A framework for comparing regional open innovation systems in Russia

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Abstract: Like many of the post-soviet countries, Russia has entered the new century targeting at creation of competitive economy, based on knowledge and innovation with strong emphasis at the role of the regions. At the same time, the western world has entered an era of a new approach to innovation, shifting from a closed to an open innovation (OI) paradigm. This paper focuses on the development of an integrated regional open innovation system (ROIS) and introduces a framework for the analysis of OI implementation within regional innovation system in Russia. St Petersburg region of Russia is studied as an example for the developed framework. This paper contributes the ROIS and related constituting concepts by offering a framework for studying and comparing ROISs in Russia.

Keywords: OI; open innovation; RIS; regional innovation system; Russia; ROIS; regional open innovation system; BREG framework.

Reference to this paper should be made as follows: Savitskaya, I. and Torkkeli, M. (2011) 'A framework for comparing regional open innovation systems in Russia', *Int. J. Business Innovation and Research*, Vol. 5, No. 3, pp.332–346.

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1 Introduction

The importance of regions as drivers of economic growth has become increasingly acknowledged in the literature (Braczyk et al., 1998; Cooke et al., 1997; Howells, 2005). The concept of the regional innovation system (RIS), elaborated in the 1990s, approaches innovation as a systemic process (Cooke, 1992). Florida (1995) states that due to the nature of economic transformation, regions become key economic units in the global economy. The development of a broad infrastructure at the regional level is a basis for firms' growth in the knowledge economy (Aaboen and Lindelöf, 2008; Elfving et al., 2006; Florida, 1995). Howells (2005) sees the role of universities to be of highest importance for the region, as they are involved in knowledge creation and transfer. Nelson and Winter's evolutionary theory views industrial firms as the only players at the market (Leydesdorff and Etzkowitz, 1996). Leydesdorff's Triple Helix model adds beside industrial firms such market players as academic institutions and governmental agencies (Leydesdorff and Etzkowitz, 1996), introducing the three main elements of the innovation system.

The above-mentioned concepts view innovation from the systemic perspective. On the other hand, the open innovation (OI) paradigm sees innovation as a result of joint collaborative efforts of many organisations, such as firms, universities and public agencies (Aaboen and Lindelöf, 2008; Rothwell, 1992; Vanhaverbeke and Trifilova, 2008), however some researchers entitle such collaboration as open system approach (Czuchry et al., 2009). The actors within the OI paradigm are the same (but not limited to) as the main players within the Triple Helix model. Hence OI adds rather than contradicts the principles of the RIS and the Triple Helix model. This complementarity creates an opportunity to synthesise the three concepts (OI, Triple Helix and regional system of innovation) into elaborating a framework for a regional open innovation system (ROIS) (Torkkeli et al., 2007).

This paper aims at highlighting to what extent the OI approach to collaboration shapes the relations within the RIS. The RIS of St. Petersburg (Russia) has been chosen as the background for the research as it represents an indicative case of a shift from evolutionary RIS development to the construction of a top–down purposeful ROIS. Adapted to the city RIS, the Triple Helix model is used as a tool for describing relationships between the main players in the region. The analysis of Triple Helix-based linkages from the relational, OI point of view makes it possible to develop an analytical framework for analysing and comparing the ROISs of countries with similar erosion of Triple Helix model – e.g. post-soviet countries.

This paper is structured as follow: Section 2 discusses the theoretical background for emergence of ROIS and it constituting concepts. Section 3 describes research design and methodology, followed by analysis of the Triple Helix adaptation to specifics of St. Petersburg in Russia in Section 4. In Section 5, a framework for studying and comparing ROISs within Russia and other post-soviet countries is discussed. This paper concludes with the outcomes and suggestions for further research.

2 Theoretical background

ROIS has been described by Torkkeli et al. (2007) as an innovation network comprised different actors working towards the creation of innovations in a certain region.

The concept represents an integration of such approaches as RISs, the Triple Helix model and the OI paradigm, with certain roles for each of them. OI acts within this framework as a stimulating approach to collaborate inside the region of innovation; Triple Helix is viewed as a tool to describe collaboration between universities and other actors of the system, and the regional system creates a background and backs up this collaboration (Etzkowitz and Leydesdorff, 2000). The role of OI for national system of innovation has been well discussed by Santonen et al. (2008), however with a major focus on the customers' role as a resource for business community to fulfil governmentally defined national innovation strategy. ROIS approach in this paper addresses the transformation of linkages within regional system into relationships as presumed by OI approach.

