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Problems and Perspectives of Performance of Higher education institutions in the Development of Russian Innovative System (regional aspect)

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Abstract

The paper is concerned with the assessment of current trends in the development of Russia's innovative activity. Problems of the national innovation system performance at a regional level are revealed. The paper analyses the activity of the Special Economic Zone of technological development type "Tomsk" (SEZ) and universities in the field of innovations development and creation of necessary conditions for setting up a modern innovation center. A comparative analysis of the factors related to the theory of innovations, which provide the necessary conditions for creating a well-functioning innovation center, as well as the results of the performance of the above-mentioned subjects is conducted. The assessment of the innovative activity of Tomsk universities and the Special Economic Zone demonstrates the lack of provision of a number of conditions for the effective functioning of the innovation center in Tomsk. The results of the study demonstrate that it is necessary to make changes in the educational, research, and motivational activities of universities in terms of students in order to involve them in innovative activity. Universities should be encouraged to develop and implement an independent innovation strategy and participate in the work of the special economic zone in Tomsk.

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1. Introduction

In the first decade of the 20th century Russia became well aware of the need to stimulate its innovative development. This was due to several factors - the overall economic growth, increased financial capacity of the state to invest in research and development (R&D), the need to modernize the military-industrial complex. In addition, with the growth of the Russian budget revenues from oil and gas exports, a number of Russian scientists, economists and politicians began to point out the danger of the further development of Russia only as an exporter of energy resources and raw materials for the developed economies of Western Europe, North America and Asia. It was

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stressed that such kind of development would inevitably result not only in technical and technological dependence of Russia on developed countries, but in the long run in economic and political one.

Russia inherited many elements of the national innovation system from the Soviet Union. This system was formed in the conditions of tough confrontation with the West. Public institutions virtually kept a monopolistic position: they not only formed orders to conduct research, but also provided scientific and research organizations with resources and sold the final innovative products. It is obvious that in the early 1990s, the dismantling of the state monopoly in the economy, the emergence of private enterprises, reducing tension in political relations with the West were to result in changes in Russia's innovation system. In addition, the nature of these changes was largely affected by the socio-economic and political crisis that gripped Russia at that period. Universities and research institutes almost stopped their activities in many R&D areas. Changes were required to be made in the innovation system of Russia in accordance with the new political and socio-economic realities.

The higher education system (HES), which played an important role in the innovation system of the country, also needed alterations. In the USSR, it was designed to provide the scientific and engineering expertise of existing institutions and enterprises of the country. Since most of the research was done for the military-industrial complex, a considerable part of scientists were deprived of the opportunity to openly communicate with their colleagues in other countries and publish their papers in foreign journals.

The results of functioning of innovative system of the USSR have shown the Post-Soviet Russia the inefficiency of preservation of the state monopoly in realization of researches and developments (R&D), and have demanded to make changes in higher education system. The new approach to development of innovations, stimulation of researches and developments out (R&D) was embodied in the adoption of experience of world-developed countries. In the beginning of 2000, there appear projects on creation of special economic zones in some regions of Russia, where based on cooperation of the state, higher educational institutions and business, the enterprises making innovative products should open.

The present paper deals with the consideration of the state policy concerning the activation of innovative activity in Russia on the example of activity of the Special economic zone of technological development type "Tomsk". Besides, this research will be focused on the research of influence of system of higher education (HES) on development of innovative system of Russia.

In in this work, the basic results of innovative activity of the Special economic zone of technological development "Tomsk" for the period from 2005 to 2014 will be analyzed, the attention to the estimation of influence which was rendered by higher educational institutions of Tomsk on expansion of researches and developments, which are carried out in the given economic zone, is also paid.

Today there are many researches concerning the general questions of influence of the state on development of innovative activity (Freeman, 1987; Schumpeter, 1939; Schumpeter, 1967).

More and more researches concerning the questions of interaction of the system of higher education, state authorities and business on the development of innovative activity, including within the limits of special economic zones are conducted. Basically they deal with questions of interaction of universities and the innovative centers working on the territory of countries of Western Europe, North America, South East Asia, Japan, India (Nelsen, 2005; Suh, 2010).

