Regional Innovation System in the South Moravian Region

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Abstract

Innovations are generally considered a key factor of the socio-economic development. Innovation policy strives to create favourable conditions for introduction and diffusion of innovations. The Czech Republic has dealt with this topic intensively since the turn of the century. Another trend in innovation policy has been detected over the world in the last decades and it is the transfer of competences to regional level. It is generally accepted that the location and spatial proximity are important for innovation development. In the article we demonstrate functioning of regional innovation system on the example of analysis of one region in the Czech Republic which is the South Moravian Region. The region pays big attention to innovation policy and has its own Regional innovation strategy. A specialized institution that puts most of innovation support measures into practice was established too. Brno (regional capital city) and its surroundings have industrial character and specialize in ICT, machinery and life sciences (especially biotechnology). Besides industry agricultural primary production and viniculture is important for the region too.

Key words: innovation, innovation environment, innovation system, South Moravian Region, Czech Republic

1. Introduction

Innovation policy strives to create favourable conditions for introduction and diffusion of innovations. Its importance is also illustrated by the fact that innovations are generally considered a key factor of the socio-economic development and an important tool for productivity increase and added value growth. The Czech Republic has dealt with this topic intensively since the turn of the century. Also a reform of innovation policy has taken place recently in the CR. The reform has consolidated the innovation and the research policies, has established the Technology Agency, has changed the way of evaluation and financing of R&D and has increased the emphasis on internationalization. The Europe 2020 strategy, which provides main objectives and development priorities of the EU till 2020, has been influenced by the importance of innovations as well. One of its priorities is the smart growth based on knowledge and innovations; therefore, the EU wants to increase investments in R&D and the education level of its population.

Another trend in innovation policy has been detected over the world in the last decades and it is the transfer of competences to regional level. It is generally accepted that the location and spatial proximity are important for innovation development. The spatial proximity allows regions to create a unique competitive advantage achieved by e.g. tacit knowledge sharing, mutual formal and informal linkage of players and networking.

Concepts of national and regional innovation systems, which serve as an analytical framework creating an empirical base for innovation policy creation, deal with innovation importance on a theoretical level (Doloreux, Parto, 2005). Lundvall, Cooke, Nelson, Edquist, Tödtling,

Freeman and others can be classified as the main representatives of these concepts. Generally, we can define the innovation system as a group of players in the private and public spheres whose activities and interactions influence development and diffusion of innovations in a particular territory. Innovative firms, government, knowledge institutions, intermediaries and capital providers are among the main players. It follows that the technologies are a necessary but not a sufficient condition for economic development of regions. Also long-term intangible assets (e.g. functioning regional innovation networks) are important.

The transition to knowledge economy is often mentioned in the context of the growing importance of innovations. The knowledge economy differs from the traditional one by the fact that the main source of growth is knowledge, not mineral resources or land. There is no single and universal definition of the term knowledge economy. The knowledge economy is defined e.g. by Foray (2004), Cooke and Piccaluga (2006) and OECD (1996). The features of the knowledge economy are summarized by Brinkley (2006): the knowledge economy does not mean new guidelines but it represents a slight discontinuity from the past and is present in all sectors of economy. It is also characterized by high and growing intensity of ICT usage and well-educated workers. The share of GDP created by intangible assets grows at the expense of the share created by tangible assets. The knowledge economy consists of innovative organizations and the organizations reorganize their work to be able to obtain, store and share information through the knowledge management practices.

