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Competence centres as a method of innovation cooperation enhancement in the Czech Republic

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Abstract

Innovation networks and cooperation can contribute significantly to the improvement of companies' innovation capabilities. Innovation policy supports innovation and research cooperation through a wide range of policy tools. Competence centres are one of them. The main aim of this paper is to evaluate the features of innovation cooperation through the analysis of competence centres in the Czech Republic. The research focuses on competence centre projects supported by the Technology Agency, and the analysis is carried out with respect to the regions and participants. Our analysis is accompanied by the point method and correlation analysis. The results show that the activities of competence centres are strongly concentrated in Prague and the South Moravian Region. This type of innovation cooperation is also well developed in the Central Bohemian, Pilsen and Moravian–Silesian Regions. It is proved that universities can play the role of a facilitator of innovation cooperation.

Keywords

Competence centres, enterprise, innovation, innovation cooperation, university.

JEL Classification: R12, O31, O38

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1. Introduction

Innovation and knowledge exert a significant impact on economic and social development and long-term sustainability. It is believed that innovation is an important source of competitiveness in developed regions and countries and an essential prerequisite for economic prosperity and wealth creation (Viturka, 2014; Adámek et al., 2015).

The importance of innovation and the possible ways of supporting it are currently discussed with the concept of national and regional innovation systems. The innovation system concept stresses the innovation network as a key factor influencing innovation performance (Doloreux, 2002; Lundvall, 2007; Kološta and Flaška, 2015). The importance of innovation cooperation is also reflected in the implementation of the cohesion policy and in the European legislation dealing with public aid (Commission Regulation, 2014). To keep up with the pace of the markets and to remain competitive, companies cannot rely only on in-house innovation (Arvanitis and Bolli, 2013).

The innovation network represents a network of relations among various actors, and it enhances the introduction and diffusion of innovations. The activities practised in these networks include the creation, combination, exchange, transformation, absorption and utilization of resources through a wide range of formal and informal relations (Tijssen, 1998; Fischer, 2001). The innovation network is a way for various organizations to gather and exchange resources with each other and to develop new ideas and skills together (Powell and Grodal, 2005). Companies that use knowledge from various sources (other firms and knowledge organizations) at various levels (regional, national and international) are the most likely to generate product innovations that are new to the market (Tödtling and Grillitsch, 2015). Due to the cooperation, the companies can determine tasks in the innovation process and reach targets that they would not achieve alone (Powell and Grodal, 2005). Cooperation between companies and research organizations is one of the channels through which science is linked to technology and leads to innovation. In the framework of mutual cooperation, companies access new knowledge sources, benefit from research spillovers and share the risks and costs of their innovative projects (Marzucchci et al., 2015).

However, the willingness of companies to cooperate on innovation depends on incoming and outgoing spillovers and on the type of cooperating partner (Arvanitis and Bolli, 2013). The incoming spillovers represent the amount of external knowledge that flows into the firm, and the outgoing spillovers represent the amount of the firm's knowledge that seeps out of the firm and can be used by other firms. When collaborating with universities, maximizing incoming spillovers is important for a cooperating firm, and when cooperating with other enterprises, the firm strives to maximize incoming spillovers and minimize outgoing spillovers. In other words, incoming spillovers may encourage cooperation, but outgoing spillovers may discourage it.

The main aim of this article is to evaluate the features of innovation cooperation through an investigation of Czech competence centres. Our analysis is based on data about the collaborative projects that have been supported by the Technology Agency of the Czech Republic. We assess the engagement of different types of actors and individual Czech regions in competence centre projects. The analysis is conducted at the level of NUTS3 regions, and we distinguish four types of participants – universities, research institutes, businesses and other participants. The second aim of our article is to contribute to the discussion on the importance of innovation cooperation.

This paper is organized as follows. Chapter 2 deals with the issue of competence centres in general. Chapter 3 explains the methodology and data used. The results and discussion are presented in Chapter 4. Chapter 5 concludes the paper.

