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Systems in Russia**

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## **SPATIAL DEVELOPMENT OF INNOVATION SYSTEMS IN RUSSIA**

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**Key words:** innovation systems, spatial development, regional economy, investment activity, research expenditure, innovation activity factors.

### **A b s t r a c t**

While the development of the country's national innovation system as a whole is very important and should be prioritized, its regional aspect is even more important. The specifics of the Russian Federation's transition to an innovation-based economy is in that that, at the present time, prioritized is the need to ensure the effective development of those economy sectors that underlie the country's specialization and may provide regional and national competitive advantages. To such sectors belong the chemical industry, machine-building and power energetics.

We would like to note that initial innovation awareness indicators in the regions are comparable and do not differ greatly but the growth of activity can be observed only in some of the regions. The problem of large differentiation among the constituent entities of the Russian Federation by their level of economic development remains important and has to be dealt with.

## **ROZWÓJ PRZESTRZENNY SYSTEMÓW INNOWACYJNYCH W ROSJI**

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**Słowa kluczowe:** systemy innowacji, rozwój przestrzenny, gospodarka regionalna, innowacje, koszty badań, czynniki aktywności innowacyjnej.

### **A b s t r a k t**

Mimo że rozwój krajowego systemu innowacji w kraju jako całości jest bardzo ważny i priorytetowy, coraz ważniejszy staje się również jego wymiar regionalny. Specyfiką transformacji Federacji Rosyjskiej do gospodarki innowacji jest to, że jej priorytetem jest zapewnienie efektywnego rozwoju tych sektorów gospodarki, które determinują specjalizację w kraju i mogą przyczynić się do podniesienia regionalnej i krajowej konkurencyjności. Do sektorów tych należą przemysł chemiczny, maszynowy i energetyczny.

Wstępne wyniki badań wskazują, że wskaźniki innowacyjności w regionach są porównywalne i różnią się tylko nieznacznie, wzrost aktywności obserwuje się jednak tylko w niektórych regionach. Problemem, którym należy się zająć, pozostaje więc silne zróżnicowanie poziomu rozwoju gospodarczego podmiotów Federacji Rosyjskiej.

Abbreviations:

RIS – Regional Innovation System;

NAIDIT – National Association of Innovations and Development of Innovation Technologies;

EIS – European Innovation Scoreboard;

GRD – Gross Regional Product;

GAZ, OJSC – Gorky Automobile Plant, an open joint stock company;

SIBUR Holding – Siberia Urals Petrochemical Company, an open joint stock company;

IT Park – a techno park specializing in information and communication technologies;

IDSEZ – an industrial/developmental special economic zone;

ISEZ – an industrial special economic zone.

## Introduction

The main problem that this article raises is the need for ways to determine regional innovation activity factors which affect the economic development of the nation's economic space and also the need to look into ways to realize the innovation potential of the nation's regions. At the current stage in the development of national economies, priorities are given to the development of innovation systems as integral parts of such economics along with, for example, their financial or industrial systems. An important consideration here is that the spatial development of innovation systems defines and predetermines the competitiveness of Russia's regions, is the sources of changes in the GDR increasing its research intensity due to the growth of the proportion of high technology industries and improvement in the territorial organization of the economy.

While the development of the country's national innovation system as a whole is very important and should be prioritized, its regional aspect is even more important. This is related to the fact that the gestation and development of innovative activity is taking place on the regional level where the institutionalized infrastructure is in operation in a varying degree. On the same level a special competitive environment is formed – the environment which is based not only and not so much on available natural resources as much as on the synergy of a knowledge-based economy, competitive advantages, traditions and so on.

A significant aspect is the geographical proximity of regional economies. Thus, a diffusion of innovation processes extends to territorially close regions possessing sets of similar knowledge skills and competences. If the proximity is not close enough, integration has no stable nature and the innovative activity itself is checked. For this reason, the fundamentals of a modern spatial

innovation system concept are the development of the foundations of regional innovation systems (RIS); while the main underlying principle is the development of a mechanism aimed at ensuring the flow of development in the direction from the nation center to its peripheral regions and cities. On the example of one of Russia's economic leaders / macro-regions – the Volga District, we conducted a research into the innovation activity of entities constituting said district.

## **Research Results**

From the viewpoint of regional spatial development, innovation activity constitutes the totality of acts which activate new growth points in the existing space, add new qualities to the regional economies – a multiplication effect which makes it possible to reduce territorial imbalances.

It is known that national innovation system products and services are mainly consumed by major corporations working, as a rule, to fulfill public contracts; but on the regional level the center stage is taken by small and medium businesses which are viewed as main innovators all over the world. This explains the importance of a research into the influence of regional economies on the success of innovation activity nationwide.