B. A. Lundvall is a recognized author who connects the innovation system concepts with the meaning of knowledge (e.g. 2010, 1994). Lundvall distinguishes between codified knowledge and tacit knowledge. The codified knowledge can be written down or recorded and in this way it can be available to other people. On the contrary, the tacit knowledge can only be obtained through our own experience. The tacit knowledge represents a source of competitive advantage because it is fixed to a specific region and locality and it is non-transferable. Lundvall and Johnson (1994) differentiate among four types of knowledge: know-what, know-why, know-how and know-who. Know-what and know-why usually represent the codified knowledge and are especially important for so called linear innovation mode (sometimes called STI mode – Science, Technology and Innovation mode). Know-how and know-who represent the tacit knowledge and are important for so called interactive innovation mode (DUI mode – Doing, Using and Interacting mode). More details are presented in e.g. Jensen et al (2007) and Skokan (2004). The tacit knowledge can be obtained through four types of learning: learning by doing, learning by using, learning by searching and learning by interacting (Jensen et al, 2007).

When implementing an innovation policy it is necessary to bear in mind that each region is specific and different from the others. The natural conditions, historical development, structure of economy, demographic features etc. are different. Accordingly, it is not possible to accept the one-size-fits-all concept (e.g. Tödtling and Trippl, 2005, Bristow, 2010) but if we wish an efficient and effective innovation policy it should be adapted to specific features of individual regions. Tödtling and Tripple have demonstrated this problem on the example of three types of regions that have different problems and those should be resolved in different ways: 1) peripheral regions with a low level of R&D and innovations and absence of knowledge institutions, 2) old industrial regions threatened by technological lock-in, and 3) metropolitan regions with a fragmented innovation system and absence of industrial patterns. According to the authors, the key challenge in the peripheral regions is to strengthen and upgrade the regional economy by fostering the 'catching up' learning. Adequate policy measures include attracting external companies and attempting to embed them in the region.

Firms should be linked to external clusters and knowledge institutions and higher spatial innovation systems (national, European). For old industrial regions, the transformation of old sectors, support of innovation activities in those and related industries and upgrading of the knowledge base are the most important challenges. The policy should focus on industrial and technological diversification and reorganization of the existing networks, firms and institutions. Interventions in metropolitan regions should be aimed at encouraging the growth of internationally linked knowledge intensive clusters, fostering science base and radical innovations. Also the policy aimed at enhancing communication and interactive learning within the system should be developed.

Complicated implementation of an innovation policy is reflected by 'the innovation paradox': a system failure causes insufficient innovation performance. The regional innovation paradox emphasizes the conflict between a relatively higher need for investments in innovations in less developed regions on the one hand and their lower ability to absorb public resources for innovation activities on the other hand (Skokan, 2010, Oughton et al, 2002). Here, the conflict between regional policy, which makes effort to eliminate regional disparities, and innovation policy, which on the contrary reinforces the position of the most developed regions, is apparent.

2. Aim and methodology

The aim of the article is to confirm the hypothesis that the approach to an evaluation of regional innovation systems needs to be differentiated with respect to their structure which is affected by previous development, institutional framework and real economic potentials. At the same time, it is necessary to prove that parameters of a regional innovation system can be improved using public support, especially resources provided in the framework of the EU cohesion policy (operational programs).

For the purposes of this study the South Moravian Region has been selected. This region is expected quite high quality of its innovation system. It is a territory with more than one million inhabitants that has dominant and strong capital – Brno (380,000 inhabitants). The second largest town of the region Znojmo has only 34,000 inhabitants (CZSO, 2011c). From the point of view of innovations, which have a considerable tendency to concentrate in larger residential areas, this fact could influent the evaluation of innovation (There is a direct causality with the concept of agglomeration effects here. e.g. Maier, Tödtling, 1998). These key parameters have been set for the evaluation of a regional innovation system:

- specialized institutions supporting system management,
- regional innovation strategy,
- higher education,
- research and development,
- economic environment,
- public support for innovations,
- innovation infrastructure.

On the basis of the analysis of the stated parameters of regional innovation systems of the region it will be possible to verify the above mentioned hypothesis and achieve the set objective.

3. Results

3.1 Specialized institutions supporting management of innovation system

The institutional framework of a regional innovation system in the Czech Republic falls within the competences of regions with respect to the existing administrative arrangement. Political responsibility lies with the regional board and council, executive competences are divided between the council and the regional authority. Individual regions can transfer some part of the competences to specialized institutions that concentrate qualified human resources with knowledge required for an efficient functioning of the system.

