THE ANALYSIS OF THE REGIONAL INNOVATION SYSTEMS – CZECH CASE

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Abstract

Regional Innovation Systems (RIS) are a relatively new instrument in regional policy. This instrument was developed from National Innovation System in 1990s according to the fact that innovation was the most important for regional development. This instrument became immediately very popular among regional policy makers. However, there could be problems with its successful application in the region. In order to avoid these problems, this paper provides an overview of basic information about RIS.

This paper further explores the existence and working of the Regional Innovation System in Czech Republic. We try to define the basic components by which we are able to decide if the RIS exists and if it works properly.

Key words: *Regional Innovation System, Innovation, Region,*

1. Introduction

The role of innovation and knowledge is very important in today's economy in general while it has been of utmost importance in regional economy for the last ten years. We could say that innovation is the corner stone of economic development. There are many authors who were interested in innovations. Based on their findings we can say that innovation may be understood as interactive learning process, which is socially and territorially embedded and culturally and institutionally contextualized. (Lundwall, 1992 in Asheim, Coenen 2005).

Every region tries to support innovation by some tools. There is not any universal solution how to effectively create "innovation friendly" environment. The first researcher who dealt with support of innovation was Porter, who was looking for links between firms and research institutions which could lead to innovation. And he said that the best form of this link could be in clusters.

The idea of clusters led to creation of innovation systems. The first step was founding the National System of Innovation (NIS), which has been used since 1980s. There is no clear definition of this approach. The most suitable definition is by Freeman (1987): "NIS is a network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies." (OECD 1997) and Lundvall (1992) adds that "these interactions are located within or rooted inside the borders of a nation state" (OECD 1997).

However, there is one problem with the nation state framework; the nation state can be divided into several regions, and each of them might need different tools to support innovation process as each of them is on a different level of innovation and in each region there are different geographical and economic conditions. Therefore, we cannot use the same regional policy tools in each of the regions of a nation state.

In order to resolve this problem, Regional Innovation System (RIS) was developed and region became the central point in the innovation process. Because at regional level the innovation is produced through regional networks of innovators, local clusters and the cross-fertilizing effects of research institutions (Lundwall and Borrás 1997, in Asheim, Isaksen 2002). And as

Cooke (2006) adds "regional innovation interaction among firms and other innovation organizations has been regarded as playing an important role in fostering regional innovation potential".

This paper should inform about last trends and facts about regional innovation systems and provide information about RIS in the Czech Republic. In the first part there are some essential information about RIS and in the second part there is an analysis of RIS in the Czech Republic in the Pardubice region and in the Moravia-Silesia. In the final part, there is conclusion and some recommendation.

2. Regional Innovation System

At the beginning we have to explain the term of region. There are two proposed definitions of a region. In the first definition, a region is described as a geographically defined, administratively supported arrangement of innovative networks and institutions that interact heavily and on a regular basis with innovative output from regional firms. In the second definition, emphasis is placed at the cultural aspects of the region. It means that a region need not have a determinate size, it can be distinguished from bordering areas by a particular kind of association or relation features, and it possesses some type of internal cohesion (Cooke 2002 in Doloreux, Parto 2005).

According to the above mentioned definitions of a region we can state that a region is a dimension with key importance. There are some reasons which were summarized by Tödtling and Trippl (2005): First, regions differ with respect to their industrial specialization pattern and their innovation performance (Breschi 2000, Howells 1999, Paci and Usai 2000). Second, it was shown that knowledge spillovers, which play a key role in the innovation process, are often spatially bounded (Anselin et al. 1997, Audretsch and Feldman 1996; Bottazzi and Peri 2003). Third, the ongoing importance of tacit knowledge (Polanyi 1966) for successful innovation has to be mentioned (Gertker 2003, Howells 2002). Finally, policy competences and institutions are partly bound to subnational territories (Cooke et al. 2000).

If we accept the fact, that region is the most important area for innovation, than we need some framework or tool how to support innovation process in a region. For this reason the Regional system of Innovation (RIS) was founded in the 1990s. Since this time there have been many researchers who are interested in RIS and who have tried to define RIS. All of them finally agree with definition of RIS by Cooke (2006) which says that RIS are useful for studying economic and innovative performance; they are also functional tools to enhance the innovation processes of firms. They do this by knitting together knowledge flows and the systems on which they rely, building trust and confidence in institutional reliability; and above all, they do it by generating institutional self knowledge and a certain kind of collective dissatisfaction with the status quo. RIS comprise a set of institutions, both public and private, which produce pervasive and systemic effects that encourage firms in the region to adopt common norms, expectations, values, attitudes and practices, where a culture of innovation is nurtured and knowledge-transfer processes are enhanced.

