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Strategic Development Priorities for the Karelian Arctic Region in the Context of the Russian Arctic Zone Economic Space Integration *

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Abstract. The Russian Arctic has been attracting a growing interest in terms of research and management. The former is due to the lack of knowledge about current processes in its development in the rapidly changing internal and external environments, and the latter is driven by the rising significance of this macroregion in ensuring the country's economic, ecological, geopolitical stability, and national security. Being interdependent, these interest spheres evidence the demand for the study of Arctic regions, especially newly established ones, and underlie its practical value, which consists in building the analytical foundations for working out and implementing the administrative mechanisms for socio-economic space integration in Arctic regions. Hence, the aim of this study is to define the strategic development priorities for the regional socio-economic system of the Karelian Arctic as a newly established region in the context of the multifarious Russian Arctic integration processes. This aim is achieved through the following tasks: analysis of the strengths and weaknesses of the socio-economic system of the Karelian Arctic, identification of key challenges and opportunities for its development, identification of the strategic priorities to overcome threats and realize opportunities. The principal methods were expert and in-depth interviews, SWOT analysis and content analysis, the dialectic method and system approach, which were applied in the context of the propositions of spatial economics. As a result of the study, characteristics of the Karelian Arctic's socio-economic system are identified in the context of the high-relevance problems of managing the development of the Arctic macroregion as a complex system. Directions for further research are defined, with the aim to build the scientific foundations for managing the spatial development of the Russian Arctic zone and its constituent regions and for handling the challenges hindering such development.
Keywords: *Russian Arctic zone, economic space integration, Karelian Arctic, SWOT analysis, Arctic macroregion, flagship area, special economic regime*

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Introduction

Ensuring the coherence of the Russian Arctic economic space and reducing the extreme development differentiation of its territories are the strategic tasks of the country in the northern dimension of its foreign and domestic policy. The implementation of these strategic objectives in the context of current challenges and risks represented by an increase in macroeconomic instability [1, Amiri H., pp. 7–11; 2, Li W., pp. 13–17], environmental threats [3, Postigo J.C., pp. 70–72; 4, Wu K-J., Tseng M-L., Ali M.H., Xue B., Chiu A.S.F., Fujii M., Xu M., Lan S., Ren M., Bin Y. pp. 6–12], an increase in climate change [5, Ravindran S., pp. 6–8; 6, Leksin V.N., Porfiriev B.N., p. 642] and challenges to social development [7, Badina S.V., pp. 4–7; 8, Fauzer V.V., Lytkina T.S., Smirnov A.V., p. 1378] of the macroregion determines the active development of public administration institutions in the Russian Arctic (AZRF), observed in the last decade. This process is inevitably connected both with the formalization of the very concept of the Arctic zone of Russia and its transformation into an independent object of management [9, Skufyina T.P., p. 425], and with the definition of the spatial contours of the implementation of state measures for its development. In practice, one can see the linkage between the formats of economic development in the Arctic (for example, the program of "supporting development zones" [10, Smirnova O.O., Lipina S.A., Kudryashova E.V., Kreydenko T.F., Bogdanova Yu.N., pp. 151–154; 11, Lipina S.A., Cherepovitsyn A.E., Bocharova L.K., p. 31; 12, Dmitrieva T.E., Buryi O.V., p. 43], "special economic regime of the Russian Arctic" [13, Volkov A.D., p. 1399]) and changes in its contours, due to both the need for comprehensive coverage of regional socio-economic systems by program activities (systematic implementation of regulatory measures), and the interest of business entities and regional government in being included in these programs. The contours of Russia's Arctic zone and the territory of the development programs have thus already been changed three times by mid-2021: in 2017 [1], 2019 [2], and 2020 [3]. The formal aspects of this expansion are striking: if the changes in the basic Decree of the President of the Russian Federation "On the land territories of the Arctic zone of the Russian Federation" [4], to which all strategic documents for the development of the Russian Arctic refer, took place on the

[1] Ukaz Prezidenta Rossiyskoy Federatsii ot 27.06.2017 g. № 287 «O vnesenii izmeneniy v Ukaz Prezidenta Rossiyskoy Federatsii ot 2 maya 2014 g. № 296 «O sukhoputnykh territoriyakh Arkticheskoy zony Rossiyskoy Federatsii» [Decree of the President of the Russian Federation of June 27, 2017 No. 287 "On Amendments to Decree of the President of the Russian Federation of May 2, 2014 No. 296 "On Land Territories of the Arctic Zone of the Russian Federation"]. URL: http://www.kremlin.ru/acts/bank/42021 (accessed 01 August 2021).

[2] Ukaz Prezidenta Rossiyskoy Federatsii ot 13.05.2019 № 220 "O vnesenii izmeneniy v Ukaz Prezidenta Rossiyskoy Federatsii ot 2 maya 2014 g. № 296 «O sukhoputnykh territoriyakh Arkticheskoy zony Rossiyskoy Federatsii» [Decree of the President of the Russian Federation of May 13, 2019 No. 220 "On Amendments to Decree of the President of the Russian Federation of May 2, 2014 No. 296 "On Land Territories of the Arctic Zone of the Russian Federation"]. URL: http://kremlin.ru/acts/bank/44231 (accessed 01 August 2021).

[3] Federal'nyy zakon ot 13.07.2020 № 193-FZ «O gosudarstvennoy podderzhke predprinimatel'skoy deyatel'nosti v Arkticheskoy zone Rossiyskoy Federatsii» [Federal Law No. 193-FZ of July 13, 2020 "On State Support for Entrepreneurial Activities in the Arctic Zone of the Russian Federation"]. URL: http://publication.pravo.gov.ru/Document/View/0001202007130047 (accessed 01 August 2021).

[4] Ukaz Prezidenta Rossiyskoy Federatsii ot 02.05.2014 g. № 296 «O sukhoputnykh territoriyakh Arkticheskoy zony Rossiyskoy Federatsii» [Decree of the President of the Russian Federation of 02.05.2014 No. 296 "On land territories of the Arctic zone of the Russian Federation"]. URL: http://www.kremlin.ru/acts/bank/38377 (accessed 01 August 2021).

basis of climatic and hydrographic features of the territories, allowing them to be attributed to the Arctic zone , then within the framework of implementation of the Federal Law “On state support of entrepreneurial activities in the Arctic Zone of the Russian Federation” into the AZRF (albeit with the proviso — “in order to implement this Law” (Paragraph 2, Article 2 of the Law)), the territories were included in its zone of effect, and the economic and social development prevailed. The combination of this objective conditionality and economic feasibility in the implementation of measures for the AZRF socio-economic development is fully reflected in the process of the gradual formation of the Arctic Karelia region, which represents the object of this study.

Taking into account the format adopted by the state for uniting the economic space of the Russian Arctic through the implementation of “complex interrelated projects” (this issue is discussed in detail in [12, Dmitrieva T.E., Buriy O.V., p. 42]), a comprehensive analysis of the socio-economic and natural resource potentials of the newly formed regions of the Russian Arctic in the context of the search and justification of areas for enhancing interregional cooperation becomes relevant. It determines the purpose of this study — the definition of strategic priorities for the development of the regional socio-economic system of the Karelian Arctic in the context of complex processes of AZRF space integration. The tasks to be solved to achieve the goal of the study include the analysis of the strengths and weaknesses of the socio-economic system of the region, the identification of key challenges and opportunities for its development, the definition of strategic priorities aimed at overcoming threats and realizing opportunities.

Features of the object under study and approaches to its investigation

The analysis of the spatial aspects of the implementation of program measures for the development of the Russian Arctic is based on the traditions of the domestic school of spatial economics, one of the founders of which is the academician P.A. Minakir. The approach outlined by him in [14, p. 28; 15, p. 25] quite accurately reflects the trend of increasing complexity of socio-economic processes and management structures of the AZRF territory. According to P.A. Minakir, the actual modern challenges are the consideration of a spatially defined socio-economic system as a “matryoshka doll” with an infinite number of “nested” and interacting spatial socio-economic clusters (regions)” [15, p. 25].

The management structure corresponding to this principle is defined in the program of “supporting zones” for the Arctic development, the fate of which is currently unclear due to the disappearance of a direct mention of it in the updated state program “Socio-economic development of the Arctic zone of the Russian Federation” [5]. It represents, according to T.E. Dmitrieva, “project of projects” [12, p. 43], due to the interdependent nature of the implemented regional “anchor” initiatives, focused both on the development and addition of the infrastructure of the

[5] Gosudarstvennaya programma «Sotsial'no-ekonomicheskoe razvitie Arkticheskoy zony Rossiyskoy Federatsii»: utverzhdena Postanovleniem Pravitel'stva ot 30 marta 2021 goda № 484 [State program "Socio-economic development of the Arctic zone of the Russian Federation": approved by the Government Decree of March 30, 2021 No. 484]. URL: http://government.ru/rugovclassifier/830/events/ (accessed 01 May 2021).

Arctic backbone — the Northern Sea Route, and on its operation in solving the problems of transporting manufactured products. However, the interdependent nature of ongoing projects for the AZRF development, designed to enhance the synergy effects of regional projects, has the potential to turn into a negative factor in their implementation in the context of current challenges and risks. Among the key risks and challenges we refer to the COVID-19 pandemic and the resulting decline in global economic activity [2, Li W., pp. 15–1816; 16 Bontempi E., Coccia M., p. 8], the failure of oil deals and the fall in the profitability of the development of Arctic oil and gas fields [17, Kozmenko S.Yu. from. pp. 27–29; 18, Norouzi N., Fani M., p. 12; 19, Fadeev A. M., Cherepovitsyn A.E., Larichkin F.D., p. 108], the growth of environmental risks [20, Samsonova I.V., Potravniy I.M., Pavlova M.B., Semenova L.A., p. 255], a decrease in consolidated budget revenues, etc. The lack of budgetary funds associated with their simultaneous action, as well as the lack of development of individual economic initiatives [21, Vetrova E.N., Bogachev V.F., p. 156] threaten to "scatter" the matryoshka "project of projects" and not only negate the positive systemic effects, but also drag down successful regional projects.

Obviously, these challenges are related to the forced transition of the federal center from the policy of integrating the Arctic spaces at the expense of costly and risky "anchor" projects to the formation of the AZRF special economic zone, unique in its scale not only for Russia, but also for the world practice. Despite the fact that the institutions of the special economic regime are still in their infancy, one can note a trend towards the transition to the current self-sufficiency of Arctic initiatives on a macroregional scale, linking their support measures to the Arctic Development Fund [6,7], formed on the basis of tax deductions from enterprises localized in the Russian Arctic.

Considering the integration of the Karelian Arctic region, formed for the first time, into these spatial development mechanisms, it is necessary to briefly describe its features as an object of study. Administratively, this region was established as a result of the successive inclusion of the northern municipalities of the Republic of Karelia into the Arctic zone of Russia:

- On July 27, 2017, the territories of the Belomorskiy municipal district, Loukhskiy municipal district and Kemskiy municipal district of the Republic of Karelia were included in the land territories of the AZRF [8] (marked in blue in Fig. 1);

[6] Rezidentam arkticheskoy zony predlagaetsya shirokiy spektr preferentsiy / Upravlenie press-sluzhby Glavy Respubliki Kareliya [Residents of the Arctic zone are offered a wide range of preferences / Office of the Press Service of the Head of the Republic of Karelia]. URL: https://gov.karelia.ru/news/16-10-2020-rezidentam-arkticheskoy-zony-predlagayutsya-bolshie-preferentsii/ (accessed 01 August 2021).

[7] Minvostokrazvitiya ozvuchilo prioritetnye napravleniya raboty v Arktike / Press-sluzhba Minvostokrazvitiya RF [The Ministry for the Development of the Russian Far East announced the priority areas of work in the Arctic / Press Service of the Ministry for the Development of the Russian Far East]. URL: https://minvr.ru/press-center/news/23921/ (accessed 01 August 2021).

[8] Ukaz Prezidenta Rossiyskoy Federatsii ot 27.06.2017 g. № 287 O vnesenii izmeneniy v Ukaz Prezidenta Rossiyskoy Federatsii ot 2 maya 2014 g. № 296 «O sukhoputnykh territoriyakh Arkticheskoy zony Rossiyskoy Federatsii» [Decree of the President of the Russian Federation of June 27, 2017 No. 287 On Amendments to Decree of the President of the Russian Federation of May 2, 2014 No. 296 "On Land Territories of the Arctic Zone of the Russian Federation"]. URL: http://www.kremlin.ru/acts/bank/42021 (accessed 01 August 2021).

