Sub-theme2.1.: Transferability of innovation models and systems

The applicability of a model of interaction between universities, business and government as an instrument for the development of Russia's modern economy.

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Abstract

Analysis of the applicability of a model of interaction between universities, business and government as an instrument for development was carried out by comparing different innovation systems. About 50 major conditions have been identified under which the model has been successfully implemented abroad. They were compared to conditions in Russia, the region and the cluster formed around the Technical University. It is shown that the internal environment of innovation in the region and the cluster is able to largely offset the adverse conditions of Russia. The model of interaction between universities, business and government can be implemented in the regions of Russia in the form of innovative clusters based on technical and natural science universities, academic and applied research centers in the direct interaction with federal and regional authorities in the framework of national development strategies.

Keywords: interaction of university – business – government, innovation systems, development strategy.

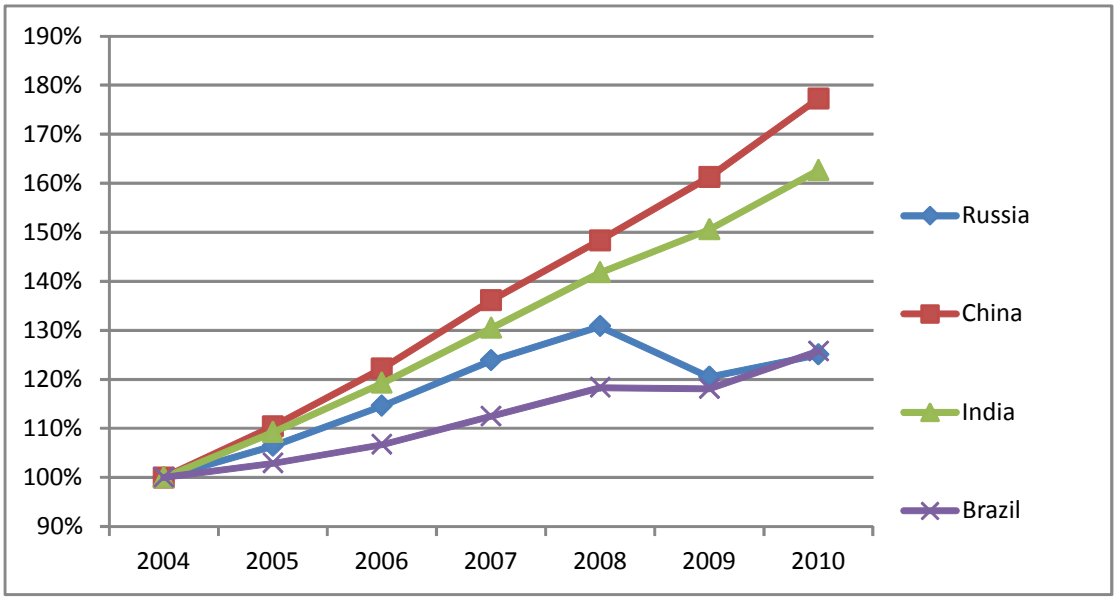
The strategy of innovative development of the Russian Federation until 2020 "Innovative Russia – 2020", developed by Ministry of Economic Development in 2011, the project which is now being discussed by the expert community defines the challenges of innovation development.

Because of the acceleration of technological development of the global economy, Russia's real competitors are not only countries leading in innovation area, but also many developing countries, including countries of CIS.

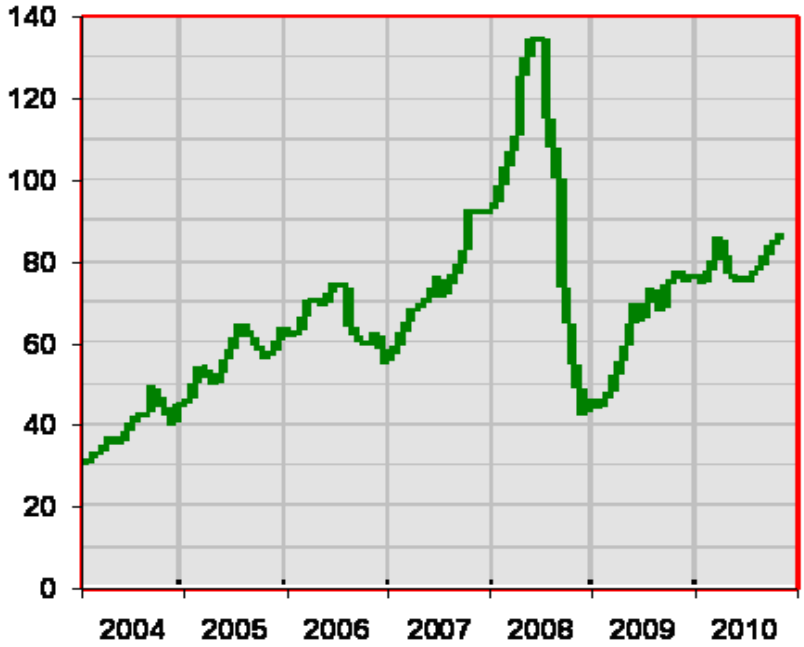
The strengthening of global competition for the factors determining the competitiveness of innovation systems, especially for highly skilled labor force and "smart" money demonstrates a sharp increase in mobility of these factors.