The South Moravian Region is an example of a region that has placed a substantial part of competences into the sphere of activity of the South Moravian Innovation Centre (JIC), an institution co-established by four Brno universities and the City of Brno. The main task of JIC is to support innovative enterprises, commercialization of R&D and it is also a provider of the innovation infrastructure (JIC, 2012). JIC is connected with preparation and creation of the Regional Innovation Strategy (RIS) of the South Moravian Region and it is responsible for management and implementation of the strategy. Another institution that has been entrusted some competencies within the innovation system is the South Moravian Centre for International Mobility, which focuses on support of talented students and human resources for R&D in the South Moravian Region (JCMM, 2012). This Centre is responsible for some projects of RIS within the Human Resources priority.

3.2 Regional Innovation Strategies

The creation of Regional Innovations Strategy of the South Moravian Region is a continuous process where the first RIS was gradually replaced by the RIS2 and consequently RIS3. The Strategy is aimed at four sectors: machinery industry, electrotechnology, ICT, life sciences.

The SMR declares that it would like to become the most innovative region in the CR and be one of the 50 most innovative regions in the EU, increase its regional competitiveness through cooperation of the research sphere with firms and maximize contributions of ICRC and CEITEC projects that are being carried out nowadays (JIC, 2009). The document respects the logics of vision (global objective) – priorities – specific objectives. The priorities and the number of their specific objectives are presented in table 1.

Table 1: Priorities and the number of their specific objectives

Priorities	Specific objectives
Technology transfer	2
Human Resources	7
Internationalization	3
Consultancy and services for SMEs	3

Source: JIC (2009)

It is apparent the RIS of SMR sets 15 specific objectives and it also defines partial activities within individual specific objectives that will lead to meeting the objectives and the projects are assigned to those activities. It is possible to state that the RIS is good quality documents with regard to structure as well as content and it has potential to contribute to the development of the innovation environment in the region. The document reflects the experience gained in the past, as confirmed by the number and especially the structure of supported activities and implemented projects.

3.3 Higher education

Also universities are among the entities that are parts of regional innovation systems. They carry out not only educational activities that are perceived as their primary function but also research activities. The results of research are naturally transferred into teaching and only in this way they can provide high quality and up-to-date education to their students. At the same time, these results can be offered to customer sphere. The results are used by public administration for optimization of public policies or by enterprises to increase their revenues. The ability to commercialize university research results is perceived as a part of the innovation potential of a territory.

There are four public universities and one state university in the observed region. They provide subjects of study oriented to preparation of natural science, medical, technical and ICT professionals. These universities have a specific position in the regional innovation system. In the South Moravian Region universities are concentrated in Brno (except for one faculty). Although the concentration of universities in SMR in the capital would be perceived as a certain disadvantage, it is not possible to confirm this in practice especially due to very good accessibility of the city.

The universities have 27 faculties and 77 thousand students study at them including master and doctoral students (i.e. part of ISCED 5A and whole ISCED 6), the sum of students of all universities in the MSR is 28113 (UIV, 2011).
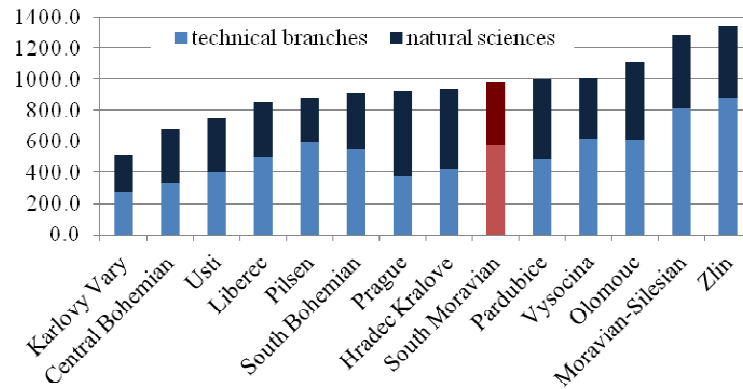
Table 2: Number of master and doctoral students at public and state universities (2010/2011)

