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# Analysis of Innovation Potential of Northern Russian Regions*

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**Abstract.** The purpose of the study is to improve theoretical and methodological techniques for assessing innovation potential and determine the main areas of scientific and technological development of Northern Russian regions. The theoretical part of the article reveals the essence of innovative potential and provides the author's classification of approaches to its measurement. It demonstrates that the majority of modern domestic and foreign studies are aimed at assessing the territory's innovative potential through the calculation of the integrated index; however, this leads to the merging of diverse characteristics into a unified scale. The paper describes the features and limitations of factor analysis and hierarchical cluster analysis of the phenomenon under study, monitoring of specific profile and inward similarities of the analyzed objects. Factor analysis has revealed five most important characteristics which determine innovative development of Northern Russian regions: level of scientific development of the regions, level of inventive activity, human capacity, level of financing of innovation, ICT development. By means of the hierarchical cluster analysis method, four types of Northern Russian regions have been distinguished by type of their innovative potential: single leader; regions with high potential for creating innovation; regions with increased susceptibility to innovation; "defense areas". The authors indicate the options of the state and corporate innovation policies in the identified groups; they emphasize the expediency of transition from importing ready technologies to international cooperation in their development in a unique natural environment of the Russian North, as well as the value of "eco-friendly" innovations compared to "resource-consuming". The results of the research may be useful in inter-regional comparisons and searching for new approaches to territorial development. Thus they may be applicable to the development of strategic program documents on innovative development of Federal districts, regions under study, individual industries and enterprises. Methodological techniques of the present research should provide the basis for future research of innovative potential of both Northern territories and all Russian regions.

**Key words:** innovative potential, factor analysis, cluster analysis, innovation investment, Northern Russian regions.

## Introduction

Improving competitiveness and transition to an innovative way of development has currently become a priority for the Russian regions. The issue of innovative development is especially acute for the Northern territories[1] due to the elevated costs of life support, spatial and climate management peculiarities, as well as export-and-resource specialization of enterprises. Innovation potential of the Russian Northern regions varies greatly due to the

[1] The Northern regions are defined as the RF constituent entities, the territory of which, according to the Resolution of the USSR Council of Ministers no. 12 (with subsequent amendments and additions) dated January 3rd, 1983, belongs to the Far North and comparable regions: Republic of Karelia, Komi and Sakha republics, Kamchatka Krai, Arkhangelsk, Magadan, Murmansk and Sakhalin oblasts, Khanty-Mansi, Yamalo-Nenets, Nenets and Chukotka autonomous okrugs. The Republic of Tyva is excluded due to very low innovative activity and its geographical remoteness from other regions under review.

specific nature of territory development and economic structure, peculiarities of human and scientific potential. That is why it is necessary to develop state economic policy differentiated by groups of regions, implying appropriate assessment of innovation potential of the regions.

**Innovative potential and its components**

Modern economic literature contains many studies examining the concept of "innovation potential"; however, it still has no unique interpretation, debates about its nature and structure still continue.

For example, D. A. Kornilov and O. G. Belyaev insist there are six different approaches to the interpretation of innovation potential: it is defined as the synthesis of scientific, technological, intellectual and creative potentials; as an ordered set of resources for implementing innovation activity; as a combination of realized and unrealized resources (hidden) resource capabilities; as measures of an economic entity's (system's) ability and willingness to carry out innovation activity; as a reflection of the final result of realizing the existing opportunities in the form of a new product; as a combination of resource and result approaches [2].

A review of literature [11; 18; 20; 21] shows that in most cases the category "innovative potential" is interpreted as a set of resources and as a system's ability to make effectively use of them for future innovative development of a country or region. Accordingly, the present study defines innovation potential of a region as the territory's ability to create, perceive and introduce in practice innovations during socio-economic development. Under such an approach, the structure of innovation potential usually includes isolated resource, infrastructure and productive components [4; 15; 18].

