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Resource Potential for Innovation Development of the Russian Arctic Industry: Assessment and Significance *

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Abstract. The aim of the work is to determine a scientifically based assessment of the resource potential of the Arctic industry, which determines the possibility of transition the economy to an innovation type of development, taking into account its specific features. The considered scientific works of foreign and domestic scientists made it possible to determine the methodology for rational assessment of the resource potential of the industry of the Arctic territories. The study was performed on the basis of production, technical, investment, staffing and innovation development indicators for 2013–2019. The study showed that in terms of production and technical indicators the Arctic regions generally have an average level of resource potential while the maximum values are typical for the Nenets and Yamalo-Nenets Autonomous Okrugs. In terms of investment indicators, the Arctic regions are characterized by high potential. In terms of staffing, the Arctic regions are characterized by low potential while Murmansk Oblast demonstrated effective personnel policy. Innovation development indicators of the Nenets Autonomous Okrug and the Murmansk Oblast are lower than in the Chukotka and Yamalo-Nenets Autonomous Okrugs. The Arctic regions are characterized by the differentiation of indicators of resource provision of economic development associated with differences in production, investment, personnel and innovation spheres. The study showed that the highest aggregate resource potential for innovation development is typical for the Yamalo-Nenets Autonomous Okrug while the lowest one is typical for the Chukotka Autonomous Okrug and the Murmansk Oblast. Proposals for further scientific research in the direction of enhancing innovation and accordingly increasing socio-economic indicators of the Arctic regions were developed.
Keywords: *Resource potential, Arctic, region, innovation development, methodology, indicator, differentiation*

Introduction

The problems related to the competition for the natural resources of the Arctic, which have become more acute in recent years, necessitate the intensification of fundamental scientific research on the integrated innovation development of the Arctic territories, taking into account their specific features, including increased costs [1].

It is necessary to develop a scientifically based assessment of the resource potential, taking into account external threats, possible changes in the world's commodity markets and allowing making managerial decisions for further innovation development of industry and socio-economic trans-

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formation of the Arctic. In this regard, the purpose of this work is to determine a scientifically based assessment of the resource potential of the Arctic industry.

The extraction and processing of mineral and hydrocarbon resources in the Arctic is associated with a number of specific economic, technological, social, environmental and other problems. The development of resource potential is possible with a systematic strategic approach to technological development, which ensures the growth of the Arctic economy in the near future [2, 3].

Various scientific forums, business communities, and the government discuss issues related to improving the efficiency of resource enterprises and accelerating the development of Russia's Arctic territory. It should be noted that the emphasis in long-term planning is always on the experience of developing the resource potential of areas with a temperate climate, and the specific features of the Arctic environment remain outside the attention of operators and authorities. An important problem is the imperativeness of innovation development, which will require a scientific justification of managerial decisions at the regional and federal levels.

Literature review and research methodology

The paper analyzes published works, scientific and analytical papers and official information of the Federal State Statistics Service (Rosstat) in the regional context.

Methodologies developed by the Higher School of Economics [1], the National Association of Innovation and Information Technology Development [2], the Financial University under the Government of the Russian Federation [3], and the Association of Innovation Regions of Russia [4] are focused on assessing the innovation potential and development of innovation activity. At the same time, surveys of the expert community and data from specialized Internet portals are widely used in most methods for assessing innovation development, which makes it difficult to obtain information. It is also possible to use other methodologies for assessing innovation and scientific–technological development, but they have their own characteristics [4].

The scientific works of foreign and domestic scientists, as well as methodologies for assessing the resource potential are considered [5–16]. It should be noted that almost every author offers a reasonable set of indicators and calculation methodology for the purposes of the study. For example, Y.V. Markina proposes to calculate five indicators that reflect organizational, information, human, financial and entrepreneurial resources to assess resource potential [5]. It is envisaged that the value of each indicator correlates with all Russian regions and is divided in as-

[1] Abashkin V.L., Abdrakhmanova G.I., Bredikhin S.V. et al. Reyting innovatsionnogo razvitiya sub"ektov Rossiyskoy Federatsii [Rating of innovative development of subjects of the Russian Federation]. Moscow, NRU VSHE, 2021, 274 p. URL: https://www.hse.ru/primarydata/rir2021 (accessed 10 September 2021).
[2] Rating of innovative activity of regions. URL: http://www.fbip.ru/articles/newsdetails/id/1108 (accessed 10 September 2021).
[3] Index of innovative development of Russian regions. URL: https://www.yumpu.com/xx/document/view/31819701/-/21 (accessed 13 September 2021).
[4] Rating of innovative regions of Russia: version 2018. URL: https://roscongress.org/materials/reyting-innovatsionnykh-regionov-rossii-versiya-2018/ (accessed 10 September 2021).

cending intervals according to the points (from 1 to 6). At the same time, Chelyabinsk and Samara oblasts are considered in Markina's work.

