Modeling Open Innovation Effects in Czech Manufacturing Firms

Petr Hajek and Jan Stejskal

Abstract This chapter deals with the effect of open innovation on innovation activity in Czech manufacturing firms. We analyze the European CIS 2010 data using the methodology of Laursen and Salter (Strateg Manag J 27(2):131–150, 2006), Van de Vrande et al. (Technovation 29(6):423–437, 2009) and Ebersberger et al. (Res Policy 43(3):495–504, 2012) based on the depth (intensity) and breadth (variety) for open innovations. In our paper we focus on measuring the depth and breadth in various manufacturing industries (from low to high-tech firms) oriented on different markets (from local to non-EU regions). We distinguish two types of innovation, new-to-market and new-to-firm, respectively. To analyze the indirect effect of open innovation (measured via the depth and breadth of knowledge acquisition and innovation cooperation), we use structural equation models. The results confirm that open innovation mediates the effect of public support (mainly government and EU) on innovation activity. We also show that firms oriented on new-to-market innovation report significantly higher breadth of open innovation. We propose several important implications for innovation policymakers, stressing that the variety (breadth) of open innovation is the critical determinant to promote innovation activity.

Keywords Open innovation • Collaboration • Knowledge acquisition • Structural model • Czech manufacturing firms

P. Hajek (✉)
Faculty of Economics and Administration, Institute of System Engineering and Informatics, University of Pardubice, Studentska 95, Pardubice 53210, Czech Republic
e-mail: petr.hajek@upce.cz

J. Stejskal
Faculty of Economics and Administration, Institute of Economic Sciences, University of Pardubice, Studentska 95, Pardubice 53210, Czech Republic
e-mail: jan.stejskal@upce.cz

A. Dias et al. (eds.), *Modeling Innovation Sustainability and Technologies*,
Springer Proceedings in Business and Economics,
https://doi.org/10.1007/978-3-319-67101-7_9

1 Introduction

Innovation is currently considered the most important long-term determinant of the economic performance of firms (see a review by Grossman and Helpman 1994). Innovative companies grow and develop more quickly by gaining benefit from the economies of scale (Almus and Nerlinger 1999) and other benefits. However, firms also have to invest in new technology, skilled employees and the acquisition of new knowledge. In other words, firms must ensure the so-called critical factors for successful innovations. Van der Panne et al. (2003) provide a list of firm related critical factors such as experience, R&D intensity, knowledge and innovation strategy, etc. These factors cannot be easily attained at the firm level. Therefore, it is necessary to use the existence of various external interfaces, which include information gathering, collaborations and alliances with actors ranging from universities to suppliers and customers (Ebersberger et al. 2012).

Firm management must ensure synthesizing the necessary internal and external production factors and ensure the involvement of the company in the new knowledge creation. In practice, the firms are involved in business alliances (George et al. 2002), knowledge networks (Tsai 2001), regional innovation systems (Asheim et al. 2011) and industrial clusters (Stejskal 2010; Stejskal and Hajek 2012), depending on the potential of the region (Uramova and Koziak 2008), type of industry, etc. When connecting to networks, firms find that it is not possible to only receive from other actors in the network, but also provide (usually knowledge, experience, know-how and contribute financially to the purchase or development of new technologies). Openness is a natural consequence of the firm's involvement in the network. According to Ebersberger et al. (2012), interfacing or "openness" cannot be reduced to formal ties or to one single dimension, such as alliances, purchases of patents or collaboration; and that these dimensions should not be considered in isolation from each other. Firm's openness should not only be the result, but a means to get new ideas and increase capacity to absorb innovation. The strategic intent of the firm should be to create a suitable environment for the creation of open innovation.