We should try to imagine RIS as a framework which includes, according to Cooke (2002), two sub-systems:

- the knowledge application and exploitation sub-system,
- the knowledge generation and diffusion sub-system.

The first is principally concerned with firms while the second is mainly concerned with public organizations like universities, research institutes, technology transfer agencies, and regional and local governance bodies responsible for innovation support practices and policies. In

reality, there may be some overlaps since firms conduct knowledge creation activities, especially where they have formalized R&D laboratories, and universities and public or private research institutes conduct knowledge application activities.

Tödtling, Trippl (2005) adds to above mentioned subsystems another one. The third dimension is the regional policy because policy actors at this level can play a powerful role in shaping regional innovation processes, provided that that there is sufficient regional autonomy to formulate and implement innovation policies. (Cooke et al. 2000, Cooke and Memedovic 2003 in Tödtling and Trippl 2005). Tödtling, Tripple 2005 further add that in the ideal case, there are intensive interactive relationships within and between these subsystems facilitating and continuous flow or exchange of knowledge, resources and human capital. On the other hand, there are several types of RIS problems and failures such as deficits with respect to organizations and institutions and lack of relations within and between subsystems.

2.1 Taxonomy of RIS

We can see in the literature on the topic of RIS that some authors try to divide RIS into some categories which are similar in some characteristic.

The first division is according to Braczyk (in Cooke 2005). He says that there are three types of RIS emerged:

- localist,
- interactive,
- globalized.

The localist type has few major public innovation or R&D resources, but may have smaller private ones. There will be high degree of associativeness among entrepreneurs and between them and local or regional policymakers.

The mix of public and private research institutes and laboratories in the interactive RIS is balanced, reflecting the presence of larger firms with regional headquarters and a regional government keen to promote the innovation base of the economy.

The innovation system in globalized RIS is dominated by global corporations, often supported by clustered supply chains of rather dependent small and medium-sized enterprises (SMEs). The research reach is largely internal and private in nature rather than public, although a more public innovation structure aimed at helping SMEs may have developed.

The second division is provided by Cooke (2004 in Cooke 2005) and it is based on the government dimension. There are three forms of RIS again:

- grassroots,
- network,
- dirigiste.

Grassroots is where the innovation system is generated and organized locally, at town or district level. Financial support and research competences are diffused locally, with a very low amount of supra-local or national coordination. Local development agencies and local institutional actors play a predominant role.

A network RIS is more likely to occur when the institutional support encompasses local, regional, federal and supranational levels, and funding is often guided by agreements among banks, government agencies and firms. The research competence is likely to be mixed, with both pure and applied, blue-skies and near-market activities geared to the needs of large and small firms.

A dirigiste system is animated mainly from outside and above the region itself. Innovation often occurs as a product of central government policies. Funding is centrally determined, with decentralized units located in the region and with research competences often linked to the needs of larger, state-owned firms in or beyond the region.

This taxonomy by Cooke is followed by Asheim and Coenen (2005) who divide the RIS this way:

- territorially embedded regional innovation systems,
- regionally networked innovation system,
- regionalized national innovation system.

Territorially embedded regional innovation systems are similar to grassroots RIS by Cooke, the best examples of this type are networks of small and medium enterprises (SMEs) in industrial districts. These systems provide bottom-up, network-based support through, for example, technology centers, innovation networks, or centers for real service providing market research etc. (Storper and Scott 1995 in Asheim and Coenen 2005).

Regionally networked innovation system means that firms and organizations are also embedded in a specific region and characterized by localized, interactive learning. This type is very similar to network RIS by Cooke. We can say that a networked innovation system is a result of policy intervention to increase innovation capacity and collaboration.

Regionalized national innovation system is different from the two systems above in two main points. First, parts of industry and the institutional infrastructure are more functionally integrated into national or international innovation systems. Second, the collaboration between organizations within this type of RIS conforms more closely to the linear model, as the co-operation primarily involves specific projects to develop more radical innovations - based on formal analytical-scientific knowledge. Cooke named this type of RIS system dirigiste RIS. The concrete example of this system could be technopoles or science parks. For more information see Asheim and Coenen 2005.