The resource component of innovation potential is a basis for its formation. It includes the following core components: human, research, logistical, financial, informational, natural and other resources. In the authors' opinion, investment flows should be partly taken into account only in terms of their innovative component when analyzing innovation potential.

The second (infrastructural) component of innovation potential is expressed in the system's ability to secure resources for initiation, creation and distribution of various innovations according to the principles of commercial effectiveness. It includes the resources of state support and infrastructure components: technology parks, business incubators, innovation and information centers, technology transfer centers, etc.

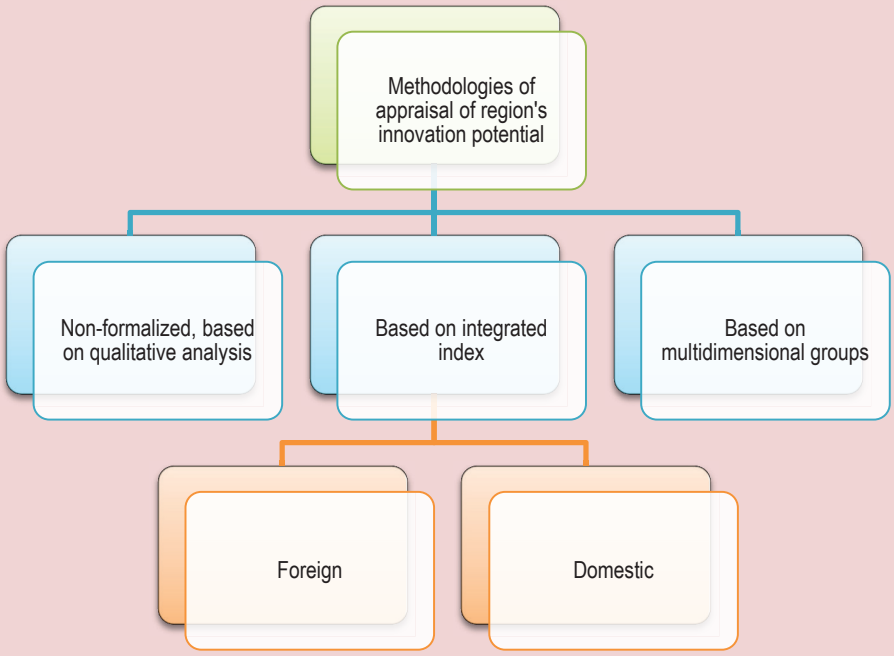
The third (result) component of innovative potential reflects the final result of possibility realization and is characterized primarily by innovative activity of organizations and the volume of innovation products.

**Methodological approaches to appraisal of innovative potential**

Modern domestic and foreign theory and practice contains many techniques and indicators for analyzing and comparing innovation potential of countries and regions. The authors present their classification *(Fig. 1)*.

First, innovation potential may be characterized with the use of methods of qualitative analysis – review of disconnected indicators, surveys and interviews, analysis of speeches and publications (including non-scientific), SWOT analysis, etc. (examples: [9; 10]). These methods do not provide accurate estimates and are very limited in terms of comparison of the subjects among themselves and in dynamics; however, they help see some hidden phenomena and identify internal interests and relations of the participants of the innovation process. Most often this

Figure 1. Methods of appraisal of region's innovation potential*




* Compiled by the authors.

type of analysis may be found in various analytical reports, government strategies and programs.

The second group of methods, the most popular and developed so far, is the calculation of integrated indices for both individual components of innovation potential and the whole set of its characteristics. Such studies are have been conducted abroad for more than 30 years, in Russia, however, they proliferated during the last decade [1]. Of the most well-known foreign methods of this type are: the methodology of the World Economic Forum for assessing competitiveness[2]; monitoring of the European Commission which includes more than ten different tools[3]; methodology of the Organization for Economic Cooperation and Development[4]; methodology of the National Science Foundation[5]; the Global Innovation Index[6] and etc. The authors also note that developed countries use more sophisticated measures of appraising innovation potential of the fourth generation and develop models of their processing based on fuzzy calculations and neural networks [33].