In modern researches that deal with questions of development of innovative activity and an education system, the preference is given to the use of the system approach to the analysis of processes of development and creation of innovations (Freeman, 1987; Lundvall, 1992; Lundvall, 1998; Lundvall, 1999; Lundvall, 2003; Nelson, 1988) which will be applied in this case as well.

In this research, we will focus attention on consideration of questions of innovative development on an example of the specific region of Russia - Tomsk region, which has rather unique for Russia intellectual, personnel and resource basis for the development of economy. The given region is unique because 6 large universities are concentrated in the regional center Tomsk. The further development of the given universities and the region as a whole is in many respects connected with successful development of innovative activity.

For this reason, it is important to analyze the results of interaction of higher educational institutions and the Special economic zone of technological development type "Tomsk" (SEZ) on development of researches and developments

(R&D) in order to eliminate the possible obstacles to their development and to reveal the perspective directions of their cooperation. In this research, we will try to answer the following questions:

Why does the innovation center in Tomsk develop insufficiently successfully?

How could Tomsk higher educational institutions promote activation of innovative activity?

The results of this research will help to make a certain contribution to the formation of knowledge of innovative system of Russia and its regional peculiarities. The empirical data and results of the analysis might be integrated into the formation of national strategy on strengthening of innovative system of Russia.

The structure of the paper consists of the following parts:

Section 1. gives introduction and substantiation of research. In Section 2. the representation of theoretical basis of work is given. In Section 3. the research methodology is described. In Section 4 the results and tendencies of development of the Tomsk innovation center, presented by the companies operating within the limits of the Special economic zone of technological development type "Tomsk" and Tomsk higher educational institutions are considered. Correlates in their activity in the field of researches and developments (R&D) are defined. Section 5. deals with the posing of problems in the development of innovative activity within the limits of the SEZ, a role of higher educational institutions in their formation. There is also an assumption of promotion of recommendations concerning the innovative policy directed on the increase of potential of the further development of the center of innovative activity in Tomsk. In section 6 possible directions of activity of universities on development of innovative activity within the limits of a special economic zone and the Tomsk innovative center as a whole are represented.

2. Theoretical basis of research

In order to analyze the results of innovative activity, a system approach offered within the limits of the concept of national innovative system (Lundvall, 1992; Lundvall, 1998; Lundvall, 1999; Lundvall, 2003) is applied. The national innovative system represents a set of co-operating state and private establishments and companies, universities which activity is directed on development, protection and regulation of new scientific knowledge and technics. The NIS concept allows tracking the interrelations between technological development of the country and institutional establishment of innovative organisations. (Freeman, 1987; Lundvall, 1992; Lundvall, 1998; Lundvall, 1999; Lundvall, 2003; Nelson, 1988).

NIS concept is basically applied to the analysis of development of innovative systems of rather vast scale - states or extensive territories. However, each small region can have its own specific features and possibilities, which can influence the innovative activity of people. National factors create necessary conditions for the growth of innovative activity, but they could be insufficient for the maintenance of innovative activity in each specific region. Therefore, it is important to consider this circumstance at the development of a policy with for the promotion of researches and innovations, entrepreneurial activity on regional level (Sleuwaegena, Boiardia, 2014).

Various units of the analysis, in particular, the 'innovative milieu' (Camagni, 1995), the 'industrial district' (Becattini, 1987), the 'learning region' (Morgan, 1997) and the 'system of innovation' (Cooke, 1998) are applied in modern researches at the analysis of importance of influence of local factors on development of innovations. These are the concepts which allow to consider innovative activity in various geographic scales, whether it be the city (Camagni, 2001), the metropolitan region (Diez, 2002), the wider region (Porter, 1998; Enright, 2003), the NUTS region (Evangelista et al, 2001). In our case we will consider the development of innovations in the scale of the agglomeration covering Tomsk and territories and connected with it uniform infrastructure which form the uniform innovative center that within the limits of the Project «INO Tomsk' 2020» has received a quite official name «the Center of education, researches and developments» (<http://gubernator.tomsk.ru/words/novyy-vektor-ino-tomska>).

