Innovation Systems in the Federal Districts of Russia: Moscow and St.-Petersburg Regions

Kuroedova Margarita[1] Khvatova Tatiana[2]
1 The insurance company «SBK "A+"», 197022, Russia, St.-Petersburg, Kamennoostrovsky 40;
2 St.-Petersburg State Polytechnic University, International Graduate School of Management, 195251, Russia, St.-Petersburg, Grazhdansky prospect 28/2
(E-mail: margarita5@bk.ru, tatiana413@mail.ru)

Adstract The article is dedicated to studying Regional Innovation Systems (RIS) of the Federal districts of Russia, and in particular, RIS of Moscow and St.-Petersburg regions. Regional innovation system (RIS) is defined as a part of National System of Innovation (NSI) that builds in the innovation processes into region economy and region development. RIS are considered to be the basis for the whole country's NSI and the source of sustainable development. The RIS are being studied with the help of such indicators as processes and policies supporting education and knowledge transfer; arrangements for the governance of innovation; the level of investment, especially in R&D; the type of firms and their degree of linkage and communication, in terms of networking, subcontracting, etc. In the article SWOT analysis of Russia's NSI is made, strengths and weaknesses of St.-Petersburg and Moscow regions are discussed. We chose these two regions because they are the most advanced in our country and exactly in these regions a lot of governmental programs and policies are being put into practice now. Therefore, these regions could be considered to be pilots for the governmental programs. Finally, studying the regions leads us to working out recommendations on how to improve the NSI of the whole country.
Key words NIS, RIS, innovation, federal district, region

1 Introduction

Transition to the Knowledge Economy and constructing the National System of Innovation (NSI) are essential for providing dynamic and sustainable growth of contemporary Russia's economy. At present numerous attempts are being made to form the new techno-socio-cultural structure of the society and institutions that should ensure the future existence of the Russian nation and the independent State. Without any doubt, it is regional innovation policies that provide competitiveness of national business in the world market. And these policies are the basis of the National System of Innovation.

Russia's economy is now characterized as constantly growing, but its NSI is not functioning effectively, which is proved by the following data: Knowledge Economy Index KEI for Russia is 5.95 (47th out of 140), Global Competitiveness Index GCI is 4.19 (48th out of 131) and Global Summary Innovation Index GSII equals to 0.39 (25th out of 49 countries explored). Comparison of R&D expenses per capita in Russia and developed countries is also the reason for concern: in 2006 in Finland, for example, these expenses were $905.2 while in Russia they were only $102.3.Now Russia's technological development is based mainly on imported technologies. Russia's expenses on fundamental science and all applied research is 1% of GDP. From those 0.7% comes from Federal budget and 0.3% comes from private businesses. In institutional development Russia is on 166th place.1 Therefore, it is essential that NSI be reformed now in order to provide our country a respectable place in the World innovation space, and provide people a good standard of living, which should be defined not only by the size of the salary, but also by the range of opportunities given to everyone to develop themselves.

In this work we are going to study the innovation systems of the Federal regions of Russia, and, in particular, of Moscow and St.-Petersburg. These are the biggest cities in the country and at the same time a lot has been done there to increase innovation activity and tune connections between various institutions. We are going to discuss the innovation activities in the federal regions of Russia, analyze the situation in St.-Petersburg and Moscow at present, emphasize strengths and weaknesses of the policies. In our analysis we are using statistical material and case studies of St.-Petersburg and Moscow regional innovation systems.

At present there is no unified definition of NSI. One of the points of view considers NSI as a complex of institutions whose activity is aimed at generation and diffusion of innovations. This

[1] The Global Competitiveness Report 2007-2008, www.weforum.org.

definition shows that innovation processes appear together with practical processes in the economy. In this concept the main emphasis is on commercialization, and practical output of science, because new products appear as a result of many subjects' interaction.

The second concept interprets NSI as a set of interconnected economic mechanisms and activities that serve innovation processes. This definition is more functional because it emphasizes the dynamics of NSI's subjects interaction and a non-linear structure of innovation cycle. However, it doesn't say anything about the driving forces of innovation processes.