2. Competence centres

R&D is an important source for the introduction of new and especially radical innovations. Therefore, we can say that research collaboration is a key precondition for innovation development. Innovation policy supports

innovation and research cooperation through a wide range of policy tools, such as clusters (Skokan and Poledníková, 2011; Kožiak and Suchý, 2014), innovation vouchers (Fránková, 2014) and science parks (Hansson, 2007; Vásquez-Urriago et al., 2016). The rationale for public intervention is broadly discussed in the scientific and professional literature (Woolthuis et al., 2005; Crafts, 2012; McCann and Ortega-Argilés, 2013; OECD, 2015). It is usually justified by the economic importance of innovations, systemic failures and market failures. In this article we assess the support of innovation and research cooperation carried out through competence centre projects.

Competence centres are one of the policy tools to support innovation and research cooperation. They represent special networks (collaborative entities and groups of actors) that connect academic and industrial partners in a territory and aim for global excellence in specific specialization niches (Streitenberger, 2013; Korber and Paier, 2014). Their activities usually include the pooling of knowledge, the creation of new knowledge by performing research, training and the dissemination of knowledge. They aim to achieve a stronger impact and concentration of research efforts by creating research environments in which enterprises can participate actively and benefit from the results (OECD, 2011). Competence centres can be seen as platforms to stimulate the combination of local and global networking activities (Korber and Paier, 2014). They allow the connection of the demand side (companies applying knowledge) and the supply side (research institutes and universities producing new knowledge) of the innovation system (see e.g. Autio, 1998; Tödtling and Trippl, 2005). Howells et al. (2012) emphasize that public support of innovation cooperation helps to make contact between the business and the research sphere, thereby reducing one of the most important cooperation barriers. With the requirement for long-term and geographically concentrated R&D, competence centres provide an environment for collective learning and the transfer of *sticky* (tacit) knowledge. Therefore, geographical proximity plays an important role (Marrocu et al., 2013). Knowledge can also be diffused through publications, patents, utility models and so on (codified knowledge). Competence centres support innovation by enabling access to both geographically localized tacit knowledge and distant tacit knowledge via internationally networked partners (Korber and Paier, 2014). Due to competence centres, researchers have a longer planning horizon to engage in larger projects (Biegelbauer, 2007). Empirical studies investigating the macro-economic benefits of competence centres show two types of benefits (OECD, 2011): 1) those related to knowledge spillovers (the creation of formal and informal linkages and networks between firms, research institutions, public agents and other local organizations) and 2) those related to the increase in the attractiveness of the hosting regions (productivity increase, competitiveness enhancement, long-term economic growth and employment).

Summing up the above, competence centres focus on long-term cooperation in research and development, especially applied R&D, the purpose of which is to develop new innovations that can be put on the market soon. Regional actors who can communicate face to face with each other and who share tacit knowledge are an inseparable part of them. The network is also formed by national and international actors who bring knowledge (especially codified knowledge) that is absent from the region. Competence centres serve for new knowledge creation and knowledge exchange, combination and diffusion. Public-financed competence centres can have their own legal subjectivity (e.g. in Estonia, Latvia and Austria) or they can operate as a collaborative project (Czech Republic).

The first competence centres appeared in the USA, when the National Science Foundation's Engineering started to support their activities in 1985. Since the 1990s they have become an international phenomenon. Although they have some common features, they are adapted to the needs of the local innovation systems (Bumane, 2014). Nowadays competence centres are very popular in Sweden, Switzerland, Austria, Germany, Canada, the United Kingdom, Latvia, Estonia and others (Braun and Benninghoff, 2003; Biegelbauer, 2007; OECD, 2011; Bumane, 2014; Korber and Paier, 2014).

3. Data and methodology

In our article we analyse the competence centres in the Czech Republic that are supported through the Competence Centres Programme implemented by the Czech Technology Agency (TAČR, 2014). Up to now two public tenders have been put out and 34 competence centres have been supported in their framework (RVVI, 2016). The first public tender was made in 2011 and the second in 2013 (see table 1). The individual competence centres have been granted since 2012. The financing of projects should finish in 2019.

The programme supports the establishment and operation of centres for research, development and innovation in advanced fields with high application and innovative potential and the possibility of making a substantial contribution to the growth of the competitiveness of the Czech Republic (TAČR, 2014).

