possible to say that Croatian companies are influenced by the market in which they operate and which is their target outlet. Even this determinant was able to influence the amount of revenue from innovative production.

Unfortunately, even in Croatia, no positive effects from the combinations and interactions of determinants (collaboration and financing) have been demonstrated. To a certain extent, this testifies to the development of the local knowledge sector and the innovative maturity of manufacturing companies.

In Croatia, the situation was initially similar to that in Romania and most of the determinants did not influence the growth of turnover from innovation on their own (see Table 4).

The results show that Croatian companies do not sufficiently cooperate with each other. This may indicate some type of lock-in problems. However, this approach is justifiable and often occurs in CEE countries. It results from an underdeveloped business environment where public sector institutions are unlikely to contribute to the removal of barriers to entrepreneurship. They also often do not contribute to the creation of innovation systems and do not sufficiently support the involvement and cooperation of various market and non-market entities in them. It is not possible then to create the spill-over effects of knowledge, or other positive externalities resulting from synergy. As a good basis, we can see the positive influence of cooperation in business networks and the willingness to influence the requirements of the target markets and their entities.

We would suggest strengthening cooperation with universities and public research institutes in addition to focusing on promoting cooperation with clients and customers—and with competitors, because these kinds of cooperation has not yet led to significant results. Collaboration with clients is an important element of

Table 4 Croatia

	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	0.219**	0.195*	0.243**	0.210**	0.253***	0.203**	0.180**	0.181*
GP	0.054***	0.052***	0.056***	0.054***	0.057***	0.055***	0.054***	0.054***
LARMAR	0.042***	0.041***	0.043***	0.041***	0.043***	0.044***	0.040**	0.042***
FUNLOC	0.044	0.058	0.037	0.042	0.019	0.041	0.048	0.040
FUNGMT	0.018	0.001	0.017	0.014	0.006	0.006	0.019	0.017
FUNEU	0.001	0.002	−0.012	0.010	−0.010	0.010	0.007	0.006
CO_GP	0.010	−0.017	0.007	0.008	0.005	0.009	0.007	0.005
CO_SUP	−0.003	−0.009	−0.006	−0.004	−0.002	−0.007	−0.037	−0.033
CO_CUS	−0.017	−0.014	−0.017	−0.047	−0.014	−0.014	−0.025	−0.030
CO_UNI	−0.028	−0.029	−0.026	−0.025	−0.048	−0.030	0.012	−0.013
CO_GOV	0.036	0.041	0.034	0.037	0.034	−0.007	0.040	0.063
ENMRG	−0.003	−0.008	−0.003	−0.003	−0.008	−0.007	−0.001	−0.001
ENOUT	0.006	0.005	0.004	0.005	0.002	0.005	0.008	0.007
ENWEUR	−0.007	0.006	−0.007	−0.005	−0.001	0.001	−0.006	−0.015
ENNWOTH	0.004	0.003	0.005	0.004	0.009	0.006	0.001	0.014
INN_GOOD	−0.003	−0.002	−0.001	−0.001	0.002	−0.004	−0.006	−0.008
INN_SERV.	−0.009	−0.009	−0.009	−0.009	−0.007	−0.007	−0.007	−0.011
INN_PROC.	−0.037**	−0.040**	−0.038**	−0.038**	−0.039**	−0.040**	−0.036**	−0.036**
FUNLOC*CO_GP		−0.024						
FUNGMT*CO_GP		0.032*						
FUNEU*CO_GP		0.047						
FUNLOC*CO_SUP			0.025					
FUNGMT*CO_SUP			0.007					
FUNEU*CO_SUP			−0.022					
FUNLOC*CO_CUS				0.014				
FUNGMT*CO_CUS				0.012				

FUNEU*CO_CUS				0.014				
FUNLOC*CO_UNI					0.045			
FUNGMT*CO_UNI					0.024			
FUNEU*CO_UNI					−0.025			
FUNLOC*CO_GOV						0.002		
FUNGMT*CO_GOV						0.023		
FUNEU*CO_GOV						0.045		
CO_UNI*CO_GP							0.004	
CO_UNI*CO_CUS							0.010	
CO_UNI*CO_SUP							0.043	
CO_UNI*CO_GOV							−0.030	
CO_GOV*CO_GP								0.016
CO_GOV*CO_CUS								0.021
CO_GOV*CO_SUP								0.029
CO_GOV*CO_UNI								−0.030
R2	0.095	0.111	0.098	0.098	0.107	0.105	0.104	0.102