The specifics of the Russian Federation's transition to an innovation-based economy is in that that, at the present time, prioritized is the need to ensure the effective development of those economy sectors that underlie the country's specialization and may provide regional and national competitive advantages. To such sectors belong the chemical industry, machine-building and power energetics.

Another specific trait of Russia's innovation system is its „fragmentation”, its territorial asymmetry, concentration of research-intensive sectors in a small number of Russia's regions. However, whether these factors are negatively affecting innovation both in Russia as a whole and in its constituent regions is a moot point. Many developed nations in the world displaying high economic growth rates achieved it, as a rule, thanks to the faster-than-average growth in certain individual leading regions in such nations. These regions become centers for the nation's innovative growth and provide a new type of economic and social growth for other territories to aspire to. These territories then face the task of integrating into a new regional hierarchy forming in the global world a geo-economic space – industrial regions, go-between regions and financial center regions.

The current concept for the spatial development of the Russian Federation emphasizes the development of regions as growth points to form a framework

enveloping the nation's territory. The formation of such spatial structure may ensure the achievement of a rational spatial planning and development and an innovation-based growth in the economy. Large city agglomerations should act as nodes of the so-called load bearing framework – innovation and administration centers concentrating the nation's economic activity within themselves and acting as sources of change.

Such supporting regions are relatively few in the Russian Federation. At the present time, there is only one global megalopolis in Russia – Moscow and there is in addition only one national megalopolis which is Saint Petersburg. The other 13 million-plus cities are cities with a population in the region of one and a half million to one million people. In Siberia, such cities are Omsk, Novosibirsk and Krasnoyarsk. In the Russian Far East, there is not a single million-plus city. In the past decade, all major cities in this category have exhibited a population growth.

Framework supporting regions „bind together” the Russian territories as Russia's zones of integration with the global economy and innovation concentration zones. In all federal districts of Russia, one can identify regions close to the general Russian level on most significant indices or indicators or exceeding it.

Russia's regions have different start-up conditions and different innovation developmental potentials. Nevertheless measures being taken by the government to stimulate the economy have been producing some positive trends. Thus, NAIDIT compiles a ranking of regions by their innovative activity; the purpose of such ranking is to identify regions with the best performance indicators in the area of research stimulation and innovations and also to provide an objective picture of the current state of innovation in Russia.

The idea and methodology were developed by NAIDIT based on methods used to prepare some leading world rankings (the European EIS ranking). A system of quantitative innovation indicators is used for analysis. The system is based on criteria developed as part of the EIS to evaluate levels of innovation development of European countries and adapted to take into account Russia's national specifics and to reflect availability of various statistical data (*NAIRIT podvodit itogi Rejtinga innovacionnoj...* 2013).

Based on results for 2012, it may be concluded that the number of regions with a „very high” and a „high innovation activity” has increased. The stability of regional innovation processes can also be noted. Among the highest climbers, NAIDIT identifies absolute leaders – Moscow and Saint Petersburg where there operate modern innovation enterprises. The five leading regions in this respect also include the Republic of Tatarstan, the Nizhny Novgorod Region and the Tomsk Region.

Also, an earlier trend of closing the gap between the leading regions and their closest pursuers from a high-degree innovation activity group has intensified. This indicator is 12% as opposed to 15% in 2012 which is also indicative of an increased competition in the leading group. 1/4 of the regions retained their positions; while about 36% increased their innovation-based activity. The aggregate investment activity indicator for 2013 is higher by 1.9% than the same indicator for the preceding period which is indicative of a positive growth trend in the investment-based activity of Russia's regions (*NAIRIT podvodit itogi Rejtinga innovacionnoj...* 2013).

Rankings of the constituent entities of the Russian Federation by various aspects of innovation activity prepared by various organizations or researches are varied and contradictory which may be explained by the kind of source indicators used as analytical indicators. Nevertheless they provide a clear picture of the peculiarities of innovation development across the territory of the country, of those regions that have enormous potential and are realizing it and of those that have so far been unable to use their competitive advantages.

Russian researchers use indicators made available by the country's statistical authorities; but such indicators differ significantly from foreign innovation activity criteria. Thus, Russia's statistics authorities use an indicator representing the specific weight of innovation products, work or services in the total amount of shipped products, completed work or services. The closest to the ongoing processes is the same indicator but in relation to the sellable, sold products. There is no such information in Russian statistic data. All the same, available data reflect those processes that are taking place in the Russian economy.