Another point of view is more deeply connected with the essence of economic relations. NSI is treated as a part of national economic system that builds in the innovation processes into economic and social development. In this concept it is suggested that creation of formal innovation structures doesn't guarantee success of innovations. It is essential that favorable economic atmosphere and social climate be created. In our research we follow this point of view.

The concept of regional innovation systems is discussed and written about since 1990s[1]. Lundvall, one of the first authors to promote thinking about system of innovations, mentioned regionalization in relation to globalization and referred to regional networks, but he did not believe that a regional perspective on innovation could be as useful as national systems[2]. However Porter showed that the United States competitive lead on innovation was provided by regional and local innovation systems based on clusters[3]. It was especially true in new-economy sectors such as biotechnology and information and telecommunication technologies (ICT). In the new 21st century governments in almost all countries with developed economies were promoting regional innovation and cluster-building policies as ways of increasing national competitiveness. The clearest examples of this are BioValley cluster which united scientists and business from South Germany, France and Switzerland and car cluster in East Germany created by the initiative of 5 Länder governments (Berlin-Brandenburg, Thuringia, Saxony, Pomerania, Mecklenburg), the leading car producers, banks and several higher universities.

Regional innovation system (RIS) is defined as a part of national economic system that builds in the innovation processes into region economy and region development. Clusters are considered to be specific sub-systems operating within regional innovation system settings. Although it has been realized that RIS are becoming more and more important, there is still no general understanding of how to define a region[4]. Most commonly the following criteria are used[5]:

- It must not have a determinate size;
- It is homogeneous in terms of specific criteria;
- It can be distinguished from bordering areas by a particular kind of association of related features;
- It possesses some kind of internal cohesion.

To define a region from the economic perspective, the concept of industrial cluster is often[6]. Cluster is defined as a dense network of economic actors, who work together very closely and have intensive exchange relationships. All economic actors who directly participate in the production processes of a region are partners in this network, including manufacturing companies, supply and marketing companies, financial institutions, research institutes and technology transfer agencies, economic associations and unions, etc.

A strong regionalized innovation system is one with systemic linkages between external as well as internal sources of knowledge production (universities, research institutions, and other intermediary organizations and institutions providing government and private innovation services) and firms, both large and small. The key dimensions of RIS are: first, the processes and policies supporting education and knowledge transfer; second, arrangements for the governance of innovation; third, the level of investment, especially in R&D; fourth, the type of firms and their degree of linkage and communication, in terms of networking, subcontracting, etc. We will try to use these dimensions in our study.

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[1] Cooke P. Regional Innovation Systems: competitive regulation in the new Europe. Geoforum 23, 1992

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Russia's NSI is quite young. The first attempts to formulate national innovation policy took place in 1997-1998.Before there were a number of laws, initiatives and projects which were supposed to encourage innovation activity, such as "The Patent Law of the Russian Federation" (1992), "The Law on Intellectual Property" (1993), the SME Assistance Fund. However, in the early 1990s more attention was paid to organizational steps rather than to creation of legislative basis for the innovation sector of the economy. In 1999 the State Duma (the Parliament of Russia) worked out the Project "On innovation activity and State innovation policy", but it was not approved by President V.Putin because of the lack of detailed innovation activity definition and weak structure of the suggested innovation infrastructure. It is worth mentioning that neither experts from industries nor leading scientists participated in the Project formulation.

In Table 1 we summarized strengths and weaknesses, opportunities and threats of Russia's NSI

