sciendo

Public Support for Innovation: Changes in Turnover of Granted Companies

Viktorie Klímová, Vladimír Žítek, Tereza Lelková
Faculty of Economics and Administration, Masaryk University, Czech Republic

Abstract

Background: Innovation policy supports innovation in companies, as it is crucial for economic, social and environmental development. **Objectives:** The research aims to verify whether companies that have received public support for innovation are experiencing turnover growth. **Methods/Approach:** The research is carried out on the example of the Czech Innovation Programme, and the analysis included 276 projects in the manufacturing industry. The study compares the turnover of enterprises one year before receiving the aid and two years after the granting. The analysis is performed regarding the size of companies, industries and regions. **Results:** When the companies are assessed at the median level, the largest turnover growth was found in the category of small enterprises. Regarding industry, the largest increase was recorded in NACE sections 22, 27, 26, 29 and 30. The lowest increase in turnover was recorded for enterprises in sections 21, 23, 24 and 28. Differences in turnover growth were also observed across regions. **Conclusions:** Providing support for innovation contributes to the growth of turnover. A larger share of public aid should be allocated to the category of small and medium-sized enterprises and knowledge-intensive industries.

Keywords: innovation, public support, turnover, enterprise, industry, region, Czech Republic

JEL classification: O31, O38, R11
Paper type: Research article

Received: 16 Jan 2022
Accepted: 15 May 2022

Acknowledgements: This research was supported by the Czech Science Foundation, project GA20-03037S, Towards a dynamic knowledge-based business model for open innovations.

Citation: Klímová, V., Žítek, V., Lelková, T. (2022), "Public Support for Innovation: Changes in Turnover of Granted Companies", Business Systems Research, Vol. 13 No. 1, pp.120-137.
DOI: 10.2478/bsrj-2022-0008

Introduction

In the last 20 years, increased attention has been paid to innovation policy and support for innovative enterprises in Europe. In addition to the national level, innovation policy in the regions is also gaining importance (Silva et al., 2021). There is a consensus among experts and policy-makers that building a competitive advantage through innovation is essential for sustainable economic development.

It is assumed that companies that carry out research and innovation activities achieve higher growth, have higher revenues, incomes and market share, create new jobs, export more, create higher added value, have higher labour productivity and so on (Hunady et al., 2020; Zakić et al., 2020). In other words, it is important for the entire economy and society that businesses introduce innovations and thereby significantly contribute to long-term and sustainable competitiveness. However, for companies to be willing and able to bring innovations, they must have good conditions. A favourable business and innovation environment is a prerequisite for developing regions and countries.

Negative factors prevent, limit or slow down the innovative activities of companies, which subsequently harms the development of regions and countries. Obstacles to innovation can be internal (firms' capabilities) or external (issues outside the firm) in origin. (e.g. Segarra-Blasco et al., 2008; Arza et al., 2021). Following the OECD (2005) methodology, which is used for statistical and research purposes, barriers to innovation are divided into economic, knowledge, market and other reasons for not innovating. Economic barriers represent the most important of them, and the lack of financial resources for innovation activities or high costs related to innovations are the main constraints (Klímová et al., 2017; Arza et al., 2021; Mina et al., 2021).

The positive benefits of innovation on the one hand and the barriers to innovation on the other are the main reasons governments implement special programmes to support innovation. These measures aim to help businesses overcome economic barriers, lack of financial resources and high innovation costs. Public aid is considered a crucial factor contributing to economic growth (Rodríguez-Pose et al., 2021). Two groups of arguments usually justify public support for research and innovation (e.g., Grillo et al., 2011; Dodgson et al., 2011, Bleda et al., 2013). The first group of arguments is associated with neoclassical economic theory and its assertion of market failure. Arrow (1962) elaborated on these ideas to justify why the government should support research. The market mechanism does not ensure the optimal allocation of resources, as research and development results (new knowledge) behave as a public good. According to him, this is due to their features, such as indivisibility, appropriability and uncertainty. As a result, companies invest fewer resources in R&D than would be socially optimal. Innovation policy should strive for better efficiency in resource allocation (Novak, 2020). The second group of arguments is associated with institutional theoretical approaches that have identified system failures, which their representatives consider as another reason the government should support research and innovation. Woolthuis et al. (2005) defined institutional failures, interaction failures, capability failures, and infrastructural failures as the main system failures. Moreover, in recent years, environmental approaches have emerged. They argue the importance of innovation for solving social and environmental challenges. (e.g., Schot et al., 2018; Giachi et al., 2022).

The research aims to verify whether companies that have received public support for innovation are experiencing turnover growth. The paper searches for answers to two main research questions: 1) Are companies that have received support for innovation activities increasing their turnover? 2) Does the growth in turnover differ according to the size of the company, industry or region? The study is based on the

analysis of the Czech Innovation programme, which supports the implementation of product and process innovations in practice.

Our research was first presented at the ENTRENOVA conference, and this article is an extension of the presented paper (Klímová et al., 2021). The following text is structured into five chapters. After giving the theoretical context (chapter 2), we explain the research methodology (chapter 3). Chapter 4 presents the research results according to all performed partial analyses. Finally, chapter 5 outlines our conclusions.

Effects of innovation support in companies

Innovation policy interventions aim to introduce innovations into practice and their subsequent dissemination. Government support programmes primarily focus on innovations in emerging technology (i.e. product and process). Non-technology innovations (marketing and organisational) can often be supported alone. The innovation policy also includes support for research and development in companies, as R&D is considered a vital knowledge source for innovations (Halaskova et al., 2020). The positive relationship between R&D activities and innovation performance in both developing and developed countries has been confirmed by Pekovic et al. (2015). Aiding the innovation and research activities is usually implemented as programme support (grant tender). This means that the government announces calls, businesses submit their projects and only those that best meet the required criteria receive support. Financial support is usually in the form of a subsidy (grant). Exceptionally, loans and guarantees are provided.

The selection of projects suitable for financing also has its limits. The more innovative companies are more likely to ask for support, and at the same time, these companies have a higher chance of getting a grant because they better meet the required criteria. In the professional literature, the first effect is often referred to as "self-selection of firms". The latter is connected with administrative selection and is referred to as "cream-skimming" (e.g., Curran et al., 2002, Merito et al., 2010). Similar findings are confirmed by Rodríguez-Pose et al. (2021), who adds that subsidies are often obtained by larger companies with sufficient international and innovative trajectories and that the assignment system is sub-optimal. Novosak et al. (2017) address the spatial dimension of the allocation of subsidies and state that more support is directed to more developed regions.