The dynamic of the change of the share of innovation-based products, work, services testifies to the fact that a major break-through is ongoing currently in the output of innovation-based products in the services sector. Another specific feature is that Russian-wide indicators are exceeded in two federal districts: in the Central Federal District (10.2% in industrial output businesses compared to 7.8% as the Russian average) and in the Volga Federal District (12.9%, respectively). In the Central Federal District, Moscow, the Yaroslavl Region and the Tula Region are leading in terms of innovation-based products. In the Volga Federal District, the leaders are: the Samara Region and the Republic of Mordovia (in industrial output).

As regards the share of innovation products made by industrial output businesses, the average Russian indicator is exceeded by the Russian Far East (24.3% as opposed to 7.8% for all of Russia); while the North-Western Federal District exceeds a similar indicator but for the services sector businesses (10.5% versus 9.6% for all of Russia). In the Russian Far East, the Sakhalin Region is in a league of its own – the share of innovation products there is

about 60%. This is due to the fact that Sakhalin implements innovation projects in the power sector, in the fishing sector, in power conservation and in the ecological efficiency of power generation units. Based on open statistical data as at end of 2012 published by Russia's state statistic authority (Rosstat), MATRIX-Prime, an information and analytical agency, awarded the Sakhalin Region national innovative ranking BBBR (above average) (Development Strategies of the Sakhalin Region. 2014).

In the North-Western Federal District, the all-Russian innovative products output indicator is exceeded by service sector businesses (10.5% as opposed to 9.6% for all of Russia). This leadership is ensured by the Leningrad Region and the city of Saint Petersburg.

One of the main objectives in improving the innovation activity of the Russian economy is ensuring that small businesses take part in such activity. However, at the present time, what is required is not just participation but a break-through. In four out of the five leading regions, the specific weight of small businesses implementing technological innovations in the total number of small businesses inspected exceeds the same indicator for all of Russia (5.1% in Russia; 6.5% in Moscow; 8.4% in Saint Petersburg; 4.1% in the Moscow Region; 5.5% in the Republic of Karelia; 6.3% in the Republic of Mordovia) (Regions of Russia. Socio-Economic Indicators. 2013).

Innovation activity across Russia's federal districts and regions differs greatly. During the period from 2000 to 2012, the most innovation activity was characteristic of businesses and institutions of the Volga Federal District (11.9%). The difference with the average Russian indicators was 1.1% in 2005 and up to 2.8% in 2010. Among the least innovative federal districts, the situation is different on a case by case basis. Thus, in the North-Caucasian District, the specific weight of innovative entities was 6.4%. Leading position is held by the Kabardino-Balkar Republic where the growth of innovative activity by businesses or institutions increased from 3.5% in 2000 to 9.4% in 2012. This indicator is a little higher in the South District (7.4%) where only the Republic of Adygea and the Krasnodar Krai stand out (Regions of Russia. Socio-Economic Indicators. 2013).

We are going now to give a more detailed attention to the evaluation of innovation activity in the constituent entities of the Volga Federal District as one of the leaders in the Russian Federation whose only direct competitor is the Central Federal District.

It should be noted that certain constituent entities of the district, such as the Republic of Tatarstan or the Nizhny Novgorod Region, are among the most innovatively active regions in the Russian Federation. On the other hand, for example, two other republic – Mariy El and Udmurtia – hold lowly positions on the all-Russia rankings. A strong differentiation of regions by the level of

innovation activity is also characteristic of a number of other federal districts and of Russia as a whole.

This research is based on a methodology providing for ranking innovation development of regions as per basic indicators:

- gross regional product (thousand Rubles);
- year-average number of those employed (thousand persons);
- fixed assets value (thousand Rubles);
- amount of emissions of pollutants into the atmosphere by stationary facilities (thousand tons);
- internal expenditure on research and development (thousand rubles);
- internal expenditure on technological innovations (thousand rubles);
- output of innovation-based products, work, services (thousand rubles);
- population (thousand persons).

Innovation awareness factors were calculated for each of the constituent entities of the district for 2012. Among the universally accepted indicators are labor productivity, return on assets and ecological compatibility of industrial activity. Naturally, a degree of conventionality is accepted in the calculation of such indicators which is related to certain limits on available official statistic information. Many rankings by foreign and Russian researchers specify that there is no openness in such calculations. So we selected and analyzed those indicators, on which there are openly accessible statistical data.

Labor productivity is an indicator, on which the Russian Federation is significantly behind world leaders. It is reasonably sensitive to market transformations in the economy; and, taking into account the interests of society's social development, has a first-degree importance as labor productivity impacts on the labor market conditions. Nevertheless, it is hard to overestimate its contribution to the innovativeness of the country's economy. Out of the 14 constituent entities making up the Volga Federal District under review, the absolute leaders by labor productivity are the Republic of Tatarstan, the Perm Krai, the Republic of Bashkortostan, the Samara and Orenburg Regions. Given that, it should be noted that in the half of the regions this indicator is lower by a factor of two than in the leading constituent entity.