Domestic techniques can be divided into two spheres. The first is a point rating assessment of regions by agencies or research-educational organizations. Examples: the Expert RA Rating Agency Expert appraisal of innovation potential of regions as a factor in their investment attractiveness[7]; rating of innovative development of the RF constituent entities of Higher School of Economics[8]; regions' innovation index North-West Center for Strategic Research[9], etc. The advantages of these ratings are: complete coverage of regions, a long observation period, aiming at unification of the analyzed indicators with foreign methodologies. However, rating assessment itself cannot assess innovation potential of the region in absolute terms or in comparison with foreign countries; it only shows the correlation of objects between each other in dynamics and sometimes – potential formation factors. Moreover, calculation techniques are not fully disclosed by the developers.

Another group of techniques is represented by quantitative assessment of innovation potential. Several dozen of techniques already exist; the authors give the following examples of works [3; 16; 24; 25; 27]. The composition of the selected

[2] https://www.weforum.org/reports/global-competitiveness-report-2015

[3] http://ec.europa.eu/growth/industry/innovation/facts-figures_en

[4] http://www.oecd.org/sti/scoreboard.htm

[5] http://www.nsf.gov/statistics/2016/nsb20161

[6] https://www.globalinnovationindex.org

[7] http://raexpert.ru/ratings/regions

[8] Gokhberg L.M. (Ed.). *Rating of innovative development of the RF constituent entities.* Issue 3. Moscow: NIU VSHE, 2015. 248 p.

[9] http://csr-nw.ru/projects/2009/analiz_perspektiv_tehnologicheskogo_razvitiya_regionov_rossii_v_ramkah_provedeniya_nauchno-tehnologicheskogo_forsajta_rf

indicators and processing methods vary widely and depend on available statistical information and the author's preferences. As a rule, not only factor indicators, but also result indicators are identified – the volume of innovative goods, works and services, their share in total production volume. A large number of methods of this type make the creation of another one useless if it is not completely different from the existing ones.

The common drawback of all methods of integrated estimation is that they inevitably synthesize all aspects of innovative activity into one indicator and thereby ignore the "profile" of individual territories. This disadvantage is partly neutralized by the calculation of sub-indices in the methods of the Higher School of Economics, North-West Center for Strategic Research or O.A. Moskvina.

The third area of analyzing the regions' innovation potential, which is less frequently used, is multidimensional grouping, i.e., decomposition of a set of objects under examination into relatively homogeneous groups called clusters[10]. The advantage of this method is that it helps identify groups of more or less similar objects not on the basis of the aggregated indicator, but taking into account the specificity of the combination of key indicators, which forms the similarity of these objects. In other words, this method does not rank the regions, it is aimed at demonstrating the combinations of characteristics of development (in fact, the strategic image) inherent in different types of the country's entities. In the authors' opinion, this gives more opportunities for understanding different alternatives for innovative development.

Another advantage of this method lies in the possibility of pre-selection using factor analysis of key indicators which characterize a large part of the total variance of the total set of indicators [12].

However, this method has its limitations and disadvantages. First, the set of regions is not always clearly differentiated by specific groups; in this case, classification becomes quite arbitrary and the results strongly depend on the index standardization method, cluster method, etc. Second, due to lack of clear boundaries between the clusters it is almost impossible to ensure comparability of the analysis and track the regions' movements within groups.

The number of such studies is rather small in comparison with the first group. The examples are the following works [1;

[10] In this study, the term "cluster" as not a concentrated on a particular territory group of economically and technologically connected agents, but a mathematically closely related sub-group of the initial set of objects identified as a result of their multidimensional classification by several characteristics.

6; 19]. However, the authors of these works do not use factor analysis, which limits the selection of the most important variables. The method of factor analysis have been previously used by the authors of this study for analyzing innovative scientific potential of the Northern regions in 2000–2007 [7], of all regions of the Russian Federation in 2000–2006 [8] and innovative investment activity of the Northern regions in 2012–2013 [26].

