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RUSSIAN REGIONAL INNOVATIVE CAPACITY INDEX AND ITS RELATION TO THE REGIONAL ECONOMIC GROWTH

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by

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A Research paper

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TITLE: RUSSIAN REGIONAL INNOVATIVE CAPACITY INDEX AND ITS RELATION TO THE REGIONAL ECONOMIC GROWTH

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This paper aims to analyze the relationship of regional innovative capacity and economic performance. To address this question we developed integral Russian Regional Innovative Capacity Index (RRICI) for the eighty Russian regions – all regions of the first level of official classification (except three autonomous areas due to the data absence) for 2009 and 2010. Empirical analysis shows that RRICI is significant and positively related to the GRP per capita. This means that there is evidence of the relationship between regional innovative capacity and regional economic growth. We also performed Granger causality testing, which revealed that RRICI causing GRP per capita at 10% level of probability.

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1. Introduction

It is difficult to estimate the contribution of technological and innovation processes in the development of modern society. A large number of scientists from a variety of angles approached the assessment of innovations in terms of their impact on human development and the various aspects of this interaction. Leading economists analyzed the contribution of innovations to the economic growth. A number of different methods, datasets, concepts and terms have been applied at the micro and macro levels. In this context, one of the most important issues of the relationship between innovation process and economics is the role of innovative capacity. In other words, the question is does the greater innovative capacity - potential, or available capabilities to innovate - leads to the better economic performance. It appears that there is no commonly accepted definition and there are no standard methods for understanding and measuring innovation capacity in the international practice. Scholars vary broadly in their approaches to this matter; therefore we consider this to be an important issue and we are making an attempt to contribute to the study of this concept.

One of the noticeable trends in the development of innovation processes that manifest not only at national but also at the global level is the strengthening of the role of regional factors. Often it is in the regions where effective and flexible institutional mechanisms that organize and support innovation are emerging, evolving, adapting and being tested. Such areas facilitate the access of firms to the modern infrastructure that provides access to the desired markets. This phenomenon of the modern economy provoked the redistribution of powers between different levels of government and therefore increases the importance of the regional component in the national innovation policies (Gokhberg and Kuznetsova, 2011). However, the theoretical and practical problems of the formation and the effective use of the regional innovative capacity, in spite of their importance, are not

sufficiently developed. This is what we decided to concentrate in this study. We took the Russian Federation as a ground for this paper.

Economic and social conditions in different regions of Russia are extremely heterogeneous and characterized by sharp contrasts. Inequality is determined by the specifics of each region, with historical specialization, special geographical and demographic status. Territorial disparities are largely dictated by uneven distribution of capital, material and labor resources. Russian regional economies need a radical increase in the efficiency of the use of innovation potential, promotion of scientific research, and an effective system of commercial use of research results. In this regard, it seems necessary to have indicators to evaluate the innovative capacity of the regions of the Russian Federation and its level of use.

We have studied a large reservoir of economic literature of American, European and Russian authors devoted to the subject. That has allowed us to identify the concept of regional innovative capacity and ways of to interpret and measure it. In order to address our general question of the relationship of regional innovative capacity and economic performance, we developed an integral Russian Regional Innovative Capacity Index (RRICI) based on the international experience in the field, and the framework of Regional Innovation Scoreboard (RIS) by European Commission. One of the main advantages of our index is that it is based on standardized data adopted in the official statistical practice in Russia and Europe, which allows for subsequent objective comparison of the results and collation of the effectiveness of regions innovation policy. We used data on eighty regions of the first level of the Russian official region classification for two years, 2009 and 2010. That is 3360 separate values for twenty-one indicators of three sub-indexes of the Russian Regional Innovative Capacity Index (index of social and economic conditions of innovative activity; index of scientific and technical potential; index of quality of innovation policy). Our main result is

that RRICI is significant and positively related to the gross regional product (GRP) per capita that we used as our main economic growth variable. We also note that there is birectional Granger causality between RRICI and GRP per capita.

This paper is structured as follows. In the section 2 we review the literature on the matter. In sections 3 and 4, we study the approaches to the innovative capacity concept and the regional innovation performance in modern Russia. Section 5 is hypothesis statement; section 6 is the specification of methodology: concept, system of indicators of RRICI and its calculation. Finally, in sections 7 and 8 we discuss the empirical results and conclude.

2. Literature Review

Many researchers have tried to measure innovation and investigate its links with economic performance. Many approaches were tested; keen theories have been developed, different research designs, methodologies, datasets were used. General problems of innovation process with relation to economics were considered in works by Schumpeter (1943), Rosenberg (1983), Nelson (1993), Freeman (1995).

Innovations in the form of technological progress have been included in the Solow (1956) model as important input variables in economic growth. Consequently many researchers followed his paths and wrote on innovations from the perspective of economic performance. Among them: Grilliches (1990), Scherer (1999), Freeman (2002), Friedman (2005), Braga, Couto, Natario and Tiago (2011) and others. Mankew, Romer and Weil (1992) examined this model and also considered technologies but from somewhat another angle. Romer (1991) mentioned technology (R&D expenditures) as an input to his endogenous model (in this case it is treated as a nonconventional good). Another well-known scholar Porter (2003) made a significant contribution to this discussion but in the regional context using a cluster approach. We also studied publications that reflected international views,

experience and comparisons for this issue: Bassanini, Scarpetta and Visco (2000), Ollson (2000), etc. Besides we are specifically interested in Russian economic literature on the matter, among such we can list: Tarutin (2008), Pochukaeva (2001) and Ilishev (2007).

For our research it is necessary to define the concept of innovative capacity, which is also broadly studied. There are multiple definitions and ways of measuring this notion which we will discuss and analyze in the appropriate section of this paper. Such studies can be divided by the ideas of what does innovative capacity (in some cases called "innovative potential" or "innovativeness") concept actually stands for or by the scale considered in the theory (national, regional, firm). For the sake of this part of our research, we decided to list publications relying on the scale principle. At the national level innovative capacity is studied in the following publications Furman, Porter and Stern (2002), Bilbao-Osorio and Rodríguez-Pose (2004), Hu and Mathews (2005), Crescenzi, Rodríguez-Pose and Storper (2007) etc. Authoritative rankings are compiled based on the frameworks and indexes proposed by Porter and Stern (2003) and Lopez-Claros and Mata (2010). Regional level of innovative capacity was the main objective of such publications as Suarez-Villa (1990), Frenkel and Shefer (1996), Morgan (1997), Ceh (2001), Acs, Anselin and Varga (2002), Furtec, Lee, Walshok and Windham (2002), Mairesse and Mohnen (2013) and many others. We did not concentrate on the works devoted to the firm-level of the term but we feel that it is important to mention Lawson and Lorenz (1999) because of their interpretation of how organization and regional levels are linked, Rogers (1998) because of clear definitions of innovation related terms, and McGraph (2001) because of managerial oversight. There are distinctive amounts of Russian scholar literature on the issues of both national and regional innovative capacity: Moskvina (2005), Shevchenko, Shlexandrova and Yakin (2006), Ushvitsky and Tumanyan (2008), Orekhovsky (2007), Zaenchkovsky (2007).

Several publications reflect the importance of geographical factors and how it corresponds with innovation and economy, as a consequence underlying the accent on the regional economies. Rallet and Torre (2000) and Dankbaar (2007) shows that despite globalization process, geographical proximity plays very important role for the innovation activity; Howells (2002) specifies important aspects of knowledge spillovers among regions.

Cannot be ignored are the critical and largely cited publications on national innovation systems: Lundvall (1992), Jaffe, Henderson and Trajtenberg (1993), Nelson (1993), Freeman (1995), and affiliated but separate studies of regional innovation systems: Cooke (1992), Henderson (2000), Asheim (2007), Fritsch and Slavchev (2007) and others. These works emphasize the interpretation of innovative capacities as a combination or a set of quantitative and qualitative inputs, and also specifies importance of existence of appropriate innovation policies.

Also noteworthy are the works devoted to patents, its aspects and patent-law, because patents are widely used as the main output to innovative activity and sometimes are employed as the measure for innovative capacity. In this account, besides those that have already been mentioned above, are Gilbert and Shapiro (1990), Klemperer (1990), Trajtenberg (1990), Griliches (1990), Jaffe and Lerner (2006), Kortum and Lerner (1999), Cloodt and Hagerdoorn (2003).

In the context of recent trends in the innovation economics discussion, we have gone through literature on how recent global economic crisis affected region's innovative capacities: Freeman (1984), Perez (2002), Paunov (2011), Archibugi, Filippetti and Frenz (2013).

The realities of the economy of the Russian Federation and its regions is best reflected in the publications of Russian authors such as Gokhberg et al. (2011), Shehovtseva (2010), Fatkhudinov (2005), Odotyuk (2009), Klavdienko (2006), etc.

3. Concept of Regional Innovative Capacity

In modern conditions, the defining characteristic of the level and prospects of development of the region is its competitive ability, and those regions can be competitive that can generate innovative ideas and implement them in production. Regions competitive ability largely determines their potential to innovate. Analysis of the value of innovative capacity and factors of its development in the regions of the Russian Federation will identify regularities of regional development and nationwide trends.

To determine the rational dimensions of innovative capacity with well-functioning macro-economic system should have, as well as to obtain correct estimates of the potential impact of innovation economic performance, it is necessary to have a clear definition of the concept of innovative capacity and its composition. For this purpose it is necessary to clearly define all the essential determinants of its dynamics. In international practice, there are varieties of methodological approaches to the assessment of the innovative capacity of the region. However, examination of the different approaches to the definition of innovative capacity of the region, factors that determine its value and indicators that measure its level shows the lack of unity in the basic definitions of innovative capacity. This aspect is important because in the development of the strategic decisions of regional policy, you need to have indicators to evaluate the innovative capacity of the region and its level of use. Therefore in spite of their importance, theoretical approaches to the concept are not sufficiently developed. It can be said that there is no single internationally and commonly accepted definition of innovative capacity.