- On July 13, 2020, the Kalevalskiy and Segezhskiy municipal districts and the city of Kostomuksha were included in the land territories of the Russian Arctic in the framework of the implementation of the relevant Federal Law [9] (marked with hatching in Fig.1).

Relying on the objective socio-economic factors of dialectical development of spatially defined economic systems of the Arctic Karelia allocation, the region is allocated on the basis of the settlement system and economic relations caused by the historical continuity of the White Sea natural resources development and its watershed territories, which have promising strategic importance for ensuring coherence and "contraction" of economic space of priority geostrategic territory of the Arctic zone of Russia, the geostrategic territory bordering the countries of the European Union, and the territories of non-Arctic regions of Russia and limited by the Murmansk Oblast in the north, the White Sea in the east, the border with the EU [10] in the west and non-Arctic municipalities of the Republic Karelia in the south. The specifics of the spatial location of the Arctic Karelia at the intersection of the most important geostrategic territories and the connection with the non-Arctic regions determine the special role of the region in ensuring the connectivity of the economic space of the North-West of Russia.

[9] Federal'nyy zakon ot 13.07.2020 № 193-FZ «O gosudarstvennoy podderzhke predprinimatel'skoy deyatel'nosti v Arkticheskoy zone Rossiyskoy Federatsii» [Federal Law No. 193-FZ dated July 13, 2020 "On State Support for Entrepreneurship in the Arctic Zone of the Russian Federation"]. URL: http://publication.pravo.gov.ru/Document/View/0001202007130047 (accessed 01 August 2021).

[10] V sootvetstvii s polozheniyami Strategii prostranstvennogo razvitiya Rossiyskoy Federatsii na period do 2025 goda: utverzhdena rasporyazheniem Pravitel'stva Rossiyskoy Federatsii ot 13 fevralya 2019 g. № 207-r. Bank dokumentov ofitsial'nogo sayta Ministerstva ekonomicheskogo razvitiya Rossiyskoy Federatsii [In accordance with the provisions of the Strategy for the Spatial Development of the Russian Federation for the period up to 2025: approved by the Decree of the Government of the Russian Federation dated February 13, 2019 No. 207-r. Bank of documents of the official website of the Ministry of Economic Development of the Russian Federation]. URL: https://www.economy.gov.ru/material/dokumenty/rasporyazhenie_ot_13_fevralya_2019_g_207_r.html (accessed 01 August 2021).

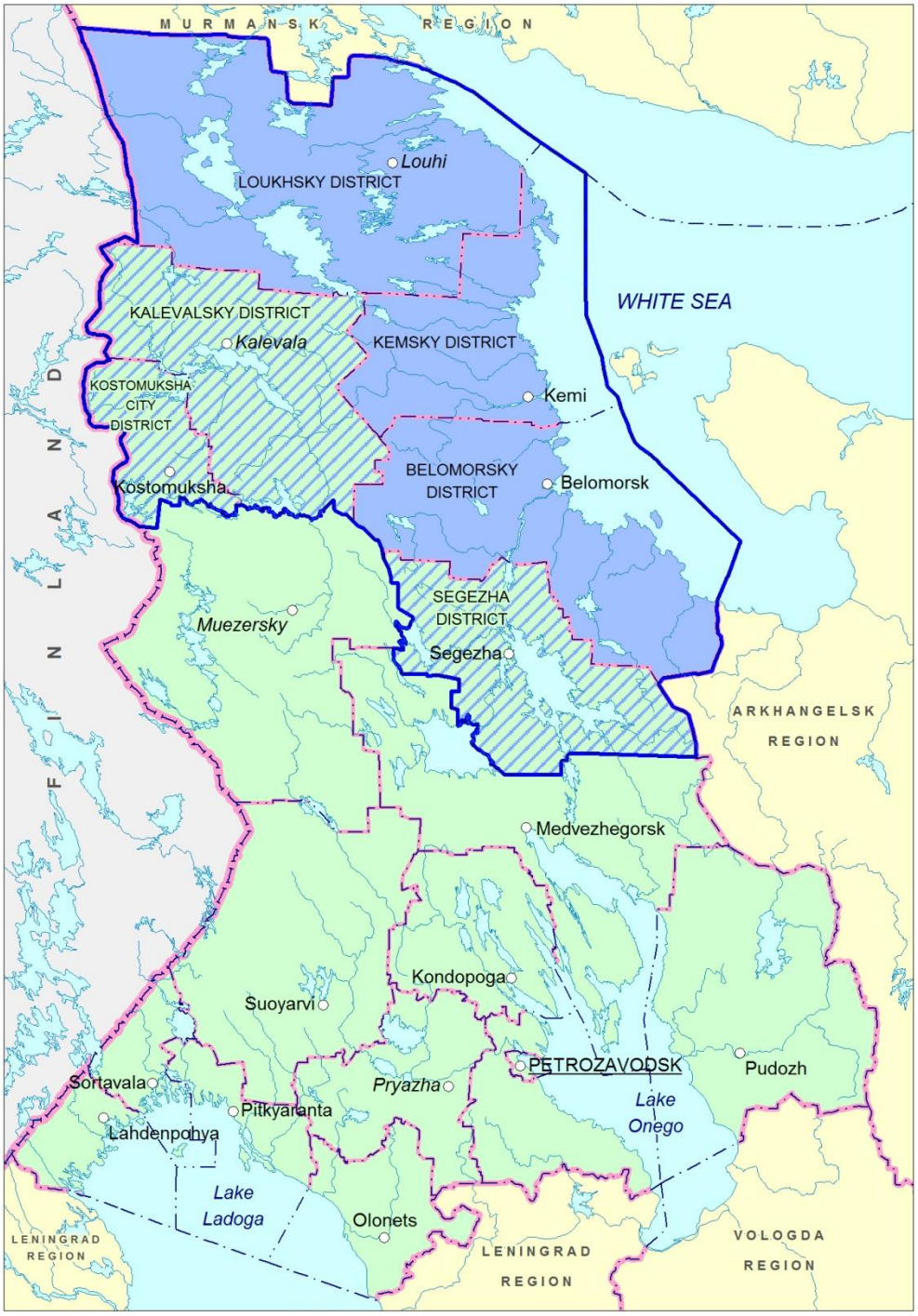

Fig. 1. The boundaries of the Karelian Arctic with the division of territories according to the time of their incorporation into the Russian Arctic.

The population of the Karelian Arctic as of January 1, 2020 amounted to 112.5 thousand people, distributed as follows by the municipalities that make up the region (Table 1). The settlement system of the region is characterized by the data in Table 1 and Table 2.

Table 1

Area and population size of the Karelian Arctic municipalities

	Area, km^2	Population, people	Number of inhabitants per 1 km^2	In the total population, %	
				urban	rural
Belomorskiy	12797	15433	1.2	59.6	40.4
Kemskiy	8029	14263	1.8	74.7	25.3
Loukhskiy	22552	10832	0.5	70.0	30.0
Segezhskiy	10723	35350	3.3	94.0	6.0
Kalevalskiy	13260	6563	0.5	58.3	41.7
*Kostomuksha	4046	30131	7.4	98.4	1.6
Total	71407	112572	1.6	83.6	16.4

Table 2

Settlements of the Karelian Arctic region and their distribution by municipalities

	Settlements and towns*, total	of them		Rural settlements in their composition, total
		urban	rural	
Belomorskiy	4	1	3	58
Kemskiy	4	1	3	18
Loukhskiy	7	3	4	27
Segezhskiy	6	2	4	34
Kalevalskiy	4	1	3	8
*Kostomuksha	1	0	0	6
Total	26	8	17	151

The industrial potential of the region, as well as the population distribution, is characterized by spatial unevenness, concentrating mainly in the cities of Segezha (Segezha district) and Kostomuksha (Kostomuksha urban district). The cities of Kem (Kemskiy district) and Belomorsk (Belomorskiy district) have practically lost their industrial significance at the moment, nevertheless, retaining their logistical and historical and cultural potential.

Materials and methods

As part of the implementation of the goal and objectives of this study, a complex of general and particular scientific approaches and methods was used, including, at the stage of compiling research tools — the dialectical method, the systematic approach; at the stage of collecting factual information — the method of expert and in-depth interviews; at the stage of data processing — the method of SWOT analysis, content analysis, the method of statistical analysis, the dialectical method and the systematic approach used in the context of the provisions of the spatial economy.

The information base of the study consisted of the data from the official publications of Rosstat and its territorial division in the Republic of Karelia, the results of inquiries to local self-governments (LSGs) of the Karelian Arctic regions and the Government of the Republic of Karelia, as well as data from in-depth and expert interviews with representatives of LSGs, private and state

enterprises, public organizations collected during the complex expeditions of July–September 2020.

The information base of the study, represented by qualitative and quantitative data, made it possible to solve its main tasks: analysis of strengths and weaknesses of the socio-economic system of the region, identification of key challenges and opportunities for its development, and determination of strategic priorities aimed at overcoming threats and realizing opportunities using the methodology SWOT analysis [22, Zonova A.V., Kislitsyna V.V., pp. 28–30]. The sample of experts was formed according to the following principle:

1) At the first stage, experts, representing different spheres of the socio-economic system, were interviewed:

- 6 enterprises reflecting the economic specialization of each district;
- 3 energy supply organizations and enterprises (one each in the fields of generation, distribution and supply of electricity);
- 6 public organizations working in the areas of environmental monitoring and education, social services and education;
- heads of subdivisions of 3 state enterprises and organizations in the field of fish farming, forestry and employment, as well as 3 specialists of district administrations in the field of housing and communal services.

Based on the information obtained during the first stage, a list of relevant factors of socio-economic development was determined.

2) At the second stage, 3 administration employees were interviewed in each of the six territorial subjects of the Karelian Arctic. The criterion for selection was the position occupied by the specialist — the Heads, their deputies responsible for solving socio-economic issues, and the heads of the regional departments of economic development were interviewed (total n=18, 3 interviewed specialists in each municipality of the Karelian Arctic).

At this stage, the significance and probability of occurrence of each factor were determined, while the experts could supplement their list.

Based on the results of these stages, SWOT analysis worksheets were compiled, an example of which is presented in table 3 and table 4.

Table 3

Strengths of the region

No.	Strength	Ability to use strength			Degree of influence on the activities of the region		
		high	medium	low	high	medium	low
1							
2							
3							

Table 4

Region's strengths matrix

Ability to use strength	Degree of influence on the activities of the region		
	High	Medium	Low
High			
Medium			
Low			

Subsequently, a SWOT analysis matrix was compiled based on a tabular representation of the strengths, weaknesses, threats and external opportunities for the development of the Karelian Arctic region. In this paper, the identified features of the socio-economic potential are described in more detail, based on both expert knowledge and empirical dependencies.

Results and discussion

At the first stage of the analysis, we determined the characteristics of the internal environment of the region, forming strong and weak components of its potential in the context of achieving the strategic goals of the AZRF development and the spatial development of Russia, defined in the relevant strategic documents — the Strategy for the socio-economic development of the Arctic zone of the Russian Federation up to 2035 and ensuring national security [11] and Spatial development strategy of the Russian Federation for the period up to 2025 [12].

Among the **strengths** of the Karelian Arctic region, the experts identified the following:

- **high transport potential of the region** due to its geographical location between Finland, the regions of the Russian Arctic and the North-West of Russia, as well as the White Sea, which connects the Arctic Karelia with global sea transport routes and other AZRF regions. The availability of transport infrastructure, represented by the Kola highway and the railway connecting the Leningrad Oblast and the Murmansk Oblast, as well as the line connecting the Belomorskiy District and the Arkhangelsk Oblast, the White Sea-Baltic Canal, a number of mothballed military airfields and port infrastructure, forms the transit potential of the region as a "gateway" to the Russian Arctic and constitutes a promising logistical basis for its economic development (most pronounced in the Lokhskiy, Kemskiy, Belomorskiy and Segezhskiy regions);
- **significant natural resource potential,** represented by mineral resources in territories of varying degrees of development (the most pronounced in the Loukhskiy, Belomorskiy

[11] Strategiya sotsial'no-ekonomicheskogo razvitiya Arkticheskoy zony Rossiyskoy Federatsii do 2035 goda i obespecheniya natsional'noy bezopasnosti: utverzhdena Ukazom Prezidenta Rossiyskoy Federatsii ot 26.10.2020 goda № 645 [Strategy for socio-economic development of the Arctic zone of the Russian Federation up to 2035 and ensuring national security: approved by Decree of the President of the Russian Federation dated October 26, 2020 No. 645]. URL: http://kremlin.ru/acts/bank/45972 (accessed 01 August 2021).