While the OI approach sees innovation emerging from relationship-based collaboration between such partners along the value chain as the public sector, businesses and academic world, etc. (Chesbrough, 2004), the Triple Helix explains linkages and communications between these partners reinforced by infrastructural organisations within the regional system (Etzkowitz and Leydesdorff, 2000). A certain amount of similarities and overlapping between OI and Triple Helix approaches create an opportunity for a RIS functioning as a platform for the open model of innovation (Torkkeli et al., 2007).

Within the OI system, businesses behave as the main actors, while the universities and the public sector are supposed to be drivers stimulating and facilitating the knowledge exchange (Torkkeli et al., 2007). The most recent research on regional systems of innovation increasingly often addresses the modes and incentives for business and university collaboration (Coccia, 2008; Czuchry et al., 2009; Piperopoulos 2007; Salmi and Torkkeli, 2009). Indeed, the academic–industry collaboration became intensified throughout recent years and is seen to be gradually more crucial for industrial innovativeness (Coccia, 2008; Piperopoulos, 2007; Salmi and Torkkeli, 2009). The involvement of government (through creation of business supporting infrastructure (Aaboen and Lindelöf, 2008; Pynnönen and Kytölä, 2008) in collaborative relations with academy and industry leads the return the stream of research to the systemic view and concept of joint regional innovation (Aaboen and Lindelöf, 2008), where open system approach plays one of central roles (Pynnönen and Kytölä, 2008).

2.1 Regional innovation systems

The concept *RIS* emerged in the early 1990s (Cooke, 1992). It can be defined as an 'institutional infrastructure supporting innovation within the production structure of a region' (Asheim and Coenen, 2005). Cooke suggests analysing the RIS in terms of two subsystems of knowledge exploitation and knowledge generation (Braczyk et al., 1998). The former reflects such regional production structures as firms and their clusters; the latter is constituted by supportive infrastructure, such as technology transfer agencies, public and private research laboratories, universities, etc. (Braczyk et al., 1998). Innovations emerge from the interaction of these elements. Thus, the stronger the linkages and collaboration, the more rapid is new knowledge creation and dissemination in the region.

The economic growth in the region is believed to be fostered by efficient regional innovation policies; the economic growth of the whole country is in turn constituted by the regional one (Howells, 2005; Torkkeli et al., 2007; Ronde and Hussler, 2005). The RIS represents on one hand a smaller replica of the national innovation system, and on

the other hand a subsystem, a detached but related element of national innovation system. This allows discussing the application of the Triple Helix model at the regional level as well.

The RIS can be defined as a set of innovative networks and institutions located in a certain geographic area, with regular and strong internal interaction that promotes the innovativeness of the companies in the region. Schiuma and Lerro (2008) approach the region from the perspective of its innovation capacity meaning 'overall innovation capabilities that a region can express, practically and potentially', distinguishing regional stakeholders, networking and local resources as main dimensions affecting this capacity. The openness of the regional firms adds to a certain extent to the efficiency of the RIS by integrating business into different types of relationships, such as business-to-business collaboration, public private partnerships, etc.

2.2 Open innovation

The propensity to collaborate for innovation and to open up the company's borders became intensified in the 1990s (Gassmann, 2006; Gassmann and von Zedtwitz, 1998), and the movement towards OI began, culminating when Chesbrough raised the issue of whether OI is 'the new imperative for creating and profiting from technology' (Chesbrough, 2004).

The OI model emerged as an opposite to the traditional closed innovation model, where every step of the innovation creating process was done inside companies (Gassmann and von Zedtwitz, 1998): own ideas generation, their development, product manufacturing, marketing and distributing were the spheres of the strategic interest of the company. Companies invested heavily in R&D, aiming to surpass competitors in launching new products, and tried hard to hire and hide the 'best brains' to make sure that the industry's smartest people worked for them (Chesbrough, 2003).