Many researchers present a number of patents associated with the certain region as a simple reflection of innovative capacity. Earlier adaptors of this approach are Pred (1966) and Ullman (1958). In these publications urban growth was strongly associated with the number of patents and inventive activity in the metropolitan areas. A perfect example of the scientific publication where the term "regional innovation capacity" directly explained as a rate of patenting activity is Ceh (2001). Using knowledge production function (KPF) framework and the United States Patent and Trademark Office data, Acs et al. (2002) have made a separate research where they treated patents as a measure of innovations at the regional level. Other publications using this approach are Jaffe (1986), Griliches (1990), Boitani and Ciciotti 1990, Beugelsdijk (2007) among others.

Suarez-Villa (1990) treated sum total of patents available for application at any given timeas the innovative capacity of a region's indigenous scientific and technological knowledge base (p. 149). Applying his own unique methodology, the author measures the value of US regions' innovative capacity (he divided country into three regions North-East, Mid-West and Sun-belt) for almost ninety years. According to him regional innovative capacity can be thought of as an index of previous performance and is equivalent to the number of new patents awarded in that year (of age zero or less than one) plus the total of patents whose legal life terms are still in effect - ages one through seventeen which was valid in the US for 1861–1994 (Suarez-Villa, 1990). Therefore in any given year t, under patenting approach, formula of innovative capacity would be defined as follows:

$$\boldsymbol{C_t = \sum_{i=t}^{t-17} \rho_i} \qquad \textbf{(1)}$$

Where C_t stands for regional innovative capacity index, ρ_i for number of patents granted in year i. Unfortunately there are multiple downfalls to patent laws in Russia, which will be discussed in the next section of this paper. That is why using only patent related data as the

complete and full reflection of what is called regional innovative capacity seems to be not applicable at present for the Russian case.

Some equalized the innovation potential as investments in research and development (R&D). For instance the Trajtenberg (1990) case-study uses R&D expenditures as the main defining input indicator for innovative process. The author also imposes that a patent weighted by citation is a relatively good indicator of innovation at the firm level. Bilbao-Osorio and Rodríguez-Pose (2004) obtained similar principal and separately considered R&D investments in private and public sectors and its impact on innovations within several European countries. Crescenzi et al. (2007) in their comparative analyses of Europe-US innovation dynamics added human capital and educational system into one list of major "inputs" to innovations with the R&D expenditures. The same was done in the San-Diego case study (Furtec et al. 2002); regional innovative capacity here was treated as a combination of R&D spendings and human capital. In our view, the use of these indicators is not sufficient to assess the innovative capacity, at least because the number of employees engaged in research and development and R&D expenditures may be greater for low-impact studies, or lower for high performance research, especially considering the high level of bureaucracy among Russian authorities.

Mairesse and Mohnen (2013) proposed to consider regional innovative capacity, or regional "innovativeness" – the term that they prefer to use - as a share of sales of innovative products, services and technologies in the region. This approach seems to be interesting; however, from our point of view, this completely neglects all other important indicators.

Asheim (2007) in his overview of regional innovation system theories cited Storper in order to identify innovation capacity as "the economic logic by which milieu fosters

innovation." Hu and Mathews (2005) stated that capacity to innovate is not concerned with the single aspect of innovation performance but with the sources of its sustainability. These studies consider innovative capacity as a combination of separate quantitative and qualitative indicators. Among them are Furman et al. (2002); they have developed a framework for the concept of national innovation capacity (NIC) - "national innovative capacity is the ability of a country to produce and commercialize flow of innovative technology over the long term" (p.2). Authors suggest that national innovative capacity consists of two important factors: strength of a nation's common innovation infrastructure and the environment for innovation in a nation's industrial clusters. Besides it depends on the strength of links between these two factors. Porter and Stern (2001) published a great chapter where they used this framework to analyze the NIC performance of OECD economies by applying an integral method to obtain Innovative Capacity Index. Although this theory seems to be one of the well-known in the innovation-economy discussion, we cannot apply it as it is targeted on the national scale.

Russian economist Orekhovsky (2007) interprets the considered concept as "a system of factors and conditions necessary for the implementation of the innovation process." Zaenchkovsky (2007) treats the innovative capacity as the amount of economic resources that society may use for the development at any given moment.

The suite of indicators, as the approach, is supported by various prestigious international organizations that develop their own systems of factors that reflect the level of innovative capacity of the country. On this basis, the ratings are constructed; they allow to compare the innovative potential and, in some cases, the performance of nations in this area. The World Economic Forum used National Innovative Capacity Index created on the Porter and Stern (2001) framework. The basis of its construction is the ranking of countries

by number of patents registered per ten thousand people population. Initially aggregated NIC Index consisted of three major sub-indexes; according to authors each represented a generic component of innovative capacity: innovation policy, cluster innovation environment and linkage sub-index. Authors included twenty-four separate variables into construction of the index. Later, several sub-indexes have been added to the system (company operations, strategy, science and engineering manpower). Overall, the Index covered seventy-eight countries.

Different from NIC Index is Innovation Index that is included in Bloomberg Innovation Quotient and conducted annually for 200 countries. It consists of seven factors: R&D intensity, productivity, high-tech density, research concentration, manufacture capability, tertiary efficiency and patent activity. Factors got their own weights to them obtained through experts' evaluations.

Another is Global Innovation Index (GII) which is developed by INSEAD with participation of the Confederation of Indian Industries. GII model includes 141 countries and contains about 100 factors. Like the index above, GII consists of seven major factors: institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs. These factors divided on two major sub-indexes: innovation input and innovation output. Therefore innovation efficiency is presented as the ratio of the output sub-index over the input sub-index. European Commission also has an instrument to reflect EU27 Member States innovation capacities – Summary Innovation Index (SII), part of the Innovation Union Scoreboard. The SII is a cumulative figure of twenty-five indicators (also clearly sectioned on input and output) taken from the Eurostat data. The main advantage of this index is that it is not overloaded with indicators and does not include subjective factors based on surveys

or expert evaluations like similar benchmarks. Another important plus of the SII is that its data and data structure have a direct analogue in official Russian statistics databases (Rosstat), which means this framework can be easily computed for Russia.

Apart from these there are many other estimates: Innovation Capacity Index (ICI) (Lopez-Claros, 2010) (according to 2011 data ICI is calculated for 131 countries and includes more than sixty different factors); OECD Science, Technology and Industry scoreboard and NESTA Innovation Index. We think that most of these scorecards focused mainly on the evaluation of innovative capacity of developed countries. In this regard, they do not take into account a number of factors specific to emerging markets, like the level of development of innovative legislation, the priorities of the public authorities on innovation development, etc.

Besides being constructed out of a set of indicators, indexes listed above have another common feature - all of them measured innovation at the national level. It is clear that although these indexes are likely to have similar features and approaches on the national and regional levels, they would also have quite a considerable amount of differences. Porter (2003) mentions how studies of economic development tend to concentrate on the national level for their analysis. In this context he outlines that “many of the essential determinants of economic performance are to be found at the regional level.” The same could be said about innovation capacity. First it is the regional aspect, difference in scale, presence and depth of statistical information, and of course innovation system and policies aspect. Review showed that regional level does not have the same variety and amount of commonly used indexes to measure innovation and innovative capacities. In the US, some states have got their own tools of such kind, among them: the Oregon Innovation Index, the Mississippi Innovation Index, the Index of the Massachusetts Innovation Economy,

etc. Russia cannot yet boast of comparable examples; we found only one reliable and applicable in this context source – rating of innovative potential of Russian regions, section in annual "Rating of investment attractiveness of Russian regions" by national rating agency "Expert RA." The drawback of this rating is that it is also constructed based mainly on expert evaluation. We believe that in the context of the global innovation society, more attention should be paid to the issue. On the foundation of annual European Commission Innovation Union Scoreboard, Regional Innovation Scoreboard (RIS) provides a comparative assessment of 190 regions for EU Member States. The indicators used for comparisons characterize the potential impact of science, technology and innovation (staff funding for R&D, patent activity, export and import of technology, costs of innovation, implementation of technological and non-technological innovations, etc.). Just like in case of the Union Scoreboard this frame can be adapted for use in Russia where the standards of statistics in the field of science, technology and innovation meet European criteria formed by Eurostat. Moreover, we think that structure of indicators of RIS can be used for our research. All components, details and methodology will be reviewed in the corresponding section of this paper.

Summarizing, we can say that in our opinion innovative capacity should be considered as a set of specific elements that allows the innovation process. Or, in other words it is the ability of the system to the transformation of the actual order of things into a new state in order to meet existing or emerging needs. More generally innovative potential is the ability to change, improve and progress.

4. Regional Innovation Performance in Modern Russia

Economic and social conditions in different regions of Russia are extremely heterogeneous and characterized by sharp contrasts. Inequality is determined by the

specifics of each region, with historical specialization and special geographical and demographic status. Territorial disparities are largely dictated by uneven distribution of capital and material and labor resources.

Differentiation of regions in terms of development was down during in the years of Soviet Union. The collapse of the Soviet Union in 1991 has exacerbated the situation. Through the transition period 1990-1998 industrial production has fallen an average of almost 80% in the worst performing regions but declined for about 30% in the top ten groups of regions (Ahrend, 2002).

The recent global financial crisis has contributed to the aggravation of all the major issues, including regional ones. Objectively assessing the situation, it can be said that the crisis increased the gap between the more developed and problematic regions, reduced business activity and grown unemployment (Akaev, 2011). Modern analytics differ about innovation during a crisis. In the literature, the works of Freeman (1984), Tylecote (1992) and Perez (2002) represented the relation of innovation and economy in perspective of business cycles. Archibugi et al. (2013, p.304) described the polarity of opinions on this topic: “according to the first, innovation is cyclical and therefore firms tend to reduce their innovation efforts during the downswing of the economy, while according to the second, it is instead counter-cyclical and claims that recessions are a fertile environment for firms to innovate.” A Russian economist Shehovtseva (2010) believes that there are some positive sides of the recent crisis - "big companies can buy interesting innovation projects for the best price ever." Other Russian expert, Akaev (2011) noted that the crisis-related devaluation of the ruble against the currency basket to some extent contributed to the development of innovative production in Russia. The devaluation of the ruble increased import prices, which pushed a small share of domestic manufacturers to produce products

with high intellectual component and higher benefit. Indirectly, such views were confirmed by recent statistical information. Dow Jones VentureSource (2013) report on venture capital financing has shown that there is a boom of venture capital investments in the high technology sector in Russia. Moreover, at the end of 2012 Russia ranked 4th in Europe in terms of investments in high-tech industries. Analysts assess this growth as "amazing." In 2006, according to a VentureSource study, investment in high-tech sector in Russia amounted to only 5 million euros, but in 2012, the same indicator equals to 236.55 million euros. That is, in the last six years, the volume of investments increased almost 50 times.