Within the framework of the proposed methodology, I.V. Panshin and A.M. Dobronravova provides for the calculation of natural-environmental, entrepreneurial, industrial, information, personnel, scientific and technical components to assess the resource potential [6]. The integral indicator of the resource intensity of the modernization process of the region's socio-economic system is determined by comparing the resources of the modernization process with the effect of modernization based on mathematical and statistical analysis.

F.N. Klotsvog and I.A. Kushnikov use six indicators to calculate the resource potential based on linear programming [7]. Within the framework of the methodology, they calculate the resource potential of all subjects of the Russian Federation on the basis of the mathematical apparatus.

The methodology for assessing the resource potential proposed by L.B. Kovalchuk provides for the calculation of seven sub-potentials (natural resource, material and technical, personnel, budgetary, legal, financial and managerial) based on the theory of fuzzy sets [8].

The methodology of V.P. Kandilov for the assessment of resource potential suggests the use of three components (human, informational and environmental-economic) on the basis of the index method [9]. V.P. Kandilov in his study considers the Republic of Tatarstan and its municipalities.

L.A. Lemdyaeva's methodology involves the calculation of resource potential by five components (natural resource, intellectual, entrepreneurial, economic, external) based on the coefficient method and expert assessment [10]. L.A. Lemdyaeva conducts an assessment based on the materials of the Sakhalin Oblast.

The methodology of D.V. Kulishkin involves covering not the entire resource potential, but only ten blocks of the financial component (resources of accumulated wealth, natural resources, labor, production, infrastructure, information and education, administrative management, investment and innovation, financial, economic and social-cultural resources) [11]. The work of D.V. Kulishkin examines the financial potential of the North Caucasian Federal Okrug and the development of the banking system.

G.I. Popodko's methodology involves assessing resource potential on the basis of four components (production and technical, investment, human and innovation development resources), the essence of which consists in comparing the value of each indicator with the national average [12]. The calculation is based on the data of the Krasnoyarsk Krai.

The work of A.V. Kozlov, S.S. Gutman, E.K. Tereshchenko [13] presents the infrastructure potential, which is considered within the framework of the construction complex of the Murmansk Oblast.

The monograph of the group of authors [14] considers the factors of economic development of Russian regions and spatial differentiation based on 49 indicators that characterize the effectiveness of territorial administration, industrial and agricultural sectors, general economic

infrastructure, production capacities, debts of organizations, activities of small and medium-sized enterprises, indexes of prices, incomes and expenditures of the population, the capacity of the consumer market, the level of innovation, investment opportunities, scientific and educational activities, as well as the efficiency of the labor market.

The work of T.A. Volkova, S.A. Volkova, A.M. Sysoeva, N.A. Serebryakova, I.Yu. Knyazeva and N.V. Grinchenko [15] considers the methodological approaches of various authors to assessing the economic security of regions. For this, human, innovation, social, financial and production indicators are used. The value of each indicator correlates with all Russian regions and is divided in ascending order into four intervals.

L. Chunguang, D.R. Mezentseva, G.E. Krokysheva, E.I. Arkhipova and O.A. Alekseeva [16] discuss the organizational and methodological foundations for ensuring economic security at the meso-level and their relationship with the resource potential. The resource potential is calculated according to seven components (resource and raw materials, production, human, financial, scientific and technical, export and tourism potential) based on the data of the Rostov Oblast.

M.A. Bagomedov proposes to assess resource potential by six components (natural, human, material, political, financial and innovation indicators) on the basis of expert methods [17]. M.A. Bagomedov presents an assessment of the resource potential of the main industries of the Republic of Dagestan.

In M.G. Guseinov's work, resource potential is calculated according to six indicators (economically active population, fixed production assets, oil and gas production, natural and climatic factor, agricultural area) based on a multifactorial econometric model [18]. M.G. Guseinov evaluates the resource potential according to the data of the Republic of Dagestan.