Table 1 Competence Centres Programme – Public tenders

Public tender	Number of projects supported	Grant (in thous. CZK)	Period of project implementation
1 (2011)	22	4,261,905	2012–2019
2 (2013)	12	1,886,708	2014–2019

Source: Authors' calculations based on RVVI (2016)

Each competence centre has to consist of at least two independent enterprises and one research organization. The research organizations are mainly represented by research institutes (in the case of the Czech Republic, especially the Public Research Institutes) and universities. Other types of organizations (e.g. non-profit organizations, hospitals) can be included in the competence centre projects as well.

We assess how actively the various types of actors from various regions participate in competence centres. The analysis is conducted at the level of NUTS3 regions (14 regions), and we distinguish 4 types of participants – universities, research institutes, businesses and other participants.

We analyse the granted projects with respect to the cooperation of the actors participating in their implementation. It is possible to evaluate the degree of participation of actors in individual regions. If actors in a certain region are active, it is possible to suppose that the innovation cooperation is well developed in this region and that the region has better prerequisites for innovation development. We focus on investigating the structure of regional actors, and we identify the regions in which the leading and other recipients reside. The results of this analysis are presented through the traffic light method. We can also assess the structure of individual projects with respect to the number of participants involved and the number of participating regions.

Individual regions differ strongly in grant amounts and eligible costs; therefore, it seems appropriate to use the point method. The point method is based on finding the region that, for the analysed indicator, reaches the maximum or minimum value. The minimum value is relevant if the indicator's decline is considered to be positive (the less, the better); the maximum value is the opposite case – namely, an increase in the indicator value is positive (Melecký and Staníčková, 2011). The point value of the specific indicator is set as follows:

- in the case of the maximum: $B_{ij} = \frac{x_{ij}}{x_{i\,max}}$ (1)
- in the case of the minimum: $B_{ij} = \frac{x_{i\,min}}{x_{ij}}$ (2)

where B_{ij} is the point value of the i^{th} indicator for the j^{th} region, x_{ij} is the value of the i^{th} indicator for the j^{th} region, $x_{i\,max}$ represents the maximum value of the i^{th} indicator and $x_{i\,min}$ is the minimum value of the i^{th} indicator.

In our cases the maximum value is positive. The region with the maximum value of the indicator is assigned 100 points within the point evaluation of each, and the other regions are rated according to their indicator values (0–100 points).

Because the Competence Centres Programme is aimed at fields with high application and innovative potential (TAČR, 2014), we can expect a close relation between the eligible costs or amount of grant and the regions' economic level. We can also expect that, if companies in a certain region are more willing to invest in research and development, they are more willing to take part in collaborative projects as well. For its validation the Pearson correlation coefficient is used:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}}. \quad (3)$$

The coefficient can take a range of values from +1 to –1, a positive correlation being anticipated. The values of the correlation coefficient can be interpreted as follows: 0.10–0.39 weak correlation; 0.40–0.69 medium correlation; 0.70–0.89 strong correlation; and 0.90–1.00 very strong correlation (Bajgar et al., 2012).

4. Analysis of competence centres in the Czech Republic: Results and discussion

The establishment of 34 centres has been granted through 2 public tenders, and 341 recipients participate in the supported projects.

Firstly, we analyse the diversity of the supported competence centres from the point of view of the number of regions engaged and the number of participants. Table 2 shows the size of the supported projects with respect to the number of regions in which they are implemented. Three projects are conducted by participants from only two regions. All the other projects involve participants from at least three regions. The highest number of projects (9) consists of participants from six different regions. An atypical project is the *Centre for Innovative Use and Strengthening of Competitiveness of Czech Brewery Raw Materials and Products*, in which 17 recipients from 10 different regions participate. Table 3 presents the size of competence centre projects with respect to the number of participants. It is apparent that 6–8 subjects take part in competence centres most frequently. However, we can find 2 competence centres with more than 20 participants.

Table 2 Size of projects with respect to the number of involved regions

Number of regions	2	3	4	5	6	7	8	9	10
Number of projects	3	8	4	7	9	2	0	0	1

Source: Authors' calculations based on RVVI (2016)

Table 3 Size of projects with respect to the number of involved participants

Number of participants	5	6	7	8	9	10	11	12	13	14	17	22	26
Number of projects	2	6	4	6	3	1	1	3	3	1	2	1	1

Source: Authors' calculations based on RVVI (2016)

We also evaluate the role that is played by various participants. Two types of roles can be observed in competence centre projects: the leading participant (recipient) and other participants (recipients). Each competence centre has one leading participant and several other participants. The highest number of leading recipients is settled in Prague (11) and the South Moravian Region (8). No leading participant can be found in five regions (see Figure 1). The role of other participants is played mainly by actors from Prague and the South Moravian and Central Bohemian Regions (see Figure 2).