University	MU	MenU	VFU	VUT	UO
Master	16 188	2 605	2 347	6 637	336
Doctoral	3 420	519	282	1 919	48

Source: UIV (2011), authors' own calculations

The above mentioned data aptly characterize the situation of higher education in the South Moravian Region. On the other hand, it is necessary to be aware of the fact that a lot of subjects of study prepare students for routine professions with a low or none potential for innovation creation. If we take into consideration only the natural sciences and technical branches that have high innovation potential the number of students reaches lower values. The natural sciences are studied by 1792 students, technical branches by 2450 students. Altogether it means approximately 15 % of all students. Graph 1 presents comparison of number of students among all Czech regions.

Graph 1: Number of students of natural sciences and technical branches in Czech regions (2010)
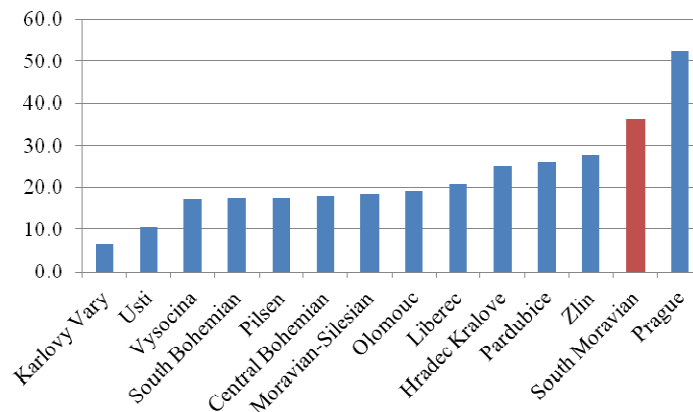
Source: CZSO (2011a)

3.4 Research institutions

Research and development is considered one of the main sources of innovations. It is determined not only by the spatial arrangement (research institutions are considerably concentrated) but also by the availability of human and financial resources. The financial resources in the Czech Republic depend on financial possibilities of the developing economy. At the same time, there are significant regional differences.

There are 420 R&D workplaces in the South Moravian Region and workplaces oriented to technical branches predominate. The most of these workplaces are found in the business sector. Following graph presents number of R&D workplaces recalculated to 100,000 inhabitants in the regions. It is apparent the South Moravian Regions with 36.4 workplaces is on the second places among all Czech regions. The first is Prague with more than 52 workplaces, the third is the Zlin Region with 27.8 ones (CZSO, 2011d).

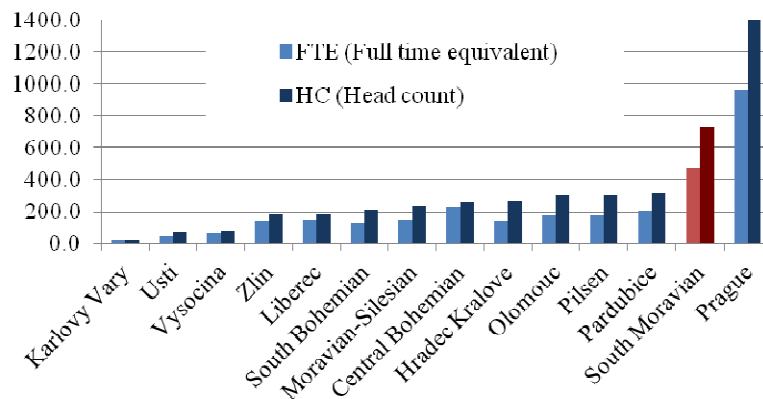**Graph 2: Number of R&D workplaces per 100,000 inhabitants in Czech regions (2010)**