The return on assets indicator reflects the level of use, or the effectiveness, of the region's fixed capital. The leading entities on this indicator are the Republic of Bashkortostan, the Penza Region, the Republic of Tatarstan and the Ulianovsk Region. The other regions have no significant discrepancies by this indicator and are well behind the leaders.

As regards ecological compatibility of industrial activity, the unquestionable leader is the Penza Region, second and third places are held by the Ulianovsk Region and the Chuvash Republic, respectively. It is thought to be due to the fact that a low level of polluting emissions was observed in these



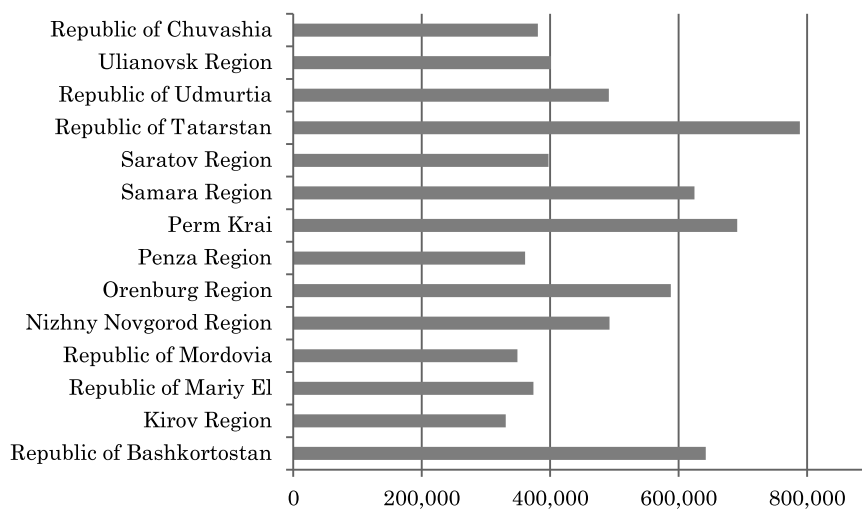


Fig. 1. Labor productivity (GRP/employed population)

Source: Regions of Russia. Socio-Economic Indicators (2013).

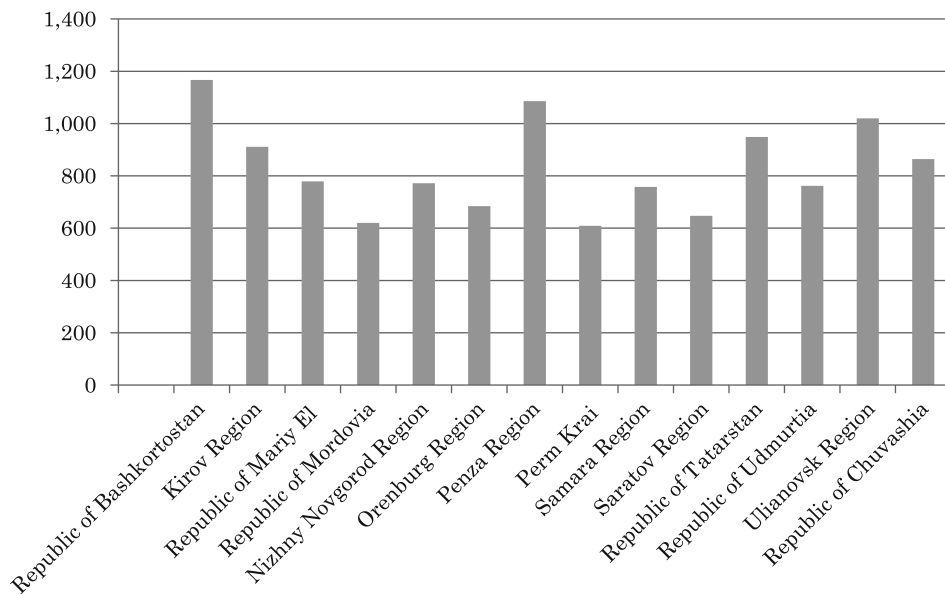


Fig. 2. Return on assets (GRP/cost of assets)

Source: Regions of Russia. Socio-Economic Indicators (2013).

regions in 2012. But the GRP in these constituent entities was also low (at the level of RUB 215 million – RUB 245 million). While the GRP of, say, Tatarstan over the same period was RUB 1 trillion 437 million. These data suggest that the constituent entities of the Volga Federal District are greatly differentiated as regards their economic development.