***sig. at $p < 0.01$; **sig. at $p < 0.05$; *sig. at $p < 0.1$

competitive advantage, as evidenced, for example, by the lead user theory, which states that user-centered innovation is a very powerful and general phenomenon that supports innovative activities (Von Hippel 1986, 2005). Also, cooperation with competitors can lead to significant results. Gnyawali and Park (2011) state that co-opetition (the simultaneous pursuit of collaboration and competition) is viewed as the sum of many different relationships, and the cooperative and competitive parts are divided between different actors. They also state that it occurs, evolves, and impacts the participating firms and the industry and that it plays an important role in enhancing common benefits as well as in gaining a proportionately larger share of the benefits. Co-opetition is a challenging yet very helpful way for firms to address major technological challenges, create benefits for partnering firms, and advance technological innovation. Moreover, co-opetition between giants causes subsequent collaboration among other firms and results in advanced technological development.

4.3 Slovenia

In Slovenia, interactions of determinants occurred rarely, even though firms effectively utilize the various determinants of innovation activities, and these determinants have strong influence on the growth of the firms' turnover from innovation in the manufacturing industry on their own. An interesting finding is the inability of Slovenian companies to use public funds from the central government effectively. Combination analyses give almost identical results (negative), which enhances the predictive power of these findings. The combination of FUNGMT * CO_GP also negatively affected the output variable. On the other hand, the use of EU resources supporting business networking has been positively evaluated. The development of a high-quality business sector (within the surveyed industry) is supported by the finding that the inclusion of the university and its research into these networks positively supports the turnover from innovative production (0.046***) (Table 5).

Companies in Slovenia are probably not forced to seek new sources of competitive advantage and change their current situation. Narula (2002) states that firms are by definition resistant to radical change, and firms will always to prefer to maintain the status quo if it does not endanger their competitiveness (firms are often slow in changing their dominant designs, because they are path dependent and technologically locked in). By their very nature, all innovation systems have some degree of inertia, and this may lead to lock-in. Moreover, while offering a veneer of protection to existing systems in the shorter term, innovation lock-in tends to create barriers to more sustainable innovation (Aylward 2006); this can lead to a country's decline in innovation performance as well as a decline in its competitive advantage and prosperity.

In Slovenia probably, the firms protect their know-how; there is no trust between firms or between firms and universities or public research institutes, which leads to a lack of cooperation and the lock-in effect. Narula (2002) states that this type of small country, for instance, simply does not have the resources to sustain world-class

Table 5 Slovenia

	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	0.401***	0.407***	0.388***	0.407***	0.403***	0.395***	0.379***	0.395***
GP	−0.017	−0.017	−0.017	−0.017	−0.017	−0.018	−0.019	−0.017
LARMAR	−0.008	−0.008	−0.008	−0.008	−0.009	−0.008	−0.008	−0.008
FUNLOC	−0.019	−0.023	−0.018	−0.026	−0.022	−0.020	−0.015	−0.019
FUNGMT	−0.028*	−0.019	−0.030*	−0.027*	−0.027*	−0.027*	−0.027*	−0.028*
FUNEU	−0.003	−0.011	0.003	−0.004	−0.002	−0.001	−0.004	−0.003
CO_GP	0.003	−0.037	0.002	0.004	0.002	0.005	0.013	0.003
CO_SUP	0.013	0.010	0.055	0.013	0.012	0.012	0.003	0.014
CO_CUS	−0.010	−0.006	−0.010	−0.029	−0.009	−0.011	−0.013	−0.012
CO_UNI	−0.005	−0.007	−0.006	−0.005	0.007	−0.008	−0.015	−0.009
CO_GOV	0.017	0.020	0.018	0.017	0.018	0.001	0.021	0.020
ENMRG	−0.016	−0.016	−0.016	−0.016	−0.017	−0.017	−0.010	−0.015
ENOUT	−0.010	−0.009	−0.010	−0.011	−0.010	−0.011	−0.011	−0.010
ENWEUR	0.014	0.017	0.016	0.014	0.014	0.015	0.007	0.013
ENNWOTH	−0.059	−0.052	−0.055	−0.060	−0.057	−0.053	−0.059	−0.058
INN_GOOD	0.095**	0.100**	0.091**	0.094**	0.095**	0.100**	0.091**	0.097**
INN_SERV.	−0.014	−0.016	−0.017	−0.014	−0.014	−0.014	−0.017	−0.01
INN_PROC.	−0.017	−0.020	−0.018	−0.016	−0.017	−0.018	−0.015	−0.017
FUNLOC*CO_GP		0.021						
FUNGMT*CO_GP		−0.035**						
FUNEU*CO_GP		0.039**						
FUNLOC*CO_SUP			−0.052					
FUNGMT*CO_SUP			−0.012					
FUNEU*CO_SUP			0.015					
FUNLOC*CO_CUS				0.023				