Source: CZSO (2011d)

Available human resources are the key prerequisite for research and development. 8386 researchers (expressed in HC units) work in the South Moravian Region and 5446 if we express it in FTE units (CZSO, 2011d). If we would like to compare the South Moravian Regions with other regions in the CR we can use recalculated values per 100,000 inhabitants (graph 3). It is evident the regions can be divided into three groups and big differences are among them. These groups are: Prague, the South Moravian Region and the other regions. The researchers (HC) work especially in technical branches (about 40 % in the SMR). In the South Moravian Region the employment in medical and natural sciences is also high (as well

as the human sciences with usage of FTE indicators). Most of all researchers (more than 50 % of HC) work at universities (but this is not valid for the FTE units).

Graph 3: R&D personnel per 100,000 inhabitants by region

Source: CZSO (2011d)

About 8.4 mld. CZK was invested in research and development in the South Moravian Region in 2010. These expenditures were invested especially in the enterprise sector. The most important financial sources are the government (46.1 %) and the enterprise (42.3 %) sector. Most of all resources are allocated into technical sciences (61.5 % in the SMR), distantly followed by natural sciences (CZSO, 2011d).
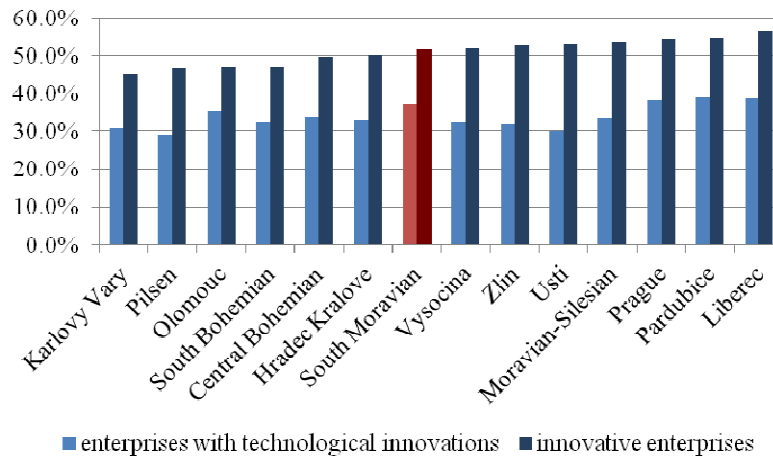
3.5 Economic environment
The sector structure of economy expressed by share of employment proves that the established clichés are not true. The South Moravian Region is not an agricultural region and the share of industry is higher than one would expect. The decisive part of industry is the manufacturing industry (consisting of B, C, D and E sections of CZ-NACE classification) whose share is 23.4 % in the SMR (CZSO, 2011e).

As regards introduction of innovations, all sectors are important, not only the manufacturing industry where the highest amount of technological innovations is conducted. According to the methodology used for the first time in the innovation survey TI2008 also the enterprise that has only non-technological innovation is considered innovative. Non-technological innovations arise in a wider range of enterprises.

The question of involving or not involving non-technological innovations significantly influences the evaluation of the innovation environment. According to TI2010 (CZSO, 2012), the total share of innovative firms is 51.8 % in the SMR. As regards enterprises with technological innovation, which are crucial for regional competitiveness growth, their share is 37.0 % in the SMR. The differences in values between these two indicators are not too high at the first glance but they are evident at close-up view. The share of innovative firms in the SMR is average. If we use the indicator of enterprises with technological innovation then the SMR is only two percentage points behind the most innovative region in the CR and it is on the 4th place (graph 4).