The concept of open innovation was introduced by Chesbrough (2003). This concept suggests that the advantages that firms gain from internal R&D expenditure have declined (Laursen and Salter 2006). The firms seeking for innovation in the open innovation system spend on R&D smaller funds, because new knowledge, information, ideas and experiences they obtain from external cooperating chains. The substitution (not total) of internal information sources for external sources needs the changes in management, typically in HR management, communication and firm strategies (Gavurova 2012). The firms, in practice, obtain new findings from external sources and cooperation networks. Based on them they create the innovation and offer it in the market. This does not include all firms, but only those who are able to recognize the opportunity. Therefore, it is needed to have an innovative management with know-how that will help to identify seemingly unrelated opportunity, to combine them and to expand their absorption and

potential. This approach may also bring some loss; respectively require additional investment to the technologies. The change in firm orientation from internal to external knowledge is sometimes referred to as the 'connect and develop' model (Sakkab 2002). The firm itself as well as its environment is changed with focus on external stimuli. The increased interest of companies about cooperation is forced to change their strategies and market behaviour.

Previous research has shown that both the breadth and depth of open innovation is an important determinant of innovation activity (Ebersberger et al. 2012; Laursen and Salter 2006; Van de Vrande et al. 2009). However, more complex models are fundamental to enhance understanding of the role of open innovation in innovation activity. Here we aim to investigate the indirect role of open innovation, mediating the effect of (1) market and industry level, and (2) internal R&D expenditure and public support.

The remainder of this paper has been divided into four sections. The paper first gives a brief overview of the evidence for the positive effects of open innovation activities on firms' innovativeness. The next section lays out the description of the data and research methodology. Section 4 provides the results of the modelling. The final section concludes the paper and discusses its implications.

2 Effects of Open Innovation on Innovation Performance

Recently, there has been much effort in finding adequate strategies for innovative firms. The essence of the changes has been the shift away from investment to intramural R&D and supplement (or substitute) them by extensive use of external knowledge sourcing and external paths to commercialization (Cassiman and Veugelers 2006). The technological progress and new communication elements are the important prerequisites for creating innovation based on cooperative open systems. It brings with it the requirement of demand for new products, innovation systems, sales, marketing, etc. Similar changes in development, however, can be observed already during the twentieth century. There is a clear shift away from innovation creation by alone entrepreneur (Schumpeter 1942) to innovation generating by cooperating entities (numerous interactions and the knowledge spill-over effects are arisen spontaneously among them; Von Hippel 1988; Lundvall 1992). Recent studies conclude that the innovation process is dependent on the number, nature and openness of the interactions between different entities. The speed of innovation production depends inter alia on "swift trust," which determines the transfer of knowledge and is a prerequisite for the development of knowledge spill-over effects and the innovations (Brown and Duguid 2000).

Many studies have shown that the application of the open innovation model has three separate processes (Gassmann and Enkel 2004; Dittrich and Duysters 2007). Each firm can decide on which one to focus on. The first is outside-out process that targets the use and application of new ideas, thoughts and knowledge gained outside of companies and their commercialization into new products and services.

The second, inside-out process focuses on the use of ideas arising out of the company through patents, licensing or divestment knowledge in the market. The third, coupled process captures activities that have arisen as a result of cooperative linkages (other than ordinary business). Individual processes utilize various information sources such as customers, competitors, suppliers, customers, universities, research institutes etc. Search processes can therefore be seen as a dynamic capability that allows firms to sustain their competitive advantage over time (Eisenhardt and Martin 2000).

Laursen and Salter (2006) found that the innovation performance increases with the breadth and depth of external search, with a variety of external information sources and with the intensity of their use. These relationships are found take on inverse U-shapes, indicating the possibility of excessive dependence on external information sources (Ebersberger et al. 2012). External sourcing can be realized in two ways: on the market principle and based on collaboration, respectively. The former approach has several specifics: since firms buy the knowledge or innovation, the demand for these final products is increased (Lichtenthaler and Ernst 2007). However, the knowledge spill-over effects are limited, no matter whether it is bought from other firms or research organizations/universities. The prerequisite for this knowledge acquisition is the good protection of intellectual rights and the use of licenses and patents. Only then the commercialization of external technology is frequently utilized.