It is clear that a decisive role in the regulation of innovation in the country and the region belongs to the government. The state creates the conditions and regulations for innovation activities. At the regional level the programs improving competitive potential of the region's priority industries manifest innovation policy. These industries attract private investors to implement innovation and the formation of economic mode-stimulating innovative activity. In a number of regions based on federal law, regional target innovative programs and concepts developing innovation are designed. Regional venture capital funds, whose main task is to support small enterprises in scientific and technical spheres, were established by the initiative of the Ministry of Economic Development and Trade. These funds are formed as follows: 25% of the funds are allocated from the federal budget, 25% - from the regional budget, 50% - private investment, which should attract management companies. State support for the regions' innovation activities is in the form of financial assistance, provision of different types of benefits, creation of investment environment, and support of innovative programs and projects.

It should be noted that a number of problems related to the formation and development of regional innovation mechanisms remains unresolved. Ushvitsky and

Tumanyan (2008) stated that the process of creating an innovation economy, "is fragmented and largely sectoral in its nature." Most of the regions, with the exception of a few that are concentrated in the Central Federal District, are characterized by a low level of innovation. In many ways, the situation is due to the underdevelopment of the market infrastructure. Successful innovation development process requires the so-called innovations intermediaries - professionals engaged in promotion of innovations in the markets. Among them are innovation managers specializing in the commercialization of scientific research, and innovation brokers who forms the demand for innovative products and promotes it in the markets. Obviously, the market of innovations intermediaries in most regions is completely undeveloped. In addition, as noted in Balatsky and Raptovsky (2007) "complexity of companies transition producing new products is due to the narrowness of the Russian regional markets and the inability to compensate the higher costs by the increased scale of production" (p. 4). Analysis of the process of introducing innovative developments to production in the region, shows that a number of difficulties arise at its early stages. A problem for the creators of innovation is to find the company to produce it. Major obstacles in the implementation of innovations in production occur because of bureaucratic barriers on stage of coordination with different regulatory bodies. The process of agreeing is unreasonably long. As a result, not all companies can overcome this bureaucratic pressure. For instance The World Economic Forum stated that corruption still is on the biggest challenges for businesses in Russia (WEF Scenarios for the Russian Federation, 2013, p. 18).

Beyond that, there is an imbalance between consumption and production of high-tech products in the regions. This is due to the predominance of using imported advanced equipment and technology. Innovative development of regions is also constrained by the low technological level of production, which is characterized by high depreciation of fixed assets.

Depreciation ratio of such funds in some regions reaches up to 50%. In developed countries, however, a complete upgrade of the fixed capital occurs in 12-15 years. The tendency for remote regions is the "brain drain" displayed in the form of out-migration of skilled personnel in the regions with a higher standard of living. People migrate not only to other parts of the country but also abroad. According to the Levada Center (Levada Center, Public Opinion, 2012, p. 150) the number of professionals who seriously considering leaving Russia exceeds 50% in particular segments.

Patents are special innovation resources. Several studies, Klemperer (1990), Gilbert and Shapiro (1990) showed that strong patent laws in the country raise the number of innovations produced. According to Portnova (1997, p. 5), Soviet Union did not have a proper system of patent protection; worldwide patent rights tradition was replaced a system of “collective ownership of certified inventions protected by inventors certificate of authorship.” Therefore any Soviet organization could use an invention without its author permission. “Although the Patent Law of the Russian Federation, adopted in September of 1992, conforms to international standards of patent legislation, remnants of Soviet practices still manifest themselves in the day-to-day practice experience of foreign investors in Russia” (p. 5). Inflow dynamic of patent applications and the issuance of security documents by region is also ambiguous. In some regions, the number of patents granted increases, in others it is reduced. The level of implementation of granted patents is consistently low. Thus, Orekhovsky notes that, "the total number of implemented registered patents is less than 2%, this means a serious problem” (Orekhovsky, 2007, p. 2).

Thus, a number of reasons and factors limit the regions innovations development. Factors impeding the development of innovations in regions, in our view, can be divided into the following groups: organizational, economic, financial and legal.

The organizational factors include:

- Low level of consulting services in the field of innovations;
- Low level of organizational and cooperation links within the region;
- Lack of experience of cooperation between regional authorities and research organizations;
- The gap between regional innovation and production sectors;
- Lack of skills in terms of commercialization of R&D products;
- Inefficient regional system of training and retraining in the field of innovation;
- Positive experiences of innovation in some regions is not used by other regions.

The economic factors:

- Excess tax administration;
- Inadequate tax law regarding the stimulation of innovation;
- The bureaucratization of economic management in the regions and a large number of regulatory authorities;
- Lack of professionals in the fields of marketing of innovation, and formation and promotion of markets for high-tech products;
- Low level of innovation risk insurance;
- Ignorance of the role of human and intellectual capital;
- Lack of producers motivation to implement innovations;
- Low technological level of production;
- High degree of depreciation of fixed assets;
- Low level of implementation of granted patents.

The financial factors may include:

- Limited regional budgets and resources devoted to innovation development;

- High interest rates - disadvantageous loans;
- High level of investment risk;
- The long period of return on investment;
- Lack of a regional private capital in the innovation economy of the regions;
- Lack of own funds in enterprises.

The legal barriers to innovative development of the regions include:

- Inadequate legal framework for innovation;
- Undeveloped legal framework for the growth of intellectual property market.

Modern Russia faces the task of forming a multi-polar model of spatial development on the basis of available natural, intellectual, industrial, scientific and technological potential, creation of regional points of growth, competitiveness and modernization. In these circumstances a key goal of the state innovation policy should be sustainable balanced economic development of each region. Also it needs strengthening its innovative orientation, identification, support of competitive advantage, and stimulating the creation, use and promotion of competitive products and services, increasing the efficiency of interaction between state and federal governments.

According to Gokhberg and Kuznetsova (2011), in this regard, of particular relevance are studies of regional innovation systems, which form together the innovative capacity of the national economy in general, and regional innovation policy. Thus, assessing the role of innovation factors in the economic growth of each region will allow a more informed approach to the selection and adjustment of national and regional scientific and technological priorities with high innovation and commercial potential, taking into account the current economic, scientific and technological specialization areas.

The formation and development of innovations mechanisms and effective innovation policy, with all the features inherent in particular regions, can provide the growth in regional economies. The result of innovation development of the regions should be: the strengthening of the economic base; the effective use of all material, labor and financial resources of the region, meeting the needs of the domestic market; the reduction of differences in socioeconomic development.

5. Problem Statement: Hypothesis

Our hypothesis partially builds upon the aspects of knowledge-based growth theory and on the concept of innovative capacity and its measurement. Schumpeter (1943) was the first economists to actually use the term "innovations" to pursue the idea of how progress drives economic development; moreover he argued that innovations lies behind any economic change. Throughout human history scientific and technological progress has been one of the most important economic transformation composes. Landes (1998), among other information, provides simple illustrative example of the invention of eye glasses, which literally has increased in decades' time when craftsmen were able to engage in production; there are thousands of such examples. The Solow (1956) highlights the great value of innovations in the function of economic growth. Actual knowledge driven growth was endogenously represented in the Romer (1990). His model shows how the technological progress drives the overall economic performance. Same was also developed in Porter (1990), where he theorized on reasons behind national competitive advantages. Author presumes that country's competitive ability relies on the industry innovative capacity. Suarez-Villa (1993) states "scientific and technological inventions are now thought to be among the most important root causes of socioeconomic change" (p. 1). Lopez-Claros (2010) agrees with such notion, stating "Economic output is no longer just a function of

capital and labor but, increasingly, of knowledge and the acquisition of new knowledge" (p. 7). Keeping in mind this acquisition let's get to the other part of the equation.

In the previous section of this paper we reviewed different approaches to the concept of innovation capacity. We concluded stating that the effective use of innovative potential makes possible the transition from the hidden opportunities to obvious reality (from one state to another). Thus, innovative potential is the ability to change, improve and progress. We also mentioned that innovative capacity may be considered as a set of specific elements that allows the innovation process.

Taking all the above into account we have the ground to ask: is it the case to suggest that the greater innovative capacity leads to the economic growth. Therefore our hypothesis is:

Regional innovation capacity positively relates to the regional economic growth.

If this hypothesis is confirmed we would want to perform a test to treat the causality question, as follows:

Does the greater regional innovation capacity causes regional economic growth, or vice versa?

In order to address these questions for the Russian we used integral approach to construct Russian Regional Innovative Capacity Index (RRICI) which is based on the framework of Regional Innovation Scoreboard. Relevant methodology, statistical methods and data description are presented in the next section of this paper.

6. Russian Regional Innovative Capacity Index (RRICI)

Researchers employed various methods to measure innovative capacity. The review of the economic literature shows that regional, "innovative capacity" category is seen by many in terms of resource approach. Our research takes into account the international

experience in this area, mainly the methods adopted by the European Commission for Regional Innovation Scoreboard. Therefore we have developed Russian Regional Innovative Capacity Index (RRICI). RRICI is composed of three sub-indexes, respectively, reflecting the socio-economic conditions of innovation (ISEC), scientific and technical potential (ISTP) and the quality of innovation policy (IQIP), that in turn, integrate specific indicators that reveal different aspects of the phenomenon of innovative capacity.

