

Innovation vouchers and cooperation: a different approach in two countries with a shared history

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Abstract

Innovation vouchers are a tool of innovation policy, which aims to initiate cooperation between different actors, particularly between the business and research entities. The paper compares the implementation of vouchers in the Czech Republic and Slovakia. Its objective is to compare the policy approaches to innovation vouchers in two countries in Central Europe which have a shared history, but which, at some point, went their own way. Vouchers in Czechia have a longer tradition and were first initiated at the regional level. In Slovakia, vouchers were only implemented at the national level and with a lower budget. The research confirmed the persistent differences in the innovation policies and the more proactive approach in Czechia. The paper's contribution also lies in the focus on transitive economies, which have received less research attention so far. Implications for the design of innovation policies in countries with emerging innovation systems are included.

Keywords: innovation voucher, innovation policy, cooperation, Czech Republic, Slovakia

Introduction

In both economic theory and political practice, there is a broad consensus that cooperation between innovation actors positively affects innovation performance. The meaning of innovation collaboration, from different points of view, is examined in several theoretical approaches and concepts, such as the concept of open innovation (Prokop et al., 2021a), the concept of innovation systems (Doloreux & Parto, 2005) and the concept of global production networks (Blažek, 2016). Public-private cooperation, contacts between universities and companies, business networks and other forms of collaboration are necessary to create and disseminate knowledge and increase the innovation performance of firms, regions and nations (e.g., Grillo & Landabaso, 2011; Huggins & Thompson, 2015).

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Participation in innovation networks enables the acquisition and exchange of knowledge and the development of new ideas and skills. Firms that use different external sources of knowledge available at different territorial levels are more likely to create new product innovations that are new to the market (Odei et al., 2020; Tödting & Grillitsch, 2015). Thanks to cooperation, companies can share innovation tasks and achieve goals that they would not achieve independently, and to share the risks and costs of their innovation projects (Marzucchi et al., 2015). Finally, collaboration has a positive impact on the sales and turnover of companies (Fedyunina & Radošević, 2022; Prokop et al., 2021).

Since cooperation accelerates the innovation process and leads to the more frequent introduction of radical innovations, innovation policy enhances it through various instruments. Cooperation-oriented innovation policy tools enable to connect the supply and demand side of the innovation system and thus contribute to the removal of one of its most significant barriers. Innovation vouchers are one in a range of such policy instruments.

The research carried out so far mainly dealt with the functioning of innovation vouchers in countries with high innovation performance and a long market economy tradition. We see a gap in the lack of research on this instrument in Central and Eastern European countries. This is also confirmed by other authors (Stojčić et al., 2020). Similarly, Vujanović et al. (2022) point out that innovation regimes differ between advanced and emerging economies, and therefore innovation policy must be adapted to this.

This paper deals with the implementation of innovation vouchers in the Czech Republic and Slovakia. The aim of our research is to compare the policy approaches to innovation vouchers in two countries in Central Europe that have a common history, but which, at some point, went their own way. Both countries are connected with close cooperation in many areas of social and economic life, but in some aspects, they still differ. One of these matters is the importance and emphasis on research and innovation policy.

The paper is structured as follows. The first part approaches the matter of innovation vouchers through a literature review. We deal here with their history, essence, organisational ensuring, financing and contribution. The second part introduces the reader to the methodology, data sources and context of both countries. Implementations of innovation vouchers in Czechia and Slovakia are analysed in the third section. Both political approaches are compared and discussed there.

1. Literature review

Previous research (Odei et al., 2021) confirmed that public support for innovations from regional, national and supranational (e.g., EU) sources significantly influences firm-level innovations. Cooperation between companies and the research sphere is not always spontaneous (Matt et al., 2012), and therefore,

eligible policy effort is mainly aimed at strengthening cooperation and the creation of a more favourable environment for the support and networking of innovative activities of local actors (Rodriguez-Pose & Di Cataldo, 2015). Public policymakers strive to support companies to cooperate with other organisations through various tools. Governments support technical services, consultancy and design innovation network schemes (Caragliu et al., 2022).

Innovation vouchers have been applied in many countries and belong to the most widespread types of government support for innovation in SMEs in the form of subsidies that partially cover the costs of accessing knowledge (Storey, 2003; Sala et al., 2016; Caloffi et al., 2022). The origin of innovation vouchers is attributed to the Netherlands, where they were first used in 1997 (Cornet et al., 2006). Currently, they are implemented, e.g., in Italy (Sala et al., 2016), Austria and Switzerland (Good & Tiefenthaler, 2011), the United Kingdom (SQW, 2014), Canada (Langhorn, 2014), and almost all countries of the European Union.

Innovation vouchers represent a tool whose purpose is to start cooperation between the business and research spheres and support technology transfer (Hlaváček, 2017). Their essence lies in the fact that the company receives an imaginary voucher of a specific financial value and must use it to purchase services (e.g., contractual research, laboratory measurements or testing) from some research organisation (university, research institute, research centre). They do not aim to support long-term cooperation but rather to give the initial impulse to start the cooperation, which will ideally continue later, even without public support. The support is mainly intended for small and medium-sized enterprises that do not have their own research capacities and the necessary research facilities and skills. These companies are thus looking for various possibilities of cooperation in order to eliminate their shortcomings (Prokop et al., 2021b). The grants in the EU usually reach low amounts and are provided as de minimis support, which, according to the rules of the European Union, does not distort economic competition (European Union, 2013).