However, due to such factors as the increased availability and mobility of skilled workers, emergence and fast development of the venture capital market, external options for unutilised ideas (as opportunities to sell IP, spin offs, etc.) and the increasing capabilities of external suppliers and their integration into the innovation process, erosion of the traditional model has happened, leading to the OI paradigm (Chesbrough, 2003, 2004; Enkel et al., 2009; Gassmann, 2006). OI represents an approach to innovation which goes far beyond the boundaries of a single organisation, where a company commercialises both its own ideas as well as ideas from other sources (other firms, research institutions, etc.). On the other hand, the paradigm also implies that the newest inventions can be realised outside the firm, bringing in additional value (Chesbrough, 2003, 2004; Enkel et al., 2009; Kock and Torkkeli, 2008).

Based on the extensive research, Gassman and Enkel introduced three core archetypes of the OI process (Enkel et al., 2009), describing the direction of the collaborative efforts of the company:

1 the *outside-in process* implies the integration of the external knowledge of suppliers, customers, etc. into the company's own knowledge base in order to increase innovativeness

2 *the inside-out process* approaches by increasing the profit by bringing ideas to market, selling IP and transferring ideas outside the company

3 the *coupled process* integrates (1) and (2) by utilising both external sources for acquiring knowledge and disseminating it and by working with complementary partners.

The OI model adds to the understanding of innovation management, treating external knowledge as important as internal one. OI implies opening up for collaboration, hence an OI approach by regional companies adds an important characteristic to the RIS – openness, which brings intensified collaboration between the market players, creates strong relationships between innovative actors and fosters knowledge flow.

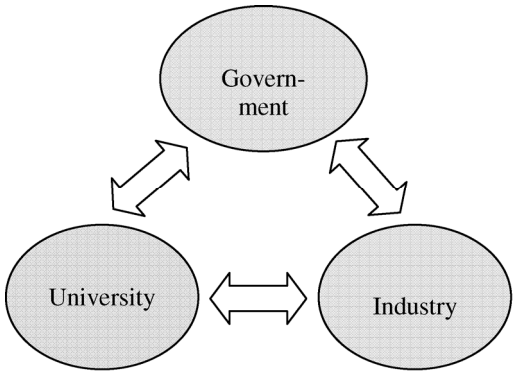
2.3 Triple Helix

Triple Helix was developed as a model explaining linkages within a national innovation system where university, industry and government feature as major actors and 'university' represents all scientific institutions (Saad and Zadwie, 2005). Since its emergence, the Triple Helix approach has been developed through three generations (Etzkowitz and Leydesdorff, 2000) and currently, in the OI era, the forth generation is emerging (Torkkeli et al., 2007).

If the RIS is treated as a smaller local replication of the national innovation system, the Triple Helix model can be applied to explain the linkages within the regional system. Indicating industry, university and government to be the main elements within both RIS and Triple Helix (Figure 1) demonstrates that despite these concepts assign the central roles of regional development drivers to different actors (firm and university, respectively), the concepts are more supplementary than contradictory.

Nowadays countries and regions try to utilise the Triple Helix model by creating an innovative environment consisting of university spin offs and strategic alliances (Torkkeli et al., 2007), and implementing OI within their business model. The Triple Helix model explains the types of linkages and communication within the innovation system, whereas OI implies the relationship nature of all collaboration links. Additionally, the Triple Helix of university–industry–government model does not hold for each and every innovation system, as the structure and composition of the RIS may vary from region to region.