Table 1 The strengths and weaknesses, opportunities and threats of Russia's NSI

Strengths of Russia's NSI:	**Weaknesses of Russia's NSI:**
Strong positions or leadership in many areas of fundamental science, for example, in Mathematics, Physics, Chemistry, Life Sciences, Human Sciences; Developed system of R&D institutes in various R&D spheres; Strong positions in the world market in such technological areas as aero-space industry, metallurgy and energy; Improved positions of higher education sector in Russia's NSI in comparison with previous years. Rich natural resources that fulfill most internal needs in raw materials and energy Large territory and big domestic market that provide huge variety of vital activities and needs of the population	Ineffective system of bank loans, lack of experience in management of innovations; High export and import taxes; High administrative barriers for entrepreneurs Low legislative activity; Underdeveloped market of innovation intermediaries; certain transitional links in Russia's NSI, such as venture company, small innovative high tech company, are missing, which presents an impediment for technology transfer; Lack of long-term industrial policy aimed at producing competitive products; Low innovative activity of industrial enterprises; orientation mostly on short-term innovative projects; Low technical and technological level of production, obsolete equipment Insufficient motivation of R&D personnel for producing innovations; low prestige of scientific activity; lack of innovation culture; Lack of qualified personnel to manage innovation processes Education is not integrated with science
Opportunitites:	**Threats:**
Building up funds for crediting small business; Creating a network of venture funds for financing priority innovation projects; Stimulating extracting companies to purchase machinery and equipment made in Russia; Renewing civil aviation park basing on production and leasing modern models of aircraft; Creating clusters, increasing innovative activity; Supporting innovative clusters instead of supporting separate R&D companies; State support of contemporary technologies diffusion processes; Development scientific and technological networking between SMEs, state research institutes and universities; Development of cooperative relations with international partners; Taking steps for defending domestic banking system from being taken over by international banks by relatively.	«Brain drain»; decreasing prestige of scientific career; Insufficient financing of R&D; Ageing of population and researchers; Decreasing quality of human resources as a result of low quality of life, decreasing quality of education and healthcare; Increasing corruption and crime, economy criminalization.

In 2002 the President formulated the main objectives of Russia's State policy in science and

technology, which were meant to provide Russia's transition to innovation way of development. Soon after the Council of Science and High Technology approved the Policy of science and technologies development until 2010.Since that time there have been discussions on NSI issues, "technoparks", centers of technology transfer. In 2005 The Investment Fund for Technologies and Innovations was created, with its budget being $100 mln.: 75% is given by Federal budget and the rest – by Russian and foreign investors. A number of various law amendments have been made, for example, the amendment granting VAT benefits to taxpayers involved in innovation activity, etc. Still, Russia's NSI is not yet functioning effectively, which is proved by a number of economic and innovation indicators.

The Federal districts (district means "Okrug" in Russian language) were created in May 2000 by Vladimir Putin and at present there are seven districts in this country: the Central Federal District, the Southern Federal District, the Northwestern Federal District, the Far Eastern Federal District, the Siberian Federal District, the Urals Federal District, the Volga Federal District. Within the Federal districts there are innovation clusters. Of course we cannot expect to find well-established innovation clusters in all districts. Federal districts in Russia differ in the closeness of cooperation, scientific traditions; in some districts the administration and public governance system may be rather weak while in others there is better developed institutional set-up. The most successful districts are Central (where Moscow and Moscow region are situated) and Northwestern (St.-Petersburg and St.-Petersburg region). Federal districts in Russia have different programs for development, different systems of financing. The situation in many districts is very far from being satisfactory neither in scale nor in the essence of innovation activities. Therefore it is very important to research and figure out the ways of improving innovation policies in the Federal districts, stimulate the innovative potential and provide recommendations for forming the strategy of innovation development in science and technology.

2 The Innovation Systems of the Federal Districts of Russia

The federal districts were created in May 2000 by Vladimir Putin as a part of a wider program designed to reassert federal authority and at present there are seven districts in this country: the Central Federal District, the Southern Federal District, the Northwestern Federal District, the Far Eastern Federal District, the Siberian Federal District, the Urals Federal District, the Volga Federal District.

Each federal district comprises the regions: Central (Moscow, Moscow Oblast, Kaluga Oblast Oryol Oblast, and others), Southern (Krasnodar Krai, Stavropol Krai, Rostov Oblast, and others), Northwestern (Saint-Petersburg, Leningrad Oblast, Arkhangelsk Oblast, Vologda Oblast and more), Far Eastern (Vladivostok, Khabarovsk, Yakutsk, and others), Siberian (Altai Krai, Irkutsk Oblast, Krasnoyarsk Krai, Novosibirsk Oblast, Tomsk Oblast), Urals (Sverdlovsk Oblast, Tyumen Oblast, Yugra, Chelyabinsk Oblast and more), Volga (Republic of Bashkortostan, Chuvash Republic, Nizhny Novgorod Oblast, Orenburg Oblast, Republic of Tatarstan, and more).