Based on the analysis of the methodology of various authors and the combination of indicators presented by various specialists, it is proposed to evaluate the resource potential by four blocks of indicators (production and technical, investment, human resources, innovation development) on the basis of statistical, comparative and categorical analysis.

The authors consider G.I. Popodko's methodology for assessing the resource potential of the transition of the economy to an innovation type of development [12] the most appropriate for the Arctic regions, taking into account their specific features. It allows determining the resource potential on the basis of available statistical data for the regions of the Russian Federation for seven years: from 2013 to 2019.

The assessment of resource potential is calculated through comparison of the indicators of the Arctic region and the Russian Federation:

$$J_n = \frac{K_n}{M_n},$$

where K_n — the value of the indicator in the Arctic region, M_n — the value of the indicator of the Russian Federation, n = l...g — the components of the resource potential.

Within the framework of the methodology, the level of the potential component is considered high if the value is greater than one. The level of the potential component is considered low if the value is less than one. If the value of the resource potential component is equal to one, the potential level is defined as average [12].

The total resource potential is calculated as the arithmetic average of all components. If the total potential exceeds one, one can state a high level of the resource potential of the Arctic region. If the total value is less than one, it can be stated that the level of resource potential is low. If the aggregate value of the resource potential is equal to one, it is possible to characterize the average level of the resource potential of the Arctic region.

Results of the study on resource potential for innovation development of the Russian Arctic

The research and the author's calculations made it possible to estimate the level of resource potential for the innovation development of four regions — the Murmansk Oblast, the Nenets Autonomous Okrug, the Chukotka Autonomous Okrug, the Yamalo-Nenets Autonomous Okrug — which are fully assigned to the Arctic zone of the Russian Federation [5].

Production and technical resources are calculated according to the coefficient of validity of fixed assets of such industrial activities as manufacturing, mining, electricity, gas and steam supply, air conditioning. The coefficient of validity of fixed assets is calculated as the difference between 100% and the degree of depreciation of fixed assets.

Research shows that the Arctic regions mainly have an average potential in terms of production and technical indicators (Table 1).

Table 1

Production and technical indicators of the Arctic regions [6]

	2013	2014	2015	2016	2017	2018	2019
Nenets Autonomous Okrug	1.25	1.26	1.25	1.20	1.15	1.08	1.05
Murmansk Oblast	0.91	0.95	0.87	0.91	0.95	0.96	1.08
Yamalo-Nenets Autonomous Okrug	1.08	1.07	1.04	1.08	1.06	1.13	1.09
Chukotka Autonomous Okrug	1.06	1.02	0.98	0.91	0.98	0.89	0.86

The maximum values of production and technical indicators are typical for the Yamalo-Nenets and Nenets Autonomous okrugs. It can be noted that the increased indicators of the Arctic regions compared to the Russian average are observed in the period 2013–2017, while the indicators are almost similar to the average Russian ones in the last three years. The minimum values of

[5] Ukaz Prezidenta RF ot 02.05.2014 N 296 "O sukhoputnykh territoriyakh Arkticheskoy zony Rossiyskoy Federatsii" (v redaktsii ukazov Prezidenta Rossiyskoy Federatsii ot 27.06.2017 № 287, ot 13.05.2019 № 220, ot 05.03.2020 № 164) [Decree of the President of the Russian Federation of 02.05.2014 N 296 "On the land territories of the Arctic zone of the Russian Federation" (as amended by decrees of the President of the Russian Federation of 06.27.2017 No. 287, of 13.05.2019 No. 220, of 05.03.2020 No. 164)]. URL: http://www.consultant.ru/document/cons_doc_LAW_162553/942772dce30cfa36b671bcf19ca928e4d698a928/ (accessed 14 January 2021).

[6] Calculated by the authors according to Rosstat. Regions of Russia. Socio-economic indicators. 2020. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 14 January 2021).

production and technical resources are typical for the Chukotka Autonomous Okrug and the Murmansk Oblast. The range of variation for the period under review is from 1.20 to 1.44 times, which characterizes an insignificant differentiation between the Arctic territories. In the Nenets Autonomous Okrug and the Chukotka Autonomous Okrug, there is a decrease in production and technical indicators. Positive dynamics are typical for the Yamalo-Nenets Autonomous Okrug and the Murmansk Oblast, characterized by the largest growth.