Central to the methodology of the measurements of RRICI is a system of indicators: determination of the composition, content and methods of their calculation, the identification of the relationships between them and systematization. Our approach includes twenty one basic indicators (relative and specific), grouped under the thematic blocks. Complete list of indicators with data sources is presented in Table 1 (you can find a detailed definition of the indicators in the Appendix E) . Each thematic block respectively describes: the socio-economic conditions of innovation (macroeconomic indicators, the educational potential of the population, the level of development of the information society); the scientific and technical potential (human and financial resources of science, publication and patent activity, trade, technology) and the quality of the regional innovation policy (legal and regulatory framework and organizational support for innovation policy, the cost of the consolidated budget of the region in support of science and innovation). The proposed system is comparable with indicators of science, technology and innovation, applicable in the Russian government statistics, and in the practice of the other countries and international organizations (OECD, Eurostat, etc.). In addition, the composition of integrated indicators is used in the similar developments of the European Commission (Regional Innovation Scoreboard). This provides the opportunity for inter-regional analysis

and comparative assessments of the level of innovative development of Russian regions and regions of foreign countries for comparable indicators.

Along with "innovative capacity" term, number of studies examines the term of regional "innovative activity", in our opinion these concepts have significant differences. Category of regional "innovative activity" must be viewed in terms of real innovation in production and real effect. In other words, the innovation potential of the region characterizes the potential for innovation – that is input, and innovation activity - innovation output. Innovation activity, in our view, characterizes the return on innovative potential of the region. That is why in our opinion, it is necessary to distinguish between indicators of the value of the innovative capacity of the region (baseline - inputs), and indicators of effectiveness (efficacy) of use of innovative potential, that is, the innovation activity in the region (result indicators - output). Therefore, since the main issue of our analysis is the regional innovative capacity we do not include the output variables from RIS into our system of indicators (in RIS those are under the section "regions innovative activity") and as a result such "output" factors are not reflected in RRICI.

Calculation of the indexes (sub-indexes) for each block forms a comprehensive evaluation of the integrated innovation capacity index of subjects of the Russian Federation. The main property of this approach is that the low value of index estimated according to one block of parameters can be compensated by another (highly rated) to allow for the better capacity of the region around the selected set of parameters.

The procedure for calculating the indexes is the following sequence of actions. The **first stage** analyzes the composition indicators proposed for inclusion in certain case blocks. The semantic content of each indicator should characterize positive phenomenon or process, i.e. higher values of the index must match the positive dynamics of the process and

Table 1: The system of indicators Russian Regional Innovation Capacity Index

#	Indicator	Data source
1.	**Index of social and economic conditions of the regions (ISEC)**	
1.1.	**Macroeconomic indicators**	
1.1.1.	Gross regional product per worker in the economy of the region (the ratio of average annual GRP to employment in the economy of the region)	Rosstat, CBSD
1.1.2.	Gross regional product to the cost of fixed assets	Rosstat, CBSD
1.1.3.	Share of employment in high-tech, high-level and mid-level industrial sectors in total employment in the economy of the region	Rosstat, CBSD
1.1.4.	Share of employment in knowledge-intensive service industries in total employment in the economy of the region	Rosstat, CBSD
1.2.	**Educational potential of the population**	
1.2.1.	Share of the population aged 25-64 with tertiary and post-graduate professional education in the total population in this age group	Rosstat, Survey on employement
1.2.2.	Number of students in educational institutions of higher education per 10 000 population	Rosstat, form #VPO-1, demographic statistic data
1.3.	**Level of development of the information society**	
1.3.1.	Share of organizations that use broadband access to the Internet, in the total number of organizations	Rosstat, form #3-inform
1.3.2.	Share of the population with access to the Internet in households, in the number of respondents aged 18-74	SRU HSE & FOM, Georating survey
2.	**Index of scientific and technical potential of regions (ISTP)**	
2.1.	**Funding for research and development**	
2.1.1.	Gross domestic expenditure on research and development as a percentage of the GRP	Rosstat, Form #2-science
2.1.2.	Gross domestic expenditure on research and development per researcher	Rosstat, Form #2-science
2.1.3.	Share of the organizations of the business sector in domestic expenditure on research and development	Rosstat, Form #2-science
2.1.4.	Ratio of the average monthly wage of employees engaged in research and development, to the average monthly salary in the region	Rosstat, Form #2-science; CBSD
2.2.	**Personnel of science**	
2.2.1.	Share of personnel engaged in research and development out of the total number of employed in the economy of the region	Rosstat, Form #2-science; CBSD

2.2.2.	Share of persons aged under 39 years in the number of researchers	Rosstat, Form #2-science
2.2.3.	Share of persons with an academic degree in the number of researchers	Rosstat, Form #2-science
2.3.	**Effectiveness of research and development**	
2.3.1.	Number of articles published in reviewed journals, indexed by RSCI, per 10 researchers	RSCI, Rosstat
2.3.2.	Number of patent applications for inventions filed with Rospatent National applicants per million economically active people in the region	Rospatent; Rosstat
2.3.3.	Number of advanced production technologies developed in the region, per million economically active people in the region	Rosstat, Form #1-technology
2.3.4.	Ratio of revenues from technology exports to GRP (per 1 thousand rubles. GRP)	Rosstat, Form #1-license
3.	**Index of quality of innovation policy of regions (IQIP)**	
3.1.	**Expenses of consolidated budget**	
3.1.1.	Share of the budget of the subject of the Russian Federation and local budgets in domestic expenditure on research and development	Rosstat, Form #2-science
3.1.2.	Share of the budget of the subject of the Russian Federation and local budgets in the overall costs of technological innovation	Rosstat, Form #4-innovation

contribute to the growth of the index. Increasing the value of the indicator should mean improvement of observed phenomenon or process. In order to ensure the stability of the model and to avoid its "overload" with an excessive number of indicators, the analysis of correlations between parameters within each theme block is supposed to be produced. If the correlation coefficient between the two indicates their close relationship, the decision is to drop one of the indicators.

At the **second stage**, values of the each "theme" block are computed to get values of the three indexes (sub-indexes) that are included in the integral index, including:

- Index of social and economic conditions of innovative activity of Russian region (**ISEC**);

• Index of scientific and technical potential of Russian regions (**ISTP**);

• Index of quality of innovation policy of Russian regions (**IQIP**);

Uniformity and comparability of the selected parameters is achieved by switching from the absolute values to the weighted (normalized) values. To smooth the influence of extreme values of parameters on the final result, they are transformed by taking the root:

$$\widetilde{x}_i^r = \sqrt[s]{X_i^r} \qquad \textbf{(2)}$$

Where $\tilde{x}_i^r$ stands for transformed value of i-indicator of r-region in single theme block, x_i^r for original value of i-indicator of r-region in single theme block, S for parameter that determines the degree of transformation. The value of S is determined by the nature of the distribution of the data. If parameter value lies within clearly defined bounds (e.g., 0 to 100%) and its distribution is symmetric, then S is assumed to be one and, therefore, the transformation of the indicator is performed. If the index value has no upper limit, but it is asymmetrical distribution (usual in such cases most regions have the lowest index value and only a small number of regions - high), then the value S takes a value greater than 1, depending on the degree of asymmetry.

Then we define the normalized values of each region as a ratio of the difference between the value of the indicator in the region and the minimum value of the indicator for all regions, to the difference between the maximum and minimum values of this indicator for all regions (including formula (2) transformation). Thus, the range of the normalized values of the indicators is limited between 0 (for the region with the minimum value of the indicator) and 1 (in the region with the maximum value of this indicator). The values of sub-indexes (values of each "theme" block) are calculated as the arithmetic mean of the

normalized values of the indicators. In this case the indicators included in a theme block are of equal importance.

Calculating formula of the regional sub-indexes of each theme block can be represented as follows (Hollanders, Loschky and Tarantola, 2009):

$$\boldsymbol{I_r = \frac{\sum_{n-1}^{n} \frac{\tilde{x}_i^r - \tilde{x}_i^{min}}{\tilde{x}_i^{max} - \tilde{x}_i^{min}}}{n}} \quad \textbf{(3)}$$

Where I_r stands for index of r-region in terms of a single theme block, n for number of indicators in the single theme block, $\tilde{x}_i^r$ for i-indicator of r-region in single theme block, $\tilde{x}_i^{min}$ for the minimum value of i-indicator in single theme block, $\tilde{x}_i^{max}$ for the maximum value of i-indicator in single theme block.

On the **third stage**, the calculation of total RRICI for each subject of the Russian Federation is performed. RRICI is defined as the arithmetic mean of the sub-indexes with the weights, levels the contribution of theme blocks in the final assessment. The values of weights are assumed to be sub-indexes of the share of the number of indicators used in the calculation of each sub-index, the total number of selected indicators. Thus, the sum of weights coefficients of sub-indexes is equal to 1.

$$\boldsymbol{RRICI_r = \frac{\frac{n_1}{N} * ISEC_r + \frac{n_2}{N} * ISTP_r + \frac{n_3}{N} * IQIP_r}{3}} \quad \textbf{(4)}$$

Where RRICI stands for Russian Regional Innovation Capacity Index for the r-region, $ISEC_r$ is the index of social and economic conditions of innovative activity for the r^{th}-region, n_1 for number of indicators in the SEC block, $ISTP_r$ is the index of scientific and technical potential for the r^{th}-region, n_2 for number of indicators in the STP block, $IQIP_r$ is the index of quality of

innovation policy for r^{th}-region, n_3 for number of indicators in the QIP block, N for total numbers of indicators in the system ($N=n_1+n_2+n_3$).

With respect to the formed system, the formula is:

$$\boldsymbol{RRICI_r = \frac{\frac{8}{21}*ISEC_r+\frac{11}{21}*ISTP_r+\frac{2}{21}*IQIP_r}{3}} \quad \textbf{(5)}$$

The Index values of the Russian Federal subjects vary over time. However, it should be borne in mind that the change in value of the Index for individual region is due not only to the dynamics of values of the indicators in the region, but also due to the changes in other regions, because the algorithm used for normalization involves comparing the values of the indicators in the region with the minimum and maximum values in the whole set of regions evaluated. Therefore, the index values may be used for a comparison between the regions. All calculated index values have been rounded to four decimal places.