In the conditions of low efficiency of the national innovation system in Russia, this means the rapid "washout" of the remaining competitive potential from the country – human resources, technology, ideas and capital.

Let us look at some countries' economies development over the last few years. As the starting point we take the year 2004 (100%). Pic.1 shows the performance of the dynamics of growth of GDP of the BRIC countries (Brazil, Russia, India and China). The calculation is based on data from The World Bank: World Development Indicators. First of all, change in GDP in our country is determined by the conjuncture of world prices for raw materials. D.S. Lvov cites that of 7% of economic growth in 2003, only 2.2% were provided by internal sources, and 4.8% formed by external factors - volume and price of crude petroleum pumped abroad (Lvov, 2005). Later, this dependence is only intensified. Russian economic growth in 2004 – 2008, the fall in 2008 – 2009, and sluggish recovery in 2010 were determined by the price per barrel of petroleum (Pic.2), over which we have no influence even in the slightest degree. Of all the BRIC countries, only Russia's GDP fell in 2009 (maximum of the global financial crisis of 2008-2009) by 7.9%.



Pic.1. The dynamics of growth of GDP of the BRIC countries.



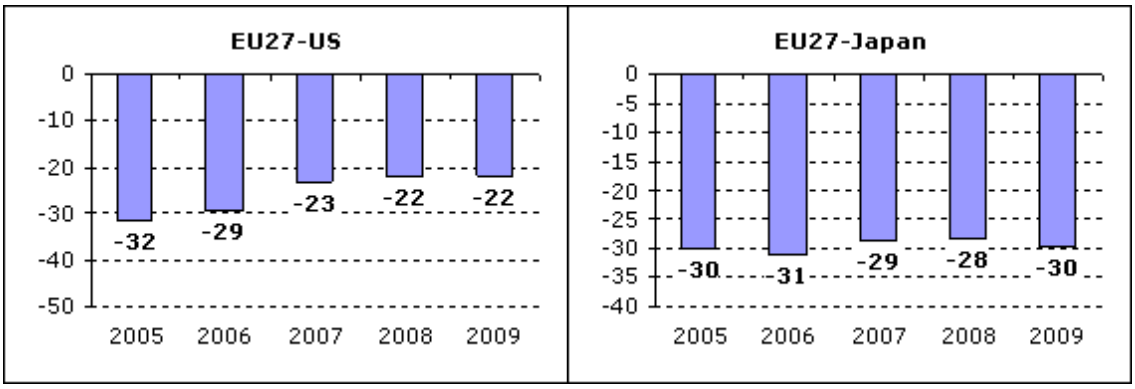
Pic.2.Petroleum prices since 2004 in USD per barrel.
Source: http://www.oilnergy.com

But not only raw materials dependence determines the characteristics of the modern Russian economy. The quality of the national innovation system is also of importance.

Evaluations of the effectiveness of innovative development of the European Union (EU27) are conducted by calculating the selected set of the economies of European countries, the Summary Innovation Index (SII). The annual results since 2001 are published in the European Innovation Scoreboard. Analyzed indicators are grouped in three blocks: "Promoting Innovation", "Activity of the Enterprise" and "Results of innovation" (European Innovation Scoreboard, 2009). Underlying this approach is the common vision of a model of post-industrial society, the global innovation system, national innovation systems, developed on the basis of the concept of neoclassical synthesis, formed over more than half a century by scientists of many nations. The core of innovation systems of developed countries is a system of generation, dissemination and use of knowledge ("innovation chain"). The national innovation system (NIS) is a "...collection of various institutes, which jointly and individually contribute to the creation and dissemination of new technologies, forming the foundation, which serves governments for the development and implementation of policies affecting the innovation process. This is a system of interrelated institutions, intended to create, store and transmit knowledge, skills and artifacts that define new technologies" (Metcalf, 1995). Being calculated for a specific country, the index (SII) provides a qualitative assessment of the effectiveness of national innovation system compared to other national innovation systems (European Innovation Scoreboard, 2009) and the proximity to the chosen standard model of an innovation chain.