Many authors underline the necessity of formation of a certain institutional environment for ensuring the development of innovations (Varsakelis, 2001; Varsakelis, 2006; Tebaldi, Elmslie, 2008). They also consider a role of universities in its formation and development. One can find in literature the influence of a role of higher educational institutions on development of national innovative system by means of two basic channels. The first channel of influence is through the realization of interaction between NIS and research activity of institutes of higher education, and the second channel is through the exploitation of pedagogical and research activity (Etzkowitz et al, 2000). We will stop on the analysis of influence of higher educational institutions of Tomsk on the development of

the Tomsk innovation center and particularly the Special economic zone of technological development "Tomsk" through these two channels.

3. Research methodology

In this research, one of examples of development of innovative activity in the conditions of a specific region is considered. Results of activity of the innovative enterprises in the conditions of a special economic zone in Tomsk, which is one of variants of organized innovative centers in Russia, similar to those created in the USA, the Western Europe, and Asia, are analyzed. Analysis unit is the system of innovative activity covering mainly the enterprises, operating within the Special economic zone of technological development type "Tomsk" and the universities of this city.

Research is based on the empirical data on the activity of the Special economic zone of technological development type "Tomsk" which has been presented in official annual reports from 2006 for 2011 and are placed on an official site of Open Society «Special economic zones» (http://www.russez.ru/disclosure_information/oa_oez_tvt_tomsk/). Reports for the next years turned out to be inaccessible; therefore, the data was obtained via other sources, which are specified in references.

The data characterizing innovative and educational activity of Tomsk universities is taken from the publications, placed on official pages in the Internet.

A comparative method, by means of which we correlated the data characterizing innovative activity of a special economic zone and universities with conditions of development of the innovative center that are defined in the theory of innovations (Suh, 2010), is used in research. The analysis of performance of some necessary conditions (such as personnel, research, and commercial) for the formation of the innovative center, which are connected with the activity of key subjects of the Tomsk center of innovations (the Special economic zone "Tomsk" and city universities) is presented in the work.

4. Results and tendencies of development of the center of innovation in Tomsk

On October, 6th, 2011 by the order of the government of Russia, the project of creation in the Tomsk region of the Center of education, researches and developments had been approved. The main goal of the project is the formation in the Tomsk region by 2020 of the Center for the promotion of research and developments in such directions as model of a continuous and multilevel education system; power-saving technologies and the means for power-intensive branches of economy; nanoelectronics and intellectual power electronics; nanotechnologies, creation of perspective materials and development of beam, plasma and electric discharge technologies; high technology medicine, medical biotechnologies and pharmaceutical technologies; rational nature management and advanced processing of natural resources; nuclear technologies.

Tomsk region was chosen as a platform for realization of the given project because of high concentration of scientific personnel of the top qualifications among all regions of Russia (more than 5 thousand doctors and candidates of science are available). Also in Tomsk there is a scientifically-educational complex (6 state universities, 6 institutes of Tomsk center of science of the Siberian branch of the Russian Academy of Sciences, 7 institutes of Tomsk center of science of the Siberian branch of the Russian academy of medical sciences, 76 subjects of scientific activity). Tomsk universities train experts in more than 300 specialties. In educational institutions of the higher vocational training of Tomsk there were trained over 86 thousand students, more than 50 percent of students - nonresidents, out of them 9 percent are foreign students from 30 countries of the world.

One of key elements of innovative infrastructure of Tomsk region is the Special economic zone of technological development type which creation was approved by the Governmental order of the Russian Federation from 2005.12.21.

By the middle of 2014 it was found out that the Concept requires the realization of certain adjustments since the results of innovative activity within the limits of the innovative center did not correspond to the goals that were set earlier. The governor of Tomsk region S. Zhvachkin pointed out in his speech three reasons that, in his opinion, have caused the necessity of change of the developed earlier Concept (<http://gubernator.tomsk.ru/words/novyyi-vektor-ino-tomska>). They are:

- Necessity of involvement of large business and the state companies in the decision of a problem of replacement of the imported goods;
- To execute decrees of the President of Russia on creation of high-efficiency workplaces, attraction of investments, increase of labor productivity;
- Necessity to obtain particular results in strict deadline.

Estimation of the content of the given corrective amendments shows that the development of the innovation center in Tomsk has encountered a number of obstacles, which did not allow reaching the planned results. The boundaries of present article do not allow us to cite the data on all establishments, which are considered to be components of the innovative center of Tomsk. Here we will be limited only to representation and the short analysis of results of activity of the Special economic zone of technological development type "Tomsk" which is considered as a key element of development of all innovative center.