(continued)

Table 5 (continued)

	M1	M2	M3	M4	M5	M6	M7	M8
FUNGMT*CO_CUS				0.006				
FUNEU*CO_CUS				−0.007				
FUNLOC*CO_UNI					−0.017			
FUNGMT*CO_UNI					−0.009			
FUNEU*CO_UNI					0.008			
FUNLOC*CO_GOV						0.005		
FUNGMT*CO_GOV						0.001		
FUNEU*CO_GOV						0.023		
CO_UNI*CO_GP							0.046***	
CO_UNI*CO_CUS							−0.016	
CO_UNI*CO_SUP							0.007	
CO_UNI*CO_GOV							−0.003	
CO_GOV*CO_GP								0.003
CO_GOV*CO_CUS								0.003
CO_GOV*CO_SUP								−0.004
CO_GOV*CO_UNI								0.006
R2	0.064	0.084	0.073	0.066	0.067	0.070	0.090	0.065

***sig. at $p < 0.01$; **sig. at $p < 0.05$; *sig. at $p < 0.1$

competences in as wide a variety of technologies as the economy may require. As such, the knowledge infrastructure may be unable to overcome lock-in as rapidly as firms need to sustain their competitiveness. Innovation lock-in, while offering a veneer of protection to existing systems in the shorter term, tends to create barriers to more sustainable innovation, and this could lead to a decline in a country's innovation performance as well as to a decline in its competitive advantage and prosperity. We therefore propose greater company openness and promoting trust and cooperation between firms as well as between firms and universities or public research institutes. In Slovenia, an open innovation approach is necessary to develop and promote to use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation. This concept is based on different research trends and suggests that valuable ideas can come from inside or outside the company and can also go to market from inside or outside the company (Chesbrough 2006; Chesbrough and Appleyard 2007). Therefore, cooperation is seen as a crucial way to increase firms' growth of turnover and a country's competitiveness.

4.4 Czech Republic

In manufacturing industries in the Czech Republic, regression models in Table 6 showed more interesting results than in the previous countries. The analysis of the influence of the individual determinants on the dependent variable showed that the innovation activity of the Czech companies is influenced mainly by the choice of the target market. Independent financial determinants gave expected results. Funds from local, regional, or national sources do not significantly affect the turnover of innovative companies. EU budget funds affect them, but in all cases negatively. All models have shown that the independent impact of EU subsidies creates a hindrance for processing companies. This is due to an unclear and complicated system of applying for European subsidies, as well as very difficult accounting and a high risk of having to repay the subsidy in the event of violating the usage conditions. These results confirm the obstacles mentioned above in the form of a high degree of bureaucracy and the instability of the legal environment affecting the innovation activity of Czech companies.

As in other countries, no positive impact of collaboration has been demonstrated. Among Czech companies in the basic group, the impact of suppliers (in M3) and universities in the M5 model was confirmed. Collaboration of a business and a university, funded from a European project, resulted in the positive influence of the company's innovation turnover. Other types of funding did not have a significant positive influence on the dependent variable. Other combinations of collaborating entities and type of funding did not provide a significant result.

The results of the analysis show that there are also many important determinants of the innovation environment in the Czech Republic (as in other CEE countries), which are more effective in their ability to innovate. It was found that these