The official provider of support is generally a regional or national government (often via a specialised agency). There is a wide range of options for designing innovation voucher schemes (Flanagan et al., 2011), and their success rates can vary considerably between countries and regions (Edler et al., 2016). The differences are mainly in the target group, the scope of supported activities, funding sources, the degree of co-financing and the administration system (Rada, 2012). The use of the tool is sometimes territorially limited, especially in the cases where it is implemented by the regional government. This then means that either a company from a certain region can receive support, or the service must be ordered from a research organisation from a pre-defined region. The tool can thus be well and simply adapted to the specific conditions and shortcomings of the regions. If the vouchers are implemented by the national government, there are usually no territorial conditions. Vouchers can also be limited by sector, and thus it is possible to support cooperation

in thematic areas that are important for solving some societal problem (e.g., pandemics or environmental problems).

Special mechanisms that would not be applicable to other instruments are sometimes used for project selection. In the Netherlands (Cornet et al., 2006) and some Czech regions, it is common that after initial formal control of the eligibility, recipients of support are selected by lottery. Usually, providers support all projects that meet the specified conditions and for which the allocated budget is sufficient. Businesses may be limited by the number of projects they can submit. The most significant risk of innovation vouchers is that they can be misused by companies that already cooperate with research organisations. In this case, the voucher does not lead to the establishment of cooperation but rather replaces private investments.

Radas and Anić (2013) proved in the example of Croatia that the more advanced the company is in terms of R&D activities, the better the team can use the financial support provided by innovation vouchers. Interestingly, these authors also found higher complementarity in projects involving universities and research centres as suppliers of knowledge than in those involving private companies that already cooperated with recipient firms in the past. In the case of the United Kingdom, Bakhshi et al. (2015) found that, due to the low amount of financial support, it is rare to see a significant impact of these innovation tools. Nevertheless, since SMEs' costs for purchasing specialised services can be financially unbearable for them, innovation vouchers help to at least partially alleviate the financial burden (Caloffi, 2022; Coletti & Landoni, 2018).

Evaluating the impact of an innovation voucher scheme in Poland, Szymański (2011) proved that the benefits were reciprocal for both recipients and providers of services. Businesses gained useful scientific knowledge, while academics were confronted with real problems and learned new business practices. In many cases, additional contracts were signed between the recipients and the university. A study of more than three hundred British micro and small businesses found that the greatest benefit of innovation vouchers was an increase in the openness of their managers to external knowledge (Chapman & Hewitt-Dundas, 2018). Experiences from Armenia, Belarus, Georgia and Moldova show that this financial instrument is successfully applied to renewable energy and energy efficiency projects (Spiesberger & Schönbeck, 2019). Ivashchenko et al. (2021) analyzed 47 innovation voucher programmes worldwide, and consider the low amount of support provided, the short-term use of vouchers, the location of the company and the university, insufficient focus on local innovations and an unclear mechanism for evaluating submitted projects as disadvantages.

There are only a few studies that have dealt directly with innovation vouchers in the Czech Republic and Slovakia. The research carried out so far has a more general character and deals with the broader support of innovation. Hlaváček (2017) evaluated the regional programme of innovation vouchers in the Ústí Region (Czechia), and confirmed that vouchers enhanced the growth of the companies,

strengthened innovations and contributed to the sectoral restructuring of the region. Matulová et al. (2015) dealt with a regional programme in the South Moravian Region (Czechia). They stated that supported enterprises are now more aware of the potential hidden in collaboration and are better prepared to organize this collaboration in the future. Klímová and Žítek (2020) evaluated the Czech vouchers and pointed out that regional voucher programmes are becoming popular even in innovatively weaker regions. They also found that a significant part of the support for national vouchers is allocated to the most innovative regions, and weaker regions are not able to use the offered resources. Research in the field of vouchers in Slovakia has so far only concerned the creative vouchers (Baláž et al., 2022; Baláž et al., 2023). Studies in the area of innovation vouchers are still lacking here, thus confirming the presence of a research gap.

2. Methodological approach and data sources

2.1. Investigated countries

The paper compares the implementation of innovation vouchers in the Czech Republic and Slovakia. Both countries formed a common state in the past. Czechoslovakia was created in 1918 after the First World War, and its economy, based mainly on the industry, achieved a high performance. After the Second World War, and particularly after 1948, the country became part of the so-called Eastern bloc of socialist countries, and the economy was managed centrally. Even in this era, it preserved the industrial character and tradition of R&D. However, the economy and research were not able to compete with developed countries based on a market economy. Huge changes in the economy and society occurred after 1989, when the country left the sphere of influence of the Soviet Union, began to build democratic values, and transformed into a market economy. In 1993, Czechoslovakia was divided, and the independent Czech Republic and Slovakia were established. Both countries have close relations in all spheres of economic and social life. However, some differences began to emerge. Slovakia has been struggling with lower economic and research performance for a long time, which is also demonstrated by the data in Table 1.

Table 1. Characteristics of the Czech Republic and Slovakia

	GDP per capita (%)			Expenditures R&D (% of GDP)		
	2010	2015	2019	2010	2015	2019
Czechia	84	89	93	1.33	1.92	1.93
Slovakia	77	79	71	0.61	1.16	0.82
EU-27	100	100	100	1.97	2.12	2.22

Note: GDP per capita in PPS expressed as a percentage of the EU average

Source: Eurostat (2023)

In terms of GDP and R&D expenditures, both countries are below the EU average; nevertheless, Slovakia's values are especially lower. These countries also have a lower innovation performance according to the European innovation Scoreboard (European Commission, 2022). The Czech Republic has long been among moderate innovators (the 3rd category) and Slovakia among emerging innovators (the 4th category). The Czech Republic clearly had a better structure of the economy, with a larger share of final production and higher added value. The automotive industry is crucial for both countries. Although both countries have an industrial character, the Czech economy is characterised by a higher proportion of services.