The latter approach is to acquire knowledge in collaboration processes towards the creation of new knowledge and innovation. First, it is necessary to establish a relationship with an organization that generates knowledge; this is with R&D organizations (Herstad et al. 2014), universities (Abramovsky and Simpson 2011), suppliers or customers (Greer and Lei 2012), etc. Firms may also enter into strategic alliances with other companies (Lew and Sinkovics 2013), associations or cooperatives (Lin et al. 2012), often in industrial clusters (Kesidou and Snijders 2012) and open innovation networks (Love et al. 2014).

Many researchers are concerned with the issue from different views. They often analyse the case studies related to changes in firm strategies, as well as the theoretical role of open innovation and the models of open innovation processes, respectively. However, few studies deal with the fact that open innovation may have different effect on innovative performance for enterprises of different industries (Sofka and Grimpe 2010; Schroll and Mild 2011). Several studies have investigated the role of open innovation in individual countries. For example, Spithoven et al. (2011) dealt with the formation of absorption capacity in the case of inside-out processes in traditional industries (Belgium), Chiarone et al. (2010) examined asset-intensive industries (Italy), and Bianchi et al. (2011) studied organisational modes for open innovation in the bio-pharmaceutical industry (Italy). Even less attention has been paid to the technology-intensive production. Martín-de Castro (2015) studied the role of openness and absorptive capacity in knowledge-based and high-tech industrial markets; Alberti et al. (2014) examined the Italian mid-high tech SMEs; and Park et al. (2014) were looking for the

competitive dynamics and the knowledge seeking behaviour of high-tech firms (South Korea).

3 Data and Research Methodology

To examine the role of open innovation in the Czech manufacturing industry, we collected data from the Community Innovation Survey (CIS), which is based on a harmonized questionnaire of EU Member States. The survey was carried out in the Czech Republic for the period 2008–2010 by combining sample (stratified random sampling) and exhaustive surveys taking into account the regional dimension of NUTS3. In total, data on 5151 Czech firms with at least ten employees was obtained (response rate greater than 60%). The CIS is regarded as a reliable source of innovation statistics in the EU owing to comprehensive data validation and measurement error reduction procedures (see Eurostat for details). After discarding the firms without variables necessary for the calculation of open innovation depth and breadth, we obtained $N = 1318$ manufacturing firms.

The basic characteristics of the dataset are given in Tables 1 and 2. The innovation activity of the firms was estimated by calculating the number of companies that introduced a new product or process to the firm/market. Table 1 shows that low-tech firms dominated in the dataset with 40.12%, most of the firms were oriented on the national market (48.36%), and only 19.12% received public financial support for innovation activity from the EU.

In calculating the variables for open innovation, we adopted the approach used by Laursen and Salter (2006), Van de Vrande et al. (2009) and Ebersberger et al. (2012), where open innovation is categorized in two ways, namely into knowledge sources for innovation/collaboration on innovation and depth/breadth. Thus, we obtained four indicators of open innovation: (1) depth of knowledge sources, (2) breadth of knowledge sources, (3) depth of collaboration, and (4) breadth of collaboration. Regarding the knowledge sources, each firm was asked to indicate on a 0–3 scale the degree of use for each of the nine sources (market source: suppliers, clients, competitors, and consultants; research institutes: universities, and government research institutes; other: conferences, scientific journals, and professional associations). To obtain the breadth of knowledge sources, the nine sources were simply added up, this is the overall score was on the scale 0–9. For the depth of knowledge sources, a similar approach was used, but only those sources were added up that were used to a high degree (this is 3 on the 0–3 scale).