Before we start analyzing the NSI of the federal districts, let us mention the main elements of NSI. Russia's NSI consists of: entrepreneurial sector, state sector, R&D sector, environment that stimulates innovation activity of the society, non-profit organizations (funds, professional unions, associations, charities), foreign partners.

Nowadays, there are 3566 organizations, which are carrying out the R&D in Russia (Central Federal District − 1393 organizations, Northwestern − 536, Southern − 310, Volga − 540, Urals − 226, Siberian − 419, Far Eastern − 142), the total employment is 813207 of people[1] (Central Federal District − 408330 people, Northwestern − 104752, Southern − 34530, Volga − 140592, Urals − 49670, Siberian − 60986, Far Eastern − 14347). The share of R&D organizations[2] is represented in the Figure 1.

[1] Российский статистический ежегодник. Госкомстат РФ. М., 2006

[2] Наука Москвы: аналитический статистический сборник. М., 2007

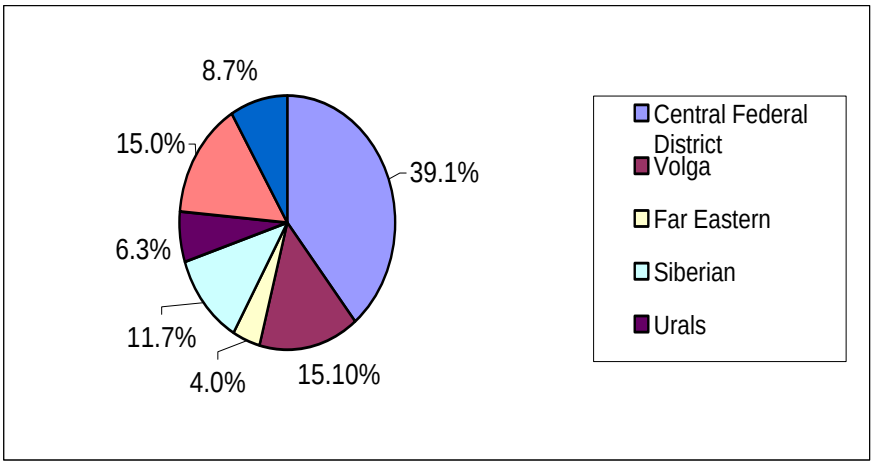

Figure 1 The Share of R&D Organizations

It is essential to say that the reduction of R&D organizations is observed (Volga Federal District − 17,9%, Northwestern − 16,2% and Southern − 14,1%). This tendency is less in the Urals Federal District and Far Eastern (Urals − 12,7%, Far Eastern − 10,1%). The quantity of R&D organizations in the entrepreneurial sector is represented in the Tabl. 2:

Table 2 Scientific and Technical Potential (according to statistics) of Regions with the Highest Parameters

Federal District	Regions	Quantity of organizations	Number of people employed in the sphere of R&D
Central	Moscow	785	249947
	Moscow Oblast	243	91062
	Kaluga Oblast	33	10708
	Vladimir Oblast	32	7640
	Yaroslavl Oblast	27	6660
	Tambov Oblast	22	2285
Siberian	Novosibirsk Oblast	110	23438
	Krasnoyarsk Territory	59	6846
	Tomsk Oblast	56	8257
	Altai Territory	40	2775
	Irkutsk Oblast	37	4557
Northwestern	St.-Petersburg	369	85290
	Arkhangelsk Oblast	25	3065
	Leningrad Oblast	18	6422
Volga	Nizhniy Novgorod Oblast	111	46989
	Penza Oblast	25	7119
	Ulyanovsk Oblast	22	7591
Far Eastern	Khabarovsk Territory	29	1390
Urals	Sverdlovsk Oblast	114	24755
	Chelyabinsk Oblast	42	17530

From the table represented above, we can see that Moscow and St.-Petersburg are undisputed leaders by the quantity of organizations, by the number of people employed in the sphere of R&D. Let us discuss these two regions in more detail.