In the 1990s, the emphasis of economic policy was put on transformation, and innovation was not a priority. New R&D relationships were built too. Prior to 1989, the collaboration between academia and business was disrupted. Applied research was carried out in specialised departments of large state-owned companies. However, these research workplaces were not competitive, and after privatisation in the 1990s, the new owners eliminated them. After 1989, a transformation of research institutes and an expansion of the network of public universities took place. However, the barriers between the academic and business spheres in both countries have not been overcome, and the level of their cooperation is quite low. In 2004, both countries joined the European Union. In 2009, Slovakia adopted the euro as its currency. The Czech Republic does not yet use the euro.

Our research also focuses on the regions in both countries, and therefore we consider it important to briefly present their characteristics as well. In the following tables, the economic characteristics relate to 2019. At that time, the economies of both countries were not yet affected by the pandemic and energy crisis and thus better reflect their long-term situation. We selected four indicators that give a basic idea of the situation in individual regions. Two indicators (population and total GDP) illustrate the size of the region and its economic power. For the evaluation of the economic and innovation performance, we chose two indicators that are widely used for comparison. The first of them is GDP per capita which, for example, the EU considers the primary indicator of economic performance and serves as the main criterion for the distribution of support from the European Structural and Investment Funds. The second indicator is the share of R&D expenditure on GDP which, for example, the EU uses as one of the key objectives of the Europe 2020 innovation strategy. For a more detailed evaluation of the innovation environment, we can refer to other studies (e.g., Halásková et al., 2022; Klímová & Žitek, 2017; Nemethova et al., 2019).

The Czech Republic has more than 10 million inhabitants and is divided into 14 self-governing regions (Table 2). The most advanced region is the capital city of Prague, whose GDP per person significantly exceeds the GDP of other regions in absolute as well as relative values. The Central Bohemian Region (ring around Prague) and the South Moravian Region are other advanced regions. The latter of

them (with its capital Brno - the second largest Czech city) has been investing more than 3 % of GDP in R&D for a long time.

Table 2. Characteristics of the Czech regions (2019)

Region (NUTS3)	Population (thous. inhab.; share)	GDP total (mil. EUR; share)	GDP per capita (EUR)	Expenditures on R&D (% of GDP)
CZ010 Prague	1,315 (12.3%)	62,640 (27.2%)	47,624	2.6
CZ020 Central Bohemian	1,378 (12.9%)	26,694 (11.6%)	19,379	2.5
CZ031 South Bohemian	643 (6.0%)	11,270 (4.9%)	17,525	1.3
CZ032 Pilsen	588 (5.5%)	11,146 (4.8%)	18,972	1.8
CZ041 Karlovy Vary	295 (2.8%)	4,027 (1.8%)	13,660	0.3
CZ042 Usti	821 (7.7%)	12,681 (5.5%)	15,455	0.4
CZ051 Liberec	443 (4.2%)	7,289 (3.2%)	16,456	2.0
CZ052 Hradec Kralove	551 (5.2%)	10,568 (4.6%)	19,173	1.1
CZ053 Pardubice	521 (4.9%)	8,811 (3.8%)	16,907	1.4
CZ063 Vysocina	509 (4.8%)	8,843 (3.8%)	17,361	0.8
CZ064 South Moravian	1,190 (11.1%)	24,071 (10.5%)	20,236	3.1
CZ071 Olomouc	632 (5.9%)	10,582 (4.6%)	16,741	1.8
CZ072 Zlin	583 (5.5%)	10,660 (4.6%)	18,294	1.4
CZ080 Moravian-Silesian	1,201 (11.3%)	20,664 (9.0%)	17,200	1.1
Czech Republic	10,669 (100%)	229,952 (100%)	21,553	1.9

Source: authors' calculations based on CZSO data (2022)

Slovakia has more than 5 million inhabitants and is divided into eight self-governing regions (Table 3). The most developed region is the Bratislava Region, which includes its capital and surroundings. The GDP per capita in this region significantly exceeds the same indicator in the other ones. Košice is the second largest city after the capital. GDP and R&D expenditures in all regions are significantly lower than in the Czech Republic.

Table 3. Characteristics of the Slovak regions (2019)

Region (NUTS3)	Population (thous. inhab.; share)	GDP total (mil. EUR; share)	GDP per capita (EUR)	Expenditures on R&D (% of GDP)
SK010 Bratislava	660 (12.1%)	26,540 (28.1%)	39,946	1.4
SK021 Trnava	564 (10.3%)	11,069 (11.7%)	19,613	0.5
SK022 Trenčín	586 (10.7%)	8,224 (8.7%)	14,053	1.1
SK023 Nitra	677 (12.4%)	10,009 (10.6%)	14,823	0.4
SK031 Žilina	691 (12.7%)	10,701 (11.3%)	15,476	0.7
SK032 Banská Bystrica	648 (11.9%)	8,089 (8.6%)	12,515	0.5
SK041 Prešov	825 (15.1%)	8,733 (9.2%)	10,580	0.3
SK042 Košice	800 (14.7%)	11,069 (11.7%)	13,824	0.6
Slovakia	5,450 (100%)	94,437 (100%)	17,317	0.8

Source: authors' calculations based on Statistical Office of the SR data (2022)

2.2. Data, methods and research questions

The analysis of innovation vouchers in both countries concerns the period from the beginning of vouchers until June 2022. The subject of the analysis and comparison is primarily the context of the creation of this instrument, the territorial level of implementation, sources of funding, the budget, supported projects and regional differences.