Table 6 Czech Republic

	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	0.260***	0.250***	0.291***	0.256***	0.292***	0.267***	0.242***	0.249***
GP	−0.002	−0.003	−0.003	−0.002	−0.002	−0.002	−0.002	−0.002
LARMAR	0.0180**	0.017**	0.0178**	0.018**	0.019**	0.018**	0.018**	0.0172**
FUNLOC	−0.023	−0.006	−0.041*	−0.015	−0.029	−0.018	−0.023	−0.022
FUNGMT	−0.013	−0.010	−0.014	−0.011	−0.013	0.003	−0.015	−0.013
FUNEU	−0.021**	−0.021*	−0.019**	−0.021**	−0.019*	−0.021	−0.020**	−0.020**
CO_GP	0.001	0.040	0.0019	0.001	0.002	0.001	−0.001	0.003
CO_SUP	0.006	0.007	0.0710***	0.007	0.009	0.007	−0.001	0.007
CO_CUS	−0.010	−0.009	−0.010	0.028	−0.008	−0.009	−0.009	0.002
CO_UNI	0.011	0.012	0.0122	0.012	0.067***	0.013	0.005	−0.008
CO_GOV	−0.010	−0.013	−0.016	−0.013	−0.014	0.002	−0.001	−0.002
ENMRG	0.016	0.017	0.017	0.017	0.015	0.017	0.016	0.016
ENOUT	0.014	0.014	0.015	0.014	0.011	0.014	0.014	0.014
ENWEUR	0.010	0.008	0.008	0.012	0.010	0.008	0.010	0.009
ENNWOTH	0.008	0.004	0.005	0.003	−0.001	0.005	0.010	0.010
INN_GOOD	−0.013	−0.013	−0.011	−0.013	−0.013	−0.015	−0.013	−0.014
INN_SERV.	−0.021**	−0.021**	−0.021**	−0.020**	−0.021**	−0.021**	−0.0204**	−0.022**
INN_PROC.	−0.013	−0.013	−0.012	−0.013	−0.012	−0.012	−0.0137	−0.014
FUNLOC*CO_GP		−0.039						
FUNGMT*CO_GP		−0.010						
FUNEU*CO_GP		0.0026						
FUNLOC*CO_SUP			−0.058**					
FUNGMT*CO_SUP			−0.010					
FUNEU*CO_SUP			−0.010					
FUNLOC*CO_CUS				−0.038				
FUNGMT*CO_CUS				−0.009				

FUNEU*CO_CUS				0.002				
FUNLOC*CO_UNI					−0.054**			
FUNGMT*CO_UNI					−0.039***			
FUNEU*CO_UNI					0.0186*			
FUNLOC*CO_GOV						−0.018		
FUNGMT*CO_GOV						−0.023		
FUNEU*CO_GOV						0.001		
CO_UNI*CO_GP							−0.008	
CO_UNI*CO_CUS							0.004	
CO_UNI*CO_SUP							0.017	
CO_UNI*CO_GOV							0.013	
CO_GOV*CO_GP								−0.003
CO_GOV*CO_CUS								−0.016
CO_GOV*CO_SUP								−0.001
CO_GOV*CO_UNI								0.0232
R2	0.026	0.029	0.034	0.029	0.044	0.029	0.029	0.028

***sig. at $p < 0.01$; **sig. at $p < 0.05$; *sig. at $p < 0.1$

fundamentals are not actually a type of collaboration or financial support. To improve the situation, it is essential to improve the business environment; to encourage "bottom-up" cooperation. Regional innovation systems can be developed across the country to encourage greater collaboration between businesses, universities and other support organisations. Financial frameworks appear to be inadequately defined and targeted, and do not encouragie innovative cooperation. Similarly, it is necessary to eliminate the high degree of bureaucracy and formalism in the request for EU funding, which in practice in the Czech Republic appears to be a form of innovation paradox.

4.5 Slovakia

In Slovakia, regression models did not provide any significant results. The results obtained do not have sufficient information from any of the models presented (M1-M8). Without emphasis on significance, it can be argued that Slovak companies are not fundamentally influenced by the type of target market (whether domestic or international). Similarly, companies in Slovakia which collaborated with universities did not achieve a positive increase in innovation turnover. Collaboration with governmental research organisations did not appreciably affect the turnover of companies (but any influence detected was mostly positive) (Table 7).

The impact of public funds on company innovation has not been confirmed. Any public funds provided are rather inefficiently used. Similarly, the impact of collaboration has not been confirmed, even with public R&D organisations and universities.

We assume that weak results in Slovak manufacturing firms are due to the smaller sample of companies.

4.6 Hungary

In Hungary, proper market orientation, as well as in the Czech Republic, leads to creation of strong links influencing dependent variable (in all cases). The force of this determinant is evident from its invariant value in all regression models. Hungarian firms are also trying to establish new subsidiaries in Hungary or in other European countries (Table 8).

A very weak (but not significant) positive was the impact of collaboration with public research institutions and universities. Supplier inputs are also used, which have a positive effect on companies' turnover from innovation.