3 Moscow and St.-Petersburg Regions

It is essential to say that Moscow has a huge scientific potential (world famous universities, industrial R&D institutes and academic laboratories). Defense R&D institutes are concentrated in Moscow and in Moscow Oblast. These institutes have developed world-class weapons: jets, rockets, complex air defense systems, control systems, tanks and armored troop-carriers, etc. The sphere of

science and innovative actions in Moscow is represented by 16 innovation-technological centers: MGU, MIFI, MGTU, MEI, Kurchatov institute, MATI, MIET, Gubkin institute, Russian-Chinese technical base “Druzhba”.

Another region – St.-Petersburg is the second education and science centre in Russia after Moscow and has sufficiently developed links with the world innovation system. 11% of the Russian scientific potential, 14% of Russian researchers and 8% of Russian students are focused in St.-Petersburg. St.-Petersburg is the center of microelectronics, optics, nanotechnologies, nuclear technologies, energy technologies, laser technologies, biotechnologies (primarily in pharmaceutics), information technologies (math modeling, speech recognition and production systems, information security, etc.). The sphere of science and innovative actions of St.-Petersburg is represented by 453 scientific organizations including 48 scientific organizations of the Russian Academy of Sciences, 327 field scientific organizations, more than 130 higher educational establishments and 13 innovative and technological centers and technology parks. After we investigated the two regions of Moscow and St.-Petersburg, we found out the following strengths and weaknesses of their scientific and innovation development (see Table 3):

Table 3 Analysis of Strengths and Weaknesses of Scientific and Innovation Development of Moscow and St.-Petersburg

Region	Strengths	Weaknesses
St.-Petersburg	• Expenditure on R&D (26329.9 million rubles [€720.770 mln.]); • Granting Ph.D. and Full professor’s degrees (Ph.D. given to − 3255 people, Full professor − to 229 people in 2007)	• Patent claims arrived (on inventions - 1689, on useful models - 837); • Ageing of the population, ageing of researchers; • Science intensiveness of innovation products • R&D expenses in entrepreneurial sector (on fundamental research – 3425300.0 thousand rubles, applied research – 3782100.0 thousand rubles [€103519.06 thousand]).
Moscow	• Expenditure on R&D (85240.3 million rubles, [€2333.09 mln.]); • Patent claims arrived (on inventions − 6318, on useful models - 2059); • Granting Ph.D. and Full professor’s degrees (Ph.D. given to − 10250 people, Full professor − to 378 people in 2007) • Expenses on R&D in entrepreneurial sector (fundamental research – 16304300.0 thousand rubles [€446261.56 thousand], applied research – 16359800.0 thousand rubles [€447780.69 thousand], others – 69271800.0 thousand rubles [€1896023.84 thousand]);	• Ageing of the population, ageing of researchers; • Science intensiveness of innovation products; • Effectiveness of R&D

It is worth mentioning that the government tries to cooperate on the development of science parks in Russia, in which innovation companies will have possibilities for development due to infrastructure that has been put in place and high concentration of qualified staff. These science parks have only started to emerge in the past few years in Russia. At present, there are 70 science parks in Russia. In Saint-Petersburg (Petergof) the IT-park will be created, which will comprise ten companies with 2500 of people. From our point of view, the cluster approach is the optimal way for competitive development of RIS and NIS. Nowadays the automobile industry enterprises are already located in industrial areas Shushary-2 and Kamenka, Predporovaya-3 area is planned to be given to IT-cluster participants, Konnaya lahta - to the mechanical engineering and Pushkinskaya – to the chemical-pharmaceutical and medical industry.