Before performing a quantitative analysis of the supported projects, we analysed administrative documents, especially the announced calls and their annexes. These documents primarily contain information on supported activities, eligible beneficiaries, the amount and rate of support, the support regime (legislation), application procedures and documents, and the way of evaluation. We compared the key elements of these documents with other documents concerning other programmes (standard grants).

Subsequently, we compiled databases of supported projects in both countries. These databases were created primarily on the basis of data from the Ministry for Regional Development of the Czech Republic and the Ministry of Economy of the Slovak Republic. Missing necessary data were complemented from the Magnusweb and Finstat databases. After processing the databases, statistical calculations were performed. Our research also includes data from the websites of statistical offices, state administration bodies and regional authorities.

Because the Czech Republic does not yet use the euro as its currency, it was necessary to convert the financial data to euros due to better data comparability. The essential part of our analysis is focused on the period May 2016 to June 2022 when, according to data from the European Central Bank, the exchange rate of the Czech crown ranged from CZK 24.135 per EUR to CZK 27.808 per EUR. We used the exchange rate of 25 CZK per 1 EUR, which better corresponds to the long-term average and enables a simple comparison and conversion.

The presented study focuses on answering *two research questions*:

- Research question 1: Are there different approaches to the implementation of innovation vouchers in the Czech Republic and Slovakia?
- Research question 2: Are there significant differences in the use of innovation vouchers by enterprises across regions of individual states?

3. Results

3.1. Innovation vouchers in the Czech Republic

In the Czech Republic, innovation vouchers were implemented at the national and regional levels. The first impulse came from the regions, and the national programme started a few years later. The main attention of our research is paid to

the national level. To make the analysis complete, we also present basic data on the implementation of the regional programmes.

At the regional level, innovation vouchers were first applied in the South Moravian Region. This new scheme was designed by the South Moravian Innovation Centre, which also ensured its administration, and the support was financed by the City of Brno. Gradually, over time, this tool has spread to all regions (with the exception of the Pardubice Region). The use of innovation vouchers culminated in approximately 2013, when they were used in 11 out of 14 regions. After that, individual regions began to close their programmes. Most regions stopped funding in 2015 (see Table 4).

Table 4. Innovation vouchers implemented by the Czech regions

Region (NUTS3)	Year of closing the scheme	Implementation	Eligible beneficiary (company)	Knowledge provider
CZ010 Prague	2016	CA	SME	CRO
CZ020 Central Bohemian	2020	SA	SME	CRO
CZ031 South Bohemian	Still going on	SA	E	CRO
CZ032 Pilsen	Still going on	CA	E	Research organ. in the region
CZ041 Karl. Vary	Still going on	SA	E	CRO
CZ042 Usti	2020	SA	E	CRO
CZ051 Liberec	2013	RA	SME	CRO
CZ052 Hradec Kralove	2012	SA	SME	SRO
CZ053 Pardubice	-	-	-	-
CZ063 Vysocina	2018	RA	E	CRO
CZ064 South Moravian	2015	SA	E	Czech or foreign res. org.
CZ071 Olomouc	2015	OP	E	SRO
CZ072 Zlin	2015	OP	E	SRO
CZ080 Moravian-Silesian	2015	RA	SME	CRO

Note: Type of implementing organisation: CA = city authority, RA = regional authority (the government of the self-governing region), OP = other public authority, SA = specialised agency. Eligible beneficiary: E (SME) = Enterprise (SME) with residence or branch in the region. Knowledge provider: CRO = Czech research organisation (all), SRO = specified research organisation (limited number).

Source: authors' representation based on websites of the implementing organisations

The main reason for reducing the regional programmes is the new national scheme carried out under the cohesion policy (operational programmes). Instead of innovation vouchers, some regions have started to implement creative vouchers that provide a contribution to fostering cooperation between companies and creatives.

The amount of support per innovation voucher varied across regions and across years. Most often, it was around 8,000 euros per voucher. The number of supported collaborations also varied considerably, ranging from tens to hundreds of

projects. Because the conditions in individual regions were significantly different, we only present basic and comparable data here.

At the national level, innovation vouchers have been supported since the 2014-2020 EU programming period. Our detailed analysis focuses on the Innovation Vouchers programme, which is a part of the Operational Programme Enterprise and Innovation for Competitiveness 2014-2020. Support is provided in the form of a subsidy to small and medium-sized enterprises for the purchase of consulting, expert and support services from research organisations and certified testing laboratories. The objective of the Innovation Vouchers programme is the development of communication and the sharing of knowledge and know-how between the business and research spheres, which business entities can use to start or intensify their own innovation activities. The increase in interactions between businesses and research organisations should have a direct impact on strengthening the competitiveness of SMEs.

Table 5. Czech national innovation vouchers - overview of calls

Call	Publishing date	Support (min-max) in EUR	Beneficiary	Allocation (budget) in mil. EUR	Intensity of support (in %)	Specifics of the call
1	31/5/2016	3,200-10,000	SME	8.00	75	-
2	30/6/2017	2,000-12,000	SME	6.56	75	-
3	29/12/2017	2,000-12,000	SME	4.00	75	-
4	17/12/2018	2,000-12,000	SME	5.80	75	Drought (intensity 85%)
5	16/4/2020	2,000-40,000	SME	2.00	50 (big) or 85 (small projects)	Only Covid-19 solutions
6	1/7/2020	2,000-40,000	SME	7.2	50, 75 or 85 (according to the size and topic)	Special conditions for drought

Note: EUR 1 = CZK 25.00.