Figure 1 Triple Helix model of university–industry–government relations



3 Research design

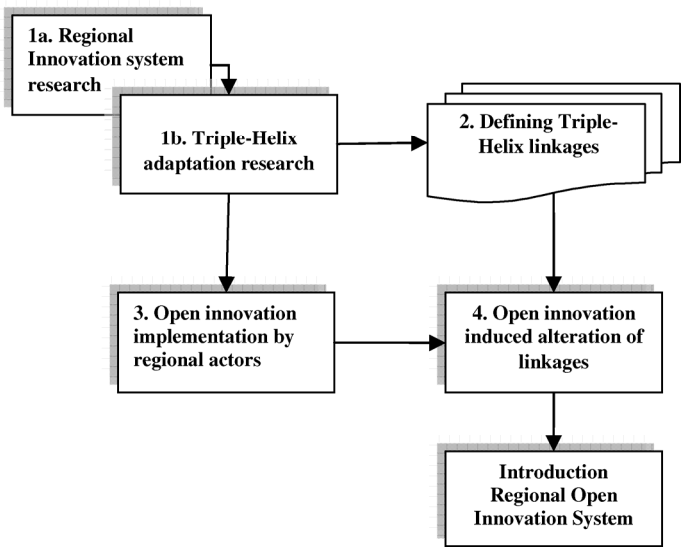
3.1 Methodology

The qualitative research method is deployed in a form of exploratory multiple case study. The case analyses is conducted using multiple sources of evidence (Yin, 1994), such as in-depth interviews, publicly available information, related scientific publications about the case area. Such type of data collection can be referred as data triangulation approach (Jick, 1979). The research of case organisations within St. Petersburg RIS was undertaken by analysing primary and secondary data sources. The primary data was collected through in-depth semi-structured interviews with four innovative SMEs in the region and three universities. The companies were interviewed about their OI implementation practices and their position within and involvement in the RIS. The secondary data was used to complete the analysis of the RIS of St. Petersburg and the Triple Helix model adaptation and to analyse not covered by interviews elements of the framework. Legislative acts, seminar proceedings, published interviews, etc. were used as sources as data.

3.2 Research layout

The research follows some lines of separated analysis, like RIS research; analysing the Triple Helix model in Russia, resulting in adapting it to county peculiarities and research on OI implementation by regional firms in St. Petersburg (Figure 2). The results of each line of analysis are integrated to form a description of a ROIS. Detection of the alteration of Triple Helix linkages by OI implementation practices is the key to distinguish ROIS from RIS.

Figure 2 Research model for RIS description



The selection of St. Petersburg as the region for research can be justified by existence of an active innovation policy in the city, probably the most active in the whole Russia, making the region one of the most innovative throughout the country. On the other hand, the research of innovations systems in Russia is rather scarce and current paper contributes to this stream of research.

4 Business–research–education–government model for ROIS

4.1 Triple Helix within the RIS in St. Petersburg

St. Petersburg is an example of city in transition towards a ROIS. The initiatives of local authorities have created certain prerequisites for such a transition, but the system cannot be viewed without taking into account innovation policies and legal initiatives issued at the country level. Nevertheless, the city was chosen for studying ROIS development as it possesses the potential to omit the phase of creating a traditional RIS and advance towards a ROIS.

This potential lies within the scientific concentration in the region, including large number of research organisations and universities (8% of all students in the county are studying in the city). Besides, St. Petersburg has over 3,000 SMEs (Dezhina and Kiseleva, 2007), about 500 of which have reported themselves to be innovative.

In 2009, Russia still demonstrates remaining features of a command innovation system as a major volume of scientific research is produced not only by universities but also by branches of the Russian Academy of Science (RAS). Moreover, RAS carries out primarily basic research; hence applied research remains undone. On the other hand, the new generation of future research personnel receives education at universities, where science is not strongly integrated into the educational process. Thereby, the creation of innovation supports infrastructure around either RAS or universities is problematic due to lack of young scientists in the former case and lack of scientific potential in the latter.

Such linkage within Triple Helix model, as industry–government, functions similarly to describe models of other countries; however, the specifics of Russian education and research sectors create certain erosion: the university element does not maintain the initial meaning imposed by traditional Triple Helix model. In developed countries universities carry out the major amount of research, whereas in Russia the research function is divided between universities and research institutions, with the latter conducting most of the basic research (Vanhaverbeke and Trifilova, 2008). The system of separating research from education goes back to the Soviet Union where research institutions were tightly connected to certain industry and were specialised in certain research field. This draw to assumption that after the collapse of Soviet Union the infrastructural component of innovation systems in newly created countries, including Russia, was inherited by them.

The role of business in the creation of scientific knowledge in Russia is rather small, with R&D expenses less than 8% and expenses for patent and license acquisition under 2% (Dezhina and Kiseleva, 2007); however, the tendency to increase R&D investments is emerging, as well as an inclination of large companies to acquire former branch research institutes.

The OI concept at the theoretical level is not yet well known in St. Petersburg region, nevertheless, with closer examination, the features of OI adoption can be found within local SMEs. The implementation of OI is mainly of the inbound type, demonstrating that

companies have recognised the value of externally available knowledge and are eager to exploit it. Additionally, partnership relations between different innovation actors in the region are created due to certain innovation system failures, e.g. the level of education is estimated by businesses to be rather low because of the outdated technical base of universities and insufficient financing. Understanding that the universities are important sources of human resource creation, companies are becoming actively involved in adjusting the quality of education to their personal needs by high involvement in the education process and integration of students into business processes at rather early stages of the education cycle, as stated by the head of scientific cooperation department at one of interviewed companies:

> "University graduates are seldom well prepared to start professional working straight after university. We have developed a special course of lectures to educate the newcomers for the company. Besides, we provide internships as well as participate in education process at universities through lecturing and commenting on curriculum."