[12] Strategii prostranstvennogo razvitiya Rossiyskoy Federatsii na period do 2025 goda: utverzhdena rasporyazheniem Pravitel'stva Rossiyskoy Federatsii ot 13 fevralya 2019 g. № 207-r [Spatial development strategies of the Russian Federation for the period up to 2025: approved by the order of the Government of the Russian Federation dated February 13, 2019 No. 207-r]. URL: https://www.economy.gov.ru/material/dokumenty/rasporyazhenie_ot_13_fevralya_2019_g_207_r.html (accessed 01 August 2021).

districts and the city of Kostomuksha), and forest resources (the most pronounced in the Kalevalskiy and Segezhskiy districts), which, however, have been subjected to certain depletion due to long-term concentrated logging in the second half of the 20th century;

- **existing industrial capacities.** This applies primarily to the mining, pulp and paper, energy and fisheries industries. Despite the pronounced focus of economic activity, these centers, provided with infrastructure, form the supporting frame of the regional economy of the Karelian Arctic;
- **tourist and recreational potential,** allowing not only to develop various types of tourism: ethno-cultural, military-historical, religious, environmental, rural, industrial and event tourism, but also to form the basis of tourist routes to other regions of the Russian Arctic (the most pronounced in the Belomorskiy, Kemskiy, Loukhskiy, Kalevalskiy districts, and the city of Kostomuksha). An expert from the city of Kostomuksha characterizes the strengths and prospects of tourism development in the following way: "*The tourism potential, I would say, is quite high. The strong point is, first of all, logistics — proximity to the EU border — and the tourist flow that we have, I think, it may be increased due to, for example, the round-the-clock operation of the Lyutta border-crossing point. Now we have significantly improved the state of the Kochkoma road with the border, the traffic flow towards the border of Finland. I think it will be increased. That is, logistics is a strong point. The second one is the presence of protected areas, a nature reserve and a national park on the territory of the Kostomuksha urban district. The next point is the development of the hospitality industry itself, let us call it that, and the creation of new tourism or, rather, the construction of hotels, guest houses, catering facilities ... and, of course, industrial tourism*";
- **aquaculture and mariculture potential,** based on significant water resources, including rivers, lakes and coastal waters of the White Sea, different both in chemical composition and temperature regime, as well as on existing capacities and experience in rainbow trout and mussels farming (expressed in all municipalities of the Karelian Arctic);
- **geostrategic location** at the intersection of the priority geostrategic territories of the Russian Arctic and the geostrategic territory bordering the EU, as well as the existing access to the White Sea and the oceans. The importance of the Arctic Karelia region for strengthening the defense capability and ensuring the national security of the country is increasing in the context of growing international tension and intensifying processes of rapprochement between Finland and NATO [23, Kilin Yu.M., p. 67]. The economic and social effect of strengthening the military presence in the Arctic Karelia can be achieved both through the use of dual defense and economic technologies, and through a local increase in demand in local markets from the military;
- **bioresource potential** of the White Sea basin is represented by economically valuable fish species (herring, saffron cod, pikeperch and others), as well as various types of algae

(fucus, kelp and others), exploited by local enterprises within the internal production cycle or in cooperation with enterprises from other AZRF and Russian regions (the most pronounced in Loukhskiy, Kemskiy, Belomorskiy regions and Kostomuksha city);

- **energy potential** based both on the existing generation capacities — HPP cascades, and on the capacities released due to the closure of a number of enterprises with an energy-intensive technological cycle (the most pronounced in the Belomorskiy, Kemskiy and Segezhskiy districts);
- **vacant production sites** for investment projects within existing and new enterprises, which could be considered as potential Greenfield and Brownfield sites. In addition to the two existing ASEZs in Kostomuksha municipality and the Nadvoitsy settlement in Segezha municipal district, there is a significant amount of free land of varying degrees of development and infrastructure provision in Arctic Karelia.

Weaknesses of the Arctic Karelia region:

- **disproportions in the structure of labor resources** in the region. All municipalities are already experiencing an acute shortage of specialists in the production sector, the social sphere and municipal management. At the same time, the majority of qualified specialists working today in the forestry sector (Lukhskiy, Segezhskiy, Kalevalskiy districts), the mining industry (Loukhskiy district), the fishery industry (Belomorskiy district), the education sector of all municipalities are pensioners, which jeopardizes the prospects for functioning enterprises in the medium and long term. At the same time, this problem is absent in the Kostomuksha city. The aging trend is aggravated by the outflow of qualified workers and young people outside the region. An expert from the city of Segezha characterizes the current situation in the following way using the example of the Segezha district: Respondent: "*All the personnel that were there, they have grown, let us say, retired safely or left somewhere. Part of the organizations that trained, for example, paper machine engineers, operators, all these professions, do not teach in the city of Segezha anymore, that is, people only study directly at the enterprise, therefore there is a shortage of personnel. Inviting people from somewhere, workers from other cities, is an option, but this exasperates the local population, although no one wants to study here, to raise their level. I have already given an example that the PPM organized groups, tried to train people there in order to attract specialists to their enterprise, to train them for the mill so that they work there Somehow it did not work out very well. And there were problems with the group, with the people they trained. They were employed, but then they all left. Therefore, personnel shortage is a top priority*";
- **difficulties in resolving land issues,** associated either with a local shortage of land (Kostomuksha city) or with an acute problem of determining land ownership and its status, as well as the status of buildings and infrastructure, often dating back to the Soviet

period (typical for all municipal districts), which is the strongest obstacle to the organization of new industries and the expansion of old ones;

- **extremely uneven distribution of the population, industrial potential and infrastructure,** due to the focal-dispersed nature of the development of economic space. Socio-economic development of the Arctic Karelia region is characterized by trends of polarization and concentration of economic activity mainly in Kostomuksha, Segezha, to a lesser extent in Belomorsk and Kem, with significant degradation of the rural areas of all districts, as well as the extreme economic sparseness of the Loukhskiy and Kalevalskiy districts;
- **uncertainty of residents and companies in the region's future and the expediency of investing in business development and life improvement**. This circumstance is observed against the background of long-term negative socio-economic trends in most of the territories of Arctic Karelia and the lack of awareness of government measures for the development of the region; it leads to increased migration moods among the most active part of the population to regions with more stable business conditions. Describing this situation, an expert from the Kalevalskiy municipal district states: Respondent: *"I think that the northern regions have prospects, the only thing that is needed is, of course, some kind of push so that people gain confidence and believe that their district was, is and will be"*;
- **small number of active people and entrepreneurs, general inactivity of the population** due to the fact that negative economic conditions and social disorder caused the outflow of the most active, skilled and mobile part of the population for a long time. An expert from the city of Kem described this phenomenon as follows: *"So if for several decades, the personnel potential and, accordingly, entrepreneurs, ready to invest, to do something at their own risk, have been washed away. There are few of them left, to count on the fingers, we try to support them all, to help, to guide them. It is good that now these supportive measures have gone from the republic, but the practice of previous years is such that it was easier for people to work "in the shade", and they were "not visible", for example, in case of sea shipping. No one is officially registered because there are too many requirements and so on. The problem is to find good workers or entrepreneurs who work in "white"; we have funds to support them, but we can't find them all, the economic department invites those, who have no documents, who have everything drawn up "crooked", so that they cannot show their expenses"*;
- **high heating and electricity costs**, which are typical for both business entities and local residents (according to the expert assessment of the Heads of municipal districts, residents' expenses for heating are on average 2 times higher than the respective costs in South Karelia), due to both the extremely deteriorated communal infrastructure and the use of costly technologies and resources (mainly coal, fuel oil);

- **disproportions in the regional energy system**, manifested in the presence of diversified energy capacities in a number of regions (Kemskiy, Segezhskiy districts), a shortage of energy resources and related significant restrictions in the implementation of investment projects (city of Kostomuksha), low stability of the energy system in the presence of free capacities (part of the territory Loukhskiy district and Kalevalskiy district), due to the non-rounded local energy system and vast territories. The latter also represents a significant deterrent to the development of investment activity, since it does not allow ensuring the technological needs of enterprises in a stable energy supply. This is how the current situation is characterized by an expert from the Kostomuksha city: Respondent: *"First of all, it is necessary to resolve the issue of gasification and a sufficient increase in electrical capacity. These are very bottlenecks at the moment. When gas will appear in the city, perhaps, there will be the construction of a thermal power plant with generation, free electric capacities will appear, and then any type of production can be developed. Now, there are restrictions for the industry. In other words, construction of big companies, where large energy consumption is expected, is, unfortunately, a big question right now"*;
- **depreciation and moral obsolescence of the infrastructure of housing and communal services and heating networks** remains an urgent problem for all municipalities, except for the Kostomuksha city. Despite the intensification of work on the modernization of communal infrastructure, most settlements lack sewage treatment facilities, while heating mains and water supply networks are prone to accidents due to extreme wear and tear. The situation is reflected in the comment of an expert from the Kalevalskiy municipal district: Respondent: *"Heat supply is exactly the same (as electricity supply — Interviewer's note) on those boilers and those networks, which were probably built back in the Soviet times. And only thanks to those people who work in these industries, it exists and operates"*;
- **pollution of water bodies and growth of social tension in the areas where aquaculture farms, primarily trout farms, are located**;
- **pollution of water bodies with fodder and waste products of cage trout** causes significant environmental damage in cases where rearing volumes exceed the natural ability of local ecosystems to regenerate, fixed in scientifically based limits on the capacity of fish farms. The situation is aggravated by the low subject study of the water bodies of the Arctic Karelia, as well as by exceeding the allowable cultivation limits. These circumstances are reflected in the following comments of an expert from the Kalevalskiy region: Interviewer: "*Are there any problematic points for trout farms that hinder development?*" Respondent: "*Well, the population continues to protest. Last year, "Kala ya maryapoyat" (one of the largest fishery enterprises in the Republic of Karelia — Interviewer's note) was supposed to set up cages near the village of Unitsa on Verkhneye Kui-*

to lake. But, unfortunately, the population was categorically against it, and therefore, everything is in a standstill. Entrepreneurs did not want to go to the territory where they would be met that way";

- **limited budgets of municipal districts.** The predominant role of federal programs in the implementation of territorial development measures and the poverty of local municipal budgets lead to limited opportunities for targeted managerial influence on bottlenecks in the development of the region;
- **lack of accommodation for tourists, lack of modern tourism infrastructure**. The problem is typical for all the districts and the city of Kostomuksha to some extent, a separate problem is the lack of elasticity of the provided tourist services, for example, in the hotel business and accommodation facilities, and pronounced seasonality, which hinder their development. This is how an expert from the Kemskiy district characterizes this problem: Respondent: *"At this stage, the means of accommodation are a weak point, i.e. it is especially felt when the flow of tourists has started, all our hotels are busy, there are no free places, and of course travel agencies plan their route so that people arrive from the train, transfer to the boat, go to Solovki, have a tour on the boat, go back to the train, and leave. They don't stay here very long because there are no facilities and our infrastructure is involved as much as it is, but there is no elasticity. For example, there is no possibility to increase the number of beds fivefold during the season and then to close for the winter. Some hotels do that and work only in summer, but this fund is still not enough. There is no elasticity in the sense that there are plans to make use of this potential in winter, as the tourist season is only in summer. For example, to organize interrepublican skiing cup stages, on skis, on dogs, do something that can fill this unused potential in winter. But we have no opportunity to do it; people have houses made only for summer. In winter, they cannot be heated or populated, they are not adapted to this. Therefore, the lack of elasticity is a weak point"*;
- **degradation of port infrastructure, a small number of fishing enterprises own vessels** and the need to rent them increase the costs and risks of doing business, limit both the development of onshore processing and the further development of the fleet. This problem is typical for the Belomorskiy, Kemskiy and Loukhskiy districts. An expert from the Kemskiy district characterizes the current situation as follows: Respondent: "*Two companies addressed to us: "We want to collect, wash, prepare algae here, but there is no infrastructure". They collected something, loaded it, but we took a trial batch, we collected it this year, it will be ready next year. Water areas are distributed to them, they collect algae there, they tried it, they looked at it, the quality of the algae suited them, they are satisfied, they will continue to develop. But they want to have a port infrastructure. Unfortunately, we do not have a port infrastructure*";

- **poor development of auxiliary industries serving trout farms (production of fodder, genetic material, cages, etc.)** on the territory of Arctic Karelia and neighbouring regions. Currently, quality feed and genetic material are purchased mainly in Norway, which not only makes the production process more expensive, but also makes it less resistant to macroeconomic shocks and exchange rate fluctuations;
- **shortage of teachers, doctors, social service resources and related infrastructure**, which is especially typical for rural areas of all municipal districts that make up Arctic Karelia. This trend is most pronounced in the Loukhskiy and Kalevalskiy districts;
- **severe climatic and geological conditions**, characterized by a short frost-free period (80–110 days, depending on the region), an annual period with temperatures above 10°C of 75–100 days (depending on the region) and, accordingly, the sum of average daily air temperatures above 10°C — 1000–1400°C [24, Shegelman], the depth of soil freezing and difficult soils significantly increase the costs of construction and operation of industrial and residential facilities, business activities and human comfort.