An interesting point was the fact that Hungarian firms seeking an innovative product or service, or process innovation, have failed to use these innovative incentives and effectively commercialise them. Significant negative effects on turnover from innovative production were identified. It can be assumed that this is a

Table 7 Slovakia

	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	0.167	0.154	0.171	0.163	0.177	0.139	0.141	0.162
GP	0.029	0.032	0.030	0.033	0.032	0.031	0.025	0.026
LARMAR	−0.014	−0.015	−0.013	−0.012	−0.011	−0.013	−0.020	−0.014
FUNLOC	0.004	0.014	0.001	0.016	0.022	0.013	0.018	0.002
FUNGMT	0.039	0.045	0.036	0.045	0.057	0.080	0.045	0.039
FUNEU	0.047	0.043	0.046	0.025	0.027	−0.007	0.055	0.049
CO_GP	−0.060	−0.149	−0.061	−0.055	−0.057	−0.056	−0.058	−0.079
CO_SUP	−0.018	−0.028	−0.006	−0.022	−0.022	−0.021	0.014	−0.009
CO_CUS	0.043	0.055	0.042	−0.027	0.051	0.046	0.057	0.056
CO_UNI	−0.028	−0.033	−0.029	−0.029	0.107	−0.029	−0.109	−0.036
CO_GOV	0.001	0.004	−0.001	−0.002	−0.008	0.005	0.035	−0.005
ENMRG	0.053	0.053	0.055	0.064	0.062	0.065	0.052	0.053
ENOUT	0.053	0.056	0.051	0.051	0.046	0.050	0.053	0.052
ENWEUR	0.035	0.039	0.037	0.033	0.038	0.039	0.043	0.040
ENNWOTH	0.012	−0.003	0.017	0.018	0.005	0.031	0.023	0.012
INN_GOOD	0.009	0.012	0.010	0.012	0.015	0.009	0.020	0.008
INN_SERV.	0.045	0.052	0.043	0.041	0.039	0.043	0.053	0.043
INN_PROC.	−0.037	−0.040	−0.036	−0.035	−0.028	−0.036	−0.036	−0.036
FUNLOC*CO_GP		0.037						
FUNGMT*CO_GP		0.035						
FUNEU*CO_GP		0.035						
FUNLOC*CO_SUP			0.000					
FUNGMT*CO_SUP			−0.016					
FUNEU*CO_SUP			0.004					
FUNLOC*CO_CUS				0.039				

(continued)

Table 7 (continued)

	M1	M2	M3	M4	M5	M6	M7	M8
FUNGMT*CO_CUS				−0.016				
FUNEU*CO_CUS				0.060				
FUNLOC*CO_UNI					−0.123			
FUNGMT*CO_UNI					−0.065			
FUNEU*CO_UNI					0.037			
FUNLOC*CO_GOV						−0.012		
FUNGMT*CO_GOV						−0.066		
FUNEU*CO_GOV						0.074		
CO_UNI*CO_GP							0.006	
CO_UNI*CO_CUS							−0.049	
CO_UNI*CO_SUP							−0.028	
CO_UNI*CO_GOV							0.047	
CO_GOV*CO_GP								0.034
CO_GOV*CO_CUS								−0.021
CO_GOV*CO_SUP								−0.014
CO_GOV*CO_UNI								0.010
R2	0.063	0.073	0.063	0.073	0.084	0.074	0.077	0.067

***sig. at $p < 0.01$; **sig. at $p < 0.05$; *sig. at $p < 0.1$

Table 8 Hungary

	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	0.168***	0.174***	0.172***	0.179***	0.184***	0.172***	0.146**	0.134**
GP	0.014	0.014	0.015	0.014	0.014	0.014	0.014	0.014
LARMAR	0.027***	0.027***	0.027***	0.027***	0.028***	0.027***	0.027***	0.028***
FUNLOC	−0.010	−0.015	−0.010	−0.021	−0.028	−0.020	−0.009	−0.009
FUNGMT	−0.012	−0.003	−0.005	−0.008	−0.008	0.025	−0.012	−0.012
FUNEU	−0.011	−0.013	−0.012	−0.009	−0.015	−0.048***	−0.011	−0.011
CO_GP	−0.001	−0.004	−0.001	0.001	−0.001	−0.002	0.001	−0.004
CO_SUP	0.013	0.013	0.011	0.012	0.013	0.012	0.011	0.005
CO_CUS	−0.015	−0.014	−0.016	−0.035	−0.013	−0.014	−0.014	−0.030
CO_UNI	0.001	0.001	0.002	0.001	−0.028	−0.001	−0.022	−0.014
CO_GOV	0.005	0.001	−0.003	0.001	0.003	−0.001	0.025	0.034
ENMRG	−0.020	−0.020	−0.020	−0.020	−0.019	−0.016	−0.019	−0.019
ENOUT	−0.013	−0.014	−0.013	−0.013	−0.012	−0.014	−0.013	−0.013
ENWEUR	0.015	0.014	0.015	0.017	0.014	0.017	0.012	0.013
ENNWOTH	0.030	0.029	0.029	0.027	0.033	0.035	0.031	0.032
INN_GOOD	−0.098***	−0.099***	−0.099***	−0.099***	−0.099***	−0.098***	−0.099***	−0.099***
INN_SERV.	−0.011	−0.011	−0.056***	−0.056***	−0.056***	−0.056***	−0.056***	−0.056***
INN_PROC.	−0.056***	−0.056***	−0.011	−0.012	−0.011	−0.009	−0.012	−0.012
FUNLOC*CO_GP		0.011						
FUNGMT*CO_GP		−0.018*						
FUNEU*CO_GP		0.003						
FUNLOC*CO_SUP			0.011					
FUNGMT*CO_SUP			−0.023**					
FUNEU*CO_SUP			0.004					
FUNLOC*CO_CUS				0.027				