Source: authors' representation based on the text of the published calls (MIT, 2022)

Support is provided by the Ministry of Industry and Trade (the managing body of the operational programme), and the Agency for Entrepreneurship and Innovation is responsible for administration and communication. The budget for innovation vouchers for the entire programming period was set at approximately EUR 15 million. If the businesses were not interested in it, the funds would be transferred to other programmes. Innovation vouchers were offered to companies in 6 calls

(Table 5). The last three of them favoured cooperation in specific areas (drought in the countryside or pandemics). The budgets for the first calls were set with a certain reserve, and their full drawing was not expected. The remaining funds were moved to the following calls. The highest support was allocated in the last call. Due to the interest of businesses, the budget of this call was increased several times. However, the government also aimed to use the entire budget by the end of the programming period. The actually drawn support corresponds to the planned budget. The beneficiaries of the support are small and medium-sized enterprises. Research services can be provided by any organisation that is legally authorised to conduct R&D activities. One company can submit a maximum of three applications for support within one call. Support is provided under the *de minimis* regime, which places less administrative demands on companies and support providers.

In total, 1,679 vouchers were supported (Table 6). Vouchers could not be provided in Prague because this region is too developed. The highest number of projects was supported in the South Moravian, Moravian-Silesian and Central Bohemian regions. All three regions have relatively high GDP per capita, but the second of them is different by lower R&D spending. The strong position of these regions is evident in all calls. A small number of vouchers were supported in the Karlovy Vary and Ústí Region. Both regions have long suffered from low innovation performance and are considered old industrial regions.

Table 6. Czech innovation vouchers - Number of supported projects

Region (NUTS3)	Call 1	Call 2	Call 3	Call 4	Call 5	Call 6	Total sum (share)
CZ010 Prague	-	-	-	-	-	-	-
CZ020 Central Bohemian	66	19	23	41	3	44	196 (11.7%)
CZ031 South Bohemian	20	13	16	19	1	23	92 (5.5%)
CZ032 Pilsen	28	8	32	47	0	51	166 (9.9%)
CZ041 Karlovy Vary	4	4	4	3	0	4	19 (1.1%)
CZ042 Usti	19	6	11	13	3	20	72 (4.3%)
CZ051 Liberec	10	10	8	15	1	17	61 (3.6%)
CZ052 Hradec Kralove	24	14	17	17	1	23	96 (5.7%)
CZ053 Pardubice	19	16	12	14	2	15	78 (4.6%)
CZ063 Vysocina	16	9	17	20	3	24	89 (5.3%)
CZ064 South Moravian	61	28	46	60	1	73	269 (16.0%)
CZ071 Olomouc	18	8	13	30	0	27	96 (5.7%)
CZ072 Zlin	47	28	21	36	3	40	175 (10.4%)
CZ080 Moravian-Silesian	64	36	47	63	1	59	270 (16.1%)
Total	396	199	267	378	19	420	1679 (100%)

Source: authors' calculations based on MRD data (2022)

In terms of the financial amount of support provided, the South Moravian and Moravian-Silesian regions received the most funds in the absolute value (Table 7).

Concerning relative values (per 1000 inhabitants), the Pilsen and Zlín Regions obtained the highest support. The lowest support (in absolute as well as relative value) went to the Karlovy Vary and Ústí Region, which are the poorest regions. Rather low support was detected for the Central Bohemian Region. This region belongs to the Czech innovation leaders, but it has a specific structure of enterprises (a significant share of large companies). In comparison with the share of the population or GDP, we consider the use of support in the Zlín and Moravian-Silesian regions quite high. Both regions have a long industrial tradition, but the second has long-term problems with economic transformation (previous dependence on mining and heavy industry).

Table 7. Czech innovation vouchers - Amount of aid granted (thous. EUR)

Region (NUTS3)	Call 1	Call 2	Call 3	Call 4	Call 5	Call 6	Total sum (share)	RS*
CZ010 Prague	-	-	-	-	-	-	-	-
CZ020 Central Bohemian	437	151	187	319	16	622	1,732 (11.4%)	1,257
CZ031 South Bohemian	119	129	78	204	17	215	761 (5.0%)	1,184
CZ032 Pilsen	205	70	333	495	0	680	1,783 (11.8%)	3,035
CZ041 Karlovy Vary	28	27	32	34	0	44	164 (1.1%)	556
CZ042 Usti	111	51	82	129	25	252	651 (4.3%)	793
CZ051 Liberec	68	66	55	112	17	231	549 (3.6%)	1,239
CZ052 Hradec Kralove	187	89	105	183	13	256	832 (5.5%)	1,510
CZ053 Pardubice	95	109	74	115	24	124	541 (3.6%)	1,038
CZ063 Vysocina	116	78	156	186	65	284	886 (5.9%)	1,739
CZ064 South Moravian	474	219	362	500	14	903	2,472 (16.3%)	2,078
CZ071 Olomouc	148	62	137	242	0	323	913 (6.0%)	1,444
CZ072 Zlin	3123	209	147	318	16	460	1,461 (9.7%)	2,508
CZ080 Moravian-Silesian	463	238	365	633	17	679	2,395 (15.8%)	1,993
Total	2,763	1,497	2,112	3,470	222	5,074	15,139 (100%)	1,419

Note: *RS = Relative support = Amount of total support per 1000 inhabitants in EUR.