In addition to the above steps we have ranked the regions in descending order of magnitude of RRICI and sub-indexes. Such ranking can be interesting for the regions evaluations and comparisons, although it is not the purpose of this study that is why we included the ranks in the Appendices (A, B, C and D).Estimates of a RRICI and sub-indexes were performed according to the method adopted for the two periods of 2009 and 2010. The objects of study are all first-level subjects of the Russian Federation. The data in regions are given without information on three autonomous areas due to the data limitations.

7. Empirical Analysis

As a control variables in our model we are using: unemployment rate by regions of the Russian Federation on average per year and resident population of the regions of the Russian Federation. As economic output variables we decided to use values of GRP per capita. Literature review showed that scholar applied many different figures to measure

economic performance. In our opinion the best one for our evaluation is the gross regional product (**GRP**); measure that is used in the official Russian statistics (since we only have two year comparison we cannot use growth rate of GRP per capita). GRP is the general measure of economic activity in the region, which reflects the process of producing goods and services for final use.

Considering the number of observations obtained we decided to use the following model to test the relationship between RRICI and Russian regions economic performance separately for the years 2009 and 2010:

$$\boldsymbol{L(GRPpc_{it}) = \beta_1 + \beta_2 RRICI_{it} + \beta_3 UR_{it} + \beta_4 RP_{it} + U_{it}} \qquad \textbf{(6)}$$

Where L stands for natural logarithm, GRPpc for gross regional product per capita, RRICIC for Russian Regional Innovative Capacity Index, UR for unemployment rate on average per year, RP is the i^{th} population in time t, β_1 is a constant (intercept point), otherβ's are the coefficients of corresponding independent variables, U is the error term, i is i^{th} region and t is the time period. The parameters estimates for 2009 and 2010 are presented in the Tables 2 and 3 respectively. The regression model both for 2009 and 2010 appears to be significant (Prob > F = 0.000). The R-square, coefficient of determination is 0.4091 in 2009, and 0.3661 in 2010, which is approximately 40% and 36% of the variance.

Table 2: Parameters estimates (2009)

Parameters	Coefficient	Std. Error	t-Statistic
β_1	11.28874*	0.29997	37.66
β_2	10.67915*	3.02344	3.53
β_3	-0.03104*	0.00819	-3.79
β_4	-2.42705	3.91718	-0.62

* Significant at 1%.

In 2009 relationship of the logarithm of GRP per capita and RRICI coefficient tells us that if RRICI increases by one unit, GRP per capita would increase by approximately 10.7% (significant at 1%). The effect of unemployment on GRP per capita is also significant at 1% and appeared expectedly negative. Resident population turned out to be insignificant (P >|t| = 0.537).

Table 3: Parameter estimates (2010)

Variable	Coefficient	Std. Error	t-Statistic
β_1	11.65364*	0.31379	37.15
β_2	7.42192*	3.08438	2.41
β_3	-0.03130*	0.00836	-3.74
β_4	-7.51991	4.07673	-0.18

* Significant at 1

Very close results can be seen in 2010. Coefficient of RRICI is equal to 7.42192 (significant at 1%), which means that one unit increase of RRICI, according to 2010 data, is associated with 7.4% increase in GRP per capita. Similar to 2009 the effect of unemployment on GRP per capita is negative (significant at 1%) and region population is insignificant (P >|t| = 0.854). Overall it can be said that our first hypothesis can be confirmed and that the effect of RRICI on economic growth is noticeable.

To address causality question we performed Granger causality test. Causality can be described as the relationship between cause and effect. Basically, the term "causality" suggests a cause and effect relationship between two sets of variables. The regression formulation of Granger causality states that a variable X is the cause of another variable Y if the past values of X are helpful in predicting the future values of Y (Granger, 1988).

For our study consider the following regression equations:

$$\boldsymbol{L(GRPpc_{i2010}) = \beta_1 + \beta_2 L(GRPpc_{i2009}) + \beta_3 UR_{i2009} + \beta_4 RP_{i2009} + U_{i2009}} \qquad \textbf{(7)}$$

$$\boldsymbol{L(GRPpc_{i2010}) = \beta_1 + \beta_2 L(GRPpc_{i2009}) + \beta_3 UR_{i2009} + \beta_4 RP_{i2009} + \beta_5 RRICI_{i2009} + + U_{i2009}} \quad \textbf{(8)}$$

If the unrestricted equation (8) is a significantly better model than restricted equation (7), we determine RRICI Granger causes L(GRPpc). First, using equations (7) and (8) we tested the "RRICI causing GDP per capita" direction. The null hypothesis here is β_5=0. To test it we obtained both restricted and unrestricted regressions, from which we can construct Granger causality F-test equation (9). Therefore we have:

$$\boldsymbol{F = \frac{(0.00382579 - 0.003652866)/1}{0.003652866/(75)} \approx 3.5504} \quad \textbf{(9)}$$

Critical F-value at the α level of 0.05 ≈ 3.9684 which is greater than F value computed. This means that RRICI does not cause GDP per capita at 5% probability level. However it is significant at 10% probability level, which value is approximately 2.7736. In other words greater value of regional innovative capacity in the form that we obtained in this paper can be the cause of better economic performance.

We also used similar approach and obtained restricted and unrestricted regressions of the following equations to check the other direction "GDP per capita causing RRICI":

$$\boldsymbol{RRICI_{i2010} = \beta_1 + \beta_2 RRICI_{i2009} + \beta_3 UR_{i2009} + \beta_4 RP_{i2009} + U_{i2009}} \quad \textbf{(10)}$$

$$\boldsymbol{RRICI_{i2010} = \beta_1 + \beta_2 RRICI_{i2009} + \beta_3 UR_{i2009} + \beta_4 RP_{i2009} + \beta_5 L(GRPpc_{i2009}) + + U_{i2009}} \quad \textbf{(11)}$$

"GDP per capita causing RRICI" direction F-test:

$$\boldsymbol{F = \frac{(0.274144827 - 0.266897359)/1}{0.266897359/(75)} \approx 2.0365} \quad \textbf{(12)}$$

This result is less than the critical F-value of 0.10 α level. It can be concluded that causation does not work in this direction; therefore GPR per capita does not cause RRICI.

8. Conclusion and Recommendations

The absence of academic consensus on the concept of innovative capacity in its regional focus and how it affects economic performance motivated our interest to the international experience in the field. We developed the Russian Regional Innovative Capacity Index, based on the Regional Innovation Scoreboard (RIS) designed by European Commission, as an aggregated value of twenty-one indicators of three sub-indexes (Index of social and economic conditions of innovative activity; Index of scientific and technical potential; Index of quality of innovation policy) each representing an important section of innovative capacity. RRICI appeared to be a proper instrument that allowed us to test how regional innovative capacity relates to the regional economic output.

One of the angles in which this research contributes to the existing literature is analysis of the data of a specific country: the Russian Federation. Developed Index is constructed out of the statistics on almost every Russian region of the first level of official classification. Besides, this data is entirely comparable with that of the European Union, which gives a prospect for future researches and related comparisons.

Our results suggest that innovative potential is significantly and positively related to the economic performance in Russia. Regression suggests that one unit increase in RRICI is associated with the increase in gross regional product per capita by approximately 10.7% in 2009 and 7.4% in 2010. Also Granger causality test revealed that RRICI may cause GRP per capita at 10% probability level. All the results are consistent with our theoretical considerations.

RRICI and associated with this rating can be continued annually to track the region's performance over the time and to control for the effectiveness of the innovation policy in the region. Moreover, in our opinion, RRICI can be useful as information basis of analysis of innovation development and a starting point for making management decisions aimed at improving the level of innovative development of the regions.

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APPENDICES

APPENDIX A - Russian regional innovation capacity index (RRICI) rating

Regions	2010		2009	
	Rating position	RRICI value	Rating position	RRICI value
Moscow	1	0.1896	1	0.1943
Saint Petesburg	2	0.1843	2	0.1793
Moscow Oblast	3	0.1434	3	0.1366
Nizhny Novgorod Oblast	4	0.1367	6	0.1278
Ulyanovsk Oblast	5	0.1344	10	0.1187
Tomsk Oblast	6	0.1337	5	0.1284
Novosibirsk Oblast	7	0.1285	4	0.1285
Samara Oblast	8	0.1268	8	0.1213
Kaluga Oblast	9	0.1252	9	0.1210
Perm Krai	10	0.1211	14	0.1138
Yaroslavl Oblast	11	0.1207	12	0.1142
Republic of Bashkortostan	12	0.1200	18	0.1081
Tyumen Oblast	13	0.1180	13	0.1142
Murmansk Oblast	14	0.1176	7	0.1236
Republic of Tatarstan	15	0.1171	16	0.1105
Smolensk Oblast	16	0.1168	48	0.0913
Magadan Oblast	17	0.1145	15	0.1110
Chuvash Republic	18	0.1142	36	0.0970
Chelyabinsk Oblast	19	0.1130	24	0.1039
Voronezh Oblast	20	0.1130	26	0.1037
Sverdlovsk Oblast	21	0.1128	20	0.1075
Republic of Mordovia	22	0.1128	49	0.0899
Kaliningrad Oblast	23	0.1115	28	0.1018
Irkutsk Oblast	24	0.1108	17	0.1096
Primorsky Krai	25	0.1098	31	0.1007
Khabarovsk Krai	26	0.1067	29	0.1011
Omsk Oblast	27	0.1062	21	0.1071
Belgorod Oblast	28	0.1053	25	0.1038
Astrahan Oblast	29	0.1034	65	0.0816
Krasnoyarsk Krai	30	0.1029	23	0.1048
Kemerovo Oblast	31	0.1027	43	0.0938
Leningrad Oblast	32	0.1025	35	0.0977
Komi Rebublic	33	0.1023	33	0.0997
Volgograd Oblast	34	0.1023	34	0.0986
Saratov Oblast	35	0.1011	37	0.0970
Orenburg Oblast	36	0.1005	27	0.1019
Rostov Oblast	37	0.0993	30	0.1011
Ivanovo Oblast	38	0.0989	19	0.1076
Novgorod Oblast	39	0.0987	50	0.0882
Oryol Oblast	40	0.0983	40	0.0958
Tver Oblast	41	0.0977	41	0.0951
Republic of Buryatia	42	0.0974	42	0.0944