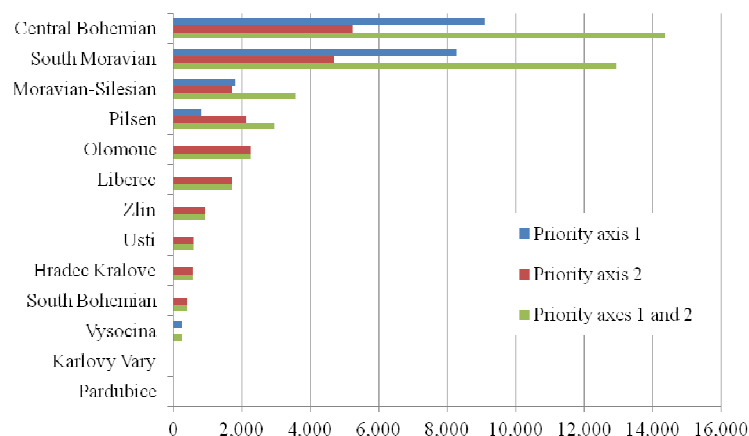**Graph 4: Share of innovative enterprises and enterprises with technological innovation**

Source: CZSO (2012)

If the estimations of the firms interviewed in the innovation survey are right, the financial effects appreciated through the ratio of costs and revenues connected with innovations are significantly different in the selected regions. Enterprises in the SMR invested in technological innovations CZK 5.9 mld. in total and got CZK 179 mld. for innovated products in the period of 2008–2010. Public support of enterprises with technological innovation is also an interesting indicator for a regional innovation system. 20.4 % of enterprises got some public support in the SMR, it was only 20.4% in the SMR (CZSO, 2012).

3.6 Operational Program Research and Development for Innovations
The aim of the Operational Program Research and Development for Innovations (OP RDI) is to support R&D infrastructure. Its resources serve for building and equipment of research workplaces and increasing of tertiary education capacity. Especially researches institutes and universities are the recipients of this program. The Program is divided into four thematic priority axes. In our analysis we focused on the first two of them because they have the biggest impact on R&D carried out in regions and they represent the substantial part of the whole program. Priority axis 1 is aimed at European centres of excellence, priority axis 2 supports regional R&D centres. The analysis is carried out according to the place of implementation. If the project is implemented in more than one region it is assigned to the region where the recipient of subsidy has their headquarters. 47 projects of total value CZK 40.5 mld. were supported till April 2012.

Graph 5: Subsidies from the OP RDI in the Czech regions (in mil. CZK)

Note: 1 EUR = 25 CZK, 1 USD = 19 CZK

Source: MSMT (2012), authors' own calculation

Graph presents the position of the South Moravian Region in the allocation of finances from the OP RDI. The projects carried out in the SMR have obtained CZK 13 mld. in total from which about CZK 8.3 mld. has been assigned to projects under the first priority axis. The SMR has obtained 32% of all allocated resources which is the second highest share among all Czech regions. The higher amount has been allocated only in the Central Bohemian Region (35%) where also the projects of entities registered in Prague are often carried out. (The projects carried out in Prague are not eligible for support from this program.) In the SMR 14 projects have been supported (3 of them within the first priority axis). The CEITEC and the ICRS are the most important projects in the SMR. CEITEC is a project aiming to set up a research centre of scientific excellence and four universities and two research institutes take part in it. The aim of the project is to build laboratories outfitted with first-class equipment that will be used for basic and applied research in the field of life sciences and advanced materials and technology (CEITEC, 2012). The ICRC is the International Clinical Research Center which is the result of long-term close cooperation between experts from St. Anne's University Hospital Brno and Mayo Clinic in Rochester in Minnesota (ICRC, 2012).