Investment indicators were calculated as the arithmetic average values of investments per capita; share of investments in the gross regional product; specific weight of investments by types of fixed assets "machinery and equipment" and "buildings and structures".

The Arctic regions are characterized by high potential in terms of investment indicators (Table 2).

The maximum values of investment indicators for the selected period are observed in the Nenets Autonomous Okrug, except for 2016, when the Yamalo-Nenets Autonomous Okrug had the best value due to investments per capita. The high indicators of autonomous okrugs are associated with investment attractiveness in the field of hydrocarbon production [19]. The Murmansk Oblast is characterized by the minimum values of investment indicators. The variation ranges from 4.29–8.50, which characterizes a significant differentiation in the Arctic regions. It should be noted that the Arctic regions demonstrate the growth of investment indicators.

Table 2

Investment indicators of the Arctic regions[7]

	2013	2014	2015	2016	2017	2018	2019
Nenets Autonomous Okrug	5.85	7.27	10.35	7.33	8.38	6.52	6.22
Murmansk Oblast	1.04	1.17	1.22	1.09	1.24	1.41	1.45
Yamalo-Nenets Autonomous Okrug	4.91	5.91	6.16	8.02	7.16	6.20	4.84
Chukotka Autonomous Okrug	1.69	1.20	1.78	1.54	1.45	1.54	2.03

Staffing indicators are calculated as the arithmetic average of the number of students in secondary and higher education.

In terms of staffing, the Arctic regions are characterized by low potential (Table 3).

Among the Arctic regions, the highest values of staffing indicators are observed in the Murmansk Oblast. Moreover, the Murmansk Oblast can be called the center of fundamental science. At the same time, even these indicators are significantly lower than the Russian average. The Yamalo-Nenets Autonomous Okrug is characterized by minimal staffing rates due to the low number of university students per 10.000 people. During the period under review, the variation range of staffing levels in the Arctic regions is from 1.57 to 2.54 times, which shows little differentiation between regions. The Murmansk Oblast is characterized by negative dynamics of staffing indica-

[7] Calculated by the authors according to Rosstat. Regions of Russia. Socio-economic indicators. 2020. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 14 January 2021).

tors, while other regions — by positive. It should be noted that the Arctic regions are pursuing a policy to reduce staffing shortages.

Table 3

Indicators of staffing in the Arctic regions [8]

	2013	2014	2015	2016	2017	2018	2019
Nenets Autonomous Okrug	0.36	0.83	0.77	0.65	0.56	0.54	0.58
Murmansk Oblast	0.89	0.93	0.87	0.80	0.75	0.74	0.71
Yamalo-Nenets Autonomous Okrug	0.35	0.44	0.41	0.43	0.45	0.46	0.45
Chukotka Autonomous Okrug	0.42	0.48	0.58	0.57	0.51	0.49	0.47

Indicators of innovation development of resource potential are calculated as the arithmetic average values of the volume of patents issued per 10.000 people; the number of advanced technologies used per one thousand resource enterprises and innovation activity.

The Murmansk Oblast and Nenets Autonomous Okrug have low potential in terms of innovation development indicators compared to the Yamal-Nenets and Chukotka Autonomous okrugs.

Table 4

Indicators of innovation development of the resource potential in the Arctic regions [9]

	2013	2014	2015	2016	2017	2018	2019
Nenets Autonomous Okrug	0.27	0.34	0.35	0.51	0.56	0.49	0.61
Murmansk Oblast	0.99	0.87	0.85	0.81	0.81	0.97	0.97
Yamalo-Nenets Autonomous Okrug	3.09	3.07	2.99	2.55	2.95	2.69	3.10
Chukotka Autonomous Okrug	0.83	3.63	3.35	2.85	1.72	1.57	0.91

In 2013 and 2017–2019, the Yamalo-Nenets Autonomous Okrug had the highest rates of innovation resource potential development, in 2014–2016 — the Chukotka Autonomous Okrug. The Nenets Autonomous Okrug showed the minimum values of innovation indicators due to low values of innovation activity and the number of production technologies used. The Arctic regions are characterized by significant differentiation in terms of innovation development within the range of variation from 5.10 to 11.60. It should be noted that the Arctic regions, except for the Murmansk Oblast, are characterized by positive dynamics of innovation development.

Based on the total assessment of the resource potential, the Arctic regions can be ranked according to the possibility of transition to an innovation development path (Fig. 1).