Source: authors' calculations based on MRD data (2022)

3.2. Innovation vouchers in the Slovak Republic

Slovakia started to actively support cooperation in the form of innovation vouchers in 2013. The main idea was to boost the cooperation between the business sector and the scientific sphere. The Ministry of Economy of the Slovak Republic (MESR), in cooperation with the Slovak Innovation and Energy Agency (SIEA), developed a system of tools for increasing the innovative capacity of companies. The aim of de minimis aid was to support business entities that have the potential to increase their competitiveness through innovations in their own products, processes

and services. The primary expected result is the connection of businesses with universities and research organisations; the second is that such cooperation have the potential to continue in the future (SOVVA, 2020).

SIEA was the provider of the innovation voucher scheme in 2013 and 2014. Since 2015, support has been provided directly by the MESR. An innovation company has to contact an authorised research organisation with its idea. This organisation consequently designs and creates the solution to the problem. The company pays for the solution with a voucher, and the authorised organisation submits it for reimbursement to the programme administrator.

The recipient of the aid (the company) chose a collaborating research organisation from the database of authorised innovation project solvers (universities, research institutions or companies) published on the website of the Ministry of the Interior of the Slovak Republic. For research organisations (solvers), it was possible to apply for registration to the database through an open call published by the MESR on its website. New applicants had to document the implementation of projects in the field of R&D in the form of a final research report or a reference (a brief description of the service, a copy of a patent/industrial design application or another result of cooperation).

The eligible and supported projects were aimed at the innovation of products, services and processes, the expected result of which was to stimulate the competitiveness and innovation potential of SMEs, especially in the fields of engineering and automation, food industry and biochemistry, social innovation, construction and transport, chemistry and agrochemistry, electrical engineering/electronics and ICT, energy and ecology, digitisation and robotics.

Between 2013 and 2020, six calls were announced (Table 8). The vouchers were financed from national sources, and the budget was determined for each call individually. Unlike the Czech Republic, no budget was set for a long-term period. The value of the vouchers has changed over the years. In 2013, the value of the voucher was €3,500 for companies with less than 250 employees, and €10,000 for bigger companies (from 250 to 500 employees). Since 2014, the value of the voucher for companies with less than 250 employees has increased to €5,000. In 2020, the amount of support was the same for all companies - €10,000 (MESR, 2022). Another call (with a planned allocation of €350,000) was announced in 2022, but it was not possible to include it in our research. This call differs significantly from the previous ones. It focuses on a Healthy society, which is one of the domains of smart specialisation in Slovakia. Innovative products, processes and procedures in healthcare will be able to obtain vouchers for up to €50,000.

Table 8. Slovak national innovation vouchers - overview of calls

Call (year)	Voucher value	Beneficiary	Allocation (budget, EUR)
2013	3,500	Small and medium-sized enterprises	73,500
	10,000	Big companies (250-500 employees)	0
2014	5,000	Small and medium-sized enterprises	215,000
	10,000	Big companies (250-500 employees)	20,000
2015	5,000	Small and medium-sized enterprises	355,000
	10,000	Big companies (250-500 employees)	10,000
2016	5,000	Small and medium-sized enterprises	225,000
	10,000	Big companies (250-500 employees)	0
2018	5,000	Small and medium-sized enterprises	115,000
2020	10,000	Small and medium-sized enterprises	300,000

Note: No calls were announced in 2017, 2019 and 2021.

Source: authors' representation based on MESR (2022)

Within the investigated period (2013-2020), 234 projects for 197 enterprises were supported (Table 9). Under this scheme, businesses could receive only one voucher within each call. The highest number of projects (70) was supported in 2015. On the other hand, in 2013 and 2018, only a little over 20 projects were funded. From the regional point of view, most projects were implemented in the Bratislava Region (76) and the least in the Košice Region (14) and the Trenčín Region (13).

Table 9. Slovak innovation vouchers - Number of supported projects

Region (NUTS3)	Call 2013	Call 2014	Call 2015	Call 2016	Call 2018	Call 2020	Total sum (share)
SK010 Bratislava	5	12	24	19	7	9	76 (32.5%)
SK021 Trnava	6	7	7	8	2	8	38 (16.2%)
SK022 Trenčín	1	1	5	1	2	3	13 (5.6%)
SK023 Nitra	0	6	9	4	3	2	24 (10.3%)
SK031 Žilina	5	5	3	2	5	2	22 (9.4%)
SK032 B. Bystrica	1	4	9	6	1	2	23 (9.8%)
SK041 Prešov	1	8	8	1	3	3	24 (10.3%)
SK042 Košice	2	2	5	4	0	1	14 (6.0%)
Total	21	45	70	45	23	30	234 (100%)

Source: authors' calculations based on MESR (2022)

The highest overall support (Table 10) was allocated in the Bratislava Region (€417,500) while the lowest in the Trenčín Region (€83,500) and the Košice Region (€72,000). In the other regions, the amount ranged from €120,000 to €221,000. The Trnava Region, which obtained the second highest amount, deserves attention. This region surrounds the Bratislava Region, has a high GDP per capita and, at the same time, low research activity (see Table 3). In other words, if the support is calculated

per 1,000 inhabitants, only the Bratislava and Trnava regions received an above-average amount. These regions, at the same time, achieve the highest GDP per capita.