The present study proposes the application of the method of multidimensional groups in order to evaluate and compare innovation potential of the Northern regions. The evaluation algorithm is as follows. First of all, inventory and selection of the most appropriate indicators available in regional statistics is carried out. Next, the indicators' dimensions are reduced by using the Principal component analysis. After that, using hierarchical cluster analysis, groups of regions with different degrees of innovation potential are distinguished. Finally, these groups (clusters) are comprehensively characterized. Factor and cluster analyses are performed using IBM SPSS Statistics.

**Appraisal of innovation potential of the Northern regions**

*Selection of indicators*. In order to evaluate innovation potential of a region, 17 indicators have been selected *(Tab. 1)*. Moreover, four indicators were selected as a resulting block, i.e. for assessing the effectiveness of using the regions' innovation potential. The total number of observations amounted to 12 Northern regions, the observation period – from 2012 to 2014.

*Reduction of indicators' dimensions*. After processing primary indicators for all years using Principal component analysis, the authors distinguished 5 principal components with eigenvalues more than 1. These components cover a large part of the total variance – 86–87%. Since the factor matrix was not clear enough for the interpretation of components, the indicators were rotated using varimax rotation.

*The first component* – $F_1$ includes four variables with highest factor loadings – $X_1$, $X_4$, $X_5$, $X_{10.}$ The most representative one has been selected among them – $X_{10}$. I.e., this factor characterizes the regions' level of scientific development.

*The second component* – $F_2$ is formed from three indicators with highest factor loadings – $X_7$, $X_8$ and $X_9$, with the selected $X_7$ having the highest correlation degree. On the basis of its meaning, this factor is interpreted as the level of inventive activity.

*The third component* is most closely related to $X_3$. Therefore, this component reflects the region's human capacity.

Table 1. Indicators of regions' innovation potential*

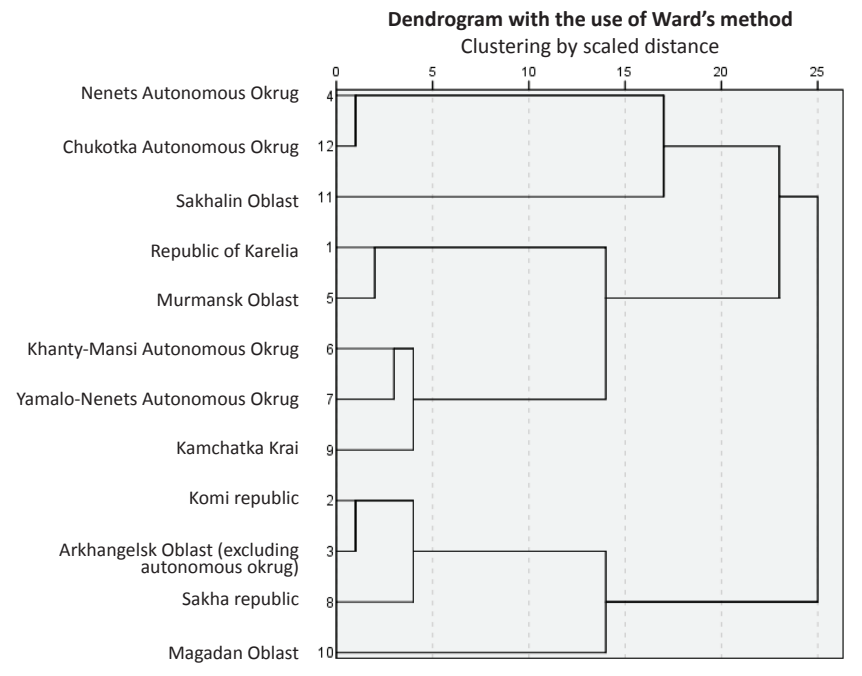
| Indicators | Notation |
|---|---|
| **HR COMPONENT** | |
| Graduation of students with Bachelor's and Mater's degrees, specialists from educational establishments of higher education, per 1000 people | $X_1$ |
| Share of people under and of working age, % of the total population | $X_2$ |
| Share of people with higher education, % of the total employed population | $X_3$ |
| Number of staff engaged in research and development, per 10 000 people engaged in the economy | $X_4$ |
| Number of researchers with a degree, per 10 000 people engaged in the economy | $X_5$ |
| **SCIENTIFIC COMPONENT** | |
| Number of organizations engaged in research and development, per 10 000 people engaged in the economy | $X_6$ |
| Coefficient of inventive activity (number of domestic patent applications for an invention, made in Russia per 10 000 people) | $X_7$ |
| Patenting of inventions and utility models, per 10 000 people | $X_8$ |
| Number of developed advanced production technologies, per 100 000 employed | $X_9$ |
| **FINANCIAL COMPONENT** | |
| Domestics research and developments costs, thousand rubles per 1 employed in the economy | $X_{10}$ |
| Costs of technological innovations, thousand rubles per 1 employed in the economy | $X_{11}$ |
| Share of innovations in fixed investment, % | $X_{12}$ |
| Costs of ICT, thousand rubles per 1 employed in the economy | $X_{13}$ |
| **INFORMATIONAL COMPONENT** | |
| Organizations which used electronic computing and other machines apart from PCs, % of the total number of the surveyed organizations | $X_{14}$ |
| Organizations which used access to broadband Internet, % of the total number of the surveyed organizations | $X_{15}$ |
| Organizations which had a website, % of the total number of the surveyed organizations | $X_{16}$ |
| Number of personal computers with Internet access, per 100 employees | $X_{17}$ |
| **RESULTING BLOCK** | |
| Organizations' innovative activity (share of organizations engaged in innovations, %) | $X_{18}$ |
| Number of applied advanced production technologies, per 1 000 employees | $X_{19}$ |
| Amount of innovative goods, works and services, thousand rubles per 1 employee | $X_{20}$ |
| Share of innovative goods, works and services in the total shipment, % | $X_{21}$ |
| * Compiled by the authors. | |