Similarly, the breadth of collaboration was calculated as the sum of collaborating partners (other firms, suppliers, clients, competitors, consultants, universities, and government institutes), leading to the 0–7 scale. To calculate the depth of collaboration, only those partners were added up, when the firm used both domestic and international partners for innovation collaboration. Table 3 shows the descriptive statistics for these variables. The sophistication of market represents a strong

Table 1 Relative frequencies of categorical variables

Industry	Low-tech	Medium low-tech	Medium high-tech	High-tech	
Rel. freq.	40.12	26.25	27.56	6.07	
Market	Local	Regional	National	EU	Other
Rel. freq.	13.62	11.09	48.36	22.87	4.07
Funding	Local	Govern.	EU		
Rel. freq.	4.17	17.30	19.12		
Innovation	New-to-firm	New-to-market			
Rel. freq.	79.71	71.19			

Table 2 Average values and standard deviations of numerical variables

	Mean	St. dev.
TURN10	1,132,335	7,584,428
EMP10	223	1057
RTOT10	33,614	275,921

TURN10 total turnover in 2010, *EMP10* average number of employees in 2010, *RTOT10* total innovation expenditure in 2010

Table 3 Descriptive statistics of open innovation variables

	Breadth of knowledge sources	Depth of knowledge sources	Breadth of collaboration	Depth of collaboration	*N*
Industry					
High-tech	7.90 ± 2.65	1.78 ± 1.71	3.15 ± 1.97	**0.97 ± 1.33**	73
Medium high-tech	**8.03 ± 2.61**	**2.07 ± 1.61**	**3.40 ± 1.87**	0.71 ± 1.06	370
Medium low-tech	7.51 ± 2.78	1.62 ± 1.41	3.04 ± 1.97	0.66 ± 1.24	279
Low-tech	7.89 ± 2.58	1.98 ± 1.60	3.16 ± 1.84	0.72 ± 1.13	576
Market					
Local	7.45 ± 2.82	1.79 ± 1.64	3.31 ± 1.83	0.42 ± 1.03	104
Regional	7.27 ± 2.97	1.68 ± 1.60	2.95 ± 2.10	0.63 ± 1.20	99
National	7.86 ± 2.56	1.91 ± 1.59	3.24 ± 1.89	0.65 ± 1.13	679
EU	7.91 ± 2.67	1.92 ± 1.44	3.05 ± 1.80	0.78 ± 1.09	358
Other countries	**8.83 ± 2.19**	**2.56 ± 1.86**	**3.96 ± 1.83**	**1.06 ± 1.31**	78
Innovation					
New-to-firm yes	8.20 ± 2.48	2.04 ± 1.57	3.33 ± 1.84	0.81 ± 1.18	735
New-to-firm no	7.97 ± 2.49	2.15 ± 1.74	3.25 ± 1.92	0.68 ± 1.18	251
New-to-market yes	**8.39 ± 2.45**	**2.22 ± 1.67**	**3.58 ± 1.83**	**0.89 ± 1.27**	587
New-to-market no	7.77 ± 2.49	1.84 ± 1.50	2.78 ± 1.81	0.56 ± 0.95	399

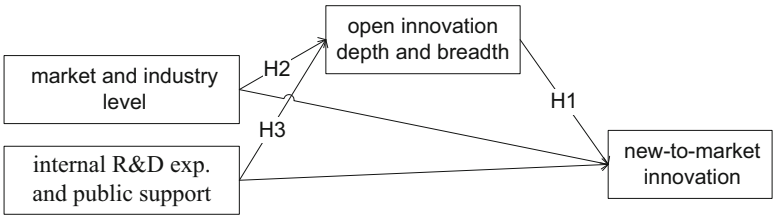

Fig. 1 Conceptual model

determinant of open innovation. Further, firms introducing new-to-market innovations strongly depend on both depth and breadth of open innovation.