In evaluating the level of innovativeness of regions, also important are such regional innovation activity factors as research and development expenditure – per 1 employed person; volume of innovation products on a per capita basis.

During the past 15 years, internal research and development growth rates exceeded on the whole the GDP growth rates. The share of internal research and development expenditure in the GDP was 1.12% in 2011 and remains below the maximum value achieved in 2003 (1.29%). In terms of international comparisons, Russia is on the same level as Brazil (1.19% in 2010) and Hungary (1.16% in 2010) falling significantly behind innovation leaders (Germany and Japan, with 2.82% and 3.26%, respectively, in 2010), and also to China (1.7% of the GDP) (State Program „Economic Development” 2013).

Figures 3, 4, 5 represent schematically the results obtained which showed significant disproportions in the innovation activity of the regions.

With regard to research and development expenditure, the clear and obvious leader is the Nizhny Novgorod Region with RUB 26,141 per each employed person. This is mainly preconditioned by reasonably well developed

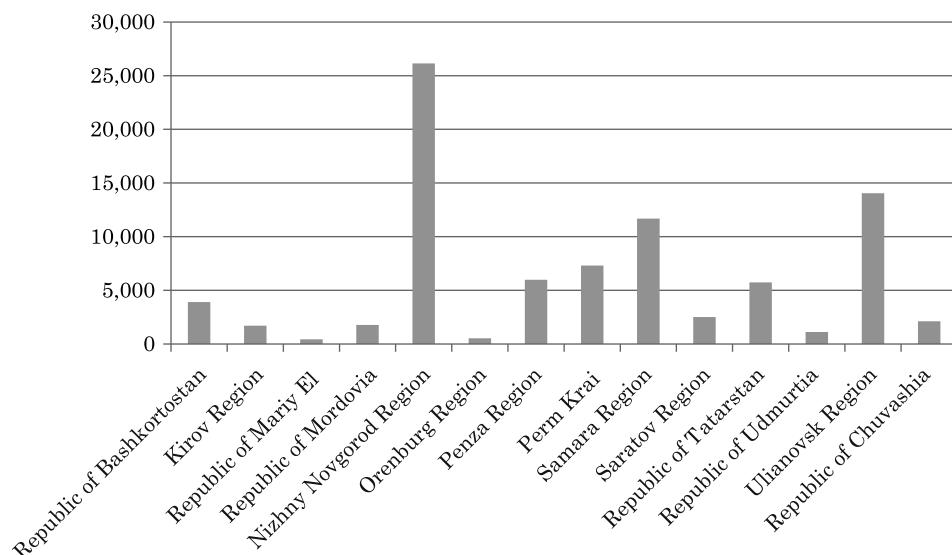


Fig. 3. Research and development expenditure (thousand RUB)

Source: Regions of Russia. Socio-Economic Indicators (2013).

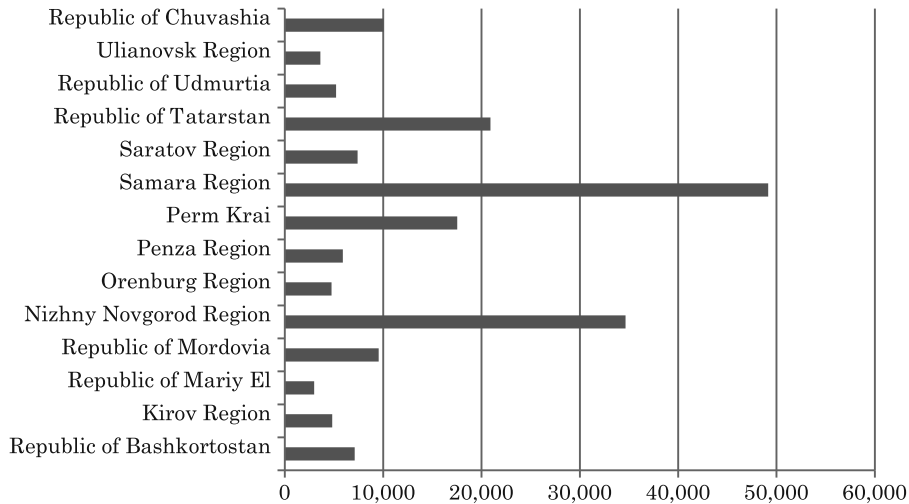


Fig. 4. Technological innovation expenditure (thousand RUB)

Source: Regions of Russia. Socio-Economic Indicators (2013).