The special economic zone of technological development type of Tomsk (SEZ) is created by the governmental order of the Russian Federation from 12/21/2005 № 783 as a result of a victory of the Tomsk region on federal competition on selection of claims of subjects of the Russian Federation on creation on their territories of special economic zones of technological development type. In total in Russia there are 4 SEZ of the given type. In a special economic zone of Tomsk, the promotion of research and developments in following directions should take place:

- Nanotechnologies and new materials;
- Electronics, information and telecommunication technologies;
- Energy efficient technologies;
- Medicine and biotechnologies.

Table 1. Operation data of Special economic zone (SEZ) Tomsk for the period from 2006 to 2014

Year	Number of residents	Volume of investments of resident companies	Volume of sales of SEZ resident companies	Administration personnel / resident companies personnel
2006		-	-	11 / -
2007		-	-	26 / -
2008		-	-	53 / -
2009		No data	No data	78 / -
2010	53	2,6 bill. roubles	505 mill. roubles	69 / 536
2011	58	3,2 bill. roubles	1,117 bill. roubles	60 / 901
2012	58	3,7 bill. roubles	1,8 bill. roubles	1085
2013	57	No data	No data	No data
2014	56	5 bill. roubles	4 bill. roubles	1300

The analysis of indicators of activity of the Special economic zone shows that in the last five years the growth of a number of the new enterprises, which would begin the activity within the limits of the given zone, has practically stopped. The return tendency - an exit of business from territory of functioning of a zone was outlined as well. The total number of the planned investors should account 130 companies. Therefore, it is now obvious that the specified indicator will not be reached in the near future. The most part of residents functions within the limits of SEZ for many years already (1 company since 2006, 7 since 2007, 18 since 2008, 4 since 2009, 9 since 2010, 8 since 2011, 4 since 2012 and 8 since 2013). Their research, industrial and marketing activity is already of quite developed and stable character.

Volumes of declared investments by the companies-residents constantly increased throughout all time of SEZ functioning, besides they considerably exceed the sales volumes of produced goods. The analysis of structure of SEZ residents shows that the considerable share of residents constitute the companies which are to a greater extent aimed at the solution of industrial problems, and not on realization of new researches and developments. The analysis of a

range of goods offered by them shows that in a greater degree they are intended for satisfaction of demands of industrial enterprises and state authorities, instead of the mass consumer, or house economy.

Among the currently operating companies-residents, there are 28 companies in the field of information technology and electronics, in the field of medicine and biotechnologies there are 15, in the area of nanotechnologies and new materials - 7 and in the sphere of energy efficient technologies one can find 6 companies. The majority of the companies operating in the field of information technology and absence of considerable progress in development of other fields of SEZ activity is obvious. At the same time, there are no structural divisions in SEZ structure, which would carry out the analysis of perspective directions of researches and developments, coordinate the work with Tomsk universities on realization of joint research activity and realization of innovative projects and worked at attraction of the venture capital. Mainly SEZ is a lessor of premises for the innovative enterprises and it maintains its infrastructure in efficient condition.

However, the experience of development of the innovative centers in the developed countries shows that the success in development of innovative activity is not so much connected with construction of buildings and premises where people will work. The most difficult and important problem, which advances to the forefront, is connected with revealing and realization of creative potential of people for the creation of new products and services. For this reason, at present time the more and more important place in development of national innovative systems and the centers is given to universities where the personnel for creation of new companies is formed, basic researches are carried out and new technical products and production technologies are created.

5. Problems and prospects of development of Tomsk innovation center. A role of universities in development of innovative activity in Tomsk region

Considering the results of functioning of the enterprises of a SEZ "Tomsk" and comparing them with results of educational and innovative activity of universities, it is possible to notice that one of the possible reasons of low results of innovative activity is the inefficient use of personnel, research and educational potential which universities of Tomsk possess. What does it consist of?

Firstly, there does not exist any research department that would study the market and requirements of potential consumers of innovative products in the structure of a special economic zone. At the same time, Tomsk higher educational institutions are practically not engaged in preparation of experts in the field of marketing research. Preparation of masters in insignificant quantity is carried out by Polytechnic university only. Absence of experts in many respects explains the deficiency of the information, characterizing the requirements of local community in innovative products and services.