To study the effect of open innovation variables on innovation activity, we constructed a structural equation model. In this model, the depth and breadth of knowledge sources/collaboration represent mediator variables, causally located between the input variables (technology level of industry, market sophistication, R&D expenditure, and public support) and output (new-to-market innovation activity). In other words, we tested both the direct and indirect (via open innovation variables) effect of the input variables on innovation activity. Previous research has shown significant positive effects of open innovation variables on innovation activity in manufacturing industries (Ebersberger et al. 2012; Laursen and Salter 2006).

However, the strength of the effect seems to be different across EU countries (Ebersberger et al. 2012). The indirect effect, on the other hand, has not been investigated so far, although Abramovsky et al. (2009) reports that both internal R&D expenditure and the receipt of public support may be positively related to open innovation variables (Stejskal and Hajek 2015). In addition, here we also examine the effect of industry technology level and market sophistication on open innovation variables. As indicated in Table 3, both the (medium) high technology firms and the firms oriented on non-EU markets show higher values of open innovation variables. Therefore, we hypothesize that (see Fig. 1):

H1: Open innovation depth and breadth positively affect new-to-market innovation activity.
H2: Market and industry level positively affect open innovation depth and breadth.
H3: Internal R&D expenditure and public support positively affect open innovation depth and breadth.

4 Empirical Results

To test the hypotheses posed in the previous section, the modeling was performed using the structural equation models in the Process tool developed by Hayes (2013) for the SPSS statistical software package. Figure 2 shows the results of the modelling.

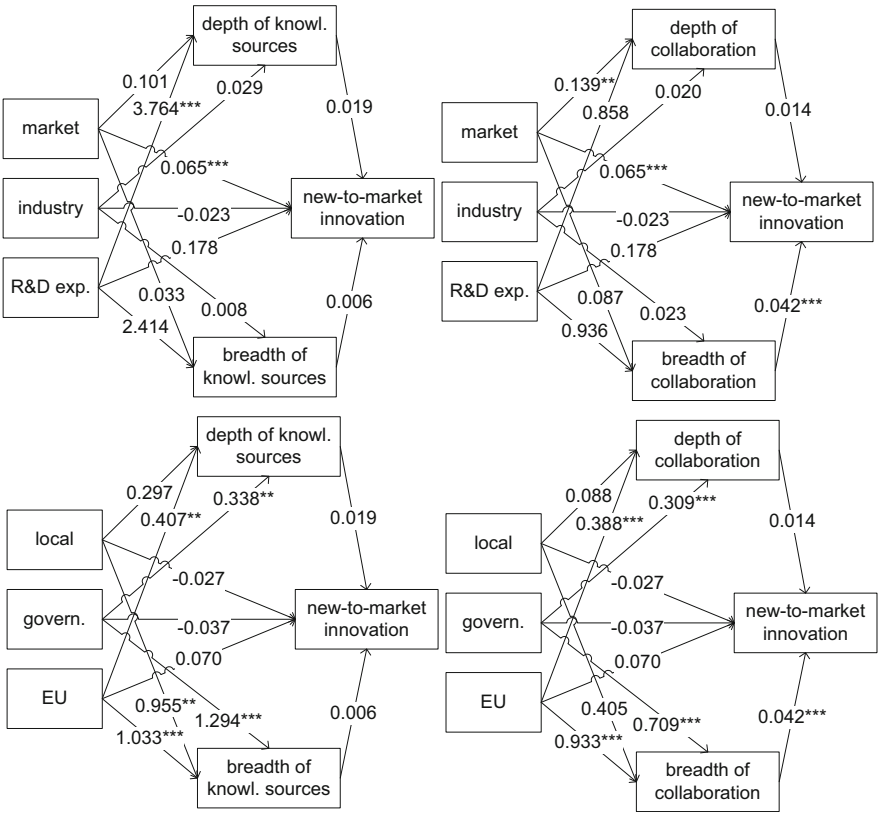

Fig. 2 Structural equation models. *Significant effect at $p = 0.10$, **Significant effect at $p = 0.05$, and ***Significant effect at $p = 0.01$

The results of the modelling confirmed that private R&D expenditures affect the depth of knowledge sources (public financing is viable due to significant differences in knowledge resources needs in individual firms). In contrast, private firms do not fund the establishment of collaboration activities. The sophistication of the target market forces firms to innovate and collaborate on a much broader level than if their sales market is "only" a local one. On the other hand, the results did not confirm that the type of industry (according to the necessity of knowledge necessary for production) significantly affects the depth of knowledge sources and depth of collaboration.