Vladimir Oblast	43	0.0967	22	0.1057
Krasnodar Krai	44	0.0967	38	0.0967
Udmurt Republic	45	0.0963	47	0.0917
Kamchatka Krai	46	0.0960	32	0.1003
Republic of Korelia	47	0.0958	39	0.0960
Sakhalin Oblast	48	0.0948	11	0.1173
Kursk Oblast	49	0.0945	44	0.0938
Stavropol Krai	50	0.0939	58	0.0851
Kabardino-Balkar Republic	51	0.0916	45	0.0934
Penza Oblast	52	0.0905	53	0.0868
Republic of Dagestan	53	0.0900	52	0.0873
Tula Oblast	54	0.0900	51	0.0874
Arkhangelsk Oblast	55	0.0894	69	0.0782
Vologda Oblast	56	0.0891	54	0.0866
Sakha (Yakutia) Republic	57	0.0885	46	0.0923
Chukotka Autonomous Oblast	58	0.0884	55	0.0865
Kostroma Oblast	59	0.0881	59	0.0843
Republic of North Ossetia-Alania	60	0.0867	60	0.0839
Ryazan Oblast	61	0.0866	67	0.0799
Mari El Republic	62	0.0851	62	0.0831
Altai Krai	63	0.0827	64	0.0827
Karachay-Cherkess Republic	64	0.0823	57	0.0858
Kirov Oblast	65	0.0820	56	0.0862
Tambov Oblast	66	0.0815	63	0.0827
Republic of Adygea	67	0.0797	61	0.0838
Republic of Ingushetia	68	0.0788	68	0.0797
Jewish Autonomous Oblast	69	0.0779	72	0.0766
Republic of Khakassia	70	0.0773	71	0.0773
Bryansk Oblast	71	0.0773	78	0.0667
Kurgan Oblast	72	0.0760	70	0.0777
Amur Oblast	73	0.0746	75	0.0704
Lipetsk Oblast	74	0.0742	66	0.0809
Altai Republic	75	0.0709	73	0.0766
Zabaykalsky Krai	76	0.0708	77	0.0670
Pskov Oblast	77	0.0687	74	0.0733
Tuva Republic	78	0.0665	76	0.0694
Republic of Kalmykia	79	0.0607	79	0.0567
Chechen Republic	80	0.0451	80	0.0439

APPENDIX B - Index of social and economic conditions of innovative activity of Russian regions (ISEC) rating

Regions	2010		2009	
	Rating position	ISEC value	Rating position	ISEC value
Moscow	1	0.7446	1	0.7873
Saint Petesburg	2	0.7100	2	0.6799
Moscow Oblast	3	0.4825	3	0.4754
Samara Oblast	4	0.4820	4	0.4619
Khabarovsk Krai	5	0.4450	12	0.3626
Republic of Tatarstan	6	0.4438	6	0.4248
Tomsk Oblast	7	0.4376	7	0.4138
Tyumen Oblast	8	0.4338	5	0.4581
Kaliningrad Oblast	9	0.4140	8	0.3978
Primorsky Krai	10	0.3984	21	0.3534
Krasnoyarsk Krai	11	0.3920	18	0.3565
Omsk Oblast	12	0.3918	17	0.3569
Kamchatka Krai	13	0.3900	19	0.3539
Nizhny Novgorod Oblast	14	0.3895	10	0.3731
Republic of Bashkortostan	15	0.3845	15	0.3573
Belgorod Oblast	16	0.3830	13	0.3595
Kaluga Oblast	17	0.3829	16	0.3570
Novosibirsk Oblast	18	0.3828	11	0.3710
Magadan Oblast	19	0.3821	37	0.3068
Vladimir Oblast	20	0.3819	23	0.3431
Chelyabinsk Oblast	21	0.3800	20	0.3536
Ulyanovsk Oblast	22	0.3770	26	0.3399
Yaroslavl Oblast	23	0.3763	24	0.3423
Sverdlovsk Oblast	24	0.3750	22	0.3520
Murmansk Oblast	25	0.3726	28	0.3381
Republic of North Ossetia-Alania	26	0.3673	40	0.3013
Perm Krai	27	0.3646	27	0.3388
Leningrad Oblast	28	0.3634	32	0.3179
Rostov Oblast	29	0.3628	14	0.3595
Udmurt Republic	30	0.3548	30	0.3304
Sakhalin Oblast	31	0.3545	9	0.3770
Kemerovo Oblast	32	0.3523	34	0.3168
Chuvash Republic	33	0.3489	33	0.3178
Novgorod Oblast	34	0.3449	29	0.3363
Arkhangelsk Oblast	35	0.3429	35	0.3165
Voronezh Oblast	36	0.3401	39	0.3014
Irkutsk Oblast	37	0.3320	36	0.3134
Saratov Oblast	38	0.3309	31	0.3201
Tula Oblast	39	0.3304	25	0.3423
Republic of Korelia	40	0.3259	43	0.2893
Ryazan Oblast	41	0.3255	41	0.2908

Republic of Mordovia	42	0.3249	53	0.2699
Volgograd Oblast	43	0.3234	45	0.2841
Mari El Republic	44	0.3226	51	0.2728
Republic of Adygea	45	0.3216	55	0.2629
Astrahan Oblast	46	0.3204	54	0.2654
Smolensk Oblast	47	0.3178	57	0.2610
Oryol Oblast	48	0.3160	46	0.2820
Kursk Oblast	49	0.3099	48	0.2754
Krasnodar Krai	50	0.3095	44	0.2860
Republic of Khakassia	51	0.3094	56	0.2628
Stavropol Krai	52	0.3076	62	0.2486
Orenburg Oblast	53	0.3059	50	0.2741
Tver Oblast	54	0.3044	61	0.2499
Pskov Oblast	55	0.3039	66	0.2368
Sakha (Yakutia) Republic	56	0.2993	47	0.2770
Republic of Ingushetia	57	0.2990	65	0.2376
Kabardino-Balkar Republic	58	0.2954	63	0.2476
Komi Rebublic	59	0.2929	59	0.2539
Vologda Oblast	60	0.2925	49	0.2751
Republic of Buryatia	61	0.2868	52	0.2708
Kurgan Oblast	62	0.2838	60	0.2538
Penza Oblast	63	0.2838	38	0.3044
Chukotka Autonomous Oblast	64	0.2773	42	0.2899
Lipetsk Oblast	65	0.2755	58	0.2573
Bryansk Oblast	66	0.2740	64	0.2468
Ivanovo Oblast	67	0.2655	67	0.2320
Tambov Oblast	68	0.2640	68	0.2313
Kostroma Oblast	69	0.2485	75	0.1904
Altai Krai	70	0.2419	72	0.2198
Amur Oblast	71	0.2351	74	0.1934
Republic of Dagestan	72	0.2300	69	0.2263
Karachay-Cherkess Republic	73	0.2299	73	0.2171
Republic of Kalmykia	74	0.2283	79	0.1430
Kirov Oblast	75	0.2255	71	0.2213
Altai Republic	76	0.2249	76	0.1896
Jewish Autonomous Oblast	77	0.2171	78	0.1573
Zabaykalsky Krai	78	0.2158	77	0.1879
Tuva Republic	79	0.2034	70	0.2239
Chechen Republic	80	0.1253	80	0.1006

APPENDIX C - Index of scientific and technical potential of Russian regions (ISTP) rating

Regions	2010		2009	
	Rating position	ISTP value	Rating position	ISTP value
Moscow	1	0.5403	1	0.5378
Saint Petesburg	2	0.5365	2	0.5313
Nizhny Novgorod Oblast	3	0.4996	5	0.4603
Ulyanovsk Oblast	4	0.4954	8	0.4322
Moscow Oblast	5	0.4697	7	0.4347
Novosibirsk Oblast	6	0.4565	3	0.4655
Kaluga Oblast	7	0.4369	10	0.4314
Tomsk Oblast	8	0.4346	9	0.4315
Perm Krai	9	0.4273	13	0.4031
Yaroslavl Oblast	10	0.4173	12	0.4043
Murmansk Oblast	11	0.4025	4	0.4612
Smolensk Oblast	12	0.4016	38	0.3258
Voronezh Oblast	13	0.3941	18	0.3721
Irkutsk Oblast	14	0.3917	14	0.3914
Magadan Oblast	15	0.3758	11	0.4106
Samara Oblast	16	0.3752	21	0.3573
Komi Rebublic	17	0.3725	17	0.3739
Sverdlovsk Oblast	18	0.3717	20	0.3583
Chelyabinsk Oblast	19	0.3706	31	0.3376
Ivanovo Oblast	20	0.3679	6	0.4429
Chuvash Republic	21	0.3673	41	0.3209
Republic of Bashkortostan	22	0.3580	22	0.3510
Tyumen Oblast	23	0.3577	48	0.3140
Astrahan Oblast	24	0.3556	62	0.2703
Volgograd Oblast	25	0.3498	25	0.3496
Orenburg Oblast	26	0.3481	16	0.3799
Republic of Buryatia	27	0.3472	32	0.3365
Republic of Dagestan	28	0.3445	35	0.3338
Republic of Tatarstan	29	0.3424	42	0.3205
Kaliningrad Oblast	30	0.3374	56	0.2934
Tver Oblast	31	0.3364	19	0.3625
Primorsky Krai	32	0.3363	44	0.3172
Saratov Oblast	33	0.3360	43	0.3175
Kemerovo Oblast	34	0.3313	52	0.3045
Oryol Oblast	35	0.3301	27	0.3409
Krasnodar Krai	36	0.3278	28	0.3405
Belgorod Oblast	37	0.3240	39	0.3238
Omsk Oblast	38	0.3226	23	0.3503
Leningrad Oblast	39	0.3225	37	0.3265
Kostroma Oblast	40	0.3219	30	0.3383
Novgorod Oblast	41	0.3144	65	0.2603
Republic of Korelia	42	0.3095	34	0.3355