Most of the research studies focus on evaluating R&D support programmes in companies (e.g., Montmartin et al., 2015; Crespi et al., 2016). However, R&D and innovation are not synonymous. R&D results may or may not lead to innovation. At the same time, R&D is not the only source of innovation. Nevertheless, radical innovations (completely new products) are usually the result of research activities (e.g., Coccia, 2017). As Lewczuk et al. (2020) stated, public aid for innovations is a way of creating institutional incentives for the desired behaviour of firms. Bianchini et al. (2019) examined the relationship between R&D subsidies and business R&D investments concerning the quality of public institutions. The research was carried out on the example of Spain and selected European regions. They rejected the crowding-out effect and confirmed the positive impact of public support, especially on companies located in regions with poorer quality public institutions. Their research showed that public support for R&D is important, especially in disadvantaged areas.

Odei et al. (2021) focused on the Visegrad Countries and confirmed that public subsidies for innovations from local, central and EU sources significantly influenced the level of innovations in companies. Galbraith et al. (2017) put their attention to absorptive capacity (i.e., the ability of the company to identify, value, assimilation, and exploit external information) of SMEs in peripheral regions in Northern Ireland (the

United Kingdom). They concluded that when designing an innovation programme for SMEs, feedback from experts and programme participants is crucial for its success.

An analysis compiled for the UK government (BEIS, 2017) dealt with the impact of innovation support schemes on companies' survival, employment and turnover. The study confirmed a positive effect on the survival rate of businesses, with higher impacts detected for young businesses. Public support also had a positive impact on employment and business turnover. Freel et al. (2019) dealt with the impact of innovation policy interventions on exports in Germany and confirmed their positive effect on the export behaviour of companies. Sidorkin et al. (2021) focused on supporting the research activities of Czech companies and evaluated the effects according to the new patents. They found that subsidies contribute to patenting at the national level but not abroad. This means that the technologies created are not sufficiently novel and do not improve companies' international competitiveness.

Neméthová et al. (2019) investigated the effectiveness of grant support for innovation and the optimal amount of support using the example of less developed regions of Slovakia. They have shown that aid positively and significantly affects labour productivity. They also found that most supported enterprises benefit from a higher subsidy and that its optimal amount is around 2 million euros. Montmartin et al. (2015) also achieved similar results in the example of OECD countries. They argue that the desired leverage effect of public support on private investment can only be achieved if the support is high enough, and if it is not high enough, a crowding-out effect may occur. Jugend et al. (2020) investigated innovation support through a meta-analysis from an open innovation perspective. They drew attention to the fact that innovations do not occur in isolation, that open innovation is increasingly emphasised in managerial practice and public policy, and that the need for public support for open innovation is increasing.

Methodology

The subject of this research is changes in the turnover of manufacturing companies that have received support for innovation activities within the Czech Innovation Programme. The purpose was to determine whether the turnover of the enterprises that received support for innovation activities is growing and whether this growth differs according to the size of the enterprise, industry or region.

The Innovation Programme scheme is part of the Operational Programme Enterprise and Innovation for Competitiveness 2014-2020, co-financed by the European Regional Development Fund (ERDF) and represents Czech companies' most important business support instrument. The analysed measure supports putting product and process innovations into practice (API - Business and Innovation Agency, 2021). In other words, the programme primarily finances the introduction of technological innovations in the manufacturing industry, which is crucial for Czech economic development. The API Business and Innovation Agency (intermediate body) ensures the administration of applications and projects, and the Ministry of Industry and Trade (managing authority) decides on project support.

The granted projects can be implemented in the territory of the Czech Republic except for Prague. This is due to the rules of EU cohesion policy, as Prague belongs to the category of more developed regions. However, it depends on the place of implementation of the project, not the residence of the company. Companies registered in Prague can receive support, but their projects must be located outside Prague.

Six calls for innovative projects have been published under this programme. However, only the first three calls, announced between 2015 and 2017, have been

included in the analysis. In the case of these projects, we can evaluate their first results, and therefore, it is possible to monitor the supported companies with a certain time lag. We generated a database of 623 supported projects based on data from the Ministry of Regional Development CZ (2021). The next task was to add information on companies from the MagnusWeb database (Bisnode, 2021)to this data set. In the next step, it was necessary to make some corrections within the created database.

First, the projects whose implementation was prematurely stopped itself or the government were excluded. Thus, 518 implemented projects remained in the data set. We focused only on the projects of enterprises from the manufacturing industry, which was the main target group of the government programme. After this selection, 457 projects remained in the database. In the third step, only those companies that received support in 2017 and earlier were left in the database to evaluate their results over time. In other words, the projects whose implementation began between 2015 and 2017 have been selected, and as a result, 370 items remained in the data set. Furthermore, it was necessary to exclude projects of companies whose economic data (turnover and number of employees) were not available. After all reductions, 276 supported projects were included in our research.

In the case of each company, the turnover a year before obtaining the subsidy and two years after the granting was investigated. It means that the change in turnover within the three years was assessed. All observed indicators fell from 2014 to 2019, i.e., when there was no economic or pandemic crisis.

Table 1:
Manufacturing industries included in the research

Division code	Division title
10	Manufacture of food products
13	Manufacture of textiles
16	Manufacture of wood and products of wood and cork
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke and refined petroleum products
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharm. preparations
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c.
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
31	Manufacture of furniture
32	Other manufacturing
33	Repair and installation of machinery and equipment