Table 10. Slovak innovation vouchers - Amount of aid granted (thous. EUR)

Region (NUTS3)	Call 2013	Call 2014	Call 2015	Call 2016	Call 2018	Call 2020	Total sum (share)	RS*
SK010 Bratislava	17.5	60.0	120.0	95.0	35.0	90.0	417.5 (31.8%)	633
SK021 Trnava	21.0	35.0	35.0	40.0	10.0	80.0	221.0 (16.8%)	392
SK022 Trenčín	3.5	5.0	30.0	5.0	10.0	30.0	83.5 (6.4%)	143
SK023 Nitra	0.0	30.0	45.0	20.0	15.0	20.0	130.0 (9.9%)	192
SK031 Žilina	17.5	30.0	15.0	10.0	25.0	20.0	117.5 (8.9%)	170
SK032 B. Bystrica	3.5	20.0	50.0	30.0	5.0	20.0	128.5 (9.8%)	198
SK041 Prešov	3.5	45.0	45.0	5.0	15.0	30.0	143.5 (10.9%)	174
SK042 Košice	7.0	10.0	25.0	20.0	0	10.0	72.0 (5.5%)	90
Total	73.5	235.0	365.0	225.0	115.0	300.0	1,313.5 (100%)	241

Note: *RS = Relative support = Amount of total support per 1000 inhabitants in EUR

Source: authors' representation based on MESR (2022)

3.3. Comparison, discussion and policy implications

Considering the *first research question* of this paper, the analysis confirmed that the Czech Republic and Slovakia differ significantly in support of innovation cooperation through innovation vouchers (Table 11). In Czechia, the implementation of vouchers in the first region started in 2009. During the following years, this tool spread to most Czech regions. The government responded to this situation by including innovation vouchers in the Operational Programme Entrepreneurship and Innovation for Competitiveness 2014-2020, within the framework of which the first national call was announced in 2016. Most Czech regions then ended their voucher support, as they would overlap with the national programme. In Slovakia, support was initiated at the national level, and the first call was announced in 2013. A more detailed comparison was carried out only for national programmes in both countries. The Czech Republic financed this instrument from the European Regional Development Fund. Slovakia used funds from the state budget. The budget for Czech vouchers was more than 11 times higher than the budget for Slovak vouchers, and seven times more projects were supported. The difference is partly due to the size of the two states (the Czech Republic has approximately twice the population), but it is still huge. The average amount of support per project also varies significantly (see Table 12) but, towards the end of the evaluated period (the last calls), the differences decreased. It is necessary to point out that if the support is too low, it cannot bring the expected effects (see, e.g., Montmartin and Herrera, 2015; Nemethova et al., 2019). Table 12 also demonstrates that during the entire period, there are significant differences between the two countries in terms of the amount of support calculated per 1000 inhabitants.

Table 11. Comparison of vouchers

	Czech Republic	Slovak Republic
Original initiative	Regional	National
Date of first vouchers	2009	2013
Financial source	EU funds*	State budget
Total allocation (EUR)	15,139,055*	1,313,500
Allocation per project (EUR)	9,017*	5,613
Number of projects	1679*	234
Eligible research organisations	General*	authorised (database)
Eligible regions	All except of Prague*	all

Note: *The data refer to the national programme only.

Source: authors' calculations

The Czech programme only allowed support for SMEs while in Slovakia, it was possible to support enterprises with up to 500 employees. However, there were only four large companies supported. The conditions of the Czech programme enabled to grant higher support for one innovation collaboration, but the support could not usually exceed 75% of the eligible costs. For Slovak companies, support could be up to 100% of eligible costs. Both states provided support under the de minimis regime. The Czech Republic announced special calls and favoured support for research solutions to specific problems (drought, pandemic).

Table 12. Comparison of supported vouchers in Czechia and Slovakia

Total allocation (in EUR)							
CZ	Call 1 (2016)	Call 2 (2017)	Call 3 (2017)	Call 4 (2018)	Call 5 (2020)	Call 6 (2020)	Total
	2,763,360	1,497,225	2,112,448	3,470,119	222,390	5,073,514	15,139,055
SK	Call 2013	Call 2014	Call 2015	Call 2016	Call 2018	Call 2020	Total
	73,500	235,000	365,000	225,000	115,000	300,000	1,313,500
Number of projects supported							
CZ	Call 1 (2016)	Call 2 (2017)	Call 3 (2017)	Call 4 (2018)	Call 5 (2020)	Call 6 (2020)	Total
	396	199	267	378	19	420	1,679
SK	Call 2013	Call 2014	Call 2015	Call 2016	Call 2018	Call 2020	Total
	21	45	70	45	23	30	234
Average support per project (in EUR)							
CZ	Call 1 (2016)	Call 2 (2017)	Call 3 (2017)	Call 4 (2018)	Call 5 (2020)	Call 6 (2020)	Total
	6,978	7,524	7,912	9,180	11,705	12,080	9,017
SK	Call 2013	Call 2014	Call 2015	Call 2016	Call 2018	Call 2020	Total
	3,500	5,222	5,214	5,000	5,000	10,000	5,613
Average support per 1000 inhabitants (in EUR)							
CZ	Call 1 (2016)	Call 2 (2017)	Call 3 (2017)	Call 4 (2018)	Call 5 (2020)	Call 6 (2020)	Total
	259	140	198	325	21	476	1,419
SK	Call 2013	Call 2014	Call 2015	Call 2016	Call 2018	Call 2020	Total
	13	43	67	41	21	55	241

Source: authors' calculations

Slovak enterprises could be supported only once within one call, while the Czech Republic allowed up to three projects of the same company to be supported within one call. The disadvantage of this Czech approach is that it can lead to the creation of dependence on subsidies (see, e.g., OECD, 2009) and is not entirely in accordance with the idea that the voucher should help start cooperation, which will later continue without public support.