At the second stage of the SWOT analysis, we considered the opportunities for the development of the Karelian Arctic region — environmental factors that are not directly dependent on the object of study, but can have a positive impact on economic processes, create prerequisites for overcoming negative trends and threats to the development of the region.

Opportunities of the Arctic Karelia region:

- **implementation of the special economic regime of the Russian Arctic** in the conditions of extremely limited municipal budgets will create a favorable environment for attracting investments and securing labor resources in the Karelian Arctic. Achieving the maximum effect requires coordinated and flexible work of all levels of government in creating optimal tax conditions, attractive investment sites such as Greenfield and Brownfield, and supporting the formation of industrial, tourism and fisheries clusters. Special attention should be paid to joint projects of enterprises from the Arctic regions, which will increase the connectivity of the economic space of the Russian Arctic;
- **activation of economic relations between enterprises of the Arctic regions** within the framework of the implementation of state programs for the development of the Russian Arctic, in particular the program of **"Development of supporting zones"** will enable the formation of value-added chains generated in single production cycles as part of taking advantages of spatial location in the territory of the Russian Arctic. The joint implementation of these state programs with a special AZRF economic regime will make it possible to intensify investment processes within the framework of interregional economic relations;
- **growth of the recreational attractiveness of the Karelian Arctic** is due to both increased consumer awareness and the development of tourism infrastructure in the region, a

separate area of activation of this area is the development and promotion of Arctic tourist routes and products;

- **implementation of natural gas supply projects** is a means of reducing heating costs for enterprises and residents, as well as solving local problems with energy shortages (typical, in particular, for the Kostomuksha municipality). The high probability of developing these projects (primarily the Volkhov-Segezha-Kostomuksha gas pipeline) is due to the interest of the corporate structures of JSC Karelskiy Okatysh (part of the Severstal Group), while it is constrained not only by high investments and long payback period of the gas pipeline, but also difficulties in maintaining the route in the conditions of its great length, low population density and lack of qualified personnel;
- **development of the White Sea–Baltic Canal**, which links Arctic Karelia with the ports of the White, Baltic, Barents, Black, Azov and Caspian seas, will significantly reduce costs when transporting goods (the route from Arkhangelsk to St. Petersburg, bypassing the Scandinavian Peninsula, is 3900 km longer) and thus increase the production and export potential of the Arctic regions. For the full realization of this potential, it is necessary to expand the dimensions of the Canal to the extent that allows vessels with a deadweight of 8000 tons to pass through it without hindrance [25, Tishkov S.V., Shcherbak A.P., Pakhomova A.A., Karginova-Gubinova V.V., Volkov A.D., p. 40];
- **growth in demand for products of mining enterprises**, primarily non-metallic construction materials (crushed stone, facing stone, stone blocks), due to the intensification of infrastructure projects both in the Russian Arctic and in the Leningrad Region, St. Petersburg and Moscow;
- **growth in demand for products of aquaculture and mariculture enterprises** in the domestic and foreign markets, as well as the lack of significant competition from producers from other regions in the cultivation and sale of rainbow trout and mussels, makes it possible to increase the volume of aquaculture with guaranteed sales;
- **development of the Belkomur infrastructure project**, the updating of which is determined in accordance with the NSR infrastructure development plan for the period up to 2035 [13]. This project will make it possible to intensify the work of the Belomorsk–Obozerskaya railway section, and to continue the unfinished construction of the railway linking Finland, the West Karelian and Murmansk railways, the ports of Belomorsk and Belkomur, which stopped at the Kochkoma–Ledmozero section. Implementation of even some of these infrastructure projects will increase the transit potential of Arctic Karelia, with the prospect of creating a multimodal transport hub at Belomorsk;

[13] Plan razvitiya infrastruktury SMP na period do 2035 goda. Utverzhden rasporyazheniem Pravitel'stva Rossiyskoy Federatsii ot 21 dekabrya 2019 goda № 3120-r [NSR infrastructure development plan for the period up to 2035. Approved by Decree of the Government of the Russian Federation dated December 21, 2019 No. 3120-r]. URL: http://publication.pravo.gov.ru/Document/View/0001201912300038 (accessed 01 August 2021).

- **implementation of state programs for the development of communal infrastructure** and improvement of energy efficiency in municipal and state funds have now made it possible to achieve positive trends in these areas, as noted by respondents in all municipalities;
- **extension of the state programs "Zemskiy doctor" and "Zemskiy teacher"**, as well as education of the disabled, pre-pensioners and other socially vulnerable groups of population will create more favorable living conditions, securing and attracting labor resources.

Threats to the Arctic Karelia region:

1. **curtailment of the development programs of the Russian Arctic, in particular, the program "Development of supporting zones",** is a possible consequence of the decline in revenues of the Federal budget of Russia, observed in recent years. In the absence of federal support, local and regional budgets will be extremely limited in creating investment conditions, and regional development will follow an inertial path, potential economic ties between the regions of the Russian Arctic will not be realized or will be weakly expressed;
2. **restrictions in the implementation of the special economic regime of the Russian Arctic.** In the absence of support from macro-regional institutions, local and regional budgets will be extremely limited in creating investment conditions, and the development of the region will follow an inertial path with a gradual decline in economic activity;
3. **increased competition for skilled labor from economic centers external to the Karelian Arctic** — Moscow, St. Petersburg and abroad — stimulates a further outflow of human capital and its narrowed reproduction in the region. At present, the majority of small and medium-sized enterprises of mining, forestry and fishing specialization have qualified personnel represented by workers of pre-retirement and retirement age, which will lead to an acute shortage of qualified workforce in the region in the next 10-15 years if there is no replacement of personnel;
4. **external global shocks** caused by the COVID-19 pandemic, growing geopolitical tensions, sanctions pressure and deterioration of macroeconomic parameters of the environment provoke economic instability, significantly narrowing the purchasing power of the population and the capacity of local markets, which can become a critical factor for small and medium-sized businesses focused on primarily local markets;
5. **degradation of the settlement system,** caused by the effects of attracting labor and capital to growth poles outside the Karelian Arctic region, and exacerbated by an internal decrease in the connectivity of the economic space due to the long-term destruction of transport infrastructure, the decline of socially necessary services in the territory. The consequences of this trend will lead to an aggravation of the sparseness of the economic space of the Karelian Arctic and an increase in the operating costs of enterprises;

6. **growth of tariffs for the services of natural monopolies,** which threatens to increase the costs for enterprises and households;
7. **curtailment or limited implementation of state programs of sectoral and social orientation** will lead to further degradation of social and communal infrastructure.

At the next stage of the analysis, we have identified the most significant factors influencing the socio-economic and spatial development of the Karelian Arctic region. Systematization and generalization of the previously identified factors in the SWOT analysis matrix allows us to answer the questions "How to use strengths to get the effect of existing opportunities?", "What weaknesses hinder the implementation of opportunities?", "How to use strengths to overcome emerging threats?" and "What weaknesses exacerbate existing threats, increasing risks for the region?" and identify cause-and-effect relationships that unite various groups of factors [22, Zonova A.V., Kislitsyna V.V., p. 32].

Table 6

Matrix of SWOT-analysis of the Karelian Arctic region

Internal environment / External environment	Strengths (No. in order of listing)	Weaknesses (No. in order of listing)
Opportunities (No. in order of listing)	Opportunities + Strengths **1** — **1**,**2**,**3**,4,5,7,**8**,9 **2** — **1**,**2**,**3**,4,5,6,7,**8**,9 3 — **1**,4,7,**8** **4** — **1**,**2**,**3**,4,5,6,7,**8**,9 **5** — **1**,**2**,**3**,5,6,7,**8**,9 6 — **1**,**2**,**8**,9 7 — **1**,**3**,5,7,**8**,9 8 — **1**,**2**,**3**,6,**8**,9 9**–** **1**,4,6,**8** 10 — **3**	Opportunities → Weaknesses **1** — **1**,**2**,**3**,4,5,6,7,8,9,12,13,15 **2** — **1**,**2**,4,5,6,8,9,11,12,13,15 **3** — **1**,**2**,4,5,6,9,11,12 4 — **1**,**3**,8,10,15 5 — **1**,12,15 **6** — **1**,**2**,**3**,4,6,7,12,15 7 — **1**,**2**,**3**,6,9,12,13 8 — **1**,**2**,**3**,4,5,6,12 9 — **1**,**2**,**3**,6,8,10,15 10 — **1**,**3**,8,9,14,15
Threats (No. in order of listing)	Strengths → Threats 1 — **1**,**2**,**4** 2 — **1**,**2**,**4** **3** — **1**,**2**,3,**4**,7 **4** — **1**,**2**,**4**,5,7 5 — **1**,**2**,**4**,5 6 — **4**,5,7 7 — **1**,**2**,**4**,5 8 — **1**,**2**,5 **9** — **1**,**2**,**4**,5,6	Threats + Weaknesses **1** — **1**,2,**3**,**4**,5,6,7,10,11,12,13,15 **2** — 1,2,**3**,**4**,5,10,11,12,13,15 3 — **1**,**3**,**4**,5,8,14,15 **4** — **1**,**3**,**4**,5,6,8,10,12,14,15 **5** — **1**,2,**3**,**4**,5,6,7,8,10,14,15 6 — **4**,6,7,8,15 7 — **1**,**3**,**4**,8,9,10,14,15

Conclusions about the relationship and significance of various factors of the external and internal environment in the development of the region are based on tables for assessing the strength of these factors and the likelihood of threats and the implementation of external opportunities, formed on the basis of the corresponding matrices of strengths and weaknesses, opportunities and threats. These analytical tools are presented in table 7 and table 8 on the example of the strengths of the Karelian Arctic region.

Table 7

Strengths of the region

No.	*Strengths*	Ability to use strength			Degree of influence on the activities of the region		
		high	medium	high	medium	high	medium
1	high transport potential	*			*		
2	significant natural resource potential		*		*		
3	existing industrial facilities		*		*		
4	tourist and recreational potential	*				*	
5	aquaculture and mariculture potential		*			*	
6	geostrategic position			*			*
7	bioresource potential of the White Sea basin			*			*
8	energy potential			*		*	
9	free production sites			*		*	

Table 8

Region's strengths matrix

Ability to use strength	Degree of influence on the activities of the region		
	High	Medium	Low
High	1	4	
Medium	2;3	5	
Low		8;9	6;7

The analysis reveals that the most significant strengths of the region are the following:

- high transport potential of the region;
- significant natural resource potential;
- existing industrial capacities;
- tourist and recreational potential.

Critical weaknesses that require special attention when determining the strategic priorities for the spatial development of the region:

- disproportions in the structure of labor resources in the region;
- complexity of solving land issues;
- extremely uneven distribution of population, industrial potential and infrastructure;
- uncertainty of residents and businesses in the future of the region and the expediency of investing in business development and life improvement.

The most significant opportunities of the external environment of the region:

- implementation of the special economic regime of the Russian Arctic;
- activation of economic relations between the enterprises of the Arctic regions, in particular within the framework of the implementation of the program "Development of supporting zones";
- growth of recreational attractiveness of the Karelian Arctic.