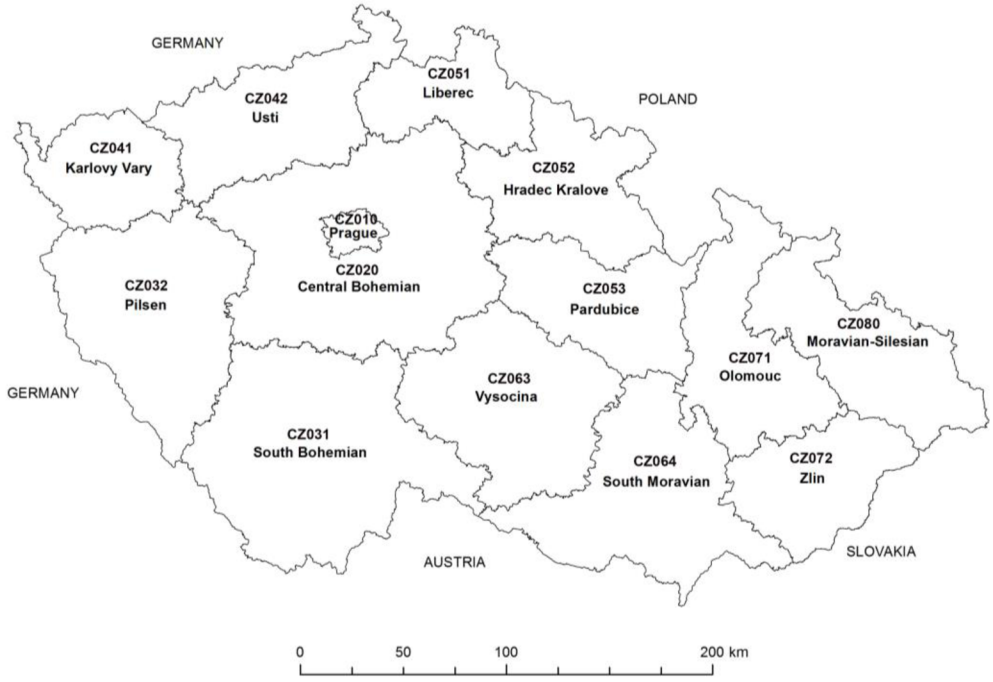
Note: The division list is incomplete; the table shows only the industries where the granted aid was recorded.
Source: authors' processing based on Eurostat (2008)

The analysis was performed according to the size category of the company, the industry and the region in which the company is resident. Firstly, the analysis concerning the size category was conducted. The size of the company was determined based on the number of employees following the Eurostat definition

(European Commission, 2003): small enterprises (0-49 employees), medium-sized enterprises (50-249 employees) and large enterprises (more than 250 employees). Secondly, the industry analysis was carried out. The industries are defined according to the NACE Rev. 2 classification (Eurostat, 2008). NACE (Nomenclature statistique des activités économiques) is the statistical classification of economic activities in the European Community. In this research, the attention is focused only on the manufacturing industry (section C, divisions 10-33; see Table 1).

Thirdly, attention was paid to regional differences in turnover change. The analysis was processed at the level of NUTS3 Regions according to the European NUTS (Nomenclature of territorial units for statistics) classification (Eurostat, 2021).

Figure 1
Map of NUTS3 regions in the Czech Republic



Source: authors' processing

The Czech Republic consists of 14 NUTS3 regions, as shown in Figure 1. The projects within the data set were divided according to the location of the company's registered office, and this criterion was chosen since the enterprises may operate in several regions.

Results and discussion

The research is based on an analysis of 276 companies that implemented a project co-financed by the Innovation Programme. The total amount of subsidy (see, e.g., Table 2) provided to these companies amounted to CZK 3,789.4 million (EUR 147,4 million; EUR 1 = CZK 25.535 at the rate of the European Central Bank at the end of 2017). Individual enterprises got different subsidy amounts, ranging from CZK 1.004 to 100 million (EUR 39,342 – 3,916,193). The average support per company is CZK 13.7 million (EUR 537,683). In more than 90% of projects, the grant is lower than CZK 30 million, i.e., up to EUR 1.17 million. Following Montmartin et al. (2015) or Neméthová et al. (2019), the subsidy provided is quite low, and the results achieved may not be as high.

Size of supported companies and changes in their turnover

Table 2 shows information about the amount of subsidy according to enterprise size. Most of the aid was directed to medium and large enterprises, whereas small enterprises received less than 14% of the allocation. Smaller enterprises also received a lower average subsidy per project, despite state aid rules providing small companies with a higher rate of support (expressed as a percentage of eligible costs).

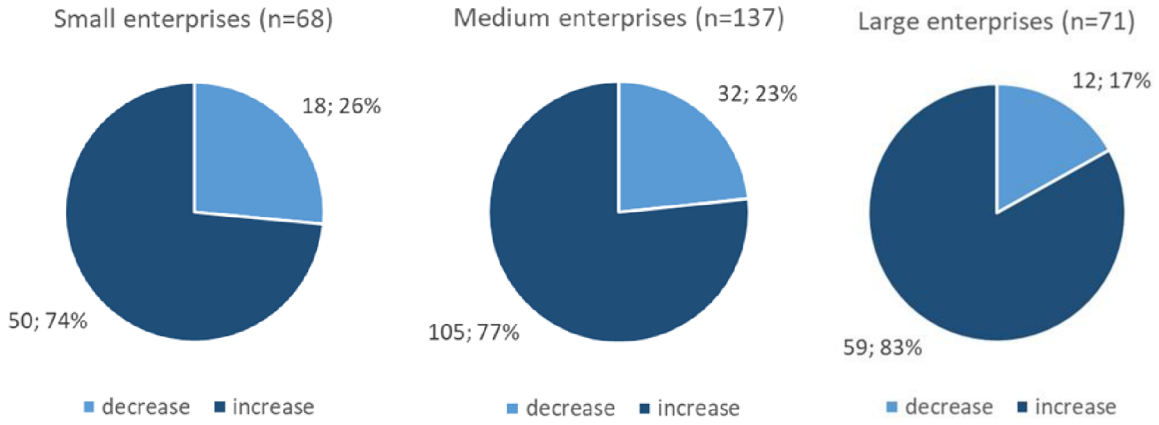
Table 2
The amount of subsidy by the size of enterprises (in CZK, n=276)

Size category	MIN	MAX	Median	Average	Total	Share *
Small enterprises	1,055,250	41,118,449	6,075,000	7,619,093	518,098,327	13.67%
Medium enterprises	1,004,608	100,000,000	7,037,736	11,624,103	1,592,502,114	42.03%
Large enterprises	2,555,503	100,000,000	13,986,020	23,645,131	1,678,804,302	44.30%
Total	**1,004,608**	**100,000,000**	**7,778,426**	**13,729,727**	**3,789,404,742**	**100.00%**

Note: * The percentage share of the size category in all enterprises
Source: authors' processing based on Ministry of Regional Development CZ (2021)

The basic calculation revealed that not all companies grew in turnover in the examined period, which does not correspond with the basic assumption of evaluation. We identified 62 enterprises with a decrease in turnover within the tested group, i.e., 22.46% of them (see Figure 2).

Figure 2
Number and share of enterprises with increasing or decreasing turnover (n=276)



Source: authors' processing based on Ministry of Regional Development CZ (2021)

The highest share of companies with decreasing turnover was observed in small enterprises (26.47%). The lowest share of such companies was found among large entities (16.90%). We consider the number of companies whose turnover has decreased relatively high, both given the favourable economic situation and because of the general positive expectations concerning innovative companies.