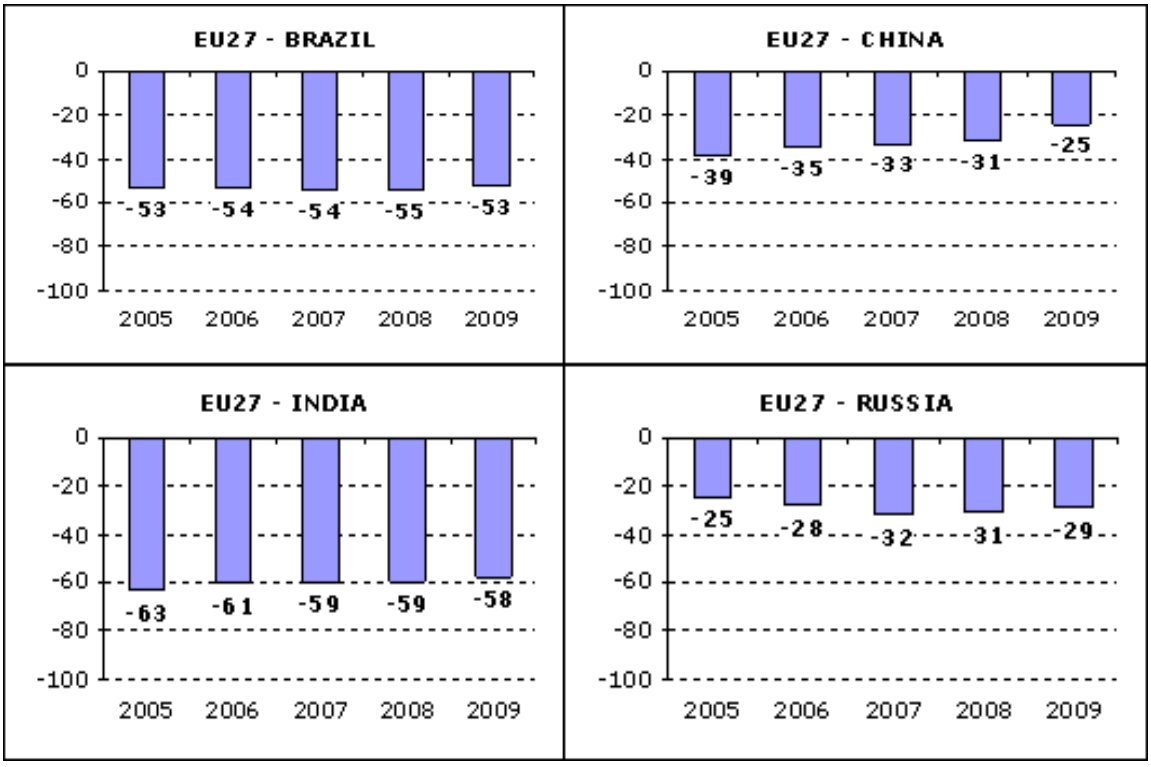
Non-EU countries are not included directly in the analysis of the selected set. Estimates for SII are just examples of comparisons based on a number of comparable indicators. The European Innovation

Scoreboard 2009 (European Innovation Scoreboard, 2009) contains a separate analysis of the effectiveness of innovation in the EU 27 compared to the U.S. and Japan, as well as the BRIC countries.



Pic.3. Innovation lagging behind of the EU 27 from U.S. and Japan

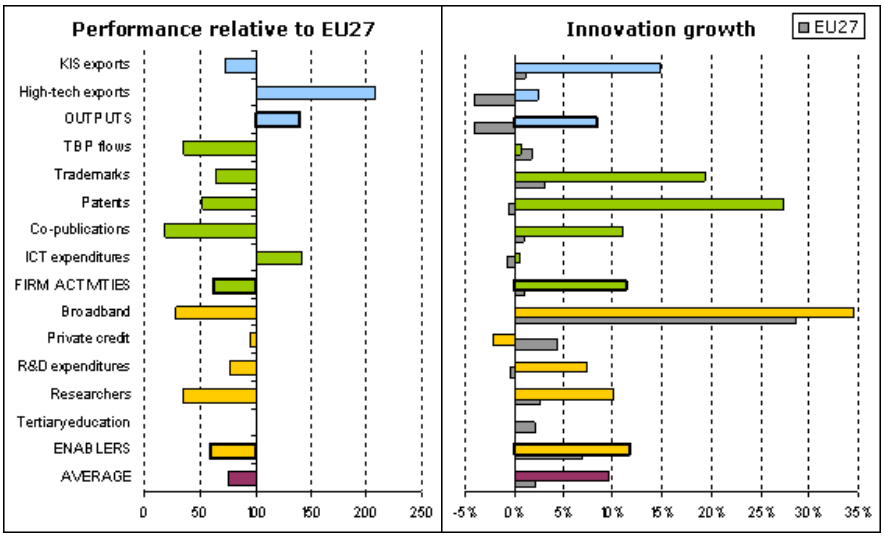
Pic.3 shows that the EU 27 innovation performance relative to the U.S. grew steadily and remained stable with respect to Japan. Nevertheless, the EU lags far behind these countries, and speed of overcoming this distance is reduced.