*The fourth component* – $F_4$ includes the indicators with highest factor loadings – $X_{11}$ and $X_{12}$, with $X_{11}$ selected as the most reliable in terms of calculations, although with a slightly lower factor loading. Thus, factor $F_4$ may be called "innovation financing level".

*The fifth component* – $F_5$ is clearly determined by indicators $X_{15}$ and $X_{16}$, with the leading $X_{16}$. Accordingly, this factor shows the degree of ICT development in the region.

*Clustering of regions and their comprehensive characteristics*. Northern regions were classified according to the selected indicators of innovation potential for 2012–2014 using the method of Ward hierarchical analysis and primary indicators standardization according to the Z-score. The graphic image (dendrogram) of the regions' multidimensional classification for 2014 is presented in *Fig. 2* with four groups of Northern regions. The ranking and comprehensive characteristics of the clusters are presented in *Tab. 2*. The regions' grouping in other years differ significantly from this one, which demonstrates continuous changes in the

Figure 2. Dendrogram of multidimentional classification of Russian Northern regions by indocators of innovation potential in 2014*




* Compiled by the authors according to: Rosstat Unified Interdepartmental Statistical Information System. Available at: https://www.fedstat.ru; *Russian regions. Socio-economic indicators. 2015: statistical book. Rosstat*. Moscow, 2015. 1266 p.