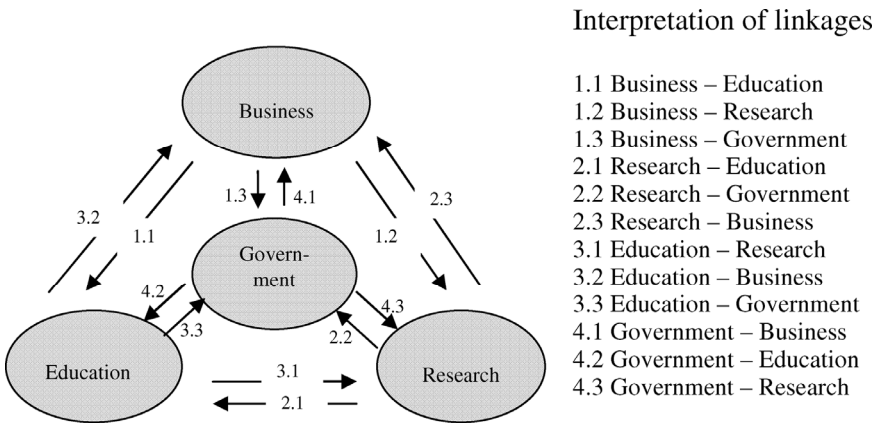
The division of basic and applied research between public and private research institutes and universities creates a need for formation of strong research–education–business relations, since universities are able to apply the outcomes of basic research into technology development projects. As companies do little research, their absorptive capacity is rather low and hence the universities act as transformers of not-ready-to-absorption knowledge into more appropriate one. The role of universities as technology transfer institutions is increasingly important in countries with a post-command innovation system where research is separated from the universities.

4.2 Business–research–education–government interconnections

As mentioned above, the research and education functions are divided mainly between universities and the Academy of Sciences, which should be reflected in the Triple Helix model by splitting one element into two (Figure 3), resulting in the appearance of a business–research–education–government (BREG) model. Every interconnection can be viewed as a double loop: in terms of what every agent receives from another and what it gives back.

There are certain specifics in the interconnections inside the Russian model of Triple Helix: the *government–business* relations are strong in two cases: when dealing with state holding ownership in the enterprise and when the enterprise personnel has informal connections to the government and the same applies to science–government relations (Dezhina and Kiseleva, 2007). However, the growing number of governmental research projects creates prerequisites for more profound cooperation. As one of companies clarified these relations: "governmental research projects are done through tenders. We participate, often win and conduct research".

Figure 3 Business–research–education–government



The research–business interconnection seems to be weakly developed, enforcing the government–research interconnection – a large share of public financing of science exists due to the low demand for scientific results from the business side. According to statistics, only 0.8% of research institutions have collaboration with business and 8% with universities (Dezhina and Kiseleva, 2007). The *research–government* connection is the only formal relationship of science in this model; all other science connections are not specified and have a random nature, which makes the scientific component the weakest in the whole model (Figure 3).

The cooperation within research–government–business–education framework is currently highly stimulated by governmental policies as stated by head of Science Park by one of the interviewed universities:

> "One of very important prerequisites to obtain governmental financing for a certain project is a formation of research consortium between research and/or educational institution and business entity"

The research–education connection is quite undeveloped due to full separation of these two spheres in the command system, and no visible interceptions. However, the trend of intensifying the university research is noticeable, and with proper support from industry, the integration of these separated components (research and education) is possible, although it would involve the restructuring of RAS and elimination of its numerous research centres.

The government–education interconnection is stronger than it should be, breaking the balance in the system, as education is primarily state financed, and the share of university research is rather small and is done mainly during the academic degree-acquiring process, which again involves governmental financing. One more complication lies within the fact that all the possessions of universities (as land, buildings etc.) are in practice owned and strictly controlled by the state, meaning that university. As mentioned by the university Science Park interviewee, "being a governmental organization, university cannot give premises for rent for SMEs, which hinder the cooperation between former and latter; it applies above all to academic spin-off organizations".