The further analysis of turnover growth is focused on 214 companies that have shown a positive change. The crucial decision for calculating and interpreting the results was whether we should work with average values. Because the monitored values for the percentage increase in turnover show significant differences before and

after the granting, the use of averages would lead to distorted conclusions. As a solution, the median values are calculated too, and these values are supplemented by the boundary values of the first and third quartiles. This provides relevant insight into the maximum percentage growth achieved by a quarter, a half and three-quarters of the units in a given category. This systematic approach will also allow us to make a suitable comparison between groups of companies.

Table 3
Percentage of turnover growth according to the size of enterprises (n=214)

Size of enterprises	1st quartile (%)	Median (%)	3rd quartile (%)	Number of enterprises
Small	13.29	28.47	56.31	**50**
Medium	14.14	26.66	46.13	**105**
Large	6.87	17.89	38.04	**59**
All enterprises	**12.90**	**25.53**	**44.73**	**214**

Source: authors' processing based on Ministry of Regional Development CZ (2021)

Table 3 displays the differences in turnover growth among the size groups of companies. The highest increase at the level of the first quartile was observed within medium-sized enterprises. The value of 14.14% is gently higher than in the group of small enterprises. Nevertheless, this value is significantly higher than in the case of large companies. At the level of the third quartile, growth was inversely proportional to the company's size. The group of medium-sized enterprises does not report such significant internal differences, as the median is already lower than for small businesses, and the third quartile limit is even significantly lower (by more than ten percentage points). Large enterprises did not experience such significant growth, mainly caused by higher initial turnover values before the granting.

Industries and changes in turnover of supported companies

In the next part of the research, attention was paid to the manufacturing industry according to the NACE classification. The manufacturing industry is very important for the Czech economy and employs almost 30% of all employees, which means approximately 1.15 million people (Czech Statistical Office, 2021b). The largest number of people is employed in industries marked with codes 29 (172 thousand), 25 (146 thousand), 28 (119 thousand), 10 (84 thousand) and 22 (82 thousand).

Table 4 demonstrates the amount of subsidy according to the individual NACE divisions. The highest share of support was allocated to sections 25, 28 and 29. If the attention is focused on sections 20 to 32, where the largest number of projects was supported, section 29 stands out due to the highest median and average amount of support. Extremely high values were observed in section 10, where only three projects were supported. We negatively perceive that a very low share of subsidies was granted to sections 21, 26 and 30, which are (according to the OECD and Eurostat methodology) the high-tech industries.

Table 4
The amount of subsidy by the NACE division (in CZK, n = 276)

NACE Section C	MIN	MAX	Median	Average	Total	Share *
10	24,500,000	100,000,000	86,912,795	70,470,932	211,412,795	5.58%
13	5,179,950	95,750,000	8,970,143	37,234,732	186,173,659	4.91%
16	1,575,000	20,274,859	5,989,441	8,520,251	51,121,504	1.35%
17	7,810,532	31,250,000	14,061,881	15,540,923	108,786,460	2.87%
18	1,129,500	38,844,225	1,395,000	13,789,575	41,368,725	1.09%
19	2,317,921	2,317,921	2,317,921	2,317,921	2,317,921	0.06%
20	1,055,250	31,358,000	8,286,308	12,657,012	126,570,123	3.34%
21	6,250,000	7,500,000	6,673,250	6,774,125	27,096,500	0.72%
22	2,082,850	50,000,00	6,342,750	10,340,244	268,846,357	7.09%
23	1,925,000	41,118,449	6,362,479	12,469,188	174,568,630	4.61%
24	2,555,503	99,540,000	11,374,869	20,862,577	229,488,348	6.06%
25	1,123,500	49,000,000	8,789,846	11,943,934	692,748,150	18.28%
26	1,225,000	33,250,000	5,250,000	8,035,404	120,531,056	3.18%
27	1,940,750	62,033,004	6,464,647	13,746,559	274,931,170	7.26%
28	1,004,608	95,000,000	6,750,000	11,118,436	600,395,563	15.84%
29	6,579,919	100,000,000	25,329,181	33,113,261	430,472,394	11.36%
30	2,100,000	19,778,169	6,525,000	8,408,865	75,679,781	2.00%
31	3,482,500	33,034,400	10,247,354	12,611,292	100,890,334	2.66%
32	1,374,625	8,889,636	4,634,412	4,956,597	39,652,774	1.05%
33	26,352,500	26,352,500	26,352,500	26,352,500	26,352,500	0.70%
Section C	1,004,608	100,000,000	7,778,426	13,729,727	3,789,404,742	100.00%

Note: * The percentage share of the industry in the whole manufacturing industry (Section C)
Source: authors' processing based on Ministry of Regional Development CZ (2021)

As a relatively large group of companies achieved negative turnover growth in the period under review, it also seems appropriate to analyse this fact by industry. Table 5 shows the number of companies that achieved positive turnover growth by industry.

Table 5
Enterprises with increasing or decreasing turnover by NACE division (n=276)

NACE Section C	Decrease (number)	Decrease (%)	Increase (number)	Increase (%)
10	0	**0.00**	3	100.00
13	3	**60.00**	2	40.00
16	0	0.00	6	100.00
17	3	42.86	4	57.14
18	2	66.67	1	33.33
19	0	0.00	1	100.00
20	3	30.00	7	70.00
21	0	0.00	4	100.00
22	7	28.92	19	73.08
23	5	35.71	9	64.29
24	1	9.09	10	90.91
25	7	12.07	51	87.93
26	5	33.33	10	66.67
27	8	40.00	12	60.00
28	12	22.22	42	77.78
29	3	23.08	10	76.92
30	2	22.22	7	77.78
31	1	12.50	7	87.50
32	0	0.00	8	100.00
33	0	0.00	1	100.00
Total	**62**	**22.46**	**214**	**77.54**

Source: authors' processing based on Ministry of Regional Development CZ (2021)

Within the sections from 20 to 32, the least successful were companies in sections 27, 23 and 26. In addition, the latter belongs to the high-tech category. Good results were found in section 25, where a lot of projects were supported, and at the same time, a large part of the supported companies achieved an increase in turnover.

Table 6 displays the relationship between public support and the economic performance of enterprises by industry. Some industries include a low number of cases, so the interpretation of the results may not be unambiguous. If there are fewer than three companies in a division group, the values of the first and third quartiles cannot be calculated. At the level of the first quartile, the turnover grew the most in divisions 25 and 27. No other industry achieved a growth of 20%. If we do not consider division 13 (with two enterprises only), at the median level, the highest growth was recorded in industries 22, 27 and 29. At the third quartile level, three industries (17, 22 and 30) reached an increase in turnover by more than 100% (or slightly below 100%). We assess this positively, especially in section 22, where a relatively large number of companies have been analysed, and many people work. If we look at the most frequently supported industries (25 and 28), they grew slightly above 40% at the level of the 3rd quartile.