(continued)

Table 8 (continued)

	M1	M2	M3	M4	M5	M6	M7	M8
FUNGMT*CO_CUS				−0.009				
FUNEU*CO_CUS				−0.004				
FUNLOC*CO_UNI					0.029			
FUNGMT*CO_UNI					−0.010			
FUNEU*CO_UNI					0.011			
FUNLOC*CO_GOV						0.006		
FUNGMT*CO_GOV						−0.044***		
FUNEU*CO_GOV						0.042***		
CO_UNI*CO_GP							−0.007	
CO_UNI*CO_CUS							0.006	
CO_UNI*CO_SUP							0.002	
CO_UNI*CO_GOV							0.024	
CO_GOV*CO_GP								0.004
CO_GOV*CO_CUS								0.018
CO_GOV*CO_SUP								0.005
CO_GOV*CO_UNI								0.014
R2	0.204	0.225	0.228	0.223	0.224	0.233	0.223	0.224

***sig. at $p < 0.01$; **sig. at $p < 0.05$; *sig. at $p < 0.1$

result of a time lag between the application of market innovation and its commercialisation.

Regression models have shown that, in the manufacturing industry, public funds provided by the central government act rather negatively, thus not affecting the innovation capability of these companies. They do not act positively even when they finance collaboration with public research institutions. However, this collaboration is supported in Hungary by European subsidies, which have been found to have a positive and significant result (0.042***).

The combinations analysed worsened the results of the regression models. On the basis of the results found, it is not possible to postulate any main conclusions, but rather to estimate the causes of these results. It may be true that in Hungary (as in other CEE countries), other factors such as the business environment, lack of openness, a high degree of bureaucracy, clientelism and corruption in public financing predominate.

4.7 Estonia

The results in Table 9 show the selected combination of variables in Estonia. Significant positive effects have been identified here on the turnover of innovation revenue (even at the lowest level of significance).

The analysis allows for positive effects when implementing product innovations (though not significant). Other types of innovation do not positively affect companies' innovation performance.

None of the analysed combinations of "cooperation and funding" provided significant results. Support from national sources does not work in practice in line with its objective (negative effects, however insignificant, have been found in all combinations). Any combination of cooperation and funding from the EU budget improves the impact of these funds. Individual models showed rather positive effects. Mutual combinations of different forms of cooperation also did not bring significant results.

We can conclude that public support does not always bring positive effects, especially if subsidies are not carefully targeted to the appropriate industry and to the target activity (totally clear type of innovation).

4.8 Lithuania

The results in Table 10 show that Lithuania has different situation regarding the impact of public finance as in Estonia. We found that the greatest influence on companies' innovation capabilities in Lithuania is the choice of the markets that firms are oriented towards. Almost identical effects were found in all models.