However, the *business–education* link is intensifying, demonstrating the growing interest of business in collaboration with universities and participation in educational

processes, as well as in outsourcing research. Interview results demonstrated the growing acknowledgement of such cooperation by companies, as one of interviewed strategic development managers stated:

> "We do collaborate with universities. They conduct research and development for needs of our company on the basis of contractor's agreements or within partnership. We actively participate in educational programs, being involved into development and supervision of specialized education in the field at one of leading city universities."

However, this situation cannot be generalised, as there are a limited number of universities capable of doing state-of-the-art research, and the business–education linkage works only towards some selected ones. As head of scientific cooperation department of interviewed companies' state:

> "We cooperate with limited amount of universities; we have selected the best ones. The rest do not meet our requirements as their research expertise is outdated."

The government is the only element having true strong connections with every other element, which demonstrates active involvement of the state in all spheres, and which again hinders the independent development of each of system participants, which can be interpreted as a need for switching from public administrating to more flexible approaches of cooperation (Dezhina and Kiseleva, 2007).

5 Discussion

The role of OI implementation in regional development cannot be overemphasised. OI modifies every connection within the developed BREG model from a simple linkage to a strategically important relationship. The connections between the elements described above hold more or less for every region of Russia today. However, St. Petersburg with a proactive approach to create a RIS of an open type is currently in the transition towards it. To estimate the results of transition and to describe ROIS more thoroughly the longitudinal study is needed further on. Tables 1–4 represent a summary of how openness within the RIS described through the BREG model adds value to all connections between each and every elements of the system and modifies it.

5.1 Relations between business and others

Business is the most common unit for research within OI framework (Chesbrough et al., 2006) and firm-central network of partners is common to be examined. In case of St. Petersburg, the dissemination of OI philosophy revealed accumulated demand for collaboration between regional actors. Thereby, the relationship of industry and the other actors is the most obviously affected by OI adoption (Table 1).

5.2 Research networks

As defined by this study, 'research' represents the weakest element within open BREG model, positioned quite aside from other elements. Nevertheless, positive tendency towards research institutions being involved into OI can be noticed through increasing

amount of governmentally initiated projects involving research parties as well as business R&D departments. The direction of movement of 'research' networks is described in Table 2.

5.3 Educational institutions and OI

The involvement of higher educational institutions in OI activity within the region is already on a very high level. The main functions though remain education and training of human resource and technology transfer services. However, following the recent regulations, the relationships between business and industry are loosing the last barriers for open cooperation – the IP issues are being clarified for governmentally funded projects involving business and research. This fosters the involvement of all actors in joint research and development projects (Table 3).

Table 1 Open innovation approach in 'business-to-REG' collaboration

	Business	*Research*	*Education*	*Government*
Business	(1) Intensified partnership links between competitors, suppliers and clients Integration of value chain participants into innovation process; exchange of technology and IP, creation of spin off companies	(1.2) Integration of research organisations into R&D by outsourcing part of research, initiating joint research, subemployment of research personnel for certain projects of organisation	(1.1) Acquiring intellectual capital (e.g. human resources), utilising university publications, collaboration within educational programs	(1.3) Collaboration within different kinds of projects to meet the needs of public agencies; business as a supplier for the government

Table 2 Open innovation approach in 'Research-to-BEG' collaboration

	Business	*Research*	*Education*	*Government*
Research	(2.3) Collaboration within research projects, academic spin offs Research creates knowledge which can be utilised by business in its R&D Academic entrepreneurship	(2) Inter-organisational networks of research institutions Networking, conferences, scientific publications OI stimulates networking and speeds up knowledge creation	(2.1) Joint research, integration of newly generated knowledge into education process; preparing postgraduates and post-doctoral students for involvement into education; basic research for further applied research by universities	(2.2) Research agencies take part in the development of state innovation and science policy, and provide research for strategic sectors of the government

Table 3 Open innovation approach in 'education-to-BRG' collaboration

	Business	*Research*	*Education*	*Government*
Education	(3.2) Human resource transfer to industry, obtaining financing through providing educational and applied research services Training and additional education for employees Technology transfer intermediation; university spin offs	(3.1) Production of human resources for research; the educational sector can act as a buffer between purely academic research and business life	(3) University collaboration for research, development of education processes; dissemination of newly acquired knowledge within university networks and its integration into curriculum	(3.3) Research within federal projects Supply of human resources for public service Participation in innovation policy definition