Table 6
Percentage of turnover growth by NACE division (n=214)

NACE Section C	1st quartile (%)	Median (%)	3rd quartile (%)	Number of enterprises
10	14.99	37.42	48.32	3
13		1195.74		2
16	16.02	36.70	88.48	6
17	1.27	23.99	107.87	4
18		11.94		1
19		22.06		1
20	4.31	20.67	41.90	7
21	6.36	19.66	60.69	4
22	16.03	38.11	105.60	19
23	10.35	17.41	44.38	9
24	1.01	12.56	22.29	10
25	12.91	27.41	41.30	51
26	15.90	30.16	72.01	10
27	20.58	33.01	43.67	12
28	10.68	18.65	43.39	42
29	10.08	31.72	55.54	10
30	25.50	30.39	99.74	7
31	8.24	24.28	32.85	7
32	12.34	27.25	37.37	8
33		**22.54**		1
Section C	12.90	25.53	44.73	**214**

Note: Empty fields are cases where the group includes less than three enterprises.
Source: authors' processing based on Ministry of Regional Development CZ (2021)

Regions and changes in turnover of supported companies

In the last part of the research, the regions were paid attention to. The Czech Republic, where 10.7 million people live, is divided into 14 NUTS3 regions representing the self-governing territorial units. The Central Bohemian Region (1.4 million), Prague (1.3 million), the South Moravian Region (1.2 million) and the Moravian-Silesian Region (1.2 million) have the highest number of inhabitants (Czech Statistical Office, 2021a). In terms of GDP per capita, there is a big difference between Prague and other regions. The position of the Central Bohemian Region in all economic activities is very specific, as this region forms a ring around Prague and is closely connected with the

capital city. Research activities are concentrated mainly in Prague, the Central Bohemian Region and the South Moravian Region (e.g., Žítek, 2016).

Table 7 shows the allocation of the provided support across individual NUTS3 regions. It was observed that the enterprises in the three top regions (Central Bohemian Region, Zlin Region and South Moravian Region) received more than 40% of the funding. The amount of support in the Zlin Region is particularly surprising, as it has half the population of the other two regions.

Table 7
The amount of subsidy by the NUTS3 region (in CZK)

NUTS3 region	MIN	MAX	Median	Average	Total	Share (%)*
CZ010 Prague	1,055,250	50,244,263	5,850,000	9,925,798	248,144,951	6.55%
CZ020 Central Bohemian	2,317,921	100,000,000	8,845,499	20,861,884	584,132,763	15.41%
CZ031 South Bohemian	3,580,500	100,000,000	6,439,959	15,585,033	218,190,460	5.76%
CZ032 Pilsen	1,364,210	50,000,000	7,589,559	11,936,798	238,735,952	6.30%
CZ041 Karlovy Vary	3,638,000	13,192,016	5,929,958	7,586,658	22,759,974	0.60%
CZ042 Usti	2,449,918	99,540,000	11,202,250	22,966,609	206,699,477	5.45%
CZ051 Liberec	1,395,000	57,791,439	5,242,725	13,068,386	91,478,702	2.41%
CZ052 Hradec Kralove	3,456,250	95,750,000	8,889,636	19,580,321	254,544,176	6.72%
CZ053 Pardubice	2,452,707	43,008,261	10,712,934	13,867,054	221,872,871	5.86%
CZ063 Vysocina	2,249,515	51,575,335	7,000,000	11,012,021	187,204,349	4.94%
CZ064 South Moravian	1,004,608	70,726,065	7,500,000	11,395,041	421,616,500	11.13%
CZ071 Olomouc	1,925,000	62,033,004	8,591,771	13,984,686	293,678,406	7.75%
CZ072 Zlin	1,129,500	50,225,000	8,789,846	12,453,502	523,047,094	13.80%
CZ080 Moravian-Silesian	1,123,500	86,912,795	5,355,739	11,554,128	277,299,069	7.32%
Czech Republic	1,004,608	100,000,000	7,778,426	13,729,727	3,789,404,742	100.00%

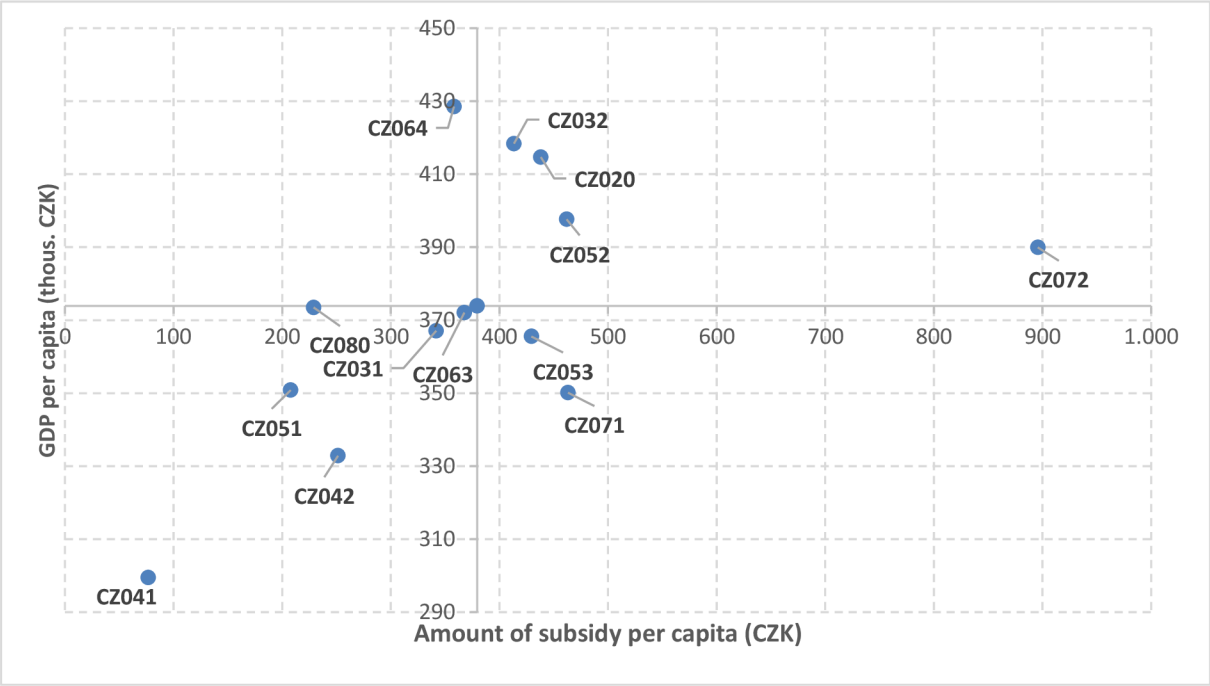
Note: * The percentage share of the region in all Czech regions
Source: authors' processing based on Ministry of Regional Development CZ (2021)

The low share of Prague is caused mainly due to the rules mentioned above in the programme. On the other hand, many companies have their headquarters in Prague, while their production is primarily in other regions. Less than 8% of the provided support was distributed among the three bottom regions (Karlovy Vary Region, Liberec Region and Vysocina Region). In terms of average and median subsidy levels, no such differences, as in the case of the manufacturing industry, were observed among the Czech regions.