Table 2. Composition and characteristics of clusters of Russian Northern regions by their innovation potential in 2014*

| Cluster | Number of regions | Regions | Factor indicators | | | | | Final indicators | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $X_3$ – Share of people with higher education, % of the total employed population | $X_7$ – Coefficient of inventive activity, units | $X_{10}$ – Domestics research and developments costs, thousand rubles per 1 employed in the economy | $X_{11}$ – Costs of technological innovations, thousand rubles per 1 employed in the economy | $X_{16}$ – Organizations which had a website, % of the total number of the surveyed organizations | $X_{18}$ – Organizations' innovative activity, % | $X_{19}$ – Number of applied advanced production technologies, per 1 000 employees | $X_{20}$ – Amount of innovative goods, works and services, thousand rubles per 1 employee |
| | | **Russian Federation** | **32.2** | **1.65** | **12.5** | **17.9** | **40.3** | **9.9** | **3.0** | **52.8** |
| | | **Northern regions** | **30.6** | **0.51** | **3.9** | **26.9** | **39.5** | **7.6** | **2.6** | **116.8** |
| 1 | 1 | Sakhalin Oblast | 26.7 | 0.10 | 4.2 | 148.4 | 39.8 | 4.1 | 2.2 | 1485.3 |
| 2 | 4 | Republic of Komi, Arkhangelsk, Sakha republic, Magadan Oblast | 28.3 | 0.64 | 6.2 | 5.1 | 33.5 | 9.5 | 2.6 | 19.1 |
| 3 | 5 | Khanty-Mansi, Yamalo-Nenets autonomous okrugs, Republic of Karelia, Kamchatka Oblast, Murmansk Oblast | 34.0 | 0.42 | 4.0 | 14.4 | 44.7 | 8.7 | 3.5 | 6.8 |
| 4 | 2 | Nenets and Chukotka autonomous okrugs | 26.7 | 0.00 | 1.6 | 0.8 | 36.2 | 16.2 | 0.2 | 0.5 |

* Calculated by the authors according to data from: Rosstat Unified Interdepartmental Statistical Information System. Available at: https://www.fedstat.ru; *Socio-economic indicators. 2015: statistical book. Rosstat*. Moscow, 2015. 1266 p.

structure of innovation potential, as well as the imperfection of statistical tools for its evaluation.

*Cluster 1* includes only one region – the Sakhalin Oblast. Its main difference from all the others is in its large costs of technological innovation – almost 150 thousand per one employed in the economy. The Oblasts also leads in the volume of innovative products – more than 1 million rubles per an employee. These figures are provided mainly by production of liquid natural gas at Sakhalin Energy plant, created mainly on the basis of imported technologies and focused on foreign customers.

The same indicators of human and scientific capacity, inventive and innovative activity of organizations in the region lag behind other territories. This is explained by

its insular position, a significant migration outflow of working-age population, especially young people, underdeveloped transport and energy infrastructure, strong appreciation of life due to seismic and environmental factors. Therefore, apart from the "gas" project, it is necessary to develop and exstensively process various minerals, develop alternative energy sources, production of organic food and other spheres.

This will require efforts in mobilizing the potential of academic and university-based science, wider cooperation with other countries, establishment of specialized centers of innovation infrastructure based on a favorable ratio between large corporations and small and medium enterprises [17]. Given the experience of innovative transformations of oil- and gas-dependent coastal countries, it can be concluded that it is reasonable to focus on aquaculture development [30]. It is better for Russia that such projects imply not just trivial purchase of existing technologies, but their joint development based on mutually profitable multilateral cooperation, as established in modern scientific-technical cooperation [39] (*Tab. 3*).

Table 3. Fields of public and corporate policy of innovation potential development in Russian Northern regions*

| Groups of regions by innovation potential | Proposed measures |
|---|---|
| Sakhalin Oblast | – Diminishing adverse climatic conditions and improving socio-economic environment of innovation activity based on special benefits at the federal and regional level;<br>– Focus on collaborative innovation development together with foreign partners (instead of purchasing off-the-shelf technologies) in mining and mineral processing, safe economic management in severe environment, alternative energy, output of organic food, biotechnologies and aquaculture, etc. |
| Komi republic, Arkhangelsk oblast, Sakha republic, Magadan Oblast | – Development of more efficient mechanisms of cooperation of regional research and development organizations with manufacturing companies;<br>– Increasing opportunities of innovative energy development of power by using special mechanisms of legislative regulation and reconsideration of approaches to corporate management;<br>– Intensifying traditional sectors of agriculture aimed at improving food security. |
| Khanty-Mansi, Yamalo-Nenets autonomous okrugs, Republic of Karelia, Kamchatka and Murmansk oblasts | – Improving mining technologies accompanies by their processing intensification and development of alternative energy sources and energy conservation;<br>– Searching for new technological decisions of federal importance by merging the interest of industry and science, including "corporate" research organizations;<br>– Raising the importance of new technical and management decisions in environment conservation aimed at preserving unique ecosystems for future generations. |
| Nenets and Chukotka autonomous okrugs | – Focus on the development of "small" innovations in the quality of life, labor conditions and preservation of natural environment by using native peoples' traditional practices and innovations created on the basis of "practice and cooperation". |
| * Compiled by the authors. | |