Stavropol Krai	43	0.3085	54	0.3026
Republic of Mordovia	44	0.3085	53	0.3035
Kursk Oblast	45	0.3062	33	0.3365
Chukotka Autonomous Oblast	46	0.3049	58	0.2795
Kabardino-Balkar Republic	47	0.3046	24	0.3500
Krasnoyarsk Krai	48	0.3019	29	0.3398
Rostov Oblast	49	0.3019	47	0.3168
Karachay-Cherkess Republic	50	0.3015	36	0.3328
Altai Krai	51	0.2960	49	0.3115
Vologda Oblast	52	0.2949	57	0.2891
Jewish Autonomous Oblast	53	0.2882	46	0.3169
Kirov Oblast	54	0.2865	55	0.2966
Sakhalin Oblast	55	0.2845	15	0.3885
Sakha (Yakutia) Republic	56	0.2842	40	0.3236
Udmurt Republic	57	0.2827	59	0.2752
Penza Oblast	58	0.2813	61	0.2728
Khabarovsk Krai	59	0.2761	50	0.3082
Vladimir Oblast	60	0.2758	26	0.3491
Tambov Oblast	61	0.2746	51	0.3055
Tula Oblast	62	0.2674	69	0.2512
Kamchatka Krai	63	0.2660	45	0.3169
Arkhangelsk Oblast	64	0.2598	74	0.2125
Ryazan Oblast	65	0.2587	71	0.2455
Amur Oblast	66	0.2549	64	0.2619
Zabaykalsky Krai	67	0.2384	72	0.2346
Mari El Republic	68	0.2379	63	0.2626
Kurgan Oblast	69	0.2275	66	0.2591
Bryansk Oblast	70	0.2255	79	0.1544
Republic of North Ossetia-Alania	71	0.2194	67	0.2537
Lipetsk Oblast	72	0.2192	60	0.2740
Altai Republic	73	0.2055	78	0.1746
Tuva Republic	74	0.2044	75	0.2077
Republic of Khakassia	75	0.2006	73	0.2219
Republic of Adygea	76	0.1955	68	0.2533
Pskov Oblast	77	0.1702	70	0.2459
Republic of Kalmykia	78	0.1693	76	0.2073
Chechen Republic	79	0.1533	80	0.1455
Republic of Ingushetia	80	0.1429	77	0.1925

APPENDIX D - Index of quality of innovation policy of Russian regions (IQIP) rating

Regions	2010		2009	
	Rating position	IQIP value	Rating position	IQIP value
Republic of Mordovia	1	0.5565	9	0.0835
Republic of Ingushetia	2	0.5000	2	0.5000
Republic of Bashkortostan	3	0.2725	17	0.0465
Altai Republic	4	0.2030	1	0.6925
Smolensk Oblast	5	0.1990	24	0.0385
Chuvash Republic	6	0.1815	40	0.0190
Penza Oblast	7	0.1675	44	0.0165
Tuva Republic	8	0.1580	8	0.1475
Republic of Adygea	9	0.1480	5	0.1945
Kirov Oblast	10	0.1045	4	0.1995
Bryansk Oblast	11	0.0975	3	0.2665
Republic of Khakassia	12	0.0940	7	0.1645
Mari El Republic	13	0.0815	10	0.0830
Chechen Republic	14	0.0770	6	0.1810
Tomsk Oblast	15	0.0705	43	0.0175
Republic of Kalmykia	16	0.0665	11	0.0730
Khabarovsk Krai	17	0.0635	22	0.0400
Udmurt Republic	18	0.0585	14	0.0530
Zabaykalsky Krai	19	0.0570	12	0.0690
Republic of North Ossetia-Alania	20	0.0550	20	0.0425
Kursk Oblast	21	0.0535	76	0.0015
Tula Oblast	22	0.0430	73	0.0020
Republic of Tatarstan	23	0.0320	41	0.0190
Voronezh Oblast	24	0.0310	47	0.0140
Lipetsk Oblast	25	0.0305	51	0.0125
Ivanovo Oblast	26	0.0300	34	0.0255
Stavropol Krai	27	0.0290	38	0.0210
Sakha (Yakutia) Republic	29	0.0285	42	0.0185
Orenburg Oblast	28	0.0285	35	0.0240
Kabardino-Balkar Republic	30	0.0275	30	0.0280
Moscow	31	0.0215	52	0.0125
Republic of Dagestan	32	0.0200	57	0.0095
Astrahan Oblast	33	0.0190	37	0.0210
Rostov Oblast	34	0.0175	69	0.0035
Arkhangelsk Oblast	35	0.0165	32	0.0275
Vologda Oblast	36	0.0160	25	0.0375
Oryol Oblast	37	0.0155	46	0.0140
Primorsky Krai	39	0.0150	45	0.0155
Tyumen Oblast	38	0.0150	26	0.0370
Karachay-Cherkess Republic	40	0.0145	70	0.0030
Krasnoyarsk Krai	41	0.0140	62	0.0070
Pskov Oblast	42	0.0140	60	0.0080

Saint Petesburg	45	0.0130	63	0.0055
Republic of Korelia	44	0.0130	36	0.0225
Saratov Oblast	43	0.0130	31	0.0280
Magadan Oblast	46	0.0125	53	0.0120
Kostroma Oblast	48	0.0120	28	0.0345
Republic of Buryatia	47	0.0120	23	0.0390
Tver Oblast	49	0.0115	78	0.0015
Altai Krai	50	0.0105	50	0.0130
Sverdlovsk Oblast	51	0.0100	59	0.0085
Kaluga Oblast	53	0.0080	56	0.0105
Irkutsk Oblast	52	0.0080	19	0.0450
Amur Oblast	54	0.0070	64	0.0050
Kurgan Oblast	55	0.0065	61	0.0080
Perm Krai	56	0.0060	48	0.0135
Novosibirsk Oblast	58	0.0055	67	0.0045
Volgograd Oblast	57	0.0055	18	0.0460
Moscow Oblast	59	0.0045	54	0.0110
Krasnodar Krai	61	0.0045	29	0.0300
Belgorod Oblast	60	0.0045	15	0.0510
Sakhalin Oblast	63	0.0040	16	0.0490
Komi Rebublic	62	0.0040	13	0.0680
Omsk Oblast	64	0.0030	39	0.0200
Ryazan Oblast	66	0.0025	68	0.0040
Kemerovo Oblast	65	0.0025	49	0.0135
Tambov Oblast	68	0.0020	77	0.0015
Samara Oblast	67	0.0020	58	0.0090
Ulyanovsk Oblast	71	0.0015	75	0.0020
Leningrad Oblast	70	0.0015	55	0.0110
Vladimir Oblast	69	0.0015	27	0.0360
Novgorod Oblast	73	0.0010	74	0.0020
Murmansk Oblast	72	0.0010	66	0.0045
Nizhny Novgorod Oblast	78	0.0005	80	0.0005
Kaliningrad Oblast	77	0.0005	79	0.0010
Kamchatka Krai	76	0.0005	72	0.0025
Chelyabinsk Oblast	75	0.0005	71	0.0025
Yaroslavl Oblast	74	0.0005	65	0.0045
Chukotka Autonomous Oblast	80	0.0000	33	0.0270
Jewish Autonomous Oblast	79	0.0000	21	0.0415

APPENDIX E – RRICI indicators and definitions.

The following definitions are designed to reveal the concepts and indicators. Index of social and economic conditions of regional innovation activity (**ISEC**) (Table 1, #1). This thematic unit combines indicators of economic performance of the region (labor productivity, capital productivity), the availability of human resources for innovation and the level of development of the information society. Macroeconomic indicators (Table 1, #1.1) are formed on the basis of the statistical data presented in Central Base of Statistical Data (CBSD) Rosstat. Fixed assets - produced assets, to be used repeatedly or continuously over a long time period (not less than one year) for the production of goods, provision of market and non-market services, for administrative purposes or for the representation of other organizations for the temporary possession and use or temporary enjoyment. These includes buildings, structures, machinery and equipment, vehicles, office and livestock, perennial plants and other fixed assets.

The gross regional product per worker in the economy of the region (Table 1, #1.1.1) characterizes the level of labor productivity. It is calculated as the ratio of the GRP - adjusted value of the cost of a fixed set of goods and services, divided on the average annual number of employed in the economy of the region. GRP is adjusted for domestic price in rubles by dividing the gross regional product on the factor of cost of a fixed basket of goods and services.

Gross regional product to the cost of fixed assets (Table 1, #1.1.2) - total gross assets, which reflect the impact of the use of fixed assets in the regions is defined as the ratio of the GRP to the cost of fixed assets.

Employment in high technology (high-tech), service industries and manufacturing allows us to estimate the level of "progressiveness" of the economy of the region. The share

of employment in high-tech and medium high-tech manufacturing industries in total employment in the economy of the region (Table 1, #1.1.3) is calculated from the data on the average number of employees (without external workers) for activities (in accordance with the European Regional innovation Index codes):

- chemical industry (code 24);

- manufacture of machinery and equipment (excluding the production of arms and ammunition) (code 38.9) 13;

- manufacture of electrical and optical equipment, including the manufacture of office machinery and computers (code 30); manufacture of electrical machinery and equipment (code 31); production of electronic components, radio, television and communication equipment (code 32); manufacture of medical devices , measurement, monitoring, control and testing instruments; photographic and film equipment (code 33);

- manufacture of vehicles including the production of motor vehicles, trailers and semi-trailers (code 34); production of ships, aircraft and space vehicles and other transport equipment (code 35).

The indicator is calculated as the ratio of the average number of employees (without external workers) for the above types of economic activity to the average number of employees in the economy of the region, multiplied by one-hundred.

The share of employment in knowledge-intensive service industries in total employment in the economy of the region (Table 1, #1.1.4) is calculated using the data on the average number of employees (without external workers) by economic activity, which, in accordance with the methodology adopted by the European Regional Innovation Index (NACE codes rev. 1.1) refer to the knowledge-intensive service industries and corresponds to the codes of the Russian Classifier of Economic Activities:

- water transport activities (code 61);

- activities of air and space transport (code 62);

- communication (code 64);

- financial activities, including financial transactions (code 65); insurance (code 66); activities in the field of financial intermediation and insurance (code 67);

- real estate, renting and business activities, including real estate transactions (code 70); rental of machinery and equipment without operator, household goods and personal effects (code 71); activities related to the use of computers and information technology (code 72); R&D (code 73); provision of other services (74);

The indicator is defined as the average number of employees (without external workers) of the above types of economic activity to the average number of employees in the economy of the region, multiplied by one-hundred.