As the Innovation Programme is implemented as part of the EU cohesion policy, it aims not only to enhance innovation activities but also to reduce disparities in the level of development of individual regions. Therefore, we were also interested in whether the financial support is allocated to the poorer or rather to the more prosperous

regions. The average gross domestic product per capita from 2015 to 2017 (Czech Statistical Office, 2021a) was calculated and compared with the subsidy per capita.

Figure 3
Amount of subsidy per capita and GDP per capita in NUTS3 regions



Note: One outlier observation (CZ010) was excluded to visualise the data better.
Source: authors' processing based on Ministry of Regional Development CZ (2021) and Czech Statistical Office (2021b)

Figure 3 presents a scatter plot of the amount of subsidy per capita against GDP per capita in NUTS3 regions. Regions in the upper right quadrant are those with an above-average amount of subsidy received (per capita) and above-average GDP (per capita). Prague was excluded from the chart because it reaches extreme values in both indicators, and the presented results would be significantly distorted. In the case of GDP per capita, Prague achieves extremely high values and is one of the most developed regions in the EU. On the contrary, it has low support values due to public aid rules. The figure indicates that high-performing regions are more likely to be subsidised. The correlation coefficient is 0.51, meaning that the variables are moderately correlated.

Table 8 illustrates the number of enterprises with increasing and decreasing turnover in NUTS3 regions. The largest share of companies with a positive turnover rate can be found in the Pardubice Region (87.5%), the South Bohemian Region and the Zlin Region (both 85.71%). On the opposite, the Karlovy Vary Region has the largest share of companies that experienced a decrease (66.67%), influenced mainly by the low number of supported projects.

Table 8
Enterprises with increasing or decreasing turnover by NUTS3 region (n=276)

NUTS3 region	Decrease (number)	*Decrease (%)*	Increase (number)	*Increase (%)*
CZ010 Prague	10	40.00	15	60.00
CZ020 Central Bohemian	8	28.57	20	71.43
CZ031 South Bohemian	2	14.29	12	85.71
CZ032 Pilsen	4	20.00	16	80.00
CZ041 Karlovy Vary	2	66.67	1	33.33
CZ042 Usti	3	33.33	6	66.67
CZ051 Liberec	2	28.57	5	71.43
CZ052 Hradec Kralove	2	15.38	11	84.62
CZ053 Pardubice	2	12.50	14	87.50
CZ063 Vysocina	7	41.18	10	58.82
CZ064 South Moravian	7	18.92	30	81.08
CZ071 Olomouc	3	14.29	18	85.71
CZ072 Zlin	6	14.29	36	85.71
CZ080 Moravian-Silesian	4	16.67	20	83.33
Czech Republic	**62**	**22.46**	**214**	**77.54**

Source: authors' processing based on Ministry of Regional Development CZ (2021)

As shown in Table 9, differences in turnover growth can be observed across regions. The most successful appears to be the South Bohemian Region – one-half of the enterprises experienced up to 47.36% higher turnover than in the year before the aid; one-quarter recorded a rise up to 74.99%. High growth at the median level was also observed in Prague, the Pardubice Region and the Zlin Region.

Table 9
Percentage of turnover growth by NUTS3 region (n=214)

NUTS3 region	1st quartile (%)	Median (%)	3rd quartile (%)	Number of enterprises
Prague	23.47	33.08	43.77	15
Central Bohemian	9.31	15.35	40.78	20
South Bohemian	11.33	47.36	74.99	12
Pilsen	8.40	20.27	59.27	16
Karlovy Vary		17.41		1
Usti	6.22	21.42	131.33	6
Liberec	12.49	22.97	50.97	5
Hradec Kralove	17.48	28.93	39.97	11
Pardubice	18.48	32.98	60.26	14
Vysocina	9.50	25.79	31.15	10
South Moravian	13.35	27.67	37.20	30
Olomouc	6.90	16.90	40.75	18
Zlin	14.95	30.57	64.82	36
Moravian-Silesian	11.90	23.08	34.05	20
Czech Republic	**12.90**	**25.53**	**44.73**	**214**

Note: Empty fields are cases where the group includes less than three enterprises.
Source: authors' processing based on Ministry of Regional Development CZ (2021)

Significant differences in turnover growth were found among companies in the Usti Region, but this is influenced by the low number of units. The lowest rates can be observed in the Central Bohemian, Olomouc and Pilsen Regions. At the level of the

third quartile, the South Moravian Region reached surprisingly low values. This region generally considered very innovative and concerning GDP, has very high expenditures on research and development.

Conclusion

The paper dealt with the changes in the turnover of companies that received support for their innovation activities. The research aimed to verify whether companies that have received public support for innovation are experiencing turnover growth. The paper searched for answers to two main research questions: 1) Are companies that have received support for innovation activities increasing their turnover? 2) Does the growth in turnover differ according to the size of the company, industry, or region?

The research was conducted on the example of the Czech Innovation Programme, and the analysis included 276 projects launched during the period 2015-2017 and implemented in the manufacturing industry. The projects were also divided into NUTS3 regions. The paper investigated the turnover a year before receiving the aid and two years after the granting for each company. Therefore, the change in turnover within the three years was assessed.

The analysis showed that 62 companies (22.46%) reported a decrease in turnover during the observed period, and therefore only 214 companies were included in the more detailed analysis. The decrease was most frequent in small enterprises and least often in large ones. The share of companies with decreasing turnover is higher than expected, both because of the favourable economic situation and the positive expectations relating to innovative companies. Nevertheless, we confirmed that state aid for innovation positively influences companies' economic performance. In the case of many companies, it was a significant increase in turnover over the examined period.