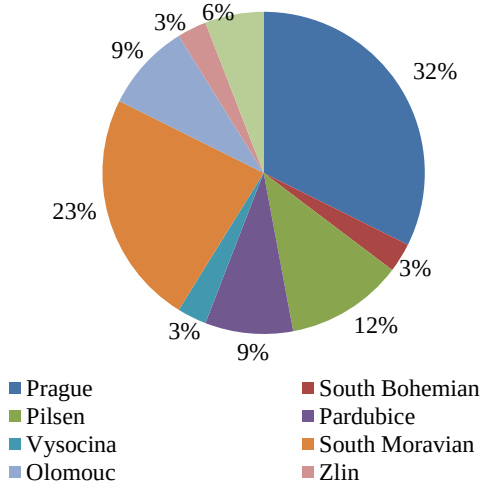

Figure 1 Leading participants from the regions' point of view (N = 34)
Note: No leading participant can be found in the Central Bohemian, Karlovy Vary, Usti, Liberec and Hradec Kralove Regions.
Source: Authors' processing based on RVVI (2016)

The role of the leading participant is usually played by a university (24 competence centres). This corresponds to the statement that universities are not only collaborators but can also function as a more general facilitator and mentor for businesses linking with other firms and innovation partners (Howells et al., 2012). In seven cases the competence centres are led by enterprises. One competence centre is managed by another participant (ENKI, o.p.s.). This charitable trust is located in the South Bohemian Region and deals with applied research in the environment.

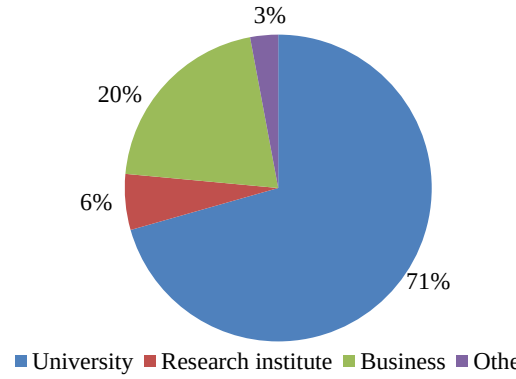

Figure 2 Leading participants with respect to the type of participant (N = 34)
Source: Authors' processing based on RVVI (2016)

Table 4 Participation of regional actors in competence centre projects (number of projects)

Region	Participations in total	Participations in total (%)	Leader	Other participant
Prague	32	94.12	11	31
Central Bohem.	17	50.00	0	17
South Bohem.	10	29.41	1	10
Pilsen	12	35.29	4	12
Karlovy Vary	1	2.94	0	1
Usti	4	11.76	0	4
Liberec	9	26.47	0	9
Hradec Kralove	6	17.65	0	6
Pardubice	8	23.53	3	8
Vysocina	8	23.53	1	7
South Morav.	22	64.71	8	20
Olomouc	10	29.41	3	9
Zlin	8	23.53	1	8
Moravian-Siles.	12	35.29	2	12

Source: Authors' calculations based on RVVI (2016)

The participation of regional actors in competence centres is perceived as willingness to cooperate with other subjects. They pursue an obvious aim, which is to achieve better results. The collaboration of actors across regional borders seems to be very important. It is clear that the situation in individual regions is different. It can be supposed that particularly participants in *active* regions cooperate more often with participants from other regions. Table 4 shows the number of projects with the participation of individual regions. The results are highlighted by the traffic light

method. We can see quite big differences among the regions; Prague and the South Moravian Regions are far above the average.

In total 341 recipients participate in the supported projects. Most of them are based in Prague (111) and the South Moravian Region (67). Fewer than 10 participants are observed in the Hradec Kralove, Usti and Karlovy Vary Regions (see table 5). We can also analyse the structure of the participants in individual regions. As is evident from the same table, we can find participants from universities and research institutes in Prague and the South Moravian Region in particular. This fact cannot be surprising. We would also like to emphasize the location of business participants. In this case the differences are smaller and their proportion is more balanced.