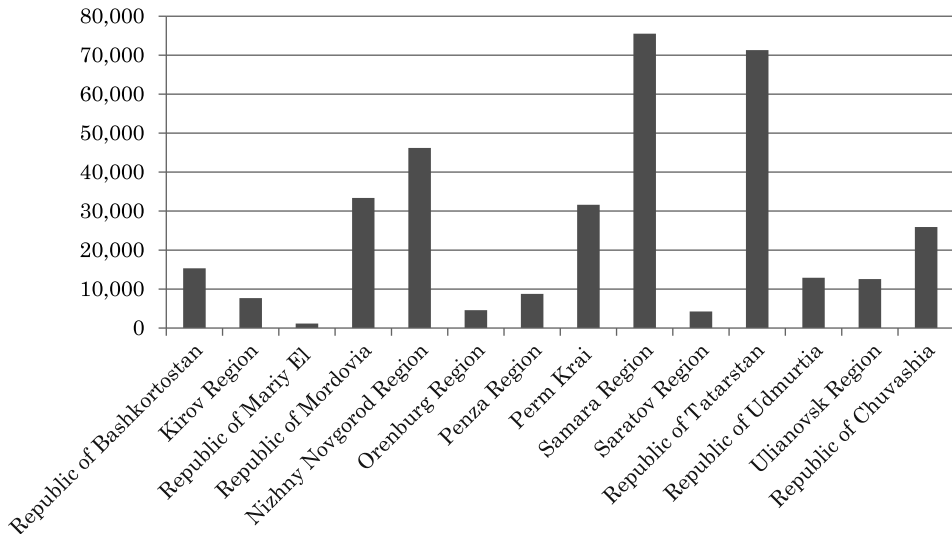


Fig. 5. Innovation products output (thousand RUB)

Source: Regions of Russia. Socio-Economic Indicators (2013).

machine-building and metal processing in the region and also by the military-industrial complex present there. In order to use the economic potential of the region and to raise the competitiveness of products made by their businesses, considerable funding is now being invested in the innovation activity in the region.

It is followed, albeit with a considerable lag-behind, by the Ulianovsk and the Samara Regions, the Perm Krai. Very little expenditure is made in the following constituent entities of the district: the Republic of Mariy El, the Orenburg Region and the Republic of Udmurtia.

As regards technological innovation expenditure, the Nizhny Novgorod Region is only second while the Samara Region holds first place. The Samara Region has particularly well developed clusters, such as the car building-, the aerospace- and also the defense and industrial clusters. It is followed by the Republic of Tatarstan and the Perm Krai. Against the backdrop of the four leaders, expenditure made by the other entities seems insignificant and insufficient.

The largest output of innovation based products by volume is characteristic of the Samara Region, its direct competitor is the Republic of Tatarstan where the industry output comprises machine-building-, oil- and petrochemical products and also extraction of mineral deposits. In terms of output of innovative products, the Nizhny Novgorod Region holds third place.

Thereafter we conducted mathematical transformations using two groups of indicators. As a result, ranking values were calculated for each of the regions.

#### A – Regional innovation activity ranking evaluations

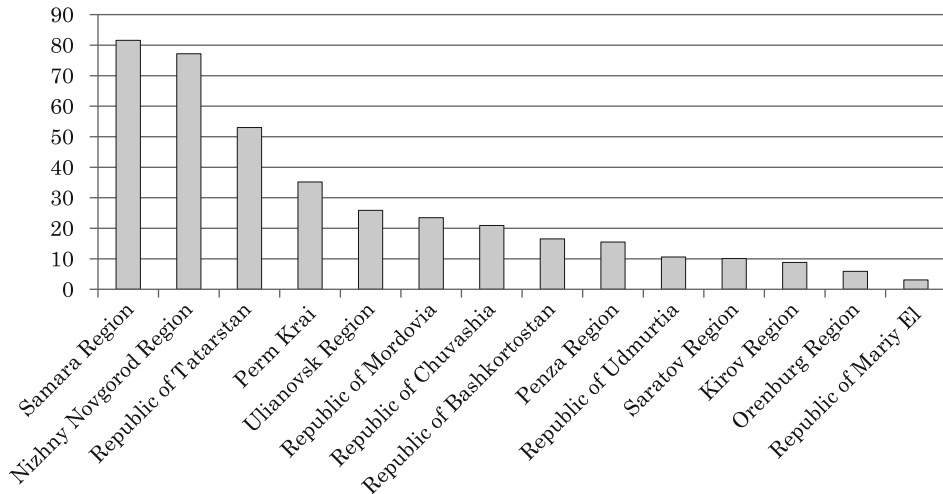


Fig. 6. Innovation activity ranking

The results of the transformations are quite what was expected – the three leaders are: the Samara Region, the Nizhny Novgorod Region and the Republic of Tatarstan. The rest of the regions lag behind them considerably and are at a low or an insignificant level of innovation activity.