2.2 Components of RIS

For successfully working RIS, the existence of all their components and links between them is very important. Andersson and Karlsson (2004) clearly explained this issue in following picture.
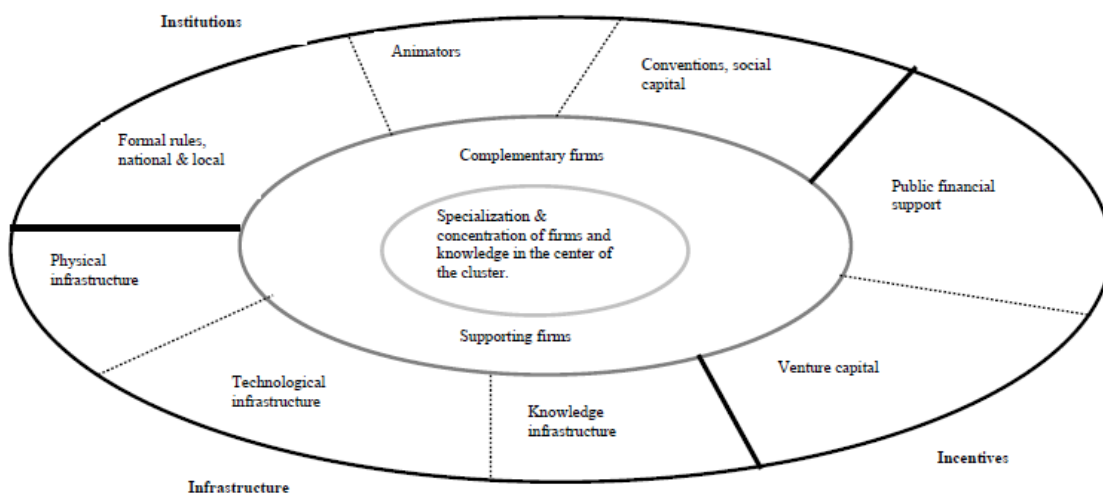

Figure 1 – Components of RIS (adapted from Andersson and Karlsson 2004)

This picture shows that in the core of RIS should be Specialized firms which are support and produce innovation and which could be concentrated for example in cluster. Around these firms there are so called Complementary firms and Supporting firms which complete the core of successfully working RIS. And the framework of RIS can be made by three groups of components which are Institutions, Infrastructure and Incentives. Institutions provide the rules, norms and legislative for RIS. Incentives include funding sources for projects which are processed within RIS and for RIS itself. And the last but not least group of components is Infrastructure which includes technological, physical and knowledge parts. We can include universities, science parks or some kind of research institutes into this group.

According to figure 1 we can say that for well-functioning RIS linkages among universities, industry and government are very important. Etzkowitz and Leydesdorff (2000 in Andersson and Karlsson 2004) call these linkages *Triple Helix*. They define Triple Helix as knowledge infrastructure in terms of overlapping institutional spheres, with each taking the role of the other with hybrid organizations emerging at the interfaces.

2.3 The Regional Innovation Paradox

This issue was processed by Oughton, Landabaso and Morgan 2002. In this part we try to summarize their conclusions.

They said that from a theoretical perspective the rationale for focusing on regional innovation systems lies in the fact that the factors which the national innovation systems theory identifies as important, such as the framework, the nature inter-firm relationships, learning capability, R&D intensity and innovation activity all differ significantly across regions.

They analyzed variance in R&D intensity, innovation activity and living standards across 178 regions and 12 nations of the EU. The conclusion of this was that the data suggest that variations across regions within nation states are greater than variations across nation states providing strong empirical evidence in favor to extending the analysis of national systems of innovation to the regional level.

Other information which is provided by data from the EU regions is that there is positive relationship between R&D intensity, innovation activity and economic prosperity. The data also provides empirical confirmation of the regional innovation paradox. This paradox is based on the fact that in lagging regions which need to increase their R&D intensity and innovation activity in order to catch-up the leading regions, but paradox they actually devote less resources even as production of GDP. Governments across Europe spend more on R&D in leading regions and less in lagging regions. This is in marked contrast to European industrial policy where there is an inverse relationship between government spending on industrial policy and GDP per capita because public funds are targeted at poorer regions.

We can finally say that the paradox reflects the difficulty that lagging regions have in absorbing funds for R&D activity even when these are offered in the form of public subsidies.

3. RIS in practice of Czech regions

3.1 RIS Definition

According to what was stated above, regional innovation system consists of following three basic layers:

a) layer of companies,

b) layer of complementing and supporting companies,

c) layer of environment and infrastructure.