Threats that require increased attention in strategy development:

- curtailment of development programs of the Russian Arctic, in particular, the program "Development of supporting zones";
- growth of competition for skilled labor from external economic centers in relation to the Karelian Arctic;
- external global shocks.

Based on the revealed features of the socio-economic system of the Karelian Arctic, it is possible to identify the strategic priorities for its development in the context of the complex projects implementation for the integration of the AZRF economic space:

- implementation of the region's logistics potential in order to integrate the spaces of the geostrategic territory of the Arctic zone of Russia, the geostrategic territory bordering the EU countries and the territories of the non-Arctic regions of Russia;
- overcoming disproportions in the structure of the region's labor resources and personnel shortages, which hinder not only the attraction of investments and the opening of new industries, but also the development of existing ones;
- integration of the Karelian Arctic region into the processes of implementing state mechanisms for uniting the space of the Russian Arctic — the program of "supporting zones" and the AZRF special economic regime aimed at stimulating economic ties between the Arctic regions, as well as between the Arctic and non-Arctic regions. The objective basis for the economic integration of the Karelian Arctic into the Arctic macroregion is its natural, transport, industrial, as well as tourist and recreational potential.

The expeditions revealed one of the peculiarities of the organization of fishery activities in the Karelian Arctic, which is more characteristic of the Louhskiy and Kemskiy districts: a significant part of the official indicators of fish catch and tax payments to local district budgets (agricultural tax), for example, up to 30% in Kemskiy district, is formed by the activities of a large enterprise registered in its territory, but actually having no production facilities and localization in the area, as well as not providing employment for the local population. A municipal government specialist describes this situation as follows: *"We have a large fishing enterprise, which is registered in the district, and they provide us with a good agricultural tax, which forms up to a third of our revenue part of the budget. Therefore, the local tax office can only care for them in every possible way, cherish and support them. I cannot say how much they are connected with the place of their registration. Agricultural tax comes from them, but I cannot say how many people from the local population work there. I don't have these statistics, but I know for sure that we don't have fish processing facilities on the shore. Agricultural vessels sail the seas and pay agricultural taxes, but there is no fish processing on the coast. Everything is unloaded somewhere in large ports, maybe processed there, but the local population here receives the same as in Moscow and in St. Petersburg through chain stores. Local fishermen, who are not engaged in large quotas, ocean-going vessels, provide some current need. So, one can always buy fresh fish from the store".*

A similar situation is developing in the Louhskiy district, where, as the expert notes, fishing is practically not carried out at all, and the "registration" of an enterprise and the payment of taxes to the local budget is related only to the existing rules for granting fishing quotas, which are actually carried out in the more northern seas, closer to the developed port infrastructure of Murmansk and Arkhangelsk oblasts. Thus, official statistics do not reflect the current situation of the development of fishing activities and fish production in the Karelian Arctic, taking into account the data of enterprises "registered", but not conducting economic activities in the White Sea.

Conclusion

The effective implementation of the state policy on the spatial development of the Arctic territories is complicated by both the extreme sparseness of its economic space and the inertia of the macroregion's economic development that has historically developed in Russia under conditions of completely different external and internal social, economic, geopolitical and environmental realities. The expansion of the AZRF contours, justified primarily by the motives for the comprehensive integration of regional economic systems into its economic space, requires timely and adequate analytical support for the current management tasks. In its absence, the effectiveness of managing the macroregion as a complex multi-level and differentiated economic system will be critically limited by the lack of reliable and relevant knowledge about the management object and its structural elements.

The identification of strengths and weaknesses, challenges and external opportunities of the constituent regions is crucial for the development of managerial mechanisms for the spatial development of the Arctic zone of Russia. As the study showed, the most important strengths for the Karelian Arctic region included in the Russian Arctic for the first time are the high logistical potential of the region, located at the intersection of the geostrategic territories of the Russian Federation and non-Arctic regions, having the capacity to integrate these spaces, as well as significant natural resources, tourism potential and existing industrial centers that have the potential to increase the connectivity of both regional and macroregional economic space. The implementation of these strengths is limited by a combination of external threats represented by external shocks, increased competition for highly skilled labor and the risk of curtailing state development programs, and the existing weaknesses of the region: disproportions in the structure of the region's labor resources and staff shortages, residents' uncertainty about the future of their place of living, the complexity of solving land issues for investors and existing businesses. At the same time, the existing opportunities for the development of the region, currently represented by the implementation of state programs for the integration of the economic space of the Russian Arctic and the growth of the tourist attractiveness of the Karelian Arctic, obviously do not cover these weaknesses and risks. The strategic priorities of its development in the context of the implementation of complex projects for the integration of the AZRF economic space are determined by maximizing the use of the strengths and opportunities of the region and overcoming its weaknesses and po-

tential threats through the mechanisms of activation of natural, transport, industrial, as well as tourist and recreational potential, represented by a special economic regime and the system of "supporting zones". The most important obstacle is the narrowed reproduction of the human capital of the Karelian Arctic.

The contribution of this study to the formation of scientific foundations for managing the spatial development of the Russian Arctic includes, firstly, filling the vacuum of knowledge about new Arctic regions that have not been previously studied in the context of current goals and tools for the development of the macroregion, and, secondly, obtaining relevant knowledge in the context of rapid changes in the external and internal environment and the "delay" of statistical data on its dynamics, and thirdly, identifying urgent problems of regional development that require further study.

Thus, more detailed analysis of the factors of socio-economic development determining the region's weaknesses and threats to its development, and first of all, disproportions in the structure of the region's labor resources, dynamics of human capital and migration moods of the population caused by the inability of its full and extended reproduction, takes on great importance.

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[The Issue of Rating of the Energy Efficiency of Economy of the Arctic Regions of Russia and Transport Infrastructure]. *Biznes. Obrazovanie. Pravo* [Business. Education. Right], 2020, no. 1, pp. 37–42.

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Foreign Economic Partners of Russia in the Arctic Zone *

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Abstract. The study expresses the readiness of foreign investors to participate in Russia's Arctic innovation projects in difficult international economic and political conditions. Key high-tech projects of the Arctic zone of the Russian Federation (AZRF) with the participation of international economic partners are presented. The tendency of economic interaction in the field of high technologies is expressed, which has not been subjected to political pressure from outside. The key investor companies of the Asia-Pacific region (APR) and the European Union (EU), with which agreements on participation in projects have been signed, are presented. The intentions of the world powers for economic partnership in the Arctic projects of Russia are discussed, the most promising areas and areas of activity are outlined. It is determined that the dominant economic attention is shown by Asian countries. The leader is the People's Republic of China (PRC), interaction with which contributes to the acceleration of investment growth in these projects and has a wide range of industry areas. The implementation of AZRF projects with the participation of foreign partners has a positive multiplier effect on the development of the Northern Sea Route (NSR), the main economic highway of the Russian Arctic. The high value of Russian and international scientific research in the Arctic is determined, as well as the critical importance of the achievements of scientific and technological progress (STP), and as a result, a high-tech economy; the increased interest of the world powers in the work of the Arctic Council is indicated; the general attention to the thin ecological system of the Arctic is presented. The aim of the study is to assess the current economic agreements with the participation of international partners and to attract foreign investment in promising long-term Arctic projects in Russia.
Keywords: *economy, investment, Arctic zone of Russia, international partner, infrastructure project, Northern Sea Route, logistics, natural resource*

Introduction

The Russian Arctic is a harsh, hard-to-reach region, rich in natural resources and greatly beloved by the inhabitants of the Far North. Improving the quality of life of the population of the Arctic zone of the Russian Federation (AZRF) is a priority issue of Russian national policy, which includes development of social, transport and digital infrastructure, ensuring a favourable environment, increasing wages and solvency of northerners, improving the availability and quality of medical services, life expectancy and much more. The issue of national security, the integrity of land and sea borders, the protection of the population, shipping routes is paramount to the implementation of the Fundamentals of Russian State Policy. Measures are being taken to strengthen the security of the northern territories of the country. Military bases of the Arctic coast with fascinating architecture are being modernized, the most high-tech equipment in the world is being put into service to control and protect the sovereignty of the Russian Federation.

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Scientific research conducted in the Arctic confirms the vast natural reserves and large territories belonging to the Russian Federation. Modern technologies and natural conditions, which are changing towards warming, openness of water areas from year-round ice fields, make the conditions for the extraction of natural resources more efficient. Russia's Arctic riches have attracted many countries, not only members of the Arctic Council [1] (Canada, the Kingdom of Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden, the United States of America), but also non-Arctic states. The Arctic Council includes the following observers: France, Germany, Japan, Great Britain, India, China and others. The chairmanship of the Arctic Council, in accordance with the principle of rotation, was taken over by the Russian Federation for two years (2021–2023). The solemn ceremony was held in Reykjavik on May 20, 2021, in the framework of the meeting of the foreign ministers of the Arctic G8 [1, Krasnopolskiy B.Kh., pp. 148–162].

The theme of "Responsible Governance for Sustainable Arctic" [2] will be a priority for Russia's chairmanship in the Arctic Council. At present, the Russian Federation is a leader in a number of areas related to the development of the Arctic — science and high-tech economy, environmental protection, defense and security, development of Arctic deposits, the Northern Sea Route, etc. In these areas, in order to increase the economic potential of the ASRF, it is advisable to develop international cooperation, to use collective approaches in high latitudes to respond to modern challenges. In order to maintain the achieved competitive advantage and its comprehensive growth, the Strategy for the Development of the Arctic Zone of the Russian Federation (AZRF) and National Security for the Period up to 2035 was approved [3].

The Northern Sea Route (NSR) in the modern concept of the Arctic development is considered as a basic potential that can connect and increase the economic power of the unified transport system of Russia with the prospect of creating an alternative to the Suez Canal and to become a safe and cost-effective international transport corridor in future [2]. Russia is building a new icebreaking fleet, creating new seaports and modernizing existing ones, and organizing a system of socio-economic development of the Russian Arctic zone, which confirms V.V. Putin's words that the Northern Sea Route will become "the key to the development of the Russian Arctic, the regions of the Far East" [4].

Main section

[1] Arctic Council. URL: https://будущее-арктики.рф/arkticheskij-sovet-arctic-council/ (accessed 16 June 2021).
[2] Predsedatel'stvo Rossii v Arkticheskom Sovete v 2021–2023 godakh [Russian Chairmanship of the Arctic Council in 2021–2023]. URL: https://arctic-council.org/ru/about/russian-chairmanship-2/ (accessed 16 June 2021)
[3] Ukaz Prezidenta RF ot 26 oktyabrya 2020 g. № 645 «O Strategii razvitiya Arkticheskoy zony Rossiyskoy Federatsii i obespecheniya natsional'noy bezopasnosti na period do 2035 goda» [Decree of the President of the Russian Federation of October 26, 2020 No. 645 "On the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period up to 2035"]. URL: https://www.garant.ru/products/ipo/prime/doc/74710556/ (accessed 15 June 2021).
[4] TASS. Severnyy morskoy put'. Dos'e [TASS. Northern Sea Route. Dossier]. URL: https://nangs.org/news/economics/severnyj-morskoj-put-dose (accessed 15 June 2021).

The Arctic natural resources and the Northern Sea Route, which are accessible under the prevailing climatic conditions, attract more and more world powers to cooperate with Russia on environmental, economic, political and other issues [3]. The international community is aware of the importance of maintaining environmental sustainability, common rules and improving the conditions for socio-economic development in high latitudes. The high-level intergovernmental forum — the Arctic Council — is a paradigm for international assistance in the development of the circumpolar region and cooperation between countries (participants and observers) to protect the environment.

Highlighting the economic component, one should consider international partners who make real investments in the AZRF development.

Due to the harsh natural conditions, the Arctic has long been restricted to human economic activity but, nevertheless, the attention from the Russian state was highly appreciated. Experts suggest that due to current conditions, such as warming, melting glaciers, etc., the Arctic ice cover will significantly decrease in size by 2030, opening up the possibility of “clean water” navigation in summer, considerably increasing the period of navigation in the NSR, and eventually achieving year-round navigation. Consequently, new international transport routes and the richest natural resources of the Arctic will open [4].