Secondly, doubtless superiority in development of information technology within the limits of SEZ "Tomsk" is concerned in a greater degree with a considerable share of experts in the field of information technology, who are trained at universities of Tomsk, than with purposeful activity of SEZ and high schools on development of innovative activity in this sphere. Thus, there is also deficiency of university graduates for promotion of development of other directions of SEZ innovative activity.

Thirdly, the opening procedure for the enterprise within the limits of a special economic zone is difficult enough. Besides usual registration of the enterprise, in addition it assumes the passage of several examinations. It is obvious that for graduates of universities, who in the course of training get very little acquainted with technology of creation of own business, entering the territory of a special economic zone for the realization of innovative activity is almost closed. This procedure can only be passed by the companies that are already operating in the market.

Fourthly, the motivation on creation in the future of own business is not practically developed in university graduates. The poll made within 2013-2014 among students of Tomsk Polytechnic university (more than 100 students trained on 3 and 4 courses in a direction of "Human resource management") concerning the question of whether they wish to begin their own business upon graduation, has shown that less than 10% from them plan it to do it.

Students as potential carriers of innovative ideas are aimed basically not at realization of innovative activity, but at the work in other spheres. For example, in 2014 in Tomsk Polytechnic university 1304 persons from 2818 graduates planned to start work after the graduation, and 1120 graduates have decided to continue training. Thus the most part of graduates of university was aimed for the employment in large enterprises of Siberian region, such as "Gazprom",

State corporation "Rosatom", "Surgutneftegaz", instead of on the enterprises connected with development and introduction of innovations.

Fifthly, universities insufficiently actively involve the graduates in innovative activity. In particular, the student's business incubator in Tomsk State University of control systems and radio electronics (the total number of students at university is about 3400 and annual graduation amounts about 700 experts) has only 13 operating residents. The student's business incubator in Tomsk Polytechnic university (the total number of students is more than 20 thousand persons and annual graduation of experts amounts about 3 thousand persons) has only 17 operating residents.

Sixthly, activity of high schools in the field of researches and developments is practically not presented within the limits of a special economic zone "Tomsk". There is no strategy of interaction of high schools and a zone management on development of joint activity in the field of researches and developments. Functioning of universities is mainly aimed at satisfaction of demands of establishments and enterprises in personnel, but high schools do not have strategy of development of their own innovative activity. For this reason a considerable part of creative people, who have finished training at Tomsk universities, leave the Tomsk region in search of possibilities to realize their ideas.

The given factor can affect rather negatively the further development of universities and innovative activity in Tomsk. It is connected with the fact that in modern conditions the increasing share of the students who are trained at Tomsk universities are the foreign citizens from countries of Europe, Asia, Africa and Latin America. Absence of strategy on use of abilities of these people for innovations will make considerable impact on decrease of competitiveness of Tomsk region among other regions of Russia.

6. Conclusions

Considering the results of innovative activity within the limits of the Tomsk innovation center, it is possible to note that the higher education system comprises considerable potential of the further development of innovative activity in Tomsk region. We believe that optimization of activity of the Tomsk innovation center should not so much consist in the attraction of large business, as in activation of work aimed at the search and attraction to innovative activity of talented and initiative people. Here the role of universities is rather important. We believe that activity of universities on activation of researches and the developments, which are carried out within the limits of SEZ and the Tomsk innovation center as a whole, can be reduced to the following basic directions:

Working out of strategy of development of innovative activity of each university is necessary. At the moment, universities are in a greater degree focused on service of requirements of the state companies, or business and are not independent participants of innovative activity;

Development and application of special programs on formation of the ability to innovations in students of universities is necessary;

It is necessary activate researches and innovative activity concerning the decision of real social problems of people. Universities with natural and engineering sciences faculties and the faculties which are carrying out researches in the field of social and the humanities could promote formation of many directions of researches and developments in this area;

Development of policy concerning the involvement of foreign students in innovative activity is necessary;

Universities should more actively and thoroughly participate in working out of career strategy of the students. Now at universities there are no programs on realization of purposeful work on selection of talented people in the field of innovative activity. Due to the lack of support from university, many talented graduates choose career not in the field of realization of researches and developments, but as administrative workers, or technicians in large companies.