Pic.4. Innovative advantage of the EU 27 over the BRIC countries

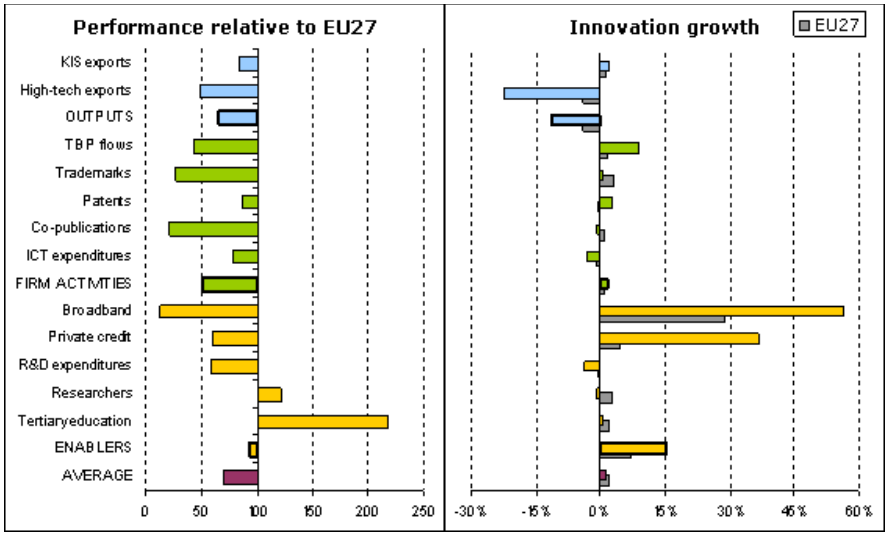
EU 27 countries have a significant advantage with respect to any of the BRIC countries, especially Brazil and India (Pic. 4). Advantages against Brazil still remain stable, and with respect to Russia have increased slightly. China and India are countries catching up in relation to the EU 27. The degree of relative improvement for India is much smaller than for China. A simple extrapolation of the rate reductions by China lagging behind the EU 27 over the past 5 years shows that it will be overcome in the near future. For completeness, we present data comparisons of the EU 27with China

and Russia (European Innovation Scoreboard, 2009) for individual components of SII.



Pic.5. Comparison between the EU 27 and China. Indicators pertaining to the blocks "Promoting Innovation" are in yellow, "Activity of the enterprises" – green, "Results" – blue.

Indicators of China's "ICT costs" and "Export of high-tech industries" is higher than in the EU 27 (Pic. 5). For "private loans" there is a slight lag and quite a lot on "the number of scientific and technical workers", "Broadband", "public-private cooperative publications" and "technology balance of payments flows". Growth rates of effectiveness are almost five times greater than for the EU 27, and this growth is based mainly on the data efficiency of "Broadband", "Patents", "Trademarks" and "knowledge-intensive services exports".



Pic.6. Comparison between the EU 27 and Russia. Indicators pertaining to the blocks "Promoting Innovation" are in yellow, "Activity of the enterprises" – green and "Results" – blue.

Russia has a higher rate than the EU 27 on "Higher Education" and "the number of scientific and technical workers" (Pic. 6). For all other indicators, EU 27 has a higher efficiency. Russia is the

only country the efficiency of growth of which is lower than the EU 27, in particular due to the sharp decline in high-tech exports.

It is impossible anymore to ignore the facts of the growing backlog of the Russian economy and the low efficiency of innovation. The above data show how serious the problems are that Russian economy faces today. Many development tools which operate successfully in other countries have already been tested during long-term experiments. A number of them did not give the expected results. At the same time, there is a continual search for new approaches and their adaptation to Russian conditions.

The aim of this paper is to analyze the applicability of the interaction between universities, business and government as a tool for developing the modern economy of Russia.

An analysis of the institutional nature of innovation development, the formal and informal institutions that interact and complement each other as well as of innovation systems implementing institutional functions shows that the significant role is played by the interaction of key powers of the innovation economy. It becomes clear that the implementation of advanced organizational models may be more important than purely technological innovation because technological breakthroughs can succeed after correct organizational solutions.

Today, one of the most notable organizational systems according to the researchers of global innovation community is the Triple Helix model "University-Industry-Government" (Etzkowitz, 2010; Etzkowitz, Leydesdorff, 2000) developed by H. Etzkowitz and L. Leydesdorff. The keynotes of the Triple Helix model are: evolutionism and parallels with living systems, openness, the priority of horizontal linkages to the vertical, the primacy of knowledge, intangible assets and secondary resources. From the perspective of the chosen approach to the analysis and construction of modern innovation systems such systems must comply with the Triple Helix criteria.

Let us suggest the extent to which this model can be used in the formation of a modern innovative economy in Russia.