## V – Regional innovation awareness ranking evaluations

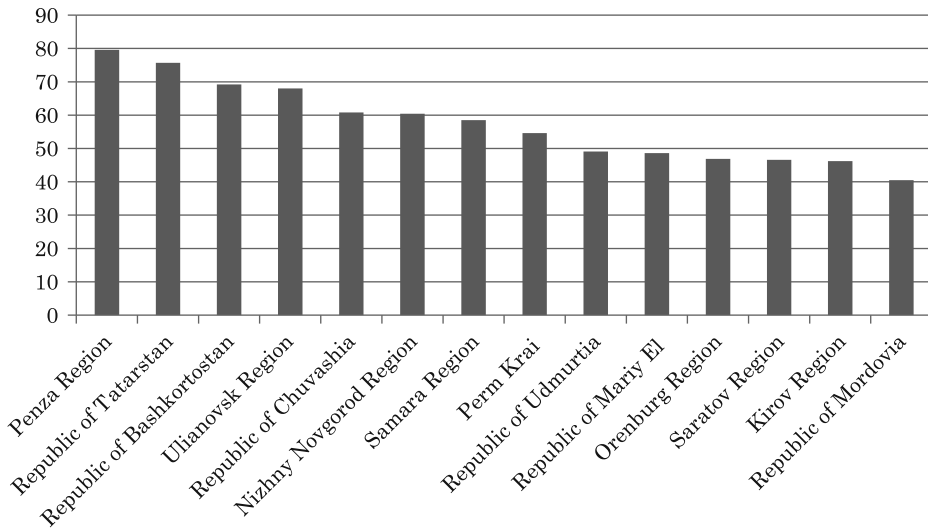


Fig. 7. Innovation awareness ranking

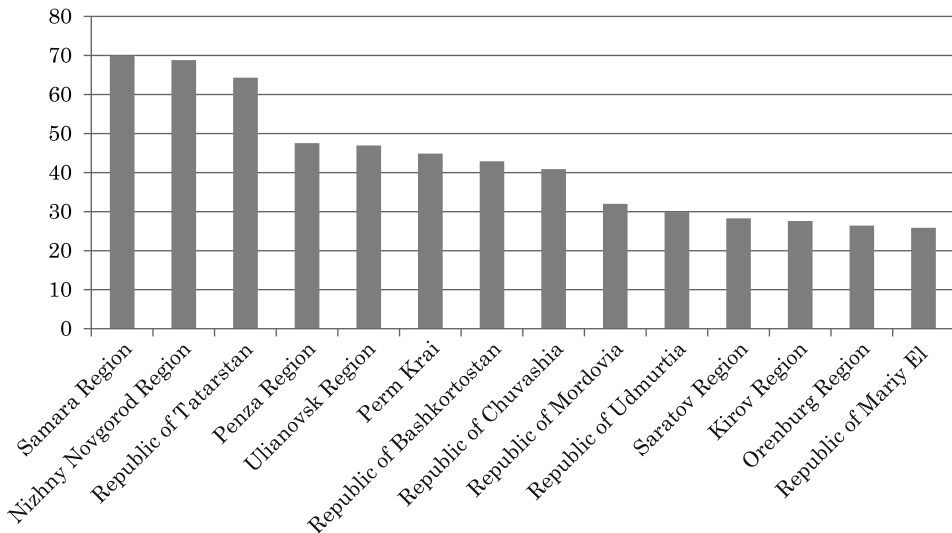


Fig. 8. Innovation development rankings

The values obtained for innovation awareness in the regions do not differ as greatly as the above activity values. 12 of the constituent entities (regions) are at a medium level of development; while 2 are at a high level. Among the leaders are the Penza Region and the Republic of Tatarstan. Good positions are

held by the Nizhny Novgorod Region, the Samara Region and the Ulianovsk Region and also by the Republic of Bashkortostan. As regards innovation awareness, virtually all constituent entities of the Volga Federal District show rather high results. However, such possibilities do not lead to a significant innovation activity in all of the regions. Only some of the regions are able to make use of their potential.

Upon calculating the arithmetic mean of the two sub-indicators, A and V, we obtain VA – an overall indicator of a region's innovative development. The positions of the Volga Federal District's constituent entities are presented in the following diagram where the rankings of each region may be clearly seen.

In accordance with accepted rules we convert indicator values by region to a letter-based code and, based on the results of such conversion, rank the regions by their level of innovation-based development.

**ZoneA – High Level (from 70 to 100):**

- Samara Region

**ZoneW – Average Level (from 40 to 70):**

- Nizhny Novgorod Region
- Republic of Tatarstan
- Penza Region
- Ulianovsk Region
- Perm Krai
- Republic of Bashkortostan
- Republic of Chuvashia.