3.7 Operational Program Enterprise and Innovations

Operational Program Enterprise and Innovations (2007–2013) focuses on the business environment development and support of enterprises, especially the innovative ones. Most of resources of this program are given to firms but also universities, research institutes and territorial administrative units can get the support. The OPEI is divided into six thematic priority axes. In our analysis we deal with programs that are aimed at introduction of innovations most of all. It means the Innovation Program and the Potential Program that are parts of the 4th priority axis and the Prosperity Program that is a part of the 5th priority axis. The analysis is also carried out according to the place of implementation.
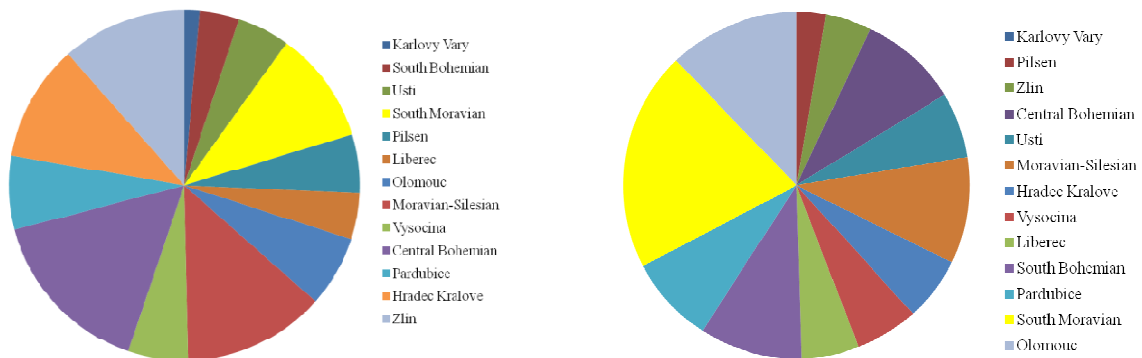
Innovations Program

This program is divided into two subprograms: Innovations – Innovation Projects and Innovations – Protection of Intellectual Property Rights (IPR). The first of them supports introducing of product and process innovations in enterprises and part of this support can be used also for marketing and organizational innovations. The second subprogram provides subsidies for getting patents, utility models, industrial designs and trademarks. Subprogram Innovations – Innovation Projects has redistributed about CZK 13 mld. up to now, 10.4% of which has been allocated to the projects in the SMR. The South Moravian Region is placed fifth among all Czech regions (the Central Bohemian Region is the first). In the SMR 7.11 projects per 100 thousand inhabitants have been supported. Subprogram Innovations – IPR has allocated about CZK 69 mil. among recipients, 20.5% of which to applicants in the SMR. With respect to the total amount of subsidy the SMR is in the first position. The number of projects per 100 thousand inhabitants is 6.42 in the South Moravian Region. More detailed information on both subprograms is shown in graph 6.

Graph 6: Subsidies from the OPEI – Innovations Program (share of individual regions)
Innovations – innovation projects   Innovations - IPR

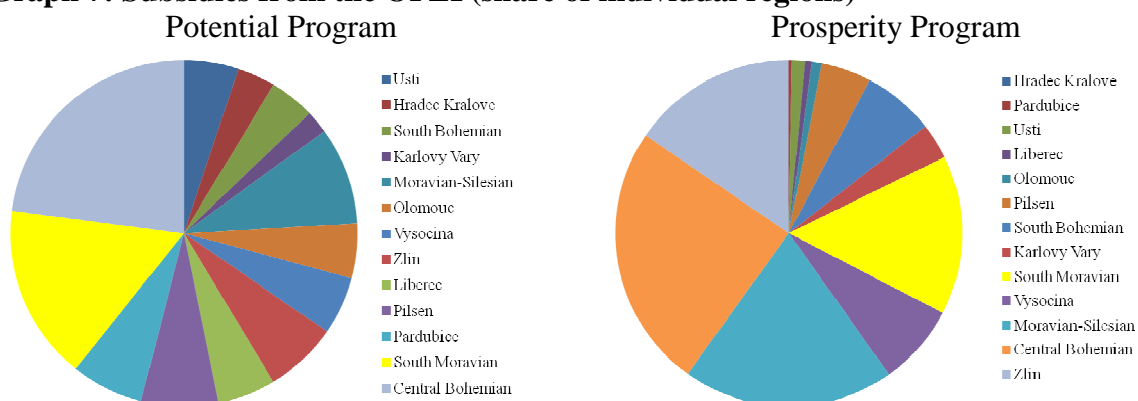Source: CzechInvest (2012), authors' own calculation