As for Moscow, the most effective science park MIET (Moscow Institute of Electronic Technology) is located in this city, which consists of 36 start-up companies. The lines of investigation of this park are: integrated optics phase modulator on lithium niobate for fiber-optical gyroscope, manufacturing of optical fiber supporting radiation polarization, fiber optical gyroscope, micromechanical gyroscope, integrated electro-optic channel switch on lithium niobate for spectral compression systems (DWDM) in optical fiber communication lines. The R&D directions of this park are represented in the Figure 2.

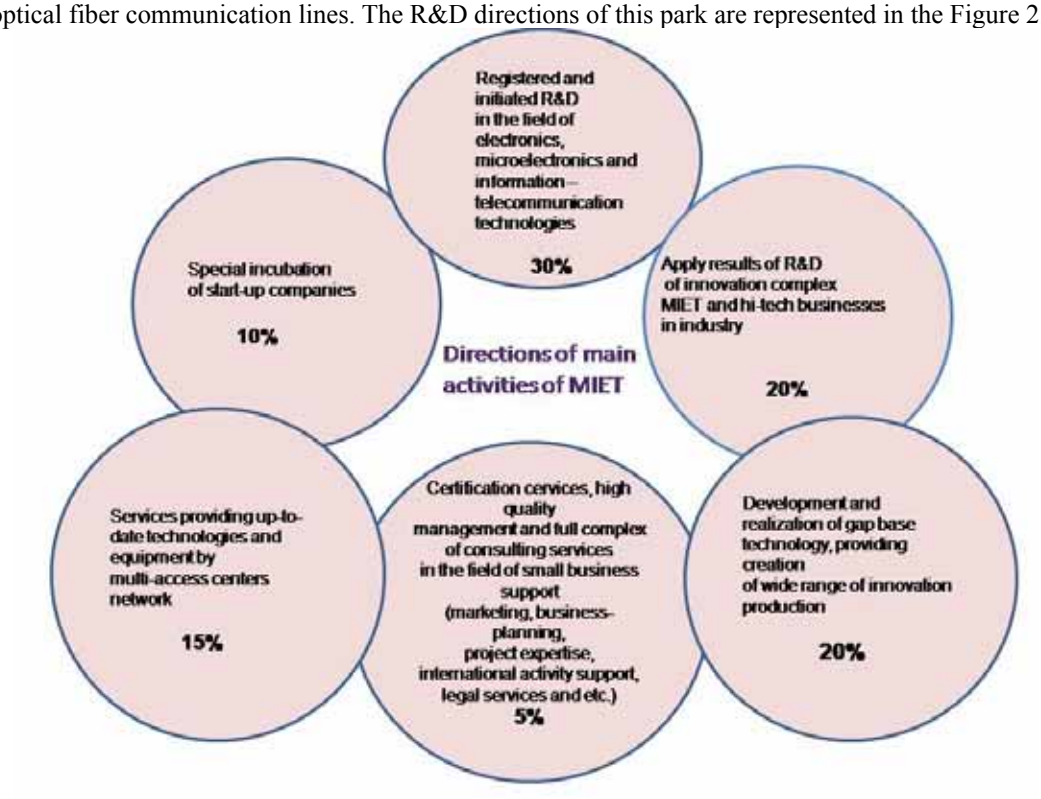

Figure 2 The R&D Directions of MIET

Let us turn to another element of innovation system – the higher education sector. In the higher education sector of Russia and federal districts the following tendency is observed: the number of the state and municipal universities is 655 (Central Federal District − 204 universities, Northwestern − 75, Southern − 79, Volga − 540, Urals − 51, Siberian − 85, Far Eastern − 38), the total employment is 813207 of people (Central Federal District − 408330 people, Northwestern − 104752, Southern − 34530, Volga − 140592, Urals − 49670, Siberian − 60986, Far Eastern − 14347). The share of the state and municipal universities is the following (see Figure 3)[1]:

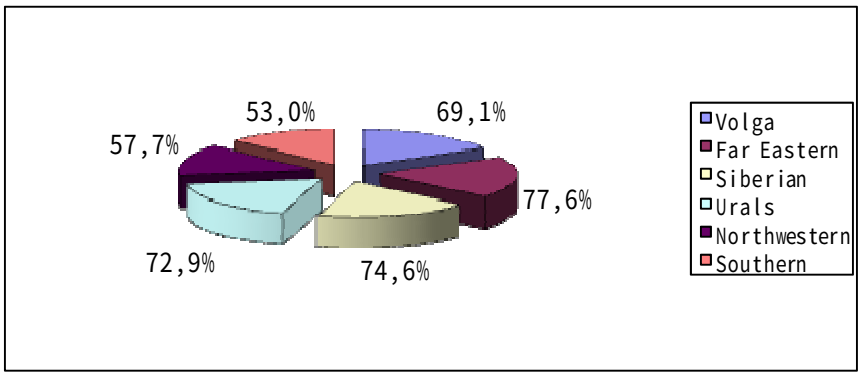

Figure 3 The Share of the State and Municipals Universities in Russia

In Russia there is a positive tendency in the higher education sector, the granting of post graduate students is 33561 people (Central Federal District − 14176 people, Northwestern − 4114, Southern −

[1] Наука Москвы: аналитический статистический сборник. М., 2007

3603, Volga − 4943, Urals − 1792, Siberian − 3921, Far Eastern − 1021), the total amount of granting Ph.D. is 1417 (Central Federal District − 522 people, Northwestern − 1012, Southern − 159, Volga − 201, Urals − 67, Siberian − 198, Far Eastern − 20)[1].

At present, the expenditure for R&D in the higher education sector is 13338 million of rubles, for comparison, this figure was 10696.1 million of rubles in 2004.Ph.D and post-graduate students average one third of all employees working in this sector of science. The main line of investigation of the higher education sector is the natural and technical sciences (natural sciences − 63,7%, technical sciences − 23,4%). It is important to note, that financing of researches and development is increasing each year, but we can't say that the situation with the works under direct contracts is stabilized.

The higher educational establishments ought to:

a. Actively cooperate with the other R&D organizations;

b. Improve finances system in the higher education sector, obtain additional off-budget financial assets;

c. Improve the preparation of eminently qualified managers in the R&D sphere;

d. Stimulate scientists in the education system to participate in making high-end technologies;

e. Retrain workers in the R&D sphere to increase the innovation activity of organizations.

During the investigation of federal districts, we have revealed the following weaknesses of Russia's NSI:

a. There is not enough demand for innovative products; many enterprises have obsolete equipment and try to harvest as much as possible without any costly innovation;

b. There is no stable technological unity between new technologies and product development and their commercialization;

c. Unfriendly climate for SME, complicated taxation. The total number of taxes a firm has to pay is 22 in Russia, which is twice as high as in the USA and Japan. For every thousand of people in Russia there are only 7.9 SME, in the USA 181.7 SME, in Japan – 60.8 SME. As a result of this, only 12-17% of Russia's GDP is produced by SME (in developed countries they produce up to 70% of GDP);

d. The banks' interest rates are very high; for example, the interest on a loan for SME is 16-17%, for larger companies it is 12% on average; the market for SME loans is growing fast in St.-Petersburg and Moscow, but still, crediting SME is considered to be quite risky; as a result, enterprises don't have enough finance;

e. Investors do not like to invest money into fundamental research because of high risks (estimated at about 90%);

f. Certain transitional links in Russia's NSI, such as the venture company, small innovative high tech company, are missing, which presents an impediment for technology transfer;

g. Such issues as external environment control, forecasting, strategy evaluation and control are not paid enough attention to;

h. Administrative workers lack theoretical and practical knowledge in managing projects, time, finance, risks, personnel, contracts, technology transfer. The same person usually performs functions of managing enterprise as well as planning.

In order to overcome these problems, in our opinion, it is important to do the following:

a. Create better climate for innovative SME;

b. Provide interest-free loans to individual inventors and small start-ups;

c. Create venture funds and provide tax benefits for them;

d. Create nets of technoparks and technopolices;

e. Introduce benefits system for participants of technologies transfer;

f. Improve coordination between ministries and departments as well as between different levels of government – federal, regional and municipal;

g. Increase volumes of state and private investment into R&D;

h. Stimulate purchasing of high-tech products produced in Russia;

i. Improve the system of managerial education; for this we suggest the system represented in Figure 3.