Table 4 Open innovation approach in, 'government-to-BRE' collaboration

	Business	*Research*	*Education*	*Government*
Government	(4.1) Intellectual property from governmentally financed business research Government may donate IP to business, carrying out publicly financed research. The government issues policies which secure the openness of business and create an infrastructure to stimulate knowledge flow	(4.3) Financing; the government acts as a client (tenders) Providing favourable conditions for new knowledge generation within basic research fields	(4.2) Cooperation within federal projects Development of legal basis for stimulating innovative activity of universities, IPR of university research outcomes, and university spin offs	(4) Collaboration between different public agencies, synchronisation of their policies, and initiatives for stimulating innovation development in the region

5.4 Government within OI networks

Government of St. Petersburg can be identified as the most active local administration what comes to innovation and support of innovation activities in Russia. Government often acts as a regulatory body developing the rules for involvement into cooperational projects as well as initiating many of them through creating support infrastructure, attracting venture capitalists and other investors to the region and stimulating creation and development of innovative start-ups (Table 4). The interconnection of government with the other elements within OI framework is rather strong however still remains more on regulatory-coordinating, than on partnership level.

6 Conclusions

Cooperation of regional actors currently reaches new heights following OI approach, widely accepted in western business practices. However, the contribution of 'OI way' of cooperation is not always obvious for public actors. This research demonstrated the situation when all the participants of regional system are moving towards cooperation in an open way. Taking into account the specific historical heritage of national system of innovation in Russia and most post-soviet countries the certain adaptation of Triple Helix model was suggested, following at the example of Russia the phenomenon of separation education and research in post-soviet countries. The further research is needed in order to asses the state-of-the-art situation in some other post-soviet countries for verifying the offered framework for analysis.

This paper contributes to the stream of research on OI practices at the regional level of analysis as well as to the research of OI practices and regional systems within transitional economies. Introduced in this paper BREG model allows describing the ROISs of countries having similar innovation system paces of development as Russia. On the other hand, the BREG model facilitates comparing the RISs within Russia and demonstrates the influence of OI adoption in the region on innovation system development.

Since this was single-region case study, there are certain limitations to apply the results to every other region in Russia, though studied region can be used as a benchmark for development of the other regions.

The OI approach in the management of innovation has shaped the relations within the RIS and led it to transition towards a regional OI system. The concept is increasingly important for countries in transition as a target point at the evolutionary development of their RISs. Future research directions should address the studies of other regions in Russia and to define the differences at the regional level of OI adoption throughout the country. The movement towards openness within RIS can be assessed following the BREG model and its characteristics presented in this paper.

Acknowledgements

We gratefully acknowledge anonymous referees for constructive comments and suggestions, which helped greatly to improve the earlier version of this paper.

References

Aaboen, L. and Lindelöf, P. (2008) 'Incubator performance: an efficiency frontier analysis', *Int. J. Business Innovation and Research*, Vol. 2, No. 4, pp.354–380.

Asheim, B.T. and Coenen, L. (2005) 'Knowledge bases and regional innovation systems: comparing Nordic clusters', *Research Policy*, Vol. 34, No. 8, pp.1173–1190.

Braczyk, H.J., Cooke, P. and Heidenreich, M. (Eds.) (1998) *Regional Innovation Systems: The Role of Governance in a Globalised World.* London: UCL Press.

Chesbrough, H.W. (2003) 'The era of open innovation', *MIT Sloan Management Review*, Vol. 44, No. 3, pp.35–41.

Chesbrough, H.W. (2004), 'Managing open innovation', *Research-Technology Management*, Vol. 47, No. 1, pp.23–26.

Chesbrough, H.W., Vanhaverbeke, W. and West, J. (Eds.) (2006) *Open Innovation: Researching a New Paradigm.* Oxford: Oxford University Press.

Coccia, M. (2008) 'New organizational behavior of public research institutions: lessons learned from Italian case study', *Int. J. Business Innovation and Research*, Vol. 2, No. 4, pp.402–419.

Cooke, P. (1992) 'Regional innovation systems: competitive regulation in the new Europe', *GeoForum*, Vol. 23, pp.365–382.

Cooke, P., Uranga, M.G. and Etxebarria, G. (1997) 'Regional innovation systems: institutional and organisational dimensions', *Research Policy*, Vol. 26, pp.475–491.