Triple Helix (Etzkowitz, 2010; Etzkowitz, Leydesdorff, 2000) describes the interaction between the institutional spheres of university, business and government, each of which under certain conditions can function as originally belonging to other spheres. The institutional model of the Triple Helix shows the intersection of three subsets, where the common areas indicate non-membership of individual elements simultaneously to different spheres, and the ability to perform functions initially belonging to other elements of subsets. In other words, the individual components of independent institutional spheres in the region of intersection can perform "foreign" features or "create hybrid institutional forms in which the preservation of a high degree of autonomy is accompanied by a strong interdependence" (Dezhina, 2011).

Ideas under consideration by the concept were first announced in the framework of classical social theory in the nineteenth century. "The contribution of Georg Simmel, Karl Marx and Max Weber in the development of the theory of the Triple Helix has been the allocation of intersecting and partly autonomous institutional spheres" (Etzkowitz, 2010, p.59). At the end of the twentieth century, based on analysis of the practice of formation and development of post-industrial society in Etzkowitz's works this direction was further developed. Drawing on a large number of specific

examples, primarily the United States and Europe, he explores the development of the interaction of three institutional spheres.

The development of these areas is as follows. “University” – the university evolves toward an entrepreneurial university. “Industry” – the company, from a simple competitive structure associated with other companies through market relations, is transformed into a company whose work is built on relationships not only with other companies, but also with the scientific community and the state. “Government” – the state evolves in the direction of the state of innovation, transforming the traditional roles for promoting innovation, developing a community of experts and trusting it to make decisions (Etzkowitz, 2010).

In this paper, the task is not to retell the content of papers by Etzkowitz. We need to assess the applicability of the model of interaction between universities, business and government as a tool for the modern economic development of Russia. For this reason, we select only three points, disclosed in the papers of Etzkowitz: 1) the initiator of the interaction can be any of the participants, but as a rule, it is the role of a leading university, 2) examples of successful implementation of the model are not only in the U.S. and the EU (Silicon Valley, Massachusetts Institute of Technology, Sophia-Antipolis), but also in countries at earlier stages of development (Mexico, Brazil), 3) a significant role in implementing a model of interaction is played by the region.

Evaluation of the applicability of the Triple Helix model in the modern economy of Russia is carried out in stages in accordance with the principles developed in (Monastyrniy, 2010).

Firstly, from the work of H. Etzkowitz it approximately 150 points have been identified that characterize the Triple Helix model as a whole or its individual aspects.

Secondly, these statements were restated in determining the necessary conditions for interaction of universities, business and government, with many conditions generalizing some points. Thus, about 50 conditions were identified.

Then the selected conditions were correlated with the wording of the postulates of the economic growth theory, adjusted positions of neo-institutionalism, and additional restrictions imposed on the basis of analysis of international experience (Monastyrniy, 2010) (Table 2). A comparison with the range of applicability of the prevailing economic theory is justified as the author of the Triple Helix model in his conclusions bases them on the description of economic phenomena that are the essence of a knowledge-based economy and an economy of the postindustrial society.

Table 2.

	Postulates of the theory of economic growth	Adjustment of the postulates in terms of neo-institutionalism
Paradigm		
1	State of market equilibrium, market(s) operates under perfect competition.	a)”Market failures” maybe compensated by the state. b) The state has no opportunity for a significant reduction in costs associated with “market failures”
2	Individuals exercise rational choice	Bounded rationality and opportunistic behavior.
3	Preferences of individuals are stable	Preferences of individuals may change

		over time
Protective shell		
4	Individuals meet their needs through the exchange that takes place without costs	Costs of operation of the market mechanism does not vanish
5	Information about transactions is quite affordable and complete.	Receipt and processing of information, as well as any other resource, not an instant and fairly expensive process
6	Property rights remain unchanged and clearly defined	Identifying and securing property rights has its price
Additional restrictions		
7	Innovations in the modern sense emerged as an economic phenomenon of post-industrial society. Innovations are the product of the production system, dissemination and application of knowledge.	
8	The high level of innovation activity. Advanced networking subjects of innovation.	
9	The relative homogeneity of regional innovation systems in postindustrial society. Globalization of the economy.	

In the fourth stage a normative Triple Helix model was developed which includes six functional blocks containing about 50 conditions of realization of the Triple Helix model. The reformatting the nine sections (Table 2) into six functional units is due to the fact that for these events (the interaction of several economic actors), not all the postulates and additional restrictions have the same value. In addition, the Triple Helix model has its roots in classical social theory, sociology has its own tools and research techniques are not identical to economic instruments, so part of the points had to be reformulated in terms of economics.