[1] Российский статистический ежегодник. Госкомстат РФ. М., 2006

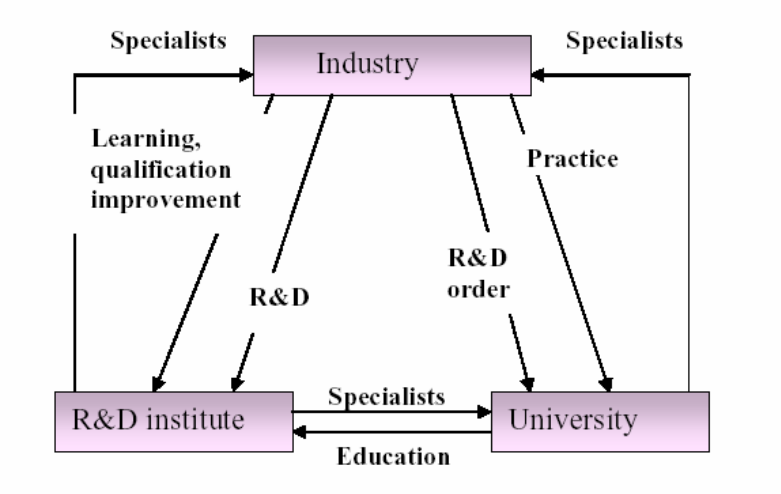

Figure 3 System of Knowledge Transfer between Industry, R&D Sphere and University

j. Introduce tax benefits using experience of foreign countries, such as:

- lower tax rates for profit spent on R&D;
- lower taxes paid on dividends from innovation enterprises shares;
- lower tax on profit received as a result of using patents, licenses, know-how and other intangible assets;
- reduce taxable profit on the price for equipment given to universities and R&D enterprises;
- subtract charity payments to funds financing innovations from taxable income.

11.Russian Academy of Science should become a link between industrial and university science and also with industrial enterprises in order to create logic and well-balanced system of knowledge generation and transfer. This will allow creating technological basis for NSI.

4 Conclusions

During the last few years Russian government has produced a lot of official documents[1] aimed to encourage development of Russia's NSI, though they still have not brought many expected results and this is the reason of very slow innovation processes in our country. The crisis in the innovation sphere – small number of innovation-active enterprises, reducing volume of R&D, low demand for new technologies, etc. – still has not been totally overcome. So, these years the proportion of R&D expenses is only 1% of Russia's GDP, while in economically developed countries this proportion is minimum 2%.

During our research we revealed weaknesses and threats for Russia's NSI and formulated recommendations on improving the situation. In this article we studied the successful Federal districts of Russia (Moscow and St.-Petersburg) where strategies for innovative development exist and are being put into practice and a lot of international experience is used. With the example of these two regions we could see that many of our recommendations are able to bring positive results. The higher educational standards are, the better innovation culture is developed; the better conditions for investors are, the more money is being put into innovative projects; the better climate for SMEs is created, the more small and medium innovative enterprises emerge. In our further research we are planning to study how traditions of entrepreneurship differ in different Federal regions and how this affects the institutions in the regions and connections between them; it is also very important to study how to overcome the huge gap between different regions of Russian Federation. Developing effective regional systems will create a basis for

[1]«The concept of state innovation policy». Approved by Russian Government on July the 24th, 1998. № 834; «The concept of state innovation policy of Russian Federation 2002-2005». Approved by the Governmental Commission on innovation policy, Case № 2, April the 24th , 2002); «The concept of innovation policy for the states-participants of Community of Independent States (CIS) for the period until 2005». Approved by the Economic Council of CIS on the 22th of June 2001; «Main directions of Russian Federation policies for national innovation system development for the period until 2010». Approved by the Government on the 5th of August, 2005 г. № 2473п-П7, and more.

reforming the whole national innovation system of Russia and will increase the scientific and technological potential of the country which would improve the effectiveness of the economy and provide higher competitiveness of the country in the world market.

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