Thus, the insular position of Sakhalin, just like most of other similar territories on the planet, clearly dictates the need for an individual innovation policy both in terms of new research areas and the mechanisms and methods of their organization [34].

*Cluster 2* – with the medium level of innovation potential. It includes four regions: Komi and Sakha republics, Arkhangelsk and Magadan oblasts. They differ from other Northern territories in higher scientific potential: training of specialists in universities, number of researchers and research organizations, research and development costs. It also has high coefficient of inventive activity which tends to increase, and the number of issued patents, which is associated with the activities of corporate and defense research organizations: in shipbuilding in the Arkhangelsk Oblast; in Yakutia – in diamond mining; in Komi republic – in oil and gas production; in Magadan – in gold mining. In the Arkhangelsk and Magadan oblasts the number of created developed advanced technologies is also high – from 2 to 8 per year per 100 thousand employed people.

However, it is obvious that a considerable amount of investment in obtaining new knowledge and even registering inventions in the regions of this group have almost no practical application yet. This is evidenced by the insignificant costs of technological innovations – about 5,000 rubles per an employee, which is several times less than the national average and the level of leading regions such as Tatarstan, Perm Krai, the Samara Oblast, etc. And this is not about lack of investment in general, but about a small share of an innovative component in them due to the prevalence of obsolete mining technologies, an extremely small share of machine building and other high-tech industries. It is obvious that these regions need to develop more effective mechanisms of interaction of regional research institutions with industrial enterprises [28]. From the example of Norway it is also clear that innovations in the Northern regions are significantly hampered by low population density and low diversity of sectoral structure of the economy [29].

There is also a noticeable gap in this group of regions in terms of ICT development influenced by both regions' geographical conditions (peripheral position, low population density, large proportion of rural residents, increased share of older generations), and the specificity of the Northern mentality, with its slow innovation perception. Such

a lag is not necessarily a disadvantage; it can be considered as a sort of a defense mechanism keeping the best practices in the accustomed way of life.

In the resulting block, the regions of this group show good results in innovative products manufacturing – from 20 to 100 thousand rubles per an employee. This is mostly ensured by the use of foreign technology (oil refining, textile and clothing manufacturing, wood processing and pulp and paper production), but to some extent – by the regions' own developments (shipbuilding and ship repair in the Arkhangelsk Oblast, energy in Yakutia).

Due to the geographical characteristics of these regions energy is one of the most "vulnerable" and, at the same time, promising spheres of innovative development. Amid modern conditions of stringent regulation, it is almost impossible for companies to move towards this direction, it requires both changes in legislation and corporations' reconsideration of their usual assessment of the manufactured product solely as economic value added [32].

During innovative development of this group, attention should also be paid to the possibility of traditional agriculture intensification. This can be used by both usual financing and support mechanisms [13] and foreign experience of regulation of relations and interests in agriculture innovative development [40].

*Cluster 3* – includes five regions: Khanty-Mansi and Yamalo-Nenets autonomous okrugs, Republic of Karelia, Kamchatka and Murmansk oblasts. This cluster has weaker potential of own developments: smaller number of graduates, researchers, practitioners and scientific organizations, a slightly lower level of financing of fundamental science and inventive activity.