The Arctic zone of Russia is a geopolitical region, and China, as an observer in the Arctic Council, considers it very important to gain a foothold in this region and promote its interests there. The PRC enters into a competitive struggle for the Arctic region and, due to economic considerations, new transport routes are opened for the transportation of goods and, most importantly, access to natural resources [5, Bertelsen R.G., Gallucci V., pp. 240–245].

The geopolitical strategy of the PRC “One Belt, One Road” includes the “Ice Silk Road” project, the main goals of which are the following: strengthening positions in international organizations, expanding cooperation with the countries of the Arctic Council to gain advantages in the processes of coordinating national interests.

In the context of limited internal resources, Russia and China agreed to cooperation, which becomes beneficial for both partners.

Years of economic growth have turned China into the second largest economy in the world and the largest consumer of energy. China cannot provide its rapidly developing economy with its own hydrocarbon production; therefore, it began to import oil and gas, including liquefied natural gas (LNG). Russia is interested in diversifying its energy exports, especially since it borders on China, which brings the states closer. Over the past ten years, China has created a big backlog to provide Russia with a profit from oil exports, thereby supporting its economy. Between 2008 and 2019, China accounted for more than half of the growth in global oil demand. An interesting dynamics is shown by the turnover of Russia's foreign trade with ten main partners (Table 1).

Table 1

Russia's foreign trade turnover (billion US dollars) [5]

Country	2014	2019	Deviation
China	40	50.3	+ 10.3
Netherlands	37.7	25.9	- 11.8
Germany	35.3	25.2	- 10.1
Belarus	15.6	15.2	- 0.4
USA	14.9	13.2	- 1.7
South Korea	13	12.7	- 0.3
Italy	25.1	11.9	-13.2
Turkey	15.7	11.9	- 3.8
Japan	15.4	9.9	- 5.5
Kazakhstan	10	8.9	- 1.1

The structure of Russian exports to China in the first quarter of 2021 shows that the leading place is occupied by mineral fuels, oil and oil products, accounting for 65.6% of all Russian supplies, with non-ferrous metals remain in second place with a share of 6.5%.

Russian LNG exports to China doubled in 2020 to 5 million tonnes worth US$1.72 billion, making it the fifth-largest LNG exporter to the China. In terms of LNG supplies to PRC, Australia is the leader — 29 million tons, Qatar — 8.1 million tons, Malaysia — 6.1 million tons, Indonesia — 5.1 million tons.

At the current stage, there are 19 LNG terminals operating in the PRC and 3 ones are at various stages of construction. Consequently, China plans to increase LNG imports, and by the end of 2020, it has accepted this energy carrier more than the pipeline one.

A significant contribution to the growth of LNG exports to China was made by the Yamal LNG infrastructure project of PJSC NOVATEK, which supplied two LNG consignments along the eastern part of the Northern Sea Route, leaving the port of Sabetta: 1) the LNG tanker Christophe de Margerie delivered LNG to the port of Jiangsu from May 19 to June 9, 2020; 2) the LNG tanker Vladimir Voronin delivered LNG to the port of Tianjin from May 24 to June 27, 2020.

The operator of the Yamal LNG project is OAO Yamal LNG, a joint venture of OAO NOVATEK [6], which owns a 50.1 percent share of the project [6, Vopilovskiy S.S., pp. 19–31].

Foreign economic partners of the Yamal LNG project are:

- Total Energies (Total changed its name to Total Energies on May 28, 2021) [7] is a French oil company, the fourth largest producer in the world. Total has a 20% stake in the Yamal LNG project, which is one of the largest projects in Russia;
- China National Petroleum Corporation (CNPC) [8] is the largest Chinese oil and gas company, holds a leading position in the world, conducts global oil and gas investment operations, owns a 20% stake in the Yamal LNG project;

[5] Tovarooborot Rossii «Vse tovary» «2014–2019 gg» [Trade turnover of Russia "All goods" "2014–2019"]. URL. https://ru-stat.com/date-Y2014-2019/RU/trade/world (accessed 15 June 2021).
[6] PAO NOVATEK. URL: https://www.novatek.ru (accessed 23 June 2021).
[7] Odna iz krupneyshikh kompaniy mira smenila nazvanie [One of the largest companies in the world has changed its name]. URL: https://www.rbc.ru/business/28/05/2021/60b0dc0f9a7947444d921831 (accessed 23 June 2021).
[8] CNPC. URL: https://www.cnpc.com.cn/ru/ (accessed 23 June 2021).

- The Silk Road Fund [9] is a Chinese investment fund that invests in the world's largest infrastructure projects, aiming to facilitate the marketing of Chinese products, owns a 9.9 percent stake in the Yamal LNG project.

In June 2021, NOVATEK began navigation along the NSR in an easterly direction. Considering the current situation, the Platts JKM index, which reflects the cost of spot LNG supplies to Northeast Asia, exceeds $10.313 per MBTU ($370 per thousand cubic meters) against $8.9 per MBTU at the main European TTF hub. On average, LNG delivery from Sabetta via the Northern Sea Route to Asia is 40% faster than via the Suez Canal. It is possible that most of the LNG from Yamal will be shipped to Asia-Pacific markets. According to experts, LNG supplies to Asia for NOVATEK will actually be equal to exports to Europe, taking into account the expected spot price differential in these markets of $1.5–2 per MBTU by the end of 2021 [10].

The next Arctic LNG-2 project of NOVATEK, which owns a 60% share of the project, is scheduled to reach full capacity in 2025, and consists of three lines for liquefying natural gas (6.6 million tons each, cumulatively 19.8 million tons), which will significantly increase LNG exports from the Russian Arctic zone. As part of the AZRF Development Strategy, an icebreaker fleet and Arctic-class gas tankers are being built, including at Chinese shipyards.

The main customers of new vessels for Zvezda Shipbuilding Complex are Rosneft, Gazprom, Novatek, Nornickel, Lukoil, Sovcomflot. Zvezda Shipbuilding Complex [11] builds all types of sea vessels, in particular, nuclear-powered icebreakers Lider, Aframax (AFRA) and Yamalmax vessels, which are important for the development of the Northern Sea Route and Arctic infrastructure projects. For the Arctic LNG-2 project, the portfolio of orders of Zvezda SC includes 12 Aframaxes with a dual-fuel power plant capable of operating on fuel oil and LNG (“green”) — 10 for Rosnefteflot and 2 for PJSC Sovcomflot. Three icebreakers of Project 10510 Lider are under construction for Atomflot. Rosneft has signed contracts for the construction of 28 vessels, bringing the total order portfolio of Zvezda Shipyard to over 50 vessels.

Foreign shareholders of the Arctic LNG-2 project are [12]:

a) French oil company Total Energies — owns a 10 percent stake in the project. In March 2021, it closed a $2.55 billion deal.
b) China National Oil and Gas Exploration and Development Corporation (CNODC), a wholly owned subsidiary of China National Petroleum Corporation (CNPC), received a 10 percent stake in the project.

[9] Fond Shelkovogo puti [Silk Road Foundation]. URL: https://ru.wikipedia.org/wiki/Фонд_Шёлкового_пути (accessed 23 June 2021).
[10] Dyatel T.U. Yamal SPG vse puskonaladilos' [Yamal LNG started up everything]. *Kommersant*, no. 92 (7054), 2021. URL: https://www.kommersant.ru/daily/132556 (accessed 23 June 2021).
[11] SSK «Zvezda» [Zvezda Shipbuilding Complex]. URL: https://sskzvezda.ru/index.php/ru/ (accessed 23 June 2021).
[12] Proekt «Arktik SPG 2» [Arctic LNG 2 project]. URL: https://www.novatek.ru/ru/business/arctic-lng/ (accessed 23 June 2021).

c) China National Oil and Gas Exploration and Development Corporation (CNODC), China's third largest national oil company after CNPC and Sinopec, owns a 10 percent stake in the project.

d) A Japanese consortium, which includes Mitsui&Co and Japan Oil, Gas and Metals National Corp (JOGMEC), owns a 10 percent stake in the project. Mitsui is a participant in the first Sakhalin-2 LNG project, it owns 12.5%, the project is controlled by PJSC Gazprom.

As a result of attracting four foreign investors, the Arctic LNG-2 project plans to receive 10.2 billion US dollars.

The natural liquefied gas market will grow steadily over the next decades: according to experts, in the next 15–20 years the LNG market will grow from 350 million tons to 800 million tons per year, therefore, Russia should be competitive in this type of energy resources in terms of technology, equipment, fleet, logistics, marketing, etc. With the successful implementation of NOVATEK's joint international projects and the development of the Northern Sea Route, Russia will become attractive to the European and Pacific markets.

Rosneft's Vostok Oil project has entered the implementation stage, within the framework of which a new Oil Terminal Port Bay Sever will be built on the Arctic coast of the Krasnoyarsk Krai, south of the port of Dikson. LLC Taimyrneftegaz-Port is the investor of a 6 hectare artificial land plot for the Port of Severn Bay on the eastern coast of the Yenisei Gulf in the Kara Sea to build the infrastructure facilities of the oil terminal. At this location, oil will be transshipped from pipeline transport to ice-class sea vessels, which will deliver it via the Northern Sea Route to the ports of Russia, the countries of the Asia-Pacific Region (APR), Europe, etc. It is planned that the initial cargo turnover will be up to 50 million tons with a further increase to 100 million tons. Technical, economic and administrative facilities of the terminal will be built for it. It is planned to produce 1 million barrels of oil per day by 2028, and more than 2 million barrels by 2035.

The unique oil and gas reserves in the Taimyr region of Russia will last for several decades, and the gradual reduction in the thickness of the ice cover in the Arctic in recent years, together with the intensive development of the icebreaker fleet, has made it possible to begin the development of onshore deposits, in the subsoil of Taimyr and on the continental shelf of the Kara Sea.

The Vostok Oil project is viewed by analysts as a very serious competitor to the largest oil projects: the Permian Basin in the US and the Ghawar oil field in Saudi Arabia.

According to the Goldman Sachs Group (one of the world's largest investment banks), Rosneft's Vostok Oil project can attract investments of over $100 billion [13].

The first foreign shareholder of the Vostok Oil project was the Singaporean company Trafigura, which bought a 10 percent stake [14] through its subsidiary CB ENTERPRISES PTE. LTD [15].

[13] Podlinova A. «Rosneft'» prodast treyderu Trafigura 10% v megaproekte «Vostok oyl» [Rosneft will sell 10% stake in Vostok Oil megaproject to Trafigura trader]. *Vedomosti*, 2020. URL: https://www.vedomosti.ru/business/articles/2020/11/17/847340-rosneft-prodast (accessed 23 June 2021).

Trafigura Pte Ltd is a Singaporean multinational stock exchange company specialising in metals, energy and hydrocarbons trading (including oil). It is the 2nd largest oil supplier in the world after Vitol and the 1st largest supplier of metals.

A stake in the Vostok Oil project will provide Trafigura with access to a new large world-class oil producing region in the Far North, with around 6 billion tonnes of high-quality oil resources, with further transportation along the Northern Sea Route to Europe and Asia.

Rosneft and a consortium of companies within Vitol S.A. (Netherlands) and Mercantile & Maritime Energy Pte. Ltd. (based in Singapore) signed an Agreement on the main terms of the transaction in June 2021. This Agreement confirms the intention of the Consortium to acquire a 5% stake in the Vostok Oil project [16].

A consortium of four Indian companies: Oil and Natural Gas Corporation Limited (ONGC); Oil India Limited (Oil); Indian Oil Corp (OC); and Bharat Petroresources (BPCL) signed a Cooperation Agreement with Rosneft in this project.

Rosneft plans to attract investors from China and other interested foreign companies. The Russian authorities guarantee favourable tax conditions for project participants, which enhances the attractiveness of the project. Table 2 shows the shareholders of AZRF investment projects.