Enterprises that showed an increase in turnover were classified into quartiles according to the increase in turnover. When the success of these companies is assessed at the median level, the largest growth was found in the category of small enterprises. Within the manufacturing industry, we focused mainly on industries with NACE codes from 20 to 32, as most projects were supported in these divisions. At the median level, there was the largest increase in companies in sections 22, 27, 26, 29 and 30 (increase in turnover by more than 30%). On the contrary, the lowest increase in turnover was recorded for enterprises in sections 21, 23, 24 and 28 (increase in turnover by less than 20%). Differences in turnover growth were also observed across regions. At the median level, companies in some regions that are not traditionally innovative recorded high growth.

On the contrary, low growth was recorded in some regions, which are considered to be highly innovative. However, this conclusion cannot be generalised. It was also worth noting that the support usually flows to regions with higher economic performance.

The research has revealed several implications for innovation policy. A high share of public support is allocated to large companies, but the support should help the smaller companies. This should be kept in mind when setting programme rules. Better information and raising public awareness can also contribute to the greater involvement of small companies. More attention should also be paid to companies from the high-tech and medium-high tech industries. The increase in turnover for some companies was low or even negative, which signals that support should not only focus on the technical side of innovation but also on raising awareness of innovations among potential customers (e,g., parallel support for marketing innovation).

The analysis has opened up several questions that offer space for further research. First, the implementation of the whole Innovation Programme, i.e. projects supported up to 2021, should be evaluated with a certain time lag. However, one limitation to this research lies in the fact that the economic performance of companies will be affected by the Covid-19 pandemic in 2020 and beyond. We see another research potential compared to the control group of companies that do not draw any public support for innovation and research activities. At the same time, we are not sure if a sufficient number of such companies will be available. Further research space is offered by qualitative research to determine whether companies would implement their innovation plan even without public support. Such research would allow a better assessment of the crowding-out effect.

The main limit of the research is the short time elapsed since implementing the Innovation Programme, and it is, therefore, not yet possible to assess the longer-term effects. In our research, we were also limited by the unavailability of economic data for many companies, so we had to reduce the research sample. This points to the fact that Czech companies often do not fulfil their obligations and do not publish financial statements. The availability of financial data for more companies and the inclusion of later implemented projects would enable us to obtain more significant research results.

References

1. API – Business and Innovation Agency (2021), „General Information on OP EIC“, available at https://www.agentura-api.org/en/op-pik-obecne (20 April 2021)
2. Arrow, K. J. (1962) , "Economic welfare and the allocations of resources of invention“, in The Rate and Direction of Inventive Activity: Economic and Social Factors, Princeton, Princeton University Press, pp. 609-626.
3. Arza, V., Lopez, E. (2021), „Obstacles affecting innovation in small and medium enterprises: Quantitative analysis of the Argentinean manufacturing sector“, Research Policy, Vol. 50 No. 9, pp. 1039-1052.
4. BEIS (2017), "The impact of public support for innovation on firm outcomes“, BEIS Research Paper, No. 3, BEIS, Department for Business, Energy & Industrial Strategy, London.
5. Bianchini, S., Llerena, P., Martino, R. (2019), "The impact of R&D subsidies under different institutional frameworks“, Structural Change and Economic Dynamics, Vol. 50 No. September 2019, pp. 65-78.
6. Bisnode (2021), „MagnusWeb“, available at https://magnusweb.bisnode.cz (15 January 2021)
7. Bleda, M., del Río, P. (2013), „The market failure and the systemic failure rationales in technological innovation systems“, Research Policy, Vol. 42 No. 5, pp. 1039-1052.
8. Coccia, M. (2017), „Sources of technological innovation: Radical and incremental innovation problem-driven to support competitive advantage of firms“, Technology Analysis, Vol. 29 No. 9, pp. 1048-1061.
9. Crespi, G., Giuliodori, D., Giuliodori, R., Rodriguez, A. (2016), „The effectiveness of tax incentives for R&D+i in developing countries: The case of Argentina“, Research Policy, Vol. 45 No. 10, pp. 2023-2035.
10. Curran, J., Storey, D. J. (2002), „Small business policy in the United Kingdom: the inheritance of the Small Business Service and implications for its future effectiveness“, Environment and Planning C: Government and Policy, Vol. 20 No. 2, pp. 163-177.
11. Czech Statistical Office (2021a), „Public database“, available at https://vdb.czso.cz/vdbvo2/faces/en/index.jsf (28 December 2021)
12. Czech Statistical Office (2021b), „Statistical Yearbook of the Czech Republic - 2021“, available at https://www.czso.cz/csu/czso/statistical-yearbook-of-the-czech-republic-rtnih2q42g (5 January 2022)