The supported players want to spend 9,031 mil. CZK on eligible costs. The highest total costs should be spent by the actors from Prague. Their costs reach 3,195 mil. CZK, which represents 35% of the total costs within all the granted projects. The expected eligible costs of the participants from the South Moravian Region are 1,697 mil. CZK, the costs of the participants from the Central Bohemian Region are 703 mil. CZK and the costs of the participants from the Pilsen Region are 694 mil. CZK. To compare the obtained results, it is necessary to express the values per inhabitant. The recalculated results differ from the absolute values only slightly. The highest costs are observed in Prague (2,537 CZK per inhabitant), the South Moravian Region (1,447 CZK) and the Pilsen Region (1,206 CZK).

The Technology Agency will grant 6.149 mil. CZK to the recipients during the implementation of their projects. The largest amount of public aid will be granted to entities from Prague. They will receive 2,305 mil. CZK, which represents 37.49% of the entire allocation for the Competence Centres Programme. The participants in the South Moravian Region will obtain 1,200 mil. CZK, those in the Pilsen Region 521 mil. CZK and those in the Central Bohemian Region 401 mil. CZK. Recalculating the figures per inhabitant, the public aid in individual regions is as follows: 1,831 CZK in Prague, 1,023 CZK in the South Moravian Region, 907 CZK in the Pilsen Region and 535 CZK in the Olomouc Region. Figure 3 illustrates the spatial differences in the amounts of grants.

Figure 4 illustrates the differences among regions with respect to the total grant amounts and the types of recipient. Because the regions and various types of participants differ strongly in this indicator, we use the point method to express the disparities. We would like to point out quite a good result of the Vysocina Region in the case of business participants. Although this region is not sufficiently equipped with knowledge institutions (universities and research institutes), it is apparent that we can find many innovative industrial enterprises here. If we calculate the differences among regions with respect to the total eligible costs by the same method, the results are very similar.

Table 5 Number of participants in competence centre projects based on the region of residence

Region	University		Research institute		Business		Other		Total		Total
	Leader	Other part.	Leader	Other part.	Leader	Other part.	Leader	Other part.	Leader	Other part.	
Prague	9	14	2	11	0	71	0	4	11	100	111
Central Bohemian	0	1	0	0	0	22	0	0	0	23	23
South Bohemian	0	0	0	1	0	13	1	0	1	14	15
Pilsen	3	6	0	0	1	15	0	0	4	21	25
Karlovy Vary	0	0	0	0	0	1	0	0	0	1	1
Usti	0	0	0	0	0	4	0	0	0	4	4
Liberec	0	3	0	0	0	7	0	0	0	10	10
Hradec Kralove	0	0	0	0	0	6	0	0	0	6	6
Pardubice	0	3	0	0	3	7	0	0	3	10	13
Vysocina	0	0	0	0	1	9	0	0	1	9	10
South Moravian	6	14	0	5	2	39	0	1	8	59	67
Olomouc	3	2	0	0	0	10	0	1	3	13	16
Zlin	1	1	0	0	0	14	0	0	1	15	16
Moravian-Silesian	2	6	0	0	0	16	0	0	2	22	24
Total	24	50	2	17	7	234	1	6	34	307	341

Source: Authors' processing and calculations based on RVVI (2016)