Table 2

The shareholders of AZRF investment projects [17]

Project shareholders, country	Project name, share in %		
	Yamal LNG	Arctic LNG-2	Vostok Oil
PAO NOVATEK Russia	50.1	60.0	-
Total Energies France	20.0	10.0	-
CNPC China	20.0	-	-
Silk Road Foundation China	9.9	-	-
CNODC China	-	10.0	-
CNOOC China	-	10.0	-
Mitsui&Co and JOGMEC Japan	-	10.0	-
PJSC Rosneft Russia	-	-	Over 51.0
Trafigura Pte Ltd Singapore	-	-	10.0
Vitol S.A. The Netherlands and Mercantile & Maritime Energy Pte. Ltd. Singapore	-	-	5.0

China's strategic intentions are multi-vectored:

- rapidly advancing to the role of a leading power in the Arctic region. China declared its interests in the Arctic in 2013, when it was included in the Arctic Council as an observer;

[14] CB ENTERPRISES PTE. LTD. URL: https://singapore-corp.com/co/cb-enterprises-pte-ltd (accessed 23 June 2021).
[15] «Rosneft'» nashla pokupatelya na dolyu v proekte v Arktike [Rosneft has found a buyer for a stake in a project in the Arctic]. URL: https://www.rbc.ru/business/06/01/2021/5ff4b4579a794767b17a6909 (accessed 23 June 2021).
[16] «Rosneft'» dogovorilas' ob usloviyakh prodazhi doli proekta «Vostok Oyl» konsortsiumu kompaniy Vitol i Mercantile & Maritime [Rosneft has agreed on terms for the sale of a stake in the Vostok Oil project to a consortium of Vitol and Mercantile & Maritime]. URL: https://www.rosneft.ru/press/releases/item/206645/ (accessed 12 August 2021).
[17] Source: official websites of OAO Yamal LNG URL: http://yamallng.ru/ (accessed 12 August 2021), Arctic LNG-2 project URL: https://arcticspg.ru/ (accessed 12 August 2021), Vostok Oil project URL: https://www.rosneft.ru/ (accessed 12 August 2021).

- Chinese investors have stakes in a number of major infrastructure projects being implemented in Russia's Arctic zone;
- cooperates with the EU states; in particular, the EU plans to expand the transport hub in Kirkenes (Norway), aiming to deploy a major logistics hub in Kirkenes for Chinese cargo to be delivered to Europe as part of the Polar Silk Road project;
- opens scientific stations for Arctic research in Iceland and Svalbard;
- enterprisingly develops the Citronen lead-zinc ore mining (one of the world's largest zinc resources) in Greenland (Denmark). Ironbark's Citronen project [18] receives support from China Nonferous Metal Industry, which has signed a memorandum of understanding and potential funding;
- develops Arctic management systems, etc develops Arctic management systems, etc.

Investments of China in the Arctic projects take place in the context of diversifying trade and transport routes, and economic corridors with the European Union. Recent developments in the global economy show that guaranteed, timely delivery of goods from producer to consumer is becoming a challenge due to various factors: Covid-19, international relations, ecology, etc.

As a result, the PRC is relying, with all formalities, on the potential of the Arctic transport corridor as one of the dominant sea trade routes between Asia and Europe.

The Arctic natural resources, the logistical advantages of the Northern Sea Route, and the development of shipbuilding are of great interest to Korean companies.

South Korean shipyard Daewoo Shipbuilding & Marine Engineering (DSME) has built a series of 15 Yamalmax-type Arc7 LNG carriers for the Yamal LNG project, whose owners are:

a) the Russian company Sovcomflot owns 1 lead gas carrier Christophe de Margerie (sailing under the flag of Cyprus);
b) the joint venture of Teekay LNG (Canada) and Cosco Cosco Dalian (a subsidiary of China LNG Shipping) owns 6 LNG carriers Eduard Toll, Rudolf Samoilovich, Nikolay Evgenov, Vladimir Voronin, Georgiy Ushakov, Yakov Gakkel;
c) a consortium of Greek Dynagas and Chinese companies owns 5 gas tankers Boris Vilkitskiy, Fedor Litke, Georgiy Brusilov, Boris Davydov, Nikolay Zubov;
d) Japanese Mitsui in partnership with Chinese China COSCO Shipping Corporation Limited owns 4 gas carriers Vladimir Rusanov, Vladimir Vize, Nikolay Urvantsev [19].

A number of vessels are already successfully operating on the LNG liquefied natural gas exports from the port of Sabetta.

NOVATEK is setting up LNG transshipment facilities in Murmansk and Kamchatka to reduce vessel maintenance costs and increase LNG transportation speed. NOVATEK has placed an order

[18] Proekt tsinka v Grenlandii poluchaet podderzhku Kitaya [Zinc project in Greenland receives support from China]. URL: https://metals-expert.com/news/mining/271.html (accessed 23 June 2021).
[19] Komu prinadlezhat gazovozy «Yamal SPG» [Who owns the Yamal LNG gas carriers?]. URL: https://zen.yandex.ru/media/id/5d9e1fc38d5b5f00b0d8dd8f/komu-prinadlejat-gazovozy-iamal-spg-600c8fa610f02c6bc2cd1db9 (accessed 23 June 2021).

with South Korea's Daewoo Shipbuilding & Marine Engineering (DSME) to build two LNG carriers with a capacity of 380 thousand cubic meters each, at an estimated cost of. France's Total Energies will participate in the projects, receiving a 10% stake in each, as well as Japan's Mitsui O.S.K. Lines and the Japan Bank for International Cooperation (JBIC), which have entered into an agreement to assist PJSC NOVATEK in building the terminals. The capacity of one terminal is estimated at 20 million tons per year. The LNG terminals are scheduled to be commissioned in Murmansk in 2022 and in Kamchatka in 2023.

South Korean shipbuilders are interested in Russian contracts, and Samsung Heavy Industries is a technological partner of LLC Zvezda in the construction of gas tankers. With their active participation (more than 90%), the first “green” “Aframax ‘Vladimir Monomakh’” was built, which is successfully operating in the Black Sea today.

Samsung Heavy Industries, within the framework of the largest commercial contract in its history, transfers technical specifications and documentation of the basic and detailed designs of vessels to LLC Zvezda, assists with the development of working design technical documentation, and delivers the most technologically advanced hull parts of gas tankers. It performs technical management, procurement of materials and equipment, training of Russian personnel, quality control of construction, installation and commissioning works.

For South Korea, with its export-oriented economy, the construction of Arctic tankers and dry cargo ships is a promising trend in strategic and commercial terms.

The Asia-Pacific market is becoming attractive for Russian companies, and with the development of the Northern Sea Route, it is a highly efficient destination for shipping hydrocarbons from Russia's Arctic zone. South Korea is an important trading partner of Russia; in 2020, the trade turnover between Russia and South Korea amounted to 19.6 billion US dollars, and the trade turnover between Russia and North Korea — 42.7 million US dollars. Table 3 shows Russia's trade figures with South and North Korea.

Table 3

Russian exports to South Korea and North Korea in 2020 [20]

Export item	South Korea		North Korea	
	Export volume (USD)	Deviation to 2019 (%)	Export volume (USD)	Deviation to 2019 (%)
Oil and oil products	9 068 808 695	- 31.7	10 992 619	- 59.6
Fish and seafood	1 580 929 185	+ 6.5		
Aluminum and products from it	332 552 197	+ 18.2		
Inorganic chemicals	263 168 980	+ 35.1		
Black metals	259 429 552	- 24.4		
Precious metals and stones	257 696 123	+ 21.1		
Ships and boats	126 983 646	+ 2673.9		
Wood	112 515 020	+ 0.5		
Paper, cardboard	72 808 415	+ 3.9		
Cereals	66 389 266	+ 149.3	15 388 579	+ 305.9
Other	303 019 787			
Fats and oils			4 465 588	+5.5
Pharmaceutical products			3 904 040	+55.3
Sugar and confectionery			2 565 174	+ 3301.6
Flour, starch			2 121 422	- 38.1
Secret code			956 728	-
Nuclear reactors, boilers			801 411	- 38.3
Various food products			152 781	+ 147.5
Meat and meat by-products			151 781	+ 296.7
Other			518 193	

The analysis shows that the main share of South Korea's imports falls on natural resources, while North Korea's main imports are food, oil and oil products.

Japan's interest in the Arctic resources is obvious; it is a matter of economic well-being in the medium and even long term, as well as diversifying the supply of hydrocarbons and rare earth metals. As a result, Japanese companies are investing in Russian Arctic infrastructure projects:

- Consortium of Mitsui & Co, Ltd (Mitsui) and Japan Oil, Gas and Metals National Corp (JOGMEC) own a 10 percent stake in the Arctic LNG-2 project;
- Mitsui owns a 12.5 percent stake in the Sakhalin-2 project;
- Mitsui, in partnership with the Chinese China COSCO Shipping Corporation Limited, owns 4 gas carriers of the Yamalmax type of the Yamal LNG project;
- Japan Bank for International Cooperation (JBIC) and Mitsui O.S.K. Lines (MOL) entered into an agreement to provide assistance to PAO NOVATEK in the construction of transshipment terminals in Murmansk and Kamchatka;
- MOL signed charter agreements for three Arc7 LNG carriers to be built by Korean DSME for the Arctic LNG-2 project by 2023;

[20] Torgovlya mezhdu Rossiey i Respublikoy Koreya (Yuzhnoy Koreey) v 2020 godu [Trade between Russia and the Republic of Korea (South Korea) in 2020]. URL: https://russian-trade.com/reports-and-reviews/2021-02/torgovlya-mezhdu-rossiey-i-respublikoy-koreya-yuzhnoy-koreey-v-2020-g/ (accessed 23 June 2021). Torgovlya mezhdu Rossiey i KNDR Severnoy Koreey) v 2020 godu [Trade between Russia and the DPRK (North Korea) in 2020]. URL: https://russian-trade.com/reports-and-reviews/2021-02/torgovlya-mezhdu-rossiey-i-kndr-severnoy-koreey-v-2020-/ (accessed 23 June 2021).

- the Japan Agency for Marine Science and Technology (JAMSTEC) reports that Japan will build a new icebreaking vessel (ice class PC4) for meteorological observations in the Arctic and Atlantic regions. The scientific icebreaker will represent an international research platform equipped with modern radar and special equipment, such as deep water sampling device, a sampler, underwater and aerial drones, etc. The project participants are: The Australian Government; Alfred Wegener Institute for Polar and Marine Research (AWI, Germany, has research stations in the Arctic); British Atlantic Service (BAS).

The new concept proposed by Japan provides for dynamic cooperation in the AZRF in logistical, energy, agricultural and scientific areas [7]. According to their estimates, the NSR is 40% more efficient than traditional shipping routes.

The navigation period of 2021 opened with the shipment of liquefied natural gas from Yamal LNG along the eastern route of the NSR on the LNG carrier Nikolay Urvantsev to Japan, which indicates the prospects for joint work through economic cooperation. This is highly relevant at this stage: transportation costs are decreasing, and the demand for energy carriers in Asia is growing, therefore, the reduction in delivery time along the Northern Sea Route creates a significant competitive advantage for Russian LNG.

India is considering opportunities and proposals for investing in projects in the Arctic zone of Russia to provide itself with energy resources, rare earth metals and bioresources [8, Bhagwat D., pp. 73–90]. According to the forecast of the International Energy Agency (IEA), by 2040, India will become the main source of growth in energy demand, accounting for 25% of the increase in energy consumption. The most promising for Russian companies may be the supply of liquefied natural gas. India currently ranks 4th in LNG imports and the position of Russian companies is not the most promising for many factors, but PJSC Gazprom entered into long-term contracts with the Indian company for the processing and distribution of natural gas (GAIL) in order to multiply the supply of LNG by Indian market.

Contracts between Russian and Indian businesses in the field of oil supplies from Arctic projects may become promising. Rosneft, which owns a 49.13% stake in the Indian oil refining company Nayara Energy Limited, holds the reserve. At the current stage, participation of Indian companies in the Vostok Oil project is being considered.

There are discussions on exports of Russian coal. India, the world's second largest steel producer, has a constant need for coking coal. The possibility of joint development of Arctic energy deposits is being considered.

The French oil company Total Energies is investing in Arctic projects, with a combined share of 50%: Yamal LNG — 20%, Arctic LNG-2 — 10%, LNG terminals in Murmansk and Kamchatka — 20%.

The progressive and systematic development of the natural resources of the Arctic, in particular, the developed and approved long-term program for the development of the LNG production, will create decent conditions for Russia to become a major player in the gas industry. After

the launch of Arctic projects at full capacity, NOVATEK could offer the market about 100 million tons of LNG per year. According to experts, low production costs are expected, which will create worthy competitive advantages.