Czuchry, A.J., Yasin, M.M. and Peisl, T.C. (2009) 'A systematic approach to promoting effective innovation: a conceptual framework and managerial implications', *Int. J. Business Innovation and Research*, Vol. 3, No. 6. pp.575–595.

Dezhina, I. and Kiseleva, V. (2007) 'Troinaja spiral v innovacionnoi sisteme Rossii', *Voprosi Ekonomiki (Questions of Economics)*, Vol. 12, pp.123–135.

Elfving, J., Brännback, M. and Carsrud, A. (2006) 'Regional development, entrepreneurial activity and the role of intangible infrastructure', *Conference Paper*, NSCB, 11–13 May, Stockholm, Sweden.

Enkel, E., Gassmann, O. and Chesbrough H. (2009) 'Open R&D and open innovation: exploring the phenomenon', *R&D Management*, Vol. 39, No. 4, pp.311–316.

Etzkowitz, H. and Leydesdorff, L. (2000), 'The dynamics of innovation: from National Systems and 'Mode2' to a Triple Helix of university–industry–government relations', *Research Policy*, Vol. 29, pp.109–123.

Florida, R. (1995) 'Toward the learning region', *Futures*, Vol. 27, No. 5, pp.527–536.

Gassmann, O. (2006) 'Opening up the innovation process: towards an agenda', *R&D Management*, Vol. 36, No. 3, pp.223–228.

Gassmann, O. and von Zedtwitz, M. (1998) 'Organisation of industrial R&D on a global scale', *R&D Management*, Vol. 28, No. 3, pp.147–161.

Howells, J. (2005) 'Innovation and regional economic development: a matter of perspective?', *Research Policy*, Vol. 35, pp.1220–1234.

Jick, T.D. (1979) 'Mixing qualitative and quantitative methods: triangulation in action', *Administrative Science Quarterly*, Vol. 24, No. 4, pp.602–611.

Kock, C.J. and Torkkeli, M. (2008) 'Open innovation: A "swingers' club" or "going steady"?' IE Business School Working Paper, WP08-11.

Leydesdorff, L. and Etzkowitz, H. (1996) 'Emergence of a Triple Helix of university–industry–government relations', *Science and Public Policy*, Vol. 23, pp.279–286.

Piperopoulos, P. (2007) 'Barriers to innovation for SMEs: empirical evidence from Greece', *Int. J. Business Innovation and Research*, Vol. 1, No. 4, pp.365–386.

Pynnönen, M. and Kytölä, O. (2008) 'From business concept innovation to a business system: a case study of a virtual city portal', *Int. J. Business Innovation and Research*, Vol. 2, No. 3, pp.314–329.

Ronde, P. and Hussler, C. (2005) 'Innovation in regions: What does really matter?' *Research Policy*, Vol. 34, pp.1150–1172.

Rothwell, R. (1992) 'Successful industrial innovation: critical success factors for the 1990s', *Research Policy*, Vol. 22, No. 3, pp.221–239.

Saad, M., and Zadwie, G. (2005) 'From technology transfer to the emergence of a Triple Helix culture: the experience of Algeria in innovation and technological capability development', *Technology Analysis and Strategic Management*, Vol. 17, No. 1, pp.89–103.

Salmi, P. and Torkkeli, M. (2009) 'Success factors of interorganisational knowledge transfer: a case of a collaborative public–private R&D project', *Int. J. Business Innovation and Research*, Vol. 3, No. 2, pp.109–125.

Santonen, T., Kaivo-Oja, J. and Antikainen, M. (2008) 'National open innovation system (NOIS): defining a solid reward model for NOIS', *Conference Paper, 1st ISPIM Innovation Symposium*, 14–17 December, Singapore.

Schiuma, G. and Lerro, A. (2008) 'Knowledge-based capital in building regional innovation capacity', *Journal of Knowledge Management*, Vol. 12, No. 5, pp.121–136.

Torkkeli, M., Kotonen, T. and Ahonen, P. (2007), 'Regional open innovation system as a platform for SMEs: a survey', *Int. J. Foresight and Innovation Policy*, Vol. 3, No. 4, pp.336–350.

Vanhaverbeke, W. and Trifilova, A. (2008) 'Creating and developing an open innovation theory', *Innovacii (Innovations)*, Vol. 111, No. 1, pp.28–84.

Yin, R.K. (1994) *Case Study Research: Design and Methods,* Thousand Oaks, CA: SAGE Publications.