Table 9 Estonia

	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	0.378**	0.369**	0.379**	0.378**	0.397***	0.414***	0.394**	0.382**
GP	0.043*	0.044*	0.043*	0.043*	0.043*	0.043*	0.043*	0.039
LARMAR	0.019	0.017	0.020	0.020	0.021	0.020	0.022	0.021
FUNLOC	−0.003	−0.002	−0.003	−0.004	−0.004	−0.004	−0.011	−0.005
FUNGMT	0.012	0.007	0.013	0.014	0.019	0.030	0.009	0.011
FUNEU	−0.016	−0.001	−0.018	−0.026	−0.039	−0.072	−0.015	−0.013
CO_GP	−0.040	−0.022	−0.040	−0.038	−0.041	−0.041	−0.023	−0.059
CO_SUP	0.009	0.011	0.004	0.009	0.009	0.008	0.013	0.010
CO_CUS	0.026	0.021	0.026	−0.020	0.027	0.029	−0.016	−0.024
CO_UNI	0.024	0.026	0.024	0.024	0.006	0.023	0.051	0.038
CO_GOV	0.016	0.016	0.015	0.020	0.015	−0.015	0.020	0.026
ENMRG	−0.010	−0.010	−0.010	−0.011	−0.009	−0.008	−0.014	−0.009
ENOUT	−0.029	−0.026	−0.031	−0.034	−0.034	−0.033	−0.021	−0.024
ENWEUR	0.022	0.017	0.022	0.025	0.025	0.017	0.020	0.0130
ENNWOTH	−0.070	−0.073	−0.073	−0.072	−0.083	−0.078	−0.098	−0.088
INN_GOOD	0.009	0.010	0.007	0.002	0.004	0.005	0.011	0.002
INN_SERV.	−0.025	−0.022	−0.026	−0.028	−0.030	−0.029	−0.022	−0.032
INN_PROC.	−0.004	−0.004	−0.003	−0.005	−0.003	−0.003	−0.005	−0.002
FUNLOC*CO_GP		0.000						
FUNGMT*CO_GP		0.009						
FUNEU*CO_GP		−0.031						
FUNLOC*CO_SUP			0.000					
FUNGMT*CO_SUP			−0.003					
FUNEU*CO_SUP			0.008					
FUNLOC*CO_CUS				0.031				
FUNGMT*CO_CUS				−0.002				

FUNEU*CO_CUS				0.023				
FUNLOC*CO_UNI					0.000			
FUNGMT*CO_UNI					−0.015			
FUNEU*CO_UNI					0.039			
FUNLOC*CO_GOV						0.000		
FUNGMT*CO_GOV						−0.022		
FUNEU*CO_GOV						0.067		
CO_UNI*CO_GP							−0.014	
CO_UNI*CO_CUS							0.061	
CO_UNI*CO_SUP							−0.008	
CO_UNI*CO_GOV							−0.027	
CO_GOV*CO_GP								0.024
CO_GOV*CO_CUS								0.056
CO_GOV*CO_SUP								−0.002
CO_GOV*CO_UNI								−0.019
R2	0.047	0.050	0.047	0.049	0.053	0.054	0.058	0.054

***sig. at $p < 0.01$; **sig. at $p < 0.05$; *sig. at $p < 0.1$

Table 10 Lithuania

	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	0.204***	0.168*	0.203**	0.210***	0.145	0.189**	0.237***	0.262***
GP	−0.006	−0.006	−0.007	−0.008	−0.006	−0.007	−0.008	−0.009
LARMAR	0.042***	0.042***	0.042***	0.042***	0.045***	0.046***	0.040**	0.041***
FUNLOC	−0.057	−0.023	−0.055	−0.067	0.004	−0.046	−0.057	−0.052
FUNGMT	−0.011	−0.006	−0.010	−0.011	−0.001	0.007	−0.020	−0.021
FUNEU	0.034**	0.036*	0.032*	0.038**	0.049**	0.056**	0.036**	0.035**
CO_GP	0.038	0.095	0.038	0.041	0.037	0.035	0.044	0.057*
CO_SUP	−0.008	−0.008	0.004	−0.010	−0.006	−0.004	−0.032	−0.044
CO_CUS	−0.011	−0.010	−0.011	0.034	−0.010	−0.009	−0.025	−0.027
CO_UNI	0.047	0.043	0.048	0.045	0.129*	0.047	0.111***	0.114***
CO_GOV	−0.042	−0.041	−0.042	−0.041	−0.039	−0.024	−0.066	−0.062*
ENMRG	0.015	0.012	0.014	0.015	0.014	0.013	0.020	0.017
ENOUT	0.037	0.038	0.037	0.040	0.035	0.039	0.032	0.031
ENWEUR	−0.030	−0.027	−0.029	−0.031	−0.026	−0.030	−0.024	−0.024
ENNWOTH	0.047	0.046	0.047	0.048	0.057	0.057	0.043	0.044
INN_GOOD	−0.141***	−0.141***	−0.141***	−0.142***	−0.140***	−0.141***	−0.136***	−0.136***
INN_SERV.	−0.054***	−0.054***	−0.054***	−0.052***	−0.060***	−0.057***	−0.063***	−0.061***
INN_PROC.	0.003	0.002	0.003	0.001	0.001	0.001	0.003	0.002
FUNLOC*CO_GP		−0.051						
FUNGMT*CO_GP		−0.009						
FUNEU*CO_GP		−0.004						
FUNLOC*CO_SUP			−0.010					
FUNGMT*CO_SUP			−0.005					
FUNEU*CO_SUP			0.005					
FUNLOC*CO_CUS				−0.047				
FUNGMT*CO_CUS				0.001				