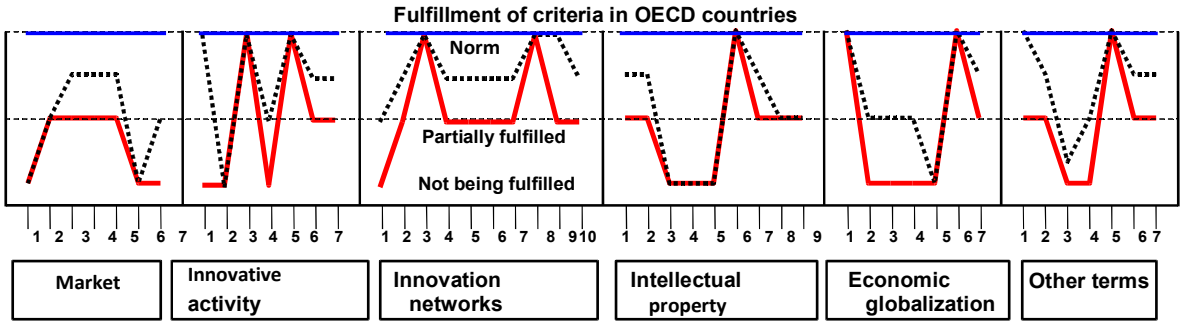
Grouping terms of realization of the Triple Helix model into blocks is as follows:

1. “The modern market. Transaction costs of technology transfer in today’s market. Compensation for market failure.” 7 conditions.
2. “Rational behavior of market participants. Innovative Activity.” 7 conditions.
3. “Information about the transactions. Innovation networks.” 10 conditions.
4. “Certainty of property rights and mechanisms for their transfer, including the IP objects.” 9 of the modalities.
5. “Realization of the Triple Helix model in a postindustrial society. The globalization of the economy.” 7 conditions.
6. Other terms and conditions. 7 conditions.

At the next stage an expert assessment of the conditions for the realization of the Triple Helix model in Russia was carried out. Since these conditions are in the overwhelming majority qualitative, the assessment was formed on an interval scale “Being carried out” – “Being carried out partially” – “Not being carried out”. Comparison was done in the “innovation system of the postindustrial economy”, “Innovative system of the Russian Federation”, “The innovation system in the region (for example, Tomsk region), as well as in the innovative clusters in the postindustrial economy”, “The innovation system in the region (for example, Tomsk region), “Innovation clusters in Russia” (for example a cluster of Tomsk State University of Control Systems and Radioelectronics). This is

possible because of a large number of examples cited in the papers of Etzkowitz. In addition, pairwise comparisons are possible to distinguish two intermediate interval estimation among three majors. (+) Sign in the "Being carried out in the region" means the realization of the relevant conditions in the region are better than in Russia.

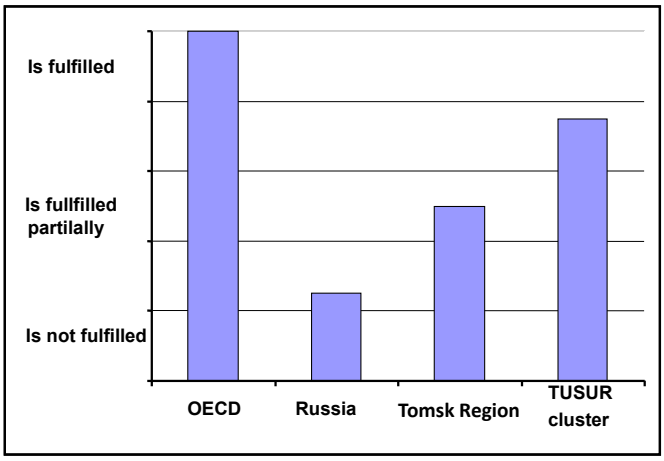
Table 3 and Pic.7 show the conditions profile of realization of the Triple Helix model in the OECD countries, Russia and the region with high scientific and educational potential.



Pic.7. Compliance with the realization of the Triple Helix model in OECD, Russia, Tomsk region.

The norm Russia Tomsk region

Profiling estimates made it possible to determine the fulfillment of conditions for the realization of the Triple Helix model and problem areas. In addition, it was possible to give a comparative assessment of the conditions in different innovation systems. A criterion for entering the relevant innovation system in a given interval (Pic.8) will take the share of higher ratings on certain conditions. We understand the rather conventional quantitative measurement of qualitative assessments. Therefore, we use an interval scale of assessment, when the principle is the fact that getting into a particular interval, not the value of intermediate numerical estimates.



Pic.8. Evaluation of the fulfillment of realization conditions of the Triple Helix model in a variety of innovation systems.

Table 3 – Results of expert evaluation of the realization conditions of the approach to Triple Helix.