[8] Calculated by the authors according to Rosstat. Regions of Russia. Socio-economic indicators. 2020. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 14 January 2021).
[9] Calculated by the authors according to Rosstat. Regions of Russia. Socio-economic indicators. 2020. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 14 January 2021).

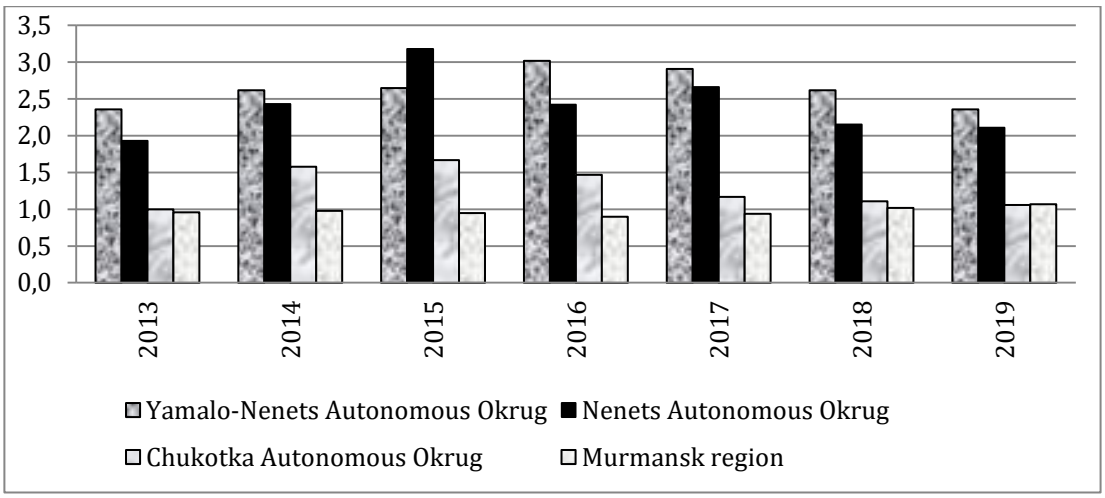

Fig. 1. Assessment of the resource potential for innovation development of the Arctic regions.

The Yamalo-Nenets Autonomous Okrug has the greatest resource potential for innovation development, except for 2015, when the Nenets Autonomous Okrug had the best indicators. The Chukotka Autonomous Okrug and the Murmansk Oblast have the lowest resource potential. The range of variation in resource potential is 2.23–3.36, which characterizes a significant differentiation between the Arctic regions.

It should be noted that the resulting indicators of potential in the Nenets and Yamalo-Nenets Autonomous okrugs are most influenced by investment resources (99% and 76%, respectively), which is associated with the investment attractiveness of the regions.

Fundamental research is required in the direction of transitioning the Arctic industry to an innovation path of development and, accordingly, increasing regional socio-economic indicators [20–22].

Conclusion

The analysis of scientific works of foreign and domestic scientists and the methodology for assessing the resource potential was carried out. The methodology for assessing resource potential of innovation development in the Arctic regions was chosen, taking into account their specific features, including harsh climate and increased costs.

The resource potential of the innovation development of the Russian Arctic was assessed on the basis of production, technical, investment indicators, indicators of staffing and innovation development for 2013–2019.

The assessment of the resource potential shows that, in terms of production and technical indicators, the Arctic regions generally have an average potential. In terms of investment indicators, the Arctic regions are characterized by high potential. In terms of staffing, the Arctic regions have shown low potential. The indicators of innovation development of the Nenets Autonomous Okrug and the Murmansk Oblast are lower than those of the Chukotka Autonomous Okrug and the Yamalo-Nenets Autonomous Okrug. The Yamalo-Nenets Autonomous Okrug has the highest

aggregate potential for innovation development. The lowest total resource potential is characteristic of the Chukotka Autonomous Okrug, as well as the Murmansk Oblast.

The analysis of the resources for innovation development of the Arctic regions showed that there is a differentiation in the indicators of resource provision for economic development, associated with differences in the production, investment, human resources and innovation spheres.

Further research is required to develop a science-based methodology for assessing resource potential in order to enhance innovation activities and, consequently, improve the socio-economic indicators of the Russian Arctic.

The proposed methodology for assessing the resource potential can be used to study not only the Arctic regions, but also the regions of the Far North and equated territories with the aim of a scientifically based assessment of the resource potential to determine the possibility of the transition of the economy to an innovation type of development.

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