FUNEU*CO_CUS				−0.010				
FUNLOC*CO_UNI					−0.057			
FUNGMT*CO_UNI					−0.054**			
FUNEU*CO_UNI					−0.021			
FUNLOC*CO_GOV						0.000		
FUNGMT*CO_GOV						−0.045*		
FUNEU*CO_GOV						−0.028		
CO_UNI*CO_GP							−0.021	
CO_UNI*CO_CUS							0.027	
CO_UNI*CO_SUP							0.034	
CO_UNI*CO_GOV							−0.068**	
CO_GOV*CO_GP								−0.028
CO_GOV*CO_CUS								0.016
CO_GOV*CO_SUP								0.045
CO_GOV*CO_UNI								−0.095**
R2	0.318	0.320	0.319	0.321	0.337	0.331	0.339	0.336

***sig. at $p < 0.01$; ** sig. at $p < 0.05$; *sig. at $p < 0.1$

Public funding from EU funds positively affects corporate results. The results are almost unchanged in each model, which confirms the information capability. The impact of funds from public budgets has not been confirmed or was found to be insignificant, or negative. Innovative results of Lithuanian companies are also affected by collaboration with universities. Their importance is enhanced by collaboration with public research institutes.

Examination of individual combinations did not lead to any clear results in this country either. The impact of public finances on the development of collaboration has also not been confirmed in Lithuania. This is a result common to the CEE countries. For example, if a company collaborated with a university and used a subsidy from the national budget, it did not positively offset the revenues from innovative production. This result (though insignificant) is also supported by the results of the study of the impact of municipal and European public subsidies. This suggests that even Lithuanian companies will likely have to overcome the barriers to bureaucracy associated with the use of subsidies (which may be reflected in the fact that companies are more committed to fulfilling these claims than the innovation itself). Similarly, no positive impact of collaboration with universities or R&D organisations has been confirmed. Again, it can be assumed that the reason is the inflexibility and the completely dichotomous objective of these knowledge-based organisations which are incompatible with the objectives of business entities.

5 Conclusions

Nowadays, innovation plays an important role in the process of gaining competitive advantage and economic growth of firms or countries. However, finding the proper determinants of innovative activities represent a complex process lacking universal formula of which variables positively affect innovation creation. Therefore, the aim of this study was to fill the gap and find proper determinants of innovative activities—drivers of economic growth in twenty-first century, and make international comparison providing some practical implications not only for these countries. Results show that determinants of innovation activities vary across countries and, separately, influence innovation activities less than in combination with each other. These findings confirm previous studies on the general shift towards a knowledge economy and the importance of factors such as knowledge (Conceição et al. 1998; Wessel 2013), innovation (Aghion et al. 2013; Braha et al. 2015) and cooperation with different partners (Brink and Neville 2016; Vásquez-Urriago et al. 2016) that allow the creation of synergies and spillover effects.

An important implication arising from these results is that public policies to encourage the innovations creation should to be selective, and should be directed to selected sector. Cooperation in the creation of a specific innovation has to be the aim. In this case, it is possible to record even the existence of knowledge spill-over effects mostly in knowledge networks. Therefore, public support should be allocated wisely and only in selected areas of the industry. Individual projects must be clearly

defined and measurable outputs of innovation and policy makers should carefully decide which projects and centers they will support (from national or European funds) and which not. The massive uncontrolled support should be mistaken for selective support focused on achieving the highest possible efficiency. The declaration of interest towards maximum efficiency should be incorporated into different strategies from national to the regional level. Public institutions and decision makers must use monitoring tools and methods using ex ante effectiveness evaluation (financial schemes must be prepared and "fit" to targeted applicants well because it is unable to apply the approach "all fits to all"). All these results should help to improve the strategic management of public sector organizations (also the regional governments) to prepare better strategies and various sectoral policies.

To increase efficiency, we recommend the clear definition of expected outputs, continuous monitoring and conditional funding. Likewise, we show that cooperation may have a greater positive effect if it occurs during the formation of a certain innovation and in combination with different entities, especially with universities and within groups of companies. These combinations significantly influence the growth of turnover from innovated products within different countries.

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