Conditions for the realization of the Triple Helix approach in OECD countries	Conditions for the realization of the Triple Helix approach in Russia	Carried out in Russia	Conditions for the realization of the Triple Helix approach in the region	Carried out in the region
The modern market. Transaction costs of technology transfer in today's market. Compensation for market failure.				
1. The state controls the competitive landscape in the technology market by creating additional conditions that eliminate random factors in the market selection of technologies.	1.1. The state does not control the competitive environment in the technology marketplace.	Not carried out	1. The state does not control the competitive environment in the technology market or on federal or regional level.	Not carried out
2. Developed markets for high-tech goods.	2. Russian high-tech products markets are part of the global markets with high barriers for the exit of domestically produced goods.	Partially carried out	2. Russian (including regional) high-tech products markets are part of the global markets with high barriers for the exit of domestically produced goods.	Partially carried out
3. Labor market. Mobility of highly skilled professionals.	3. Low mobility highly skilled professionals.	Partially carried out	3. Higher than in Russian Federation, the regional mobility of highly qualified specialists.	Partially carried out+
4. Formation of double competence (the science-business, government-science, government-business).	4. Formation of double competences has a random character.	Partially carried out	4. Formation of double competences has a random character.	Partially carried out+
5. Providing state effective channels of communication between science and business to reduce transaction costs.	5. Public measures to establish channels of communication are fragmented non-system character.	Partially carried out	5. Public measures to establish channels of communication are systemic in nature, but not sufficient.	Partially carried out+
6. The presence of the state system of compensation for "market failures".	6. No system of compensation for "market failures".	Not carried out	6. No system of compensation "market failures".	Not carried out
7. Reducing the value of military motivation and development of market incentives of economic agents with state assistance.	7. Reducing the value of military motivation. Market incentives formed by economic agents, without state involvement.	Not carried out	7. Reducing the value of military motivation. Market incentives generated by economic units with little involvement in the region.	Partially carried out
Information about transactions. Innovation Networks.				

1. Condition advanced networking, the intensification of ties, the growth of the network.	1. Networking is not developed.	Not carried	1. Networking is not developed.	Partially carried out
2. The University works closely with business and government, it is not a university model “ivory tower” isolated from society.	2. Universities in general, weakly interacting with business and government.	Partially carried out	2. Universities in general, weakly interacting with business and government.	Partially carried out+
3. The existence of research groups in the areas of potential commercialization.	3. Existence of research groups in areas of potential commercialization.	Not carried out	3. Existence research groups in areas of potential commercialization.	Carried out
4. Association of scientists and engineers interested in creating their own firms (employees of universities, graduates, scientists and engineers from government or business labs).	4. Insufficient number of associations of scientists and engineers interested in creating their own firms	Partially carried out	4. Insufficient number of associations of scientists and engineers interested in creating their own firms	Partially carried out+
5. Availability of seed capital from public or private sources.	5. Insufficient availability of seed capital from public or private sources.	Partially carried out	5. Insufficient availability of seed capital from public or private sources.	Partially carried out+
6. Cheap and appropriately equipped facilities for new companies or in industries or in universities.	6. In general, Russia is extremely lacking in affordable and adequately equipped facilities for new companies or in industries or in universities.	Partially carried out	6. In general, Russia is extremely lacking in affordable and adequately equipped facilities for new companies or in industries or in universities.	Partially carried out+
7. Availability of equipment, ranging from computers to process complexes.	7. Lack of availability of equipment, ranging from computers to process complexes.	Partially carried out	7. Lack of availability of equipment, ranging from computers to process complexes	Partially carried out+
8. Opportunity for engineers and scientists to get an education in business or contacts with people who possess these skills.	8. Opportunity for engineers and scientists to get an education in business or contacts with people.	Carried out	8. Opportunity for the engineers and scientists to get an education in business or contacts with people.	Carried out

9. Availability of applied research institutes, research centers, technology transfer centers, incubators, which help to solve the problems of development of firms and act as a bridge between academic scientists and engineers with the business.	9. Availability in certain regions of the Russian institutes of applied research, research centers, technology transfer centers, incubators, which help to solve the problems of development of firms and act as a bridge between academic scientists and engineers with the business. (innovation intermediaries).	Partially carried out	9. The presence in TR institutes of applied research, research centers, technology transfer centers, incubators, which help to solve the problems of development of firms and act as a bridge between academic scientists and engineers with the business. (innovation intermediaries)	Carried out
10. Need for a combination of linear and nonlinear model innovation chain.	10. The complexity of implementing both linear and nonlinear model innovation chain due to the low innovation activity of the Russian economy.	Partially carried out	10. The complexity of implementing both linear and nonlinear model innovation chain due to the low innovation activity of Russian (including Tomsk) economy.	Partially carried out

A comparative analysis showed that the internal environment of innovation in the region and the cluster is capable to some extent of offsetting the generally poor Russian conditions. First and foremost, it concerns the conditions in the blocks of "Rational behavior of market participants. Innovative Activity", "Information about the transactions, Innovation networks", "Certainty of property rights and mechanisms for their transfer, including intellectual property".