The layer of companies would include such companies which introduce innovations to the market, or in other words produce patents, eventually spend financial resources to research, development and creation of innovations. Innovative companies are sometimes characterized by activities stated in the Registry of Economic Subjects of the CZSO (Czech Statistical Office) or in another database. In such case it is only estimate overview as these companies do not necessarily have to innovate.

The layer of complementing and supporting companies includes also those that provide complementary and supportive services to the first layer companies. It is mainly providers of knowledge, companies cooperating on sub-deliveries, institutions for cooperation (they are often in the core of industrial clusters and execute administrative activities of cluster management) and others.

The layer of environment and infrastructure can be divided into three separate parts:

a) institutions creating environment

- institutions creating legal framework for entrepreneurship, strategic documents supporting innovative entrepreneurship and supporting creation and development of innovations within companies,

- animators, which are companies securing facilitation of businesses; they are organizations established for support of creation of industrial clusters and business chains,

- institutions and organizations which create conventions, customs and usages in area of ethics in the business. Often these are university type institutions or entrepreneur innovations. The essence is that these institutions support so called social capital.

b) sets of initiatives

- public initiatives, which financially support creation and development of innovative entrepreneurship, innovative infrastructures of all kinds,

- private initiatives which decided to financially backup ideas and thoughts of those entrepreneurs who have insufficient basic capital. Typically it is venture capital, or in other words business angels.

c) hard and soft infrastructure

- physical infrastructure such as industrial areas, technology parks, science and development parks, innovation centers and others

- technological infrastructure represented by the newest equipment and tools in centers. Often these are testing and research centers, Academy of science institutions or other research and development centers and laboratories,

- knowledge infrastructure represented by educational institutions, universities, colleges and other organizations enabling horizontal or vertical transfer of knowledge among individual organizations and companies.

In individual layers we can find private organizations (businesses), public institutions (mostly regional governments) and other public (sometimes also private) organizations which

constitute an important part of positive innovation environment. The whole structure is known as the triple helix.

There is still one unsolved problem – RIS branch focus. All the authors quoted regard RIS to be a general problem which is fixed in environment of certain region's society and integrates all branches within. According to the logic of setting basic RIS elements it is necessary to distinguish RIS branch focus, while as for some branches there could be higher number of fulfilled RIS elements, some would not be fit for other branches according to the rule "all does not fit to all".

Another element of RIS is its activity or activity resulting from geographical closeness, willingness to cooperate and confidence. Communication relations among RIS subjects cannot be left out either.

3.2 Methodology of survey and analysis

The goal of the survey and analysis is to find out whether we can find within two selected regions (districts – NUST III) of the Czech Republic a regional innovation system in a manner described above. The analysis will cover the Pardubice district and the Moravia-Silesia district. Considering the fact that it is not possible to unambiguously expertly measure individual parts of regional innovation system, taxonomy of RIS elements has been defined:

RIS layer	Sign
Businesses	Existence of industrial clusters
	Unambiguous existence of innovative companies within branches
	Number of patents within branch
Support organizations	Existence of IPS
	Existence of entrepreneur incubator
	Existence of regional development agency
	Existence of support and complementing organizations
Environment and infrastructure	Existence of regional innovative strategy (in other words update) not older than 5 years
	Existence of animators in district and in branch
	Existence of organizations creating special community in given branch
	Existence of special organizations, associations and others within branch
	Existence of public financial schemas
	Existence of private financial initiatives
	Existence of elements of hard innovation infrastructure
	Existence of technological infrastructure
	Existence of knowledge infrastructure
Relations	Existence of communication channels
	Existence of projects confirming cooperation and synergy

Findings were obtained from Regional innovation strategies, information of web pages of respective districts and cooperating institutions and organizations. We also used databases of the CZSO and SWOT analyses of analyzed regions.

3.3 Analysis results

After the analysis performed in Pardubice district we can state following findings:

- RIS is just a formal (dead) document which was elaborated in 2006, no update is being prepared so far. Document is too general and without any relations to activities, tasks and financial resources;

- In strategic documents 6 clusters are considered, while only two of those act as a cluster or quasi-cluster. The rest is either not working or they work as association of entrepreneurs of similar scope;

- Proportion of MPS with product innovation on market on overall number of MSP with innovation is higher than the Czech Republic average (Pardubice district is on the fourth place);

- Despite the fact above, only a few innovations are patented as the number of patents is very low. Progression in development is not evident, but it is notable in other districts (South Moravia, Liberec district, central Bohemia);