We also identified a noticeable difference in the publicity of the supported projects. Information about Czech projects was better accessible and disposable in a format with which we could work. Data on Slovak projects were more difficult to access, which complicates the public control of the use of public funds.

Our results confirmed the conclusions of other studies that covering the costs of purchasing specialised research services can be total or partial (in the form of co-financing by the company), but in most cases, it is below €10,000. Coletti and Landoni (2018) stated that the allowance generally ranges from €500 to €25,000, with an average of €800. The average support per voucher is higher in the Czech Republic and Slovakia (EUR 9,017 vs. 5,613). Our research also confirmed the conclusions by Schade & Grigore (2009) that the system of vouchers is quite attractive for businesses because it requires much less bureaucratic procedures than standard grants. In the Czech Republic, due to the high interest of companies, the budget for the final call was continuously increased. Submitted proposals were evaluated in both countries through a continuous system. This is also different from standard grants, which are usually evaluated in a batch system (after all applications are collected). Both countries used the *de minimis* regime. It brings a lower administrative burden. Standard grants are usually provided on the basis of other rules (e.g., GBER regime in the EU) which are associated with more demanding administration. Our research is also consistent with the conclusions of Spiesberger and Schönbeck (2019) that innovation vouchers can be also useful for solving societal challenges. Czechia used vouchers to support solutions to the pandemic situation (public health) and drought. For these cases, separate calls or specific (more favourable) conditions within the common calls were used. The currently open call (which cannot yet be evaluated) also provides support for obtaining intellectual property rights. Slovakian results are more complicated to evaluate (fewer projects), but the calls also enabled support for social innovations, energy and ecology. The call announced later (after the evaluation period) focuses on a Healthy society.

Regarding the *second research question*, we found significant differences in the drawing of support for innovation vouchers between individual regions in both countries. In the Czech Republic, it was not possible to support vouchers in Prague, as it is a very developed region that has limited support from the EU. Regions with the lowest GDP per capita and research activity (the Ústí and Karlovy Vary Regions) received the lowest support for cooperation (in absolute as well as relative values), thus deepening their lagging behind. The situation in regions with higher economic and research activity was more variable. If we express it in relative values (per

capita), some of them drew high support and some relatively low. These differences can be explained through additional characteristics which were not the subject of our research. In Slovakia, a significant part of the funds was allocated to the areas with the highest GDP (the Bratislava and Trnava Regions), which has increased disparities among regions. Based on the calculation per inhabitant, all other regions received significantly lower support. The spatial distribution of support between Slovak regions can be examined more precisely, on a wider time span when more projects are supported. Our conclusions are only to some extent consistent with other research (Prokop et al., 2021b) which has shown that businesses in poorer regions are less able to absorb new knowledge as well as the support offered. This was clearly confirmed only on the example of the poorest regions in the Czech Republic and the richest regions in Slovakia.

Several implications for innovation policy emerged from our research. The support provided was quite low, especially in Slovakia. However, as research shows (Prokop et al., 2021b), the support must reach a certain minimum level for the expected effects to occur. We therefore recommend allocating higher support to one voucher. At the same time, it is necessary to prevent abuse of this support. Policymakers should limit the number of vouchers per enterprise and encourage cooperation only between entities that have not yet cooperated with each other. The possibility of supporting cooperation through innovation vouchers should be better promoted among small and medium-sized enterprises. Both businesses and research organisations should be better informed about the space for collaboration and about their mutual possibilities and needs. Research has shown that companies located in poorer regions draw less public aid and that economic differences between regions are thus further deepening. Governments should, therefore, strive to increase the absorptive capacity of poor regions. Last but not least, it is necessary to obtain feedback from supported and non-supported enterprises and regularly evaluate and modify intervention programmes.

Conclusions

Innovation vouchers are the instrument of innovation policy which allows starting innovation cooperation between business and research sphere, which ideally will continue in the future without public support. Their advantage is low administrative requirements, quick project selection, and minimal distortion of competition. Voucher conditions can be set to reflect the specific situation of the given region. On the other hand, support is often used by companies that are already innovating and therefore has a minor impact on non-innovation companies. There is also a risk of a crowding-out effect if the vouchers are used by companies that already collaborate with research organisations.

This paper dealt with the implementation of innovation vouchers in the Czech Republic and Slovakia. Both countries are connected by close cooperation in many

areas of social and economic life, but in some aspects, they still differ. The research and innovation policy is one of them. The analysis confirmed that the two countries differ significantly in support of innovation cooperation through vouchers. In the Czech Republic, vouchers were initiated at the regional level and afterwards, the national programme was designed. In Slovakia, vouchers have been supported at the national level only. Resources from the EU enabled the Czech Republic to invest a higher amount in vouchers and support more projects. The average amount of subsidy per voucher was also higher in Czechia. In general, this country invests more resources in R&D in the long term, and innovation policy is a higher priority there. This may be one of the factors that cause the persistent differences in the innovation and economic performance between both countries. Our research also confirmed significant regional imbalances. More funds were allocated to regions with higher economic and research performance. On the contrary, poor regions usually received less funds. This can lead to a deepening of disparities among regions.

The contribution of our paper consists in filling a research gap that lies in insufficient research on innovation vouchers in Central and Eastern European countries. We also created a unique database of supported collaborations in both surveyed countries and designed implications for innovation policy in less developed countries. On the other hand, our research has certain limitations which, at the same time, provide scope for future research. The study has mainly focused on policy approaches and resource allocations. Qualitative and deeper research is needed in the area of the real impacts of supported vouchers on innovation cooperation and the long-term effects of this cooperation.

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