Regarding the public funding of innovative activities: EU funds (0.407**) and government support (0.338**) have the strongest impact on the depth of knowledge sources. The results are similar for the breadth of knowledge sources, with the significant effects of EU (1.033***), government (1.294***) and local budgets (0.955**). The direct effects of various sources of public support on innovation activity were not confirmed. Similar results were observed for the depth and breadth

of collaboration, with the strongest impact of the EU budget (0.388*** for the depth of collaboration and 0.933*** for the breadth of collaboration, respectively).

Taken together, market sophistication directly affects new-to-market innovation activity and the depth of collaboration, respectively. The depth of collaboration was however not a significant determinant of the innovation activity. The effects of industry level were not significant at all. Internal R&D expenditure showed strong effect on the depth of knowledge sources. Again, this effect did not lead to innovation activity owing to the weak effect of the depth of knowledge sources. In fact, the breadth of collaboration was the only significant open innovation determinant of innovation activity. It was the government and EU public support that mainly affected the breadth of collaboration.

5 Discussion and Conclusion

New-to-market innovation substantially contributes to the firm performance and may also ensure the firm's long-term competitiveness. This type of innovation is the result of available knowledge, experience and know-how application. In order to achieve the new-to-market innovation it is also necessary to utilize spill-over effects present both in the firm and in its innovative ties. New-to-market innovation is also the common aim of public policies. In the production of these innovations, a number of positive effects (often spill-overs) is formed, which ultimately enhance societal welfare.

Given the importance of this type of innovation, it is becoming essential that researches must help identify the determinants of the innovation environment in order to ensure maximum efficiency. These efforts also facilitate the concept of open innovation, namely the analysis of the depth and breadth of open innovation.

In our study, we present results, which confirm that the breadth of collaboration is a key factor for new-to-market innovation activity. Therefore, our results suggest that the new-to-market innovation depends on a variety of subjects that are involved in innovation (knowledge) chains. This fact may imply that the innovation is conditioned by the spill-over effects that occur naturally in these collaborative knowledge networks. The results also show that the breadth of collaboration is affected the most with the EU and government financial support. The results confirm that the resources of regional and local budgets have less effect, which may be primarily due to the budget limits. Next we examined the role of industry and market sophistication. Although these determinants have a positive effect on open innovation activities, it was not significant (however, market sophistication proved to be the strongest direct determinant of the innovation activity).

Our results confirm the results by Ebersberger et al. (2012). Their study examined the effect of open innovation activities on new-to-market innovations in four countries (Austria, Belgium, Denmark, and Norway). They demonstrated that new-to-market innovation is mostly influenced with the breadth of open innovation (from 0.124*** to 0.229***). The depth of open innovation did not show the

significant effect for all countries, respectively, their analysis showed different results, including negative effects. Namely, the breadth of collaboration showed significant influence in Belgium and Norway, whereas the depth of collaboration has seen only negative effects.

Returning to the hypotheses posed in this paper, it is now possible to state that: (1) open innovation activities have positive effect on new-to-market innovation (but significant only in the case of collaboration breadth); (2) market level is more important than industry level for both open innovation and new-to-market innovation activity; and (3) public support is critical for open innovation depth and breadth.