Expansion of activity of high schools in the given directions can provide formation of system of the higher education aimed at more fruitful cooperation with other subjects of innovative system of region on development of innovative activity in Tomsk region.

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References

- Schumpeter J.A., (1939). *Business cycles: A theoretical, historical and statistical analysis of the capitalist process*, Vol. 2, McGraw-Hill, New York.
- Schumpeter J.A., (1967). *The theory of economic development* (5th ed.) McGraw-Hill, New York.
- Freeman C., (1987). *National systems of innovation: The case of Japan technology policy and economics performance: Lessons from Japan* Pinter, London.
- Nelson R., (1988). *Institutions supporting technical change in the United States* G. Dosi, C. Freeman, R. Nelson, G. Silverberg, L. Soete (Eds.), *Technical change and economic theory*, Pinter, London.
- Freeman C., (1987). *National systems of innovation: The case of Japan technology policy and economics performance: Lessons from Japan* Pinter, London.
- Lundvall B., (1992). *National systems of innovation: Towards a theory of innovation and interactive learning* Pinter, London.
- Lundvall B., (1999). *Why study national systems and national styles of innovation?* Tech Lundvall B. *National business systems and national systems of innovation. Special issue on business systems* International Studies of Management and Organisation.
- Lundvall B., (2003). *National innovation system: History and theory* Aalborg University, Aalborg, Denmark.
- Suh P. Nam, (2010). *On Innovation Strategies: an Asian Perspective*. University Research for Innovation. Luc E. Weber and James J. Duderstadt (eds.). *Economica. Glion Colloquium Series. No. 6*. London, Paris, Genève, pp. 289 – 302.
- Nelsen, L., (2005). *The Lesson of the Massachusetts Biotech Cluster 2005*, M.I.T., Cambridge, MA.
- Sleuwaegena L., Boiardia P., (2014). *Creativity and regional innovation: Evidence from EU regions*. *Research Policy*. Elsevier. Available online 29 May 2014.
- Becattini G., (1987). *Mercato e forze locali. Il distretto industriale* Il Mulino, Bologna.
- Camagni R., (1995). *The concept of innovative milieu and its relevance for public policies in European lagging regions*. *Papers in Regional Science*, 74, pp. 317– 340.
- Camagni R., (2001). *Policies for economic development*. OECD Territorial Outlook Organisation for Economic Co-operation and Development, Paris and Washington, DC, pp. 171–199.
- Cooke P., (1998). *Origins of the concept*. H. Braczyk, P. Cooke, M. Heidenreich (Eds.), *Regional Innovation Systems*, UCL Press, London.
- Diez J.D., (2002). *Metropolitan innovation systems: a comparison between Barcelona, Stockholm, and Vienna*. *International Regional Science Review*, 25 (1), pp. 63–85.
- Enright M.J., (2003). *Regional clusters: what we know and what we should know*. J. Brocker, D. Dohse, R. Soltwedel (Eds.), *Innovation Clusters and Interregional Competition*, *Advances in Spatial Science*, Ipswich, MA, pp. 99 – 129.
- Morgan K. *The learning region: institutions, innovation and regional renewal* *Regional Studies*, 31 (5) (1997), pp. 491 – 503.
- Porter M., (1998). *Clusters and the new economics of competition* *Harvard Business Review*, 76 (6), pp. 77 – 90.
- Evangelista R., Iammarino S., Mastrostefano V., Silvan A., (2001). *Measuring the regional dimension of innovation: lessons from the Italian innovation survey* *Technovation*, 21 (11), pp. 733–745.
- Varsakelis N.C. *The impact of patent protection, economy openness and national culture on R&D investment: a cross-country empirical investigation* *Research Policy*, 30 (7) (2001), pp. 1059–1068.
- Varsakelis N.C., (2006). *Education, political institutions and innovative activity: a cross-country empirical investigation*. *Research Policy*, 35 (7), pp. 1083–1090.
- Tebaldi E., Elmslie B., (2008). *Do Institutions Impact on Innovation?* MPRA Paper No. 8757, Munich.
- Etzkowitz H., Leydesdorff L., (2000). *The dynamics of innovation: From national systems and 'mode 2' to a triple helix of university*. *Research Policy* 29, no. 2, pp. 109 – 123.