- Innovation infrastructure is insufficient; only technological park was built which can serve as an incubator, eventually science-technical park. Its occupancy is minimal, TechnoPark Pardubice does not work and its founders are leaving its management structures;

- Pardubice district has only one university which has innovative potential only in technical fields such as chemistry, chemical technology and traffic engineering. Dominant branch is chemistry with a long tradition. A new branch can be electrotechnics. Originally it should have been connected to electrotechnic cluster creation, but the cluster in fact never started working. University potential is, therefore, quite unexploited;

- It was found out that there are only a small number of support institutions and organizations which take care of innovation activities. Those who do take care reside in Pardubice and work rather formally than factually;

- In order to finance and support innovation activities only resources from structural funds are used; resources from district budget are only marginal;

- Financing from private resources is completely absent. Concrete data were not found. Venture capital or business angels were not noted;

- Private science-research activities are absent. There are only 3 companies which publicly display their ability to participate in R&D activities;

- There are no common activities in which it would be possible to see results of cooperation and effects (externalities) of cooperation and closeness.

Generally we can state that regional innovation system in Pardubice district was not created and practically does not work. Foundations of this system have been placed, it is necessary to redevelop them.

In the Moravia-Silesia region the situation is different. We found following results in this district:

- RIS in Moravia-Silesia district was founded in 2003 and therefore there was longer time period for the district to build investment and innovation infrastructure and to secure creation of sufficient amount of high quality support institutions and organizations. In 2010 the RIS was updated;

- There are 10 working clusters, 4 of which can be considered clusters and the rest of them are rather association of entrepreneurs. It is obvious that quality of cluster activities is increasing, because number of clusters is constantly increasing and necessary facilities are being created continuously;

- In the district there are institutions for cooperation which simplify clusters functionality;

- Portion of MSP innovations on republic average is low, MSK took 9. place. Innovation paradox manifestation is obviously there.

- Paradoxically, the number of patents manifested itself in both innovation results and bought passive licenses. Annual progression is obvious in there. Their number belongs to the highest in the Czech Republic (right after Prague and the Central Bohemia region);

- In the district there is sufficiently extent innovation infrastructure, which is represented by all three (park, IC and incubator). These elements of hard infrastructure are occupied, work and use to be given as an example;

- There are three large universities in the district, one of which (VŠB-TUO) is technically oriented, which enables synergy in cooperation of respective branch oriented companies (see cluster orientation);

- There is sufficient number of projects, which are solved in cooperation of various institutions, organizations and clusters, which completes regional innovation system.

After performed survey we can state that almost all basic requirements on creation and working of regional innovative system in the Moravia-Silesia district. This system evidently works and is a determining factor of competitiveness of regional players involved.

In individual regions, selected elements of regional innovation systems were evaluated. It is possible to reinforce them even more in the future under following assumptions:

- There will be strategic document Regional innovation strategy, which will be a live document, impacts and effects will be analyzed and document would be updated;

- Industrial clusters activity will be extended, as they are a significant platform of innovations. Their functioning can contribute to resolution of almost half of necessary RIS indicators. By that existence of RIS in the whole region will be reinforced;

- Output will be demanded from individual institutions, organizations and other subjects involved in execution of individual tasks within RIS system. These outputs will be subject to detailed opposition and will be mainly qualitatively evaluated. That holds true particularly for those who draw public resources for these purposes – either from structural funds of any type or from district resources organizations managed by the district;

- After performing analysis we cannot state that focus of RIS solely on geographical area of certain region is the most suitable. This focus seems to be too general and there is a problem how to appropriately define certain goals in order that they lead to effective development of innovations within region;

- A better solution would be to focus RIS rather on branches. There should be framework RIS seconded by detailed analysis revealing strengths and strategic branches within region, which would serve for custom created RIS;

- This branch focused RIS could get into problems as a result of relapse of selected and supported branch. That is why each RIS in the region should include more than one industrial branch;
- For existence of RIS individual elements stated above and also working relations among these elements are important. In some cases we are sure to find the elements, but not the working relations and it is therefore not possible to state that RIS exists and is working.

Conclusion

There are many approaches to regional innovation systems presented in current literature. However, most of them consider individual elements creating RIS not measurable or difficult to measure.

The goal of this article was to define clearly measurable indicators. By analyzing those indicators it would be possible for us to determine whether the regional innovation system is present in the region. Default group of signs was published by Tödtling, Tripl (2005). The RIS definition itself and definition of its symbols results from their publication. It is obvious that it is not an enumeration of symbols and that their analysis is not easy. During analysis, survey on element presence in region is conveyed (in other words quantity is measured), because there is no qualitative measure and it is not possible to establish one.