Based on our results, we can imply that private investment should be better used for other purposes (for example, investments to technology or staff training), rather than to promote collaboration in knowledge networks. From our results, it is also possible to deduce the implications for public decisions and policies. We unequivocally support the increase in collaboration breadth. Governments should promote collaboration between firms, market actors, as well as other knowledge-based organizations. Financial support from the EU and national governments should be directed primarily on collaborative activities. Governmental organizations should be facilitators or moderators in industry-university cooperation. Properly formed government spending programs may also help increase the interest in collaboration and help remove the obstacles in initiation phase of relationships between different organizations. Consequently, this will help produce spill-over effects and enhance societal welfare.

Acknowledgments This article was created as part of the resolution of the research task No. 17-11795S financially supported by the Grant Agency of the Czech Republic.

References

Abramovsky L, Simpson H (2011) Geographic proximity and firm–university innovation linkages: evidence from Great Britain. J Econ Geogr 11(6):949–977

Abramovsky L, Kremp E, López A, Schmidt T, Simpson H (2009) Understanding co-operative innovative activity: evidence from four European countries. Econ Innov New Technol 18 (3):243–265

Alberti FG, Ferrario S, Papa F, Pizzurno E (2014) Search breadth, open innovation and family firms: evidences in Italian mid–high tech SMEs. Int J Technol Intell Plan 10(1):29–48

Almus M, Nerlinger EA (1999) Growth of new technology-based firms: which factors matter? Small Bus Econ 13(2):141–154

Asheim BT, Smith HL, Oughton C (2011) Regional innovation systems: theory, empirics and policy. Reg Stud 45(7):875–891

Bianchi M, Cavaliere A, Chiaroni D, Frattini F, Chiesa V (2011) Organisational modes for open innovation in the bio-pharmaceutical industry: an exploratory analysis. Technovation 31 (1):22–33

Brown JS, Duguid P (2000) Mysteries of the region: knowledge dynamics in Silicon Valley. In: Lee CM, Miller WF, Hancock MG, Rowen HS (eds) The Silicon Valley edge. Stanford University Press, Stanford, pp 16–39

Cassiman B, Veugelers R (2006) In search of complementarity in innovation strategy: internal R&D and external knowledge acquisition. Manag Sci 52(1):68–82
Chesbrough H (2003) Open innovation. Harvard University Press, Cambridge, MA
Chiaroni D, Chiesa V, Frattini F (2010) Unravelling the process from closed to open innovation: evidence from mature, asset-intensive industries. R&D Manag 40(3):222–245
Dittrich K, Duysters G (2007) Networking as a means to strategy change: the case of open innovation in mobile telephony. J Prod Innov Manag 24:510–521
Ebersberger B, Bloch C, Herstad SJ, Van De Velde E (2012) Open innovation practices and their effect on innovation performance. Int J Innov Technol Manag 9(06):1–25
Eisenhardt KM, Martin JA (2000) Dynamic capabilities: what are they? Strateg Manag J 21 (10–11):1105–1121
Gassmann O, Enkel E (2004) Towards a theory of open innovation: three core process archetypes. Mimeo, Institute of Technology Management, University of St. Gallen, Switzerland
Gavurova B (2012) Source identification of potential malfunction of balanced scorecard system and its influence on system function. E+M Ekon Manag 15(3):76–90
George G, Zahra SA, Wood DR (2002) The effects of business–university alliances on innovative output and financial performance: a study of publicly traded biotechnology companies. J Bus Ventur 17(6):577–609
Greer CR, Lei D (2012) Collaborative innovation with customers: a review of the literature and suggestions for future research. Int J Manag Rev 14(1):63–84
Grossman GM, Helpman E (1994) Endogenous innovation in the theory of growth. J Econ Perspect 8(1):23–44
Hayes AF (2013) Introduction to mediation, moderation, and conditional process analysis: a regression-based approach. Guilford, New York, NY
Herstad SJ, Aslesen HW, Ebersberger B (2014) On industrial knowledge bases, commercial opportunities and global innovation network linkages. Res Policy 43(3):495–504
Kesidou E, Snijders C (2012) External knowledge and innovation performance in clusters: empirical evidence from the Uruguay software cluster. Ind Innov 19(5):437–457
Laursen K, Salter A (2006) Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. Strateg Manag J 27(2):131–150
Lew YK, Sinkovics RR (2013) Crossing borders and industry sectors: behavioral governance in strategic alliances and product innovation for competitive advantage. Long Range Plann 46 (1):13–38
Lichtenthaler U, Ernst H (2007) External technology commercialisation in large firms. R&D Manag 37(5):383–397
Lin C, Wu YJ, Chang C, Wang W, Lee CY (2012) The alliance innovation performance of R&D alliances—the absorptive capacity perspective. Technovation 32(5):282–292
Love JH, Roper S, Vahter P (2014) Learning from openness: the dynamics of breadth in external innovation linkages. Strateg Manag J 35(11):1703–1716
Lundvall BA (ed) (1992) National systems of innovation: towards a theory of innovation and interactive learning. Pinter, London
Martín-de Castro G (2015) Knowledge management and innovation in knowledge-based and high-tech industrial markets: the role of openness and absorptive capacity. Ind Mark Manag 47:143–146
Park NK, Mezias JM, Lee J, Han JH (2014) Reverse knowledge diffusion: competitive dynamics and the knowledge seeking behavior of Korean high-tech firms. Asia Pac J Manag 31 (2):355–375
Sakkab NY (2002) Connect and develop complements research and develop at P&G. Res Technol Manag 45(2):38–45
Schroll A, Mild A (2011) Open innovation modes and the role of internal R&D: an empirical study on open innovation adoption in Europe. Eur J Innov Manag 14(4):475–495
Schumpeter JA (1942/1987) Capitalism, socialism and democracy. Unwin, London