Experience, as summarized in the papers of H. Etzkowitz shows that the Triple Helix model is characterized by advanced networking, intensification of linkages between all components of the model, the capitalization of knowledge, and commercialization of research results and the increasing role of the state (the center and regions) through the formation of additional conditions that eliminate random factors in the market selection of technologies.

Where, when and under what conditions can the proposed model be realized in Russia within a reasonable timeframe? The literature has a lot of data of the individual elements of the Triple Helix model in the Russian Federation. We use the results presented by I.G.Dezhina (Dezhina, 2011):

1. "In the last 6-7 years, according to Goskomstat, appeared 8-10% of innovatively active industrial enterprises. ... The population dynamics of small innovative firms ... are negative: if in 2004 there were 22,500 small innovative firms, in 2009 there were only 12,300 ... Most innovation is imitation, new only in local terms. ... Communications businesses – both large and small – and science today are weak, fragmented, and characteristic only for certain types of businesses and industries."
2. In Russia, "Science, unlike many other countries, is provided mostly not by universities. The higher education sector accounts for only about 7% of domestic expenditure on research and development carried out in the country, and fundamental research is conducted mainly in the

institutes of the Russian Academy of Sciences. Only 45.4% of universities are engaged in research. ...Being mostly budgetary, scientific organizations have low motivation to develop ties with business. At the same time developments of university science, as well as a number of surviving "ex-branches" of government institutions and research centers in general, have little demand. Closer ties between research institutions and companies have become established only in the last two or three years, due to the hard pressure of the state. Universities, in turn, to a greater extent continue to treat companies as takers-on of staff, but not research work."

3. "The number and scope of the initiatives of the Russian government in innovation has increased over the past two years. ... The state is trying to directly or indirectly encourage business to innovate, largely relying on the administrative resource. In this case, the focus shifts to support partnerships with scientific organizations and even more so with universities. ... The state is trying to establish links between science and business and encourage the development of small innovative firms, but at the heart of the policy there is no sound and connected development strategy."

Given the limitations and challenges in the development of business, universities, and science in universities, and the complexity of the implementation of government initiatives, we can say the following:

1. ***Advanced network interaction*** is possible in a relatively small number of regions with a significant number of large and medium-size innovative enterprises and small innovative firms.

2. ***The capitalization of knowledge, the commercialization of research results*** in a meaningful, at least for the regional economy, scale is only possible in regions where, along with strong technical and natural science, universities have academic and applied research centers.

3. ***Intensification of linkages between all components of the model*** in the amount sufficient for the formation of synergistic effects is possible only where industrial and academic partners are compact, or in close proximity.

4. The federal government can ***strengthen the role of the state*** and strengthen the processes of interaction, if a national development strategy is formulated.

5. ***The increasing role of regions*** is possible only under the redistribution of powers (with the necessary financial resources) from central government to the regions.

In the current Russian environment an interactive model of universities, business and government can be realized in a limited number of regions in the form of innovative clusters based on technical and science universities, academic and applied research centers in the direct interaction between federal and regional authorities in the framework of national development strategies.

What should we do?

Summarizing the results of the analysis of the Triple Helix model and the experience gained in implementing regional initiatives and going far beyond discussing the applicability of a single development tool we can suggest the following:

1. A federal-regional innovation system.

Development of a national innovation system in Russia should be done through the development and implementation of both federal and regional initiatives. This requires a substantial upgrading of

federal and regional politics and transfer of the right to make many decisions with the necessary resources to implement them at the regional level.

When forming a national innovation system we should adhere to an evolutionary approach, by gently applying administrative measures. Today we see the opposite picture when the aggressive term "forced to innovate" is used more often, and most important decisions are made without public discussion.

2. Integration of research organizations and universities.

In the Triple Helix model the concept of university is interpreted very broadly, so that any organization generating and disseminating new knowledge falls under this status. In the Russian context in the institutional sphere "University" includes a system of national education, academies of science and applied science, and we assume that the idea of an entrepreneurial university is maintained and improved. The exact extent to which an organization can disseminate new knowledge through technology transfer, the commercialization of knowledge, a massive non-commercial use of new knowledge, is the extent to which the organization can apply for university status in the Triple Helix model. The need for integration of universities, RAS, RAMS and applied science is clear. Currently, however, this process is practically not supported by the state.

3. Development of innovative businesses.

To accelerate the development of innovative business, you need to move on to the implementation of the cluster policy, the aim was not the support of monopolies, but the growing clusters of innovation, naturally emerging in the market environment. Cluster policy in Russia is only being given thought, although worldwide it is a widely used tool for innovative development.

Nowadays it is necessary to implement a number of pilot projects for the development of regional innovation systems based on entrepreneurial universities, closely interacting with innovative business and government in order to gain experience and as soon as possible move on to more ambitious reforms.

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