13. Dodgson, M., Hughes, A., Foster, J., Metcalfe, S. (2011), „Systems thinking, market failure, and the development of innovation policy: The case of Australia", Research Policy, Vol. 40 No. 9, pp. 1145-1156.
14. European Commission (2003), „Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises", available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32003H0361 (10 May 2022)
15. Eurostat (2008), „NACE Rev. 2 - Statistical classification of economic activities", available at https://ec.europa.eu/eurostat/en/web/products-manuals-and-guidelines/-/KS-RA-07-015 (20 April 2021)
16. Eurostat (2021), „NUTS - Nomenclature of territorial units for statics", available at https://ec.europa.eu/eurostat/web/nuts/background (28 December 2021)
17. Freel, M., Liu, R., Rammer, C. (2019), „The Export Additionality of Innovation Policy", Industrial and Corporate Change, Vol. 28 No. 5, pp. 1257-1277.
18. Galbraith, B., McAdam, R., Woods, J., McGowan, T. (2017), „Putting Policy into Practice: An Exploratory Study of SME Innovation Support in a Peripheral UK Region", Entrepreneurship and Regional Development, Vol. 29 No. 7-8, pp. 668-691.
19. Giachi, S., Alvarez-Tinoco, R. (2022), „Innovation Policy Development for Sustainable Fisheries in the Global South: From R&D to System Transformation", Innovation and Development, Vol. 12 No. 1, pp. 113-134.
20. Grillo, F., Landabaso, M. (2011), „Merits, problems and paradoxes of regional innovation policies", Local economy, Vol. 26 No. 6-7, pp. 544-561.
21. Halaskova, M., Gavurova, B., Kocisova, K. (2020), „Research and Development Efficiency in Public and Private Sectors: An Empirical Analysis of EU Countries by Using DEA Methodology", Sustainability, Vol. 12 No. 17, pp. 1-22.
22. Hunady, J., Pisar P., Durcekova I. (2020), „R&D Investments in the European ICT sector: Implications for Business Performance", Business Systems Research, Vol. 11 No. 3, pp. 30-44.
23. Jugend, D., Fiorini, P. D. C., Armellini, F., Ferrari, A. G. (2020) , „Public support for innovation: A systematic review of the literature and implications for open innovation", Technological Forecasting and Social Chang, Vol. 156 No. July 2020.
24. Klímová, V., Winklerová, L. (2017), "Bariéry pro rozvoj inovací v regionech (Barriers to innovation development in regions)", in Klímová, V., Žítek, V. (Eds.) 20th International Colloquium on Regional Sciences, Masaryk University, Brno, Czech Republic, pp. 246-254.
25. Klímová, V., Žítek, V., Lelková, T. (2021), „The Influence of Public Support for Innovations on the Economic Performance of Enterprises", in ENTRENOVA - ENTerprise REsearch InNOVAtion, IRENET, Society for Advancing Innovation and Research in Economy, Zagreb, Croatia, pp. 323-331.
26. Lewczuk, A., Lewkowicz, J. (2020), „Incentives for Private Innovations - Is Public Support Necessary?", Argumenta Oeconomica, Vol. 45 No. 1, pp. 105-139.
27. Merito, M., Giannangeli, S., Bonaccorsi, A. (2010), „Do incentives to industrial R&D enhance research productivity and firm growth? Evidence from the Italian case", International Journal of Technology Management, Vol. 49 No.1/2/3, pp. 25-48.
28. Mina, A., Di Minin, A., Martelli, I., Testa, G., Santoleri, P. (2021), „Public funding of innovation: Exploring applications and allocations of the European SME Instrument", Research Policy, Vol. 50 No. 1.
29. Ministry of Regional Development CZ (2021), „DotaceEU.cz. European Funds Portal in the Czech Republic", available at https://www.dotaceeu.cz/en/home-en (15 January 2021)
30. Montmartin, B. A., Herrera, M. (2015), „Internal and external effects of R&D subsidies and fiscal incentives: Empirical evidence using spatial dynamic panel models", Research Policy, Vol. 44 No. 5, pp. 1065-1079.
31. Neméthová, V., Širanová, M., Šipikal, M. (2019), „Public support for firms in lagging regions - evaluation of innovation subsidy in Slovakia", Science & Public Policy, Vol. 46 No. 2, pp. 173-183.
32. Novak, I. (2020), „Comparative analysis of innovation performance of European Union countries", Notitia - journal for economic, business and social issues, Vol. 6 No. 1, pp. 1-11.

33. Novosák, J., Hájek, O., Novosáková, J., Lindner, M. (2017), „Enterprise support policy and territorial cohesion: The Czech Republic (2007-2013)“, Journal of Urban and Regional Analysis, Vol. 9 No. 2, pp. 141-157.
34. Odei, S. A., Stejskal, J., Prokop, V. (2021), „Revisiting the Factors Driving Firms' Innovation Performances: the Case of Visegrad Countries“, Journal of the Knowledge Economy, Vol. 12 No. 3, pp. 1331-1344.
35. OECD (2005), Oslo manual. The Measurement of Scientific and Technological Activities, Proposed Guidelines for Collecting and Interpreting Technological Innovation Data, 3rd ed., Paris, OECD.
36. Pekovic, S., Lojpur, A., Pejic-Bach, M. (2015), „Determinants of innovation intensity in developed and in developing economies: The case of France and Croatia“, International Journal of Innovation Management, Vol. 19 No. 5.
37. Rodríguez-Pose, A., Belso-Martinez, J.A., Díez-Vial, I. (2021), „Playing the innovation subsidy game: Experience, clusters, consultancy, and networking in regional innovation support“, Cities, Vol. 119.
38. Schot, J., Steinmueller, W.E. (2018), „Three frames for innovation policy: R&D, systems of innovation and transformative change“, Research Policy, Vol. 47 No. 9, pp. 1554-1567.
39. Segarra-Blasco, A., Garcia-Quevedo, J., Teruel-Carrizosa, M. (2008), „Barriers to innovation and public policy in Catalonia“, International Entrepreneurship and Management Journal, Vol. 2008 No. 4, pp. 431-451.
40. Sidorkin, O., Srholec, M. (2021), „Do Direct Subsidies Stimulate New R&D Outputs in Firms? Evidence from the Czech Republic“, Journal of the Knowledge Economy, early access.
41. Silva, P., Pires, S. M., Teles, F. (2021), „Explanatory models of regional innovation performance in Europe: policy implications for regions“, Innovation: The European Journal of Social Sciences, Vol. 34 No. 4, pp. 609-631.
42. Woolthuis, R. K., Lankhuizen, M., Gilsing, V. (2005), „A system failure framework for innovation policy design“, Technovation, Vol. 25 No. 6, pp. 609-619.
43. Zakić, N., Popović, J., Miškić, M. (2020), „The Linkages Between Investments in Innovation and Business Performance in Serbia“, Management: Journal of Sustainable Business and Management Solutions in Emerging Economies, Vol. 25 No. 3, pp. 1-11.
44. Žítek, V. (2016), "Změny zaměstnanosti ve výzkumu a vývoji v českých krajích (Changes of employment in research and development in the Czech regions)“, in Klímová, V., Žítek, V. (Eds.), 19th International Colloquium on Regional Sciences, Masaryk University, Brno, Czech Republic, pp. 289-295.

About the authors

Viktorie Klímová works as an associate professor at Masaryk University, Faculty of Economics and Administration, Department of Regional Economics and Administration. Her research focuses on the implementation of innovation policy in EU countries and the role of policy-makers and institutions in the innovation environment. She is particularly interested in the spatial and regional context of these issues. She participated in several research and developmental projects financed by national and European resources. The author can be contacted at email: **viktorie.klimova@econ.muni.cz**.

Vladimír Žítek works as an associate professor and department head at Masaryk University, Faculty of Economics and Administration, Department of Regional Economics and Administration. His research interests are the functioning of regional innovation systems and territorial disparities in economic activity. He also deals with real estate valuation and matters of the real estate market. He participated in several research and developmental projects financed by national and European resources. The author can be contacted at email: **vladimir.zitek@econ.muni.cz**.

Tereza Lelková is a PhD. Student in Regional Economics and works as an instructor at Masaryk University, Faculty of Economics and Administration, Department of Regional Economics and Administration. Her research interests are innovation policy, particularly the innovation policy aimed at solving societal challenges, mission-oriented policy and responsible research innovation. The author can be contacted at email: **tereza.lelkova@econ.muni.cz**.