Sofka W, Grimpe C (2010) Specialized search and innovation performance–evidence across Europe. R&D Manag 40(3):310–323
Spithoven A, Clarysse B, Knockaert M (2011) Building absorptive capacity to organise inbound open innovation in traditional industries. Technovation 31(1):10–21
Stejskal J (2010) Comparison of often applied methods for industrial cluster identification. In: International Conference on Development, Energy, Environment, Economics—Proceedings, pp 282–286
Stejskal J, Hajek P (2012) Competitive advantage analysis: a novel method for industrial clusters identification. J Bus Econ Manag 13(2):344–365
Stejskal J, Hajek P (2015) The influence of public expenditure on innovation activity in Czech manufacturing industry. In: Proceedings of the 25th international business information management association conference—innovation vision 2020: from regional development sustainability to global economic growth, IBIMA 2015, pp 1820–1827
Tsai W (2001) Knowledge transfer in intraorganizational networks: effects of network position and absorptive capacity on business unit innovation and performance. Acad Manage J 44 (5):996–1004
Uramova M, Koziak R (2008) Regional disparities in Slovakia from the aspect of average nominal wage. E+M Ekon Manag 11(2):6–17
Van de Vrande V, De Jong JP, Vanhaverbeke W, De Rochemont M (2009) Open innovation in SMEs: trends, motives and management challenges. Technovation 29(6):423–437
Van der Panne G, Van Beers C, Kleinknecht A (2003) Success and failure of innovation: a literature review. Int J Innov Manag 7(03):309–338
Von Hippel E (1988) The sources of innovation. Oxford University Press, New York, NY

Petr Hajek is an associate professor with the Institute of System Engineering and Informatics, Faculty of Economics and Administration, University of Pardubice, Czech Republic. He deals with the modelling of economic processes (especially in the field of public economics and public finance).

Jan Stejskal is an associate professor with the Institute of Economics, Faculty of Economics and Administration, University of Pardubice, Czech Republic. His domain is connection of the public economy in the regional scope and view. Especially, he analyzes regional policy, tools of the local and regional economical development, and public services.