The results of analyses clearly show that regions surveyed contain individual required signs of RIS in infrastructure and economical and social environment. By this they only fulfill presumed vital signs, but no signs leading to expected results.

One of the results of this study is the fact that if we manage to define measurable elements of RIS within regions, then it is possible to focus on them in more details in course of creation of strategic, legislative, institutional and financial framework. Those are currently being prepared in the Czech Republic mainly for purpose of drawing financial resources form EU. The goal is, therefore, not innovation and innovative entrepreneurship, but rather drawing resources from structural funds.

More detailed expert analysis uncovered that in the Pardubice district there are only selected premises for creation of RIS, which needs to be further built. It is vital to manage, by means of public policy supporting innovative entrepreneurship and innovative infrastructure, and also to look for suitable financial resources. If there are currently financial resources spent for support of innovations, then it is an innovation paradox.

In the other NUTS III region of Moravia-Silesia the situation is different. Presence of individual required RIS elements (knowing that we can state that presumptions for RIS existence are there), but qualitative side of RIS was also evaluated positively (thus there are communication and information relations, network entrepreneurship, common projects, industrial clusters and others). RIS in Moravia-Silesia district therefore exists and contributes to regional development.

In the conclusion of this article recommendations were defined regarding existing RIS and further development. Currently, it is more and more frequent that in developed countries with transformed economy innovation paradox occurs and thus financial resources are spent ineffectively. Mapping and analysis of RIS is one of tools to decrease this inefficiency and to enforce economic growth.

References

1. ANDERSSON, Martin; KARLSSON, Charlie. Regional Innovation Systems in Small & Medium-Sized Regions: A Critical Review & Assessment. *CESIS*. 2004, 10, s. 2-25.

2. ASHEIM, Bjorn T.; COENEN, Lars. Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Research policy*. 2005, 34, s. 1173-1190.

3. ASHEIM, Bjorn T., et al. Regional Innovation System Policy: a Knowledge-based Approach. *Circle*. 2005, 13, s. 1-23. ISSN 1654-3149.

4. ASHEIM, Bjorn T.; ISAKSEN, Arne. Regional Innovation Systems: The Integration of Local "Sticky" and Global "Ubiquitous" Knowledge. *Journal of Technology Transfer*. 2002, 27, s. 77-86.

5. COOKE, Phil. *Regional innovation Systems as Public Goods*. Vienna: United Nations Industrial Development Organization, 2006. 33 s.

6. COOKE, Philip; URANGA, Mike Gomez; ETXEBARRIA, Goio. Regional Innovation System: Instituional and organizational dimensions. *Research policy*. 1997, 26, s. 475-491.

7. COOKE, Philip. Regional Innovation Systems: General Findings and Some New Evidence from Biotechnology Clusters. *Journal of Technology Transfer*. 2002, 27, s. 133-145.

8. COOKE, Philip. Regional Innovation Systems, Clusters, and the Knowledge Economy. *Industrial and Corporate Change*. 2001, 10, 4, s. 945-974.

9. DOLOREUX, David; PARTO, Saeed. Regional innovation systems: Current discourse and unresolved issues. *Technology in Society*. 2005, 27, s. 133-153.

10. DOLOREUX, David. What we should know about regional systems of innovation. *Technology in Society*. 2002, 24, s. 243-263.

11. FRITSCH, Michael. Measuring the Quality of Regional Innovation Systems: A Knowledge Production Function Approach. *International Regional Science Review*. 2002, 25, 1, s. 86-101.

12. OUGHTON, Christine; LANDABASO, Mikel; MORGAN, Kevin. The Regional Innovation Paradox: Innovation Policy and Industrial Policy. *Journal of Technology Transfer*. 2002, 27, s. 97-110.

13. SLAVO, Radosevic. Regional Innovation Systems in Central and Eastern Europe: Determinants, Organizers and Alignments. *Journal of Technology Transfer*. 2002, 27, s. 87-96.

14. TÖDTLING, Franz; TRIPPL, Michaela. One size fits all? Towards a differentiated regional innovation policy approach. *Research policy*. 2005, 34, s. 1203-1219.

15. UYARRA, Elvira. What is evolutionary about "regional systems of innovation"? Implication for regional policy. *Springer-Verlag*. 2009, 20, s. 115-137.

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