**ZoneC – Low Level (from 10 to 40):**

- Republic of Mordovia
- Republic of Udmurtia
- Saratov Region
- Kirov Region
- Orenburg Region
- Republic of Mariy El.

On the one hand, the results of our research draw attention to large disproportions among regions confirming prevalent territorial asymmetry while, on the other hand, these results seem quite reasonable and close to the real situation with the regions' economy. Also noteworthy is a huge unrealized potential that some territories have even within a single federal district. In this connection, a question arises: what can explain such low rankings of 6 out of the 14 regions constituting the federal district?

The leading position of the Samara Region and the Nizhny Novgorod Region as well as of the Republic of Tatarstan is quite characteristic as it is these regions that received the most support from the government by way of the creation of special economic zones, or techno parks. It is clear that such

a way of a government-private partnership does stimulate businesses to innovate. One of the methods of providing support to the development of the economy of the Nizhny Novgorod Region is public contracts which ensure constant demand for innovation-based products. Also known is a policy aimed at creating and supporting „growth points” within the economy which are the locomotives of the Russian economy. But an indisputable fact is that such regions must also contribute to the growth of the economy in the territories currently lagging behind but having potential competitive advantages which they don't know how to make use of at the present time for a number of reasons.

The Samara Region is among the most developed industrial regions of the Russian Federation with a diversified economy and a powerful research-and-innovation potential. The region's economic development is based on high-technology processing industries with a high added value – car building, the aerospace complex, high processing depth industries in the raw materials sectors, chemistry, metallurgy. The implementation of innovation-based technologies is a main condition for their continued development, modernization on the basis of technological re-equipment, the use of innovative methods in management.

Their leading positions in the area of developing necessary conditions for the building of an innovation-based economy are confirmed by the high rankings awarded by independent experts, such as Expert RA, Institute for Infrastructure Innovations and Investments and the Public Opinion foundation, the National Association for Innovations and Development of Information Technologies.

A system has been created comprising infrastructure organizations for the support and advancement of innovation development: the Samara Region Innovation-Investment Foundation, the Regional Center for the Transfer of Technologies, the Regional Venture Foundation, a techno park, five business incubators, the Center for Innovation Development and Cluster Initiatives, the Guarantee Foundation, an information and consulting agency, micro-finance and other entities. Regional target programs in innovation development are being implemented; Zhigulevskaya Dolina, a techno park specializing in high technologies is about to be set up as is a special industrial/developmental special economic zone. The so-called „innovation lift” mechanism was implemented and is now operating which provides ways to support and fund innovation projects at all stages of their development (Samara Region. Innovation-Based Development. 2014).

In the Nizhny Novgorod Region, the powerful centers for innovation implementation are the Sarov Nuclear Cluster, GAZ, OJSC; and SIBUR Holding. The Nizhny Novgorod Business incubator, the Regional Center for

New Information Technologies; the Nizhny Novgorod Nano-Industry Regional Center, a non-commercial partnership; the Nizhny Novgorod Investment Center for Energy Efficiency; the Technological/Implementation Open Park in the Satis village, Diveevsky district, Nizhny Novgorod Region; and the An- kudinovka IT Park are all successfully operating now.

Tatarstan has a wide and varied infrastructure designed for stimulating and encouraging investment activity. It includes the Alabuga Type Industrial / Developmental Special Economic Zone, the Khimgrad technology based city project, Innopolis (specializing in information and communication technologies), 4 industrial parks, 9 techno parks, 7 business incubators and also 6 investment and venture foundations (*Razvitie innovacij v Respublike Tatarstan...* 2010).

Special economic zones operate as one of the most important instruments of stimulating innovation activity in another two constituent entities of the Volga Federal District – the Togliatti industrial special economic zone in the Samara Region and the Ulianovsk industrial special economic zone.

In conclusion, we would like to note that initial innovation awareness indicators in the regions are comparable and do not differ greatly but the growth of activity can be observed only in some of the regions. All of this suggests that the government is advised to develop new instruments for stimulating and supporting innovation development in the nation's regions. It is also necessary to continue working in the existing directions of activity. The problem of large differentiation among the constituent entities of the Russian Federation by their level of economic development remains important and has to be dealt with.

In order to conduct an effective government policy in building an innovation-based economy, it is necessary to make integrated evaluations of the current state of development and effectiveness of state governance. For this purpose, it is necessary to continue to further develop relevant analysis methods, to conduct research into the condition of innovation, to use data obtained with a view to developing an effective strategy for regional development for each of the constituent entities.

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