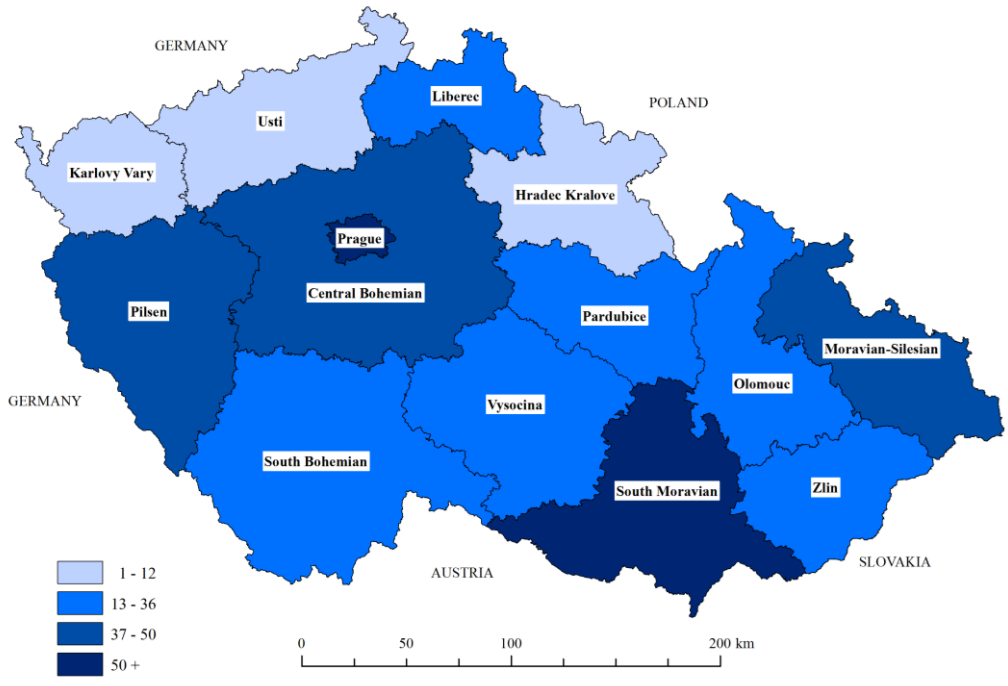

Figure 3 Grant amounts per participants' region (in CZK per inhabitant)
Source: Authors' processing and calculations based on RVVI (2016) and CZSO (2016)

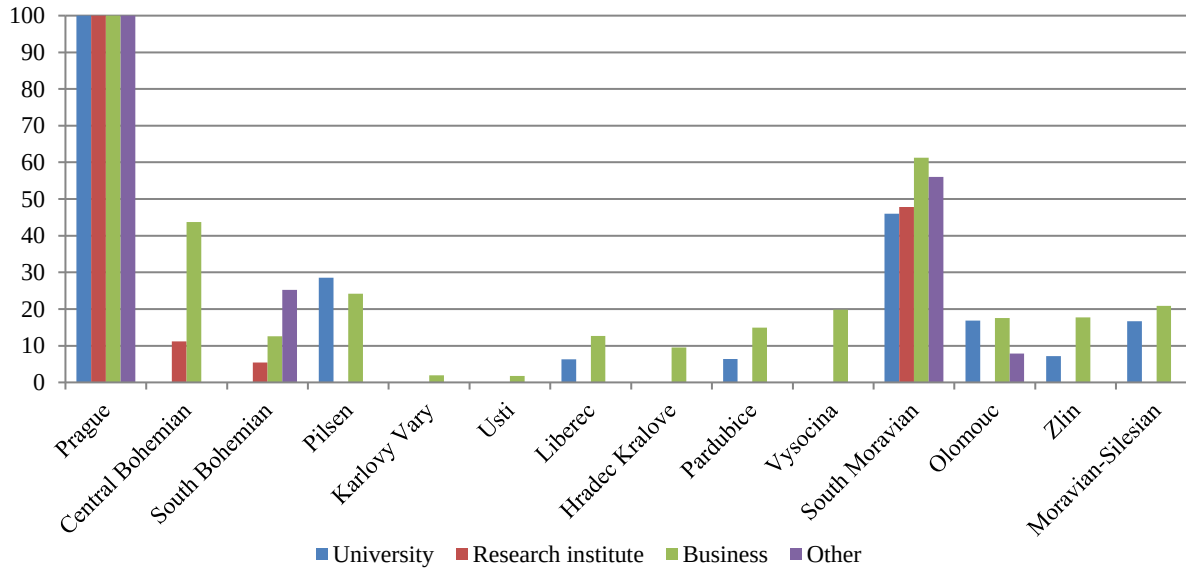

Figure 4 Total grant amounts for various types of participants (in points)
Source: Authors' processing and calculations based on RVVI (2016)