Potential Program

The Potential Program provides support to building or enlargement of development centres (departments) in enterprises. In the framework of this program subsidies of total amount CZK 4.3 mld. were allocated till April 2012, 16.3% of which went to the SMR (graph 7). Higher support has been allocated only in the Central Bohemian Region (22.9%). About 4.4 projects per 100,000 inhabitants have been carried out in the SMR. With respect to this the most successful was the Zlin Region with 5.4 projects per 100 thousand inhabitants. According to subsidy per capita, the SMR is placed second.

Prosperity Program

The Prosperity Program supports building and operation of business incubators, science and technology parks and technology transfer centres. A small part of the resources is oriented to the establishing of business angel networks. Submitters of proposals are usually innovation centres, universities and regional and municipal governments. Up to now the program has allocated CZK 3.9 mld. and the SMR has obtained 14.9 % of this amount (the 4th place in the CR). Most of all subsidies have been allocated to the Central Bohemian Region (24.7 %). Altogether 47 projects have been supported, 11 of which in the SMR. Generally spoken, the participation of the region can be considered above-average (graph 7).

Graph 7: Subsidies from the OPEI (share of individual regions)

Potential Program   Prosperity Program

Source: CzechInvest (2012), authors' own calculation

3.8 Innovation infrastructure

Innovation infrastructure, which means especially business incubators and science and technology parks (STP), is another tool for innovation support. With respect to the character of this supportive tool the establishment of incubators and STPs is usually initiated by

regional players and they represent one of the measures designed in regional innovation strategies.

The South Moravian Region is very active in building the innovation infrastructure and several incubators and STPs are concentrated in its territory. However, they are mostly located in the regional capital. The South Moravian Region has established a specialized institution for operating the most important incubators and STPs – the South Moravian Innovation Centre. Nowadays, it runs two technology incubators and STPs (INTECH) and biotechnology incubator INBIT. It will also run some infrastructure that is now being prepared, e.g. incubator INMEC that will focus on nano- and microtechnologies, new materials and communications and managing technologies. The innovation infrastructure in the SMR is built near two biggest universities in Brno – infrastructure for life sciences firms is situated near the campus of the Masaryk University and infrastructure for technology firms is usually situated near the University of Technology. There is also the Czech Technology Park (partly in the property of the City of Brno), where a lot of multinational firms are settled. Smaller incubators are also constructed by the Research Institute of Building Materials in the southern part of the city. About 10 incubators and STPs are in the preparation now.

4. Conclusions

Evaluating the regional competitiveness through the concept of regional innovation systems is one of modern approaches to innovation research. A regional innovation system is created by a network of economic entities and a wide range of relations that represent individual activities or processes that arise among these entities. The actual operation of a regional innovation system in practice can be tested on the example of regions that are expected to have a certain quality of system parameters. The South Moravian Region is such region undoubtedly.

The South Moravian Region has a sophisticated institutional framework embodied by the South Moravian Innovation Centre and its activities are under the patronage of the Regional Innovation Strategy whose third version is a universal conception document. In the field of education this region is characterized by a considerable concentration of universities into the regional capital. The high number of students corresponds with the high number of those that study natural science and technical branches, which are crucial for innovations. In the field of research and development, this centre is only comparable with Prague within the CR, concerning the number of entities or employees as well as the volume of financial resources. Nowadays, enormous development of innovation and enterprise infrastructure is in progress and this has been caused especially by the support from operational programs. About 37% of all firms carry out technological innovations which in accordance with above mentioned means a significant potential for further development. The submitted study carried out on the example of the South Moravian Region has proved that the institutional framework, existing conditions in education and research as well as the sectoral structure is specific. In accordance with theoretical concepts, this constitutes a reason for a differentiated set-up of public support for innovation activities in individual regions.

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