The educational potential of the population (Table 1, #1.2). The share of the population aged 25-64 with higher and postgraduate professional education in the total population in this age group (Table 1, #1.2.1) characterizes the level of education of the adult population (aged 25-64 years) both economically active (employed and unemployed) and economically inactive. The indicator reflects the results of the operation of the educational system for a long period of time and is widely used in international comparisons. Figure at the same time serves as a social and an economic indicator, on the one hand reflecting the level of social development and public relations, and the human capacity needed for the development of innovation on the other hand. It is defined as the ratio of population aged 25-64 years with post-graduate and higher education out of the total population in this age group.

Number of students in educational institutions of higher education in the 10 000 of population (Table 1, #1.2.2) is an indicator of the availability of higher education in the region. It reflects not only the educational potential of new generations (i.e. the prospects for change in the level of education of the population), but to a certain extent - the state of regional innovation systems in which universities play an important role in the quality of institutions. Firstly this ensures the reproduction of skills and scientific and technological capabilities required to create and commercialize innovations; secondly this controls for the development of innovative products and services and technologies; thirdly this is the part of the process of formation and development of innovation infrastructure.

Level of the development of information society (Table 1, #1.3). **Internet** is a global set of independent computer networks interconnected to exchange information on standard open protocols. Broadband access to the Internet include xDSL-technology, the connection on the cable television network, leased lines, fiber optic cables, satellite connectivity, advanced wireless and fixed wireless access (Wi-Fi connection, etc.) connection for high-speed mobile phone networks and other forms of access with the advertised download speed of more than or equal to 256 Kbit/s.

Share of organizations that use broadband access to the Internet (Table 1, #1.3.1) is an indicator of the capacity of organizations to the effective use of Internet resources; information interaction with the environment and promotion of e-commerce. The Indicator describes the level of development of the ICT sector in the region, and the presence of the general conditions for the creation and adaptation of innovations. It is calculated as the ratio of the number of organizations that have a maximum speed access to the Internet of 256 Kbit/s and higher, to the total number of examined organizations. The range consists of organizations of the following economic activities: forestry and provision of services in this

area; fishing, fish farming; mining and quarrying; manufacturing; production and distribution of electricity, gas and water supply; construction; wholesale and retail trade, repair of motor vehicles and motorcycles; household goods for personal use; hotels and restaurants; transport and communication; financial activities; operations with real estate, renting and business activities; public administration and defense; higher professional education; health and social work; recreation and entertainment; culture and sports. Source of information - the data of the Federal Statistical observation, form # 3-inform "Information on the use of information and communication technologies and the production of computer hardware, software and services in these areas."

The share of the population with the access to the Internet in households, in the number of respondents aged 18-74 years (Table 1, #1.3.2) - evaluates the population's access to the most advanced information and communication technology; which gives the ability to quickly send and receive information at any distance, use search engines, online services, including e-commerce, banking, interaction with public authorities, and other Internet capabilities including the possibility to work remotely. The indicator is calculated as the ratio of the number of respondents who have access to the Internet in households, to the number of all respondents aged 18-74 in the region and is given in percent's.

Index of scientific and technical potential of the region (**ISTP**) (Table 1, #2). Research and development is one of the main types of innovation. Formation of a sustainable and balanced research and development sector identified as a pressing problem in the strategy of innovative development of the Russian Federation until 2020 (approved by the Decree of the Government of the Russian Federation from December 8, 2011 # 2227-p). In general the indicators, presented in this section, reflect available scientific and technical potential of innovation in the regions.

Funding for research and development (Table 1, #2.1). The source of information for the calculation of #2.1 and 2.2 is the data from the Federal statistical observation form # 2-Science "Data on research and development performance". **Research and development** is the creative work undertaken on a systematic basis in order to increase the amount of scientific knowledge as well as the search for new applications of this knowledge. Criteria for differentiating between research and development from accompanying activities, is the presence of a significant element of novelty. Research and development covers three activities: basic research, applied research and development. Gross domestic expenditure on research and development expressed in monetary terms is the actual cost of performing research and development in the country (including foreign-funded, but excluding payments made abroad). Gross domestic expenditure on research and development includes current and capital expenditures. Current costs includes labor costs, deductions for unified social tax, other material costs (the cost of the purchased raw materials, components, semi-finished products, fuel, energy, production services, etc.), and other operating costs. Capital costs include the cost of land acquisition, construction or purchase of buildings, purchase of equipment to be included in the fixed assets, etc.

Gross domestic expenditure on research and development as a percentage of GRP (Table 1, #2.1.1) reflects the proportion between investments in the sector of R&D and the macro-economic indicators in the region. The indicator is defined as the ratio of total domestic expenditure on research and development to GRP, multiplied by one-hundred.

Gross domestic expenditure on research and development per researcher (Table 1, #2.1.2) is calculated as the ratio of total domestic expenditure on R&D to the number of researchers (without part-times, and persons working under contracts of civil law).

The share of the organizations of the business sector in total domestic expenditure on R&D (Table 1, #2.1.3) - defines the contribution of the business sector in the R&D funding. The organization of the business sector are all organizations whose main activity is connected with the production of products or services to sell (other than the service sector of higher education), including those owned by the State. The indicator is calculated as the ratio of domestic expenditures on R&D financed by the business sector to the total spendings on R&D, multiplied by one-hundred.

The ratio of the average monthly wage of employees engaged in R&D to the average monthly nominal wage in the region (Table 1, #2.1.3). The average monthly salary of personnel engaged in R&D is determined by the following formula:

$$\boldsymbol{WAGEave_p = \frac{IC}{\overline{NE}}/12} \quad \textbf{(6)}$$

Where $WAGEave_p$ stands for the average monthly salary of personnel engaged in R&D, IC for the internal current labor costs of employees engaged in R&D (without part-time, and persons working under contracts of civil law) and $\overline{\mathrm{NE}}$ for the average number of employees engaged in R&D (without part-time, and persons working under contracts of civil law).

Personnel engaged in R&D (Table 1, #2.2). Personnel engaged in R&D is the individuals whose creative work is undertaken on a systematic basis, and aims to increase new applications of knowledge, as well as whose engaged in rendering direct services related to the implementation of R&D. **Researchers** - employees who are professionally engaged in R&D, and directly involved in the creation of new knowledge, products, processes, methods and systems, as well as in the process of management of such activities..

The share of personnel engaged in R&D in the total employment in the economy of the region (Table 1, #2.2.1) characterizes the level of employment in R&D. It is calculated as the ratio of the average number of employees engaged in R&D (without part-timers, and persons working under contracts of civil law), to the average number of employees (without external workers), multiplied by one-hundred.

The share of persons aged under 39 in the number of researchers (Table 1, #2.2.2), this indicator reflects the effectiveness of the reproduction of scientific personnel; and calculated as the ratio of the number of researchers under the age of 39 (without part-timers, and persons working under contracts of civil law) to the total number of researchers, multiplied by one-hundred.

The share of researchers with a degree in the total number of researchers (Table 1, #2.2.3) is one of the indicators that reflect the level of qualifications of the main categories of personnel directly involved in carrying out R&D. The indicator is defined as the ratio of the number of researchers with academic degree (without part-timers and those who were carrying out the work under civil-law), to the total number of researchers, multiplied by one-hundred.

The effectiveness of R&D (Table 1, #2.3). Indicator of publication activity characterizes the impact of scientific activities at a different levels of aggregation (individual researchers, groups, organizations, regions, countries). International or national science citation databases containing bibliographical descriptions of publications and reference lists are typically used for their calculation. The main type of documents relevant to the study is an article in the scientific journal. The number of articles published in reviewed journals indexed by the Russian Science Citation Index (RISC) (Table 1, #2.3.1), per 10 researchers calculated as the ratio of the total number of articles in scientific journals indexed by RISC,

to the total number of researchers (without part-timers, and persons working under contracts civil law) employed in the region, multiplied by one-hundred.

Patent information (Table 1, #2.3.2) indicator is based on the data of the invention registration in patent offices, filing and granting of patents for inventions (certificates - documents certifying the priority, authorship, and the exclusive right to the use of intellectual property during the term of a patent). For in-country assessments databases of national patent offices (in our study - Rospatent) are used. An **Invention** is the new, highly technological, commercially applicable product (device, substance, microorganism strain, plant, etc.) or process. This reflects both the impact of R&D and innovation capacity in the regions.

Number of advanced technologies production per million economically active people in the region (Table 1, #2.3.3) is one of the indicators of scientific and technological activity. This takes into account all advanced technologies production including design; engineering; production; processing; assembling; automated transportation; automated equipment inspection; control, communications and management; information systems manufacturing; etc. Data is taken from Federal statistical observation Form # 1- technology "Information on the creation and use of advanced production technology" CBSD Rosstat for 2009 and 2010.

Ratio of revenues from technology exports to GRP (per one-thousand rubles of GRP) (Table 1, #2.3.4) characterizes the contribution of technology exports in the formation of GRP and ultimately - the competitiveness of the regional technologies in foreign markets. Source of information is the data of the Federal Statistical observations Form # 1- license "Information on the commercial exchange of technology with foreign countries (partners)," and CBSD Rosstat.

Index of quality of innovation policy of the region (**IQIP**) (Table 1, #3). The quality of the innovation policies is another element that determines the level of innovative development of the region. The proportion of the budget of the Russian Federation and local budgets in domestic expenditure on R&D (Table 1, #3.1.1), as well as the proportion of the budget of the Russian Federation and local budgets in the overall costs of technological innovation (Table 1, #3.1.2). The calculation of these parameters carried out using forms of Federal statistic report No. 2 “science” and No. 4 “Innovation.”

Formation of indicators is performed for each subject of the Russian Federation in accordance with the Russian national classification of administrative and territorial division (OKATO). Evaluation was performed on eighty regions of the first level of classification, including: republics, territories, regions, and federal cities; with the exception of the three autonomous areas due to lack of data on the number of key indicators.

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