The group's strong features are: an increased share of population under working age (1% over the average in the North and 6–8% over the national average), an increased share of people with higher education (3–4 and 1–2% respectively). There is a rise in number of issued patents for inventions and utility models and in the number of developed production technologies. An important advantage for innovative development of an oil producing region is a major investment flow resulting in a higher level of funding for innovation projects. Another indisputable and universal attribute is a better development of information technology on all indicators. All of this highlights a better ability of this group to perceive ready-made innovations.

As for resulting indicators, the volume of innovative products in relative terms is small due to predominance of "raw" goods production – oil and gas. However, it still demonstrates a positive trend, especially in the Murmansk Oblast (food industry, mechanical engineering), in Khanty-Mansi Autonomous Okrug (woodworking) and in the Kamchatka Oblast (applied research).

The prospects of regions' innovative development of this cluster are correlated with the following aspects: improvement of mining technologies (increase in recovery factor, development of small and remote fields, enhancing the security of geological works, etc.), processing of extracted raw materials, development of alternative energy sources and energy conservation [5]. An important condition for the solution of these issues is consolidation of scientific and industrial interests, as well as overcoming the current fragmentation and corporate nature of the former industrial science for the search for new technological decisions of federal importance [14].

Moreover, these regions may follow the example of foreign companies and search for more new technical and management decisions concerning environment protection, which may lead to more tangible economic results in the near future, as it is more important from the point of view of preserving their unique ecosystems for future generations [36; 41].

*Cluster 4* includes Nenets and Chukotka autonomous okrugs, which are characterized by low population, extreme peripheral position, mining in extreme climatic conditions mainly on a shift-rotating schedule.

It is clear that the potential of the region's own developments and output of innovative products is extremely low due to lack of appropriate human resources and infrastructure. However, along with this, these regions have a well developed information-computational infrastructure and a strong investment flow. It is interesting to note that since 2014, both entities create new production technologies. The regions of the Far Northern regions have an extremely vulnerable biosphere, that is why the issues of preserving environment are particularly acute in this territory. As evidenced by foreign practice, in the future such territories might become an experimental ground for many innovative projects, which will help them to not only obtain economic benefits, but also improve the quality of life, working conditions [31] and environmental sustainability [35].

Moreover, the significance of "center–periphery" model in the post-industrial paradigm is significantly reduced and the opportunities for innovation in small and medium cities are expanding, including the use of traditional practices of local peoples [22; 23]. It has also been noticed that a rational combination of scientific and technologically-based innovations (STI) with practice- and interaction-based innovations (learning-by-doing, by-using and by-interacting – DUI) is the most effective [38]. In such "preserved" territories, innovations should not be considered only as of the catalyst of production sector; their impact on economic growth and employment does not always give quick results and is not always direct, especially in terms of social and humanistic discoveries [37].

Thus, spatial analysis of the level of innovation potential of the Northern regions has identified:

– general lag of indicators of innovative development of Northern regions behind the national average due to low human capacity, lag of technological mode, lack of enterprises' interest in innovations, lack of focus of regional scientific complexes on cooperation with the real sector of economy;

– four groups which differ in the level of innovation potential. The majority of the regions was divided into two slightly distinct groups, one of which is characterized by high potential in innovation creation, the other has more opportunities for perceiving ready-made innovations;

– instability in the structure of innovation potential of Russian Northern regions, abrupt changes in indicators due to the fragmentation of the innovation process and the ambiguous nature of methods of its statistical observation;

– opportunities of increasing the efficiency of using innovation potential of Russian Northern regions on the basis of improving the system of incentives for researchers and entrepreneurs, expansion of state support, transition from the ready-made equipment purchase to cooperation in the field of creation of new technologies;

– feasibility of increased attention to both economically effective and socially- and environment-oriented innovations in the North.

If the abovementioned characteristics and trends in spatial distribution of innovation potential of Northern regions are taken into account, the authorities and businesses will be able to ensure the acceleration of the territories' innovative development and ultimately improve the population's welfare.

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