The aim of the Competence Centres Programme is to increase the competitiveness of the Czech Republic in advanced fields with high potential for the application of R&D results in innovation. We can expect that the recipients are located particularly in more developed regions. The values of the correlation coefficient stated in table 6 express the relationship between the regional gross domestic product and the eligible costs (spent by participants in the corresponding regions) or the grant amount (allocated to the region). The high values of the correlation coefficient (a very strong correlation in the case of absolute values and a strong correlation in the case of relative values) confirm that the more developed the

region, the more concentrated the participants in its territory. Table 6 also shows the relationship between business expenditures on research and development (BERD) and eligible costs or the amount of the grant. We can observe similarly high values of the correlation coefficient. It is proved that if companies in a certain region are more willing to invest in research and development (i.e. the region has a high level of BERD), they are more willing to take part in collaborative projects as well. On the other hand, this result confirms the existence of the regional innovation paradox too. The regional innovation paradox describes the situation in which regions with a lower level of innovation activity are not able to gain the offered public aid (Klímová and Žítek, 2015).

Table 6 Relation between selected indicators of the region and amount of costs or grants (values of correlation coefficient)

	GDP in total	GDP per inhabitant	BERD in total	BERD per inhabitant
Total amount of grant	0.92	–	0.90	–
Amount of grant per inhabitant	–	0.88	x	0.89
Total costs	0.93	–	0.92	–
Costs per inhabitant	–	0.89	–	0.89

Source: CZSO (2016), RVVI (2016), authors' calculations

5. Conclusion

Innovation represents an important competitive advantage of regions in developed countries. It is generally accepted that innovation cooperation is a key factor influencing innovation performance and it enables innovation targets to be reached that would not be achievable alone. Some empirical studies confirm that innovation cooperation is motivated by greater absorptive capacity and incoming spillovers. On the other hand, cost sharing and risk sharing represent weaker motivation to cooperate. Nevertheless, the cooperation has a positive influence on innovation performance and companies' innovation output; thus, the public support of innovation cooperation can foster cooperative behaviour and innovation activity (Arvanitis and Bolli, 2013).

Innovation policies around the world have used competence centres as a tool to support innovation cooperation in the last three decades. The competence centres serve for long-term research cooperation among industry, research institutes and universities. They are focused on applied research, and therefore they are expected to produce results that can be put on the market in the form of incremental and radical innovation soon. In the Czech Republic, this instrument has a short history, and the first competences centres were supported in 2012 by the Czech Technology Agency. Up to now 34 competence centres with 341 participants have been granted. Each competence centre has to consist of at least 1 research organization and 2 independent enterprises.

Competence centre projects are usually created by 6–8 participants located in 3–6 regions. The highest number of participants is located in Prague and the South Moravian Region. The participants from the Moravian-Silesian, Central Bohemian and Pilsen Regions are active as well. Our analysis shows that 24 competence centres are managed by a university. This confirms that universities act as a facilitator for businesses linking with other firms and innovation partners (Gunasekara, 2006; Paleari et al., 2015). Individual regions differ strongly in the amount of the grant obtained. The largest grant amounts are allocated to Prague and the South Moravian and Pilsen Regions. It is possible to say that the activities of competence centres are strongly concentrated in Prague and the South Moravian Region and, in general, in the areas with high gross domestic products and high business expenditures on research and development. This result could be predicted. The above-mentioned three regions can be described as metropolitan regions (Klímová and Žítek, 2016). The main innovation barriers in metropolitan regions are fragmentation and a lack of cooperation (Fischer, 2001; Tödtling and Trippl, 2005). From this point of view, our article shows that the Czech competence centres contribute to the elimination of these deficiencies in the innovation environment. On the other hand, it demonstrates certain limitations of public financing. The reason is that the position of the most developed regions is still enhanced and the disparities between more and less developed regions are deepening. This fact can be demonstrated partly by the case of the Moravian-Silesian region, which is perceived as an old industrial region (Tödtling et al., 2013). Schamp (2012) states that competence centres can play an important role in renewing these regions and support a cumulative and path-creating process. Because the Moravian-Silesian region is engaged in competence centre projects to a lesser extent, their renewing function is limited.

Due to the short history of the Czech competence centres, it is not possible to evaluate the impact of the Programme. In the first phase, collaborative projects should produce new patents, proven technologies, utility models, industrial designs and prototypes. Subsequently, these results should be transformed into new innovations with market potential. Therefore, future research should aim to undertake impact evaluation of the granted competence centres.

Attention should be paid to their effect on innovation performance.

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