The main importers of Russian gas in Europe are France, Belgium, the Netherlands; moreover, PJSC NOVATEK supplies LNG to Spain and Portugal through Spanish Repsol. In particular, in February 2021, the gas carrier Christophe de Margerie delivered another shipment from the port of Sabetta to the Belgian port of Zeebrugge. The international consultancy McKinsey & Company reports that 3.9 million tonnes of LNG were transshipped at the Belgian terminal in 2020, representing 22% of Yamal LNG's actual capacity [21]. LNG was delivered to the UK in early 2021 from the port of Sabetta by LNG tankers Nikolay Zubov, Georgiy Ushakov and Vladimir Voronin. The Russian supply amounted to 173 thousand m^3 of LNG at each Yamalmax.

The interaction between NOVATEK and Total Energies involves decarbonisation processes. As a result of negotiations, the companies signed a memorandum providing for the development of technologies for converting gas turbine equipment to hydrogen fuel, the construction of wind farms to reduce the environmental footprint of LNG projects.

Switzerland implements its comprehensive Arctic policy focused on protecting the environment, monitoring climate change, developing international cooperation and sustainable use of Arctic resources [9, Łuszczuk M., Padrtova B., pp. 608–621].

Turkey is ready to build a new 18 MW diesel-electric icebreaker of the Arc7 ice class, as well as two floating docks for Russian nuclear-powered icebreakers.

The Finnish design bureau Aker Arctic, which specialises in ice technology, has presented a project for an Arctic container ship for the Northern Sea Route. The Arc7-class Arctic container ships are scheduled for pilot operation in 2024. Rusatom Cargo, which is implementing the Northern Sea Transport Corridor (NSTC) project, can become a customer for these vessels, especially since container traffic is growing and the need to create such vessels is becoming an actual trend [10].

As part of the infrastructure development, transport and logistics hubs will be located at the NSTC points, where containers will be transshipped from feeder ships to ice-class ships [11]. According to the Rosatom State Corporation, a feasibility study has been developed for the implementation of an infrastructure project with the participation of the Dutch Royal Haskoning DHV, the British Ernst & Young, the Russian PJSC Central Design Bureau Iceberg and the Central Research and Design Institute of the Marine Fleet. In turn, Atomflot is contracting Dutch company Damen to build five arctic-class harbor tugs Arc4 at a total cost of 43.74 million euros.

The interests of Russia and Sweden in the Arctic region are represented in scientific research, as well as in ensuring favourable living conditions for indigenous peoples of the Far North

[21] Prishedshiy po Sevmorputi v fevrale iz Azii gazovoz uzhe idet v Evropu s SPG [The gas carrier that came from Asia along the Northern Sea Route in February is already on its way to Europe with LNG]. URL: https://eadaily.com/ru/news/2021/02/26/prishedshiy-po-sevmorputi-v-fevrale-iz-azii-gazovoz-uzhe-idet-v-evropu-s-spg?utm_referrer=https%3A%2F%2Fzen.yandex.com (accessed 23 June 2021).

[12, Sulyandziga L., pp. 68–74], [13, Tysiachniouk M., pp. 140–152]. The plans of the Swedish company Arctic Marine Solutions (AMS) as part of the international scientific expedition for ocean drilling ArcOP in the seas of the Arctic Ocean in 2022 will involve the diesel-electric icebreaker Viktor Chernomyrdin in ice support. The expedition is coordinated by the Swedish Polar Research Secretariat (SPRS) and the European Consortium for Oceanic Research Drilling (ECORD), the research is planned to be carried out in the high latitudes of the Arctic and on the Lomonosov Ridge.

In turn, Norway has already carried out pilot navigation along the NSR, has the opportunity to participate in the energy projects of the Russian Arctic, but the priority national direction of the strategic development of the Arctic zone is security and ways to improve it [14, Benz L., pp. 54–69], [15, Mileski J., pp. 131–137].

Taking into account the presence of commercial projects and international platforms, where cooperation between Russia and the Scandinavian countries can be carried out, it becomes obvious that there are prospects for economic cooperation, and in the foreseeable future they can become valuable partners in the areas that all parties are interested in expanding.

Conclusion

The world economy is currently suffering a significant failure in terms of the key macro indicators, due to the imposition of restrictive measures on economic activity, transport flows of goods and services (Covid-19). According to the World Trade Organization, exports decreased by 6.4% in the first quarter of 2020, imports — by 5.2% [22]. Russia's external turnover in 2020 amounted to 567.8 billion US dollars, which is 15.1% lower than the previous year.

The trade war between the United States of America and China, reduced growth in many global economies and increased geopolitical tensions (including between the USA and Russia in the Arctic) have led to a decline in global trade: growth rates in 2019 fell to 0.9% [23].

Nevertheless, unfavorable external conditions are helping to generate additional growth potential for the Russian economy. Awareness of the logic of renewal of world political and economic processes, trends in the economic development of Russia's partner countries in the Arctic zone allows formulating strategies for the foreign economic activity of our country. The relevant ministries have prepared and are implementing comprehensive programs for economic cooperation with key countries.

In accordance with the adopted strategic plans, measures are being taken to implement projects in the Arctic zone of the Russian Federation. The concept of chairmanship in the international Arctic Council and the procedures for the main areas of responsible management — social,

[22] Byulleten' o tekushchikh tendentsiyakh rossiyskoy ekonomiki [Bulletin on current trends in the Russian economy]. URL: https://ac.gov.ru/uploads/2-Publications/BRE/BRE_sept2020.pdf (accessed 12 September 2021).
[23] Ministerstvo ekonomicheskogo razvitiya Rossiyskoy Federatsii. Itogi vneshneekonomicheskoy deyatel'nosti Rossiyskoy Federatsii v 2019 godu [Ministry of Economic Development of the Russian Federation. Results of the foreign economic activity of the Russian Federation in 2019]. URL. https://www.economy.gov.ru/material/file/66eec1250c653fc9abd0419604f44bbd/VED.pdf (accessed 12 September 2021).

economic, environmental, as well as in collective cooperation with interested regional structures based on strict adherence to international legal norms were approved.

The relevance of the economic interaction of stakeholders in the development and use of the natural resources of the Russian Arctic is due to the current climatic conditions and the achievements of scientific and technological progress. Many world powers want to take part in the implementation of innovative Arctic projects and the development of the Northern Sea Route.

The main economic partners of Russia in the Arctic are the countries of the Asia-Pacific region (APR). The PRC is the main partner in the economic development projects of the Russian Arctic with a high potential. Cooperation between the parties is carried out within the framework of participation in the construction of terminals and providing them with the necessary equipment, in the production and transportation of LNG. In the future, it is possible to implement new areas — the development of resources, the development of transport and logistics infrastructure, energy and the petrochemical industry.

It is noteworthy that the world's leading companies from China, South Korea, Japan, India, and others, as well as European countries with high investment potential, take part in the implementation of Russian Arctic projects. The prospects for economic cooperation in the Russian Arctic are enormous. Thus, more than 40 projects are focused on the creation of maritime transport in AZRF, including the development of natural resources of hydrocarbons and solid minerals with a wide geography — the Kola Peninsula — the Bering Sea. To increase investment attractiveness, a new commercial fleet of high ice class is being created; projects for the construction of a network of ports-hubs in the north-west and north-east of Russia with all related infrastructure are undergoing examination. Such transport and logistics hubs can be: in the European part — Le Havre, Hamburg, Copenhagen, Rotterdam, Southampton; in the east — Busan, Tianjin, Shanghai, Yokohama. In many countries, the necessary infrastructure has already been created for the acceptance of Russian LNG, and in the future, conditions may be created for the distribution of goods to the markets of Europe and Asia.

The successful implementation of the Strategy for the Development of the Russian Arctic Zone, the Fundamentals of the State Policy of the Russian Federation create the conditions for creating a new global economic area of prosperity and international partnership.

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Assessment of the Influence of Growth Factors on the Gross Regional Product on the Example of Arkhangelsk Oblast *

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Abstract. The problem of differentiating indicators of economic development is relevant not only for the regions of Russia. One of the main indicators is the gross regional product. The work carried out a comparative analysis of its values for the constituent entities of the Russian Federation, the United States and China, which revealed differences by tens, and sometimes hundreds of times. In most cases, this is due to the specifics of a particular region. The aim of the work is to assess the influence of regional factors on the gross regional product. The article presents an analysis of existing methods for solving this problem by modern domestic and foreign researchers. A brief overview of the key factors used in the proposed models is given. However, the trends in the development of the world and domestic economies, political events, restrictions imposed by the pandemic, regional peculiarities leave this issue relevant. The paper proposes a model for assessing the impact of objective and subjective factors on the gross regional product. The testing subject was the Arkhangelsk Oblast, located in the north of the European part of the Russian Federation. Seven indicators were selected as objective factors, which have a close correlation with the resulting indicator. A multiple regression equation was developed and the quality of the model was assessed. A forecast of the values of the gross regional product for the planning period was made. The influence of subjective factors was studied using the method of expert assessments through the analysis of ratings of influential agencies. A correction factor has been introduced into the model, with the help of which the values of the volume of the gross regional product have been corrected. The results of the study can be useful for state authorities and local self-government bodies that manage the regional development of territories, and can be used to develop a strategy for the development of the constituent entities of the Russian Federation.
Keywords: *gross regional product, subjective factor, objective factor, multiple regression model, correlation, ranking, differentiation of indicators, forecasting*

Introduction

One of the main indicators of the level of development of the regional economy is the gross regional product (GRP). GRP is the main tool in economic and analytical studies conducted at the regional level, especially in comparative analysis, since its value varies significantly within one country.

Russia is the largest country in the world in terms of area — over 17.13 million km^2 [1]. The territories of such large countries as Canada, China, the USA are almost twice less. But, despite

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[1] List of states and dependent territories by area. URL: https://ru.wikipedia.org/wiki / (accessed 06 September 2021).

this, GRP differentiation is observed not only in the regions of the Russian Federation, but also in the regions of foreign countries [1–5].

On the territory of Russia, GRP per capita varies between regions by ten times (Fig. 1). In 2018, for example, the GRP per capita of the Yamalo-Nenets Autonomous Okrug was 10 times higher than the national average and 50 times higher than the value of the Republic of Ingushetia.

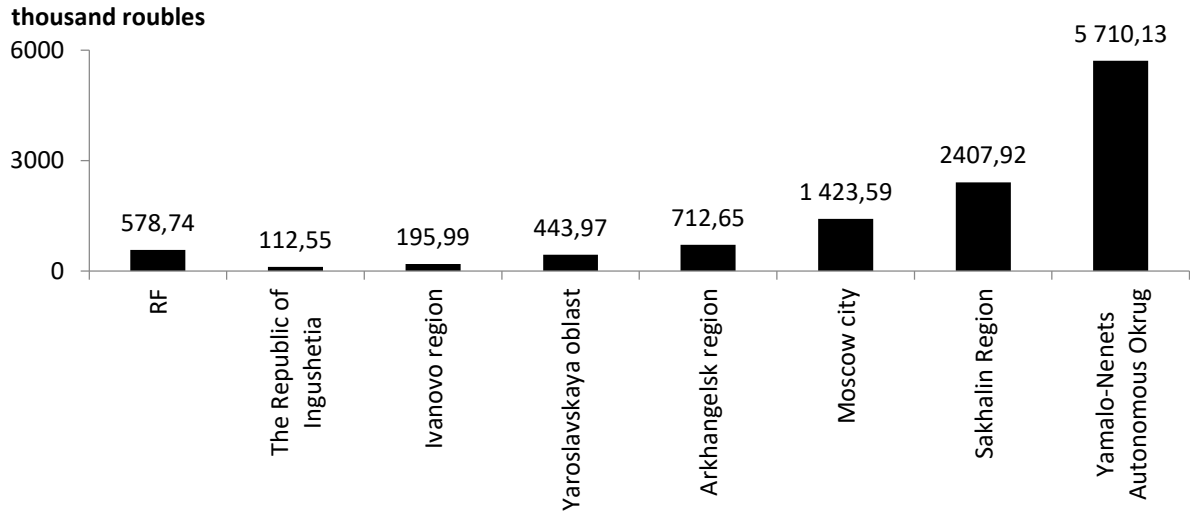

Fig. 1. Share of GRP per capita by regions of the Russian Federation (2018) [2].

In the United States (Fig. 2), this figure in 2019 in the Colombian region was 3 times higher than the national average, but 6.6 times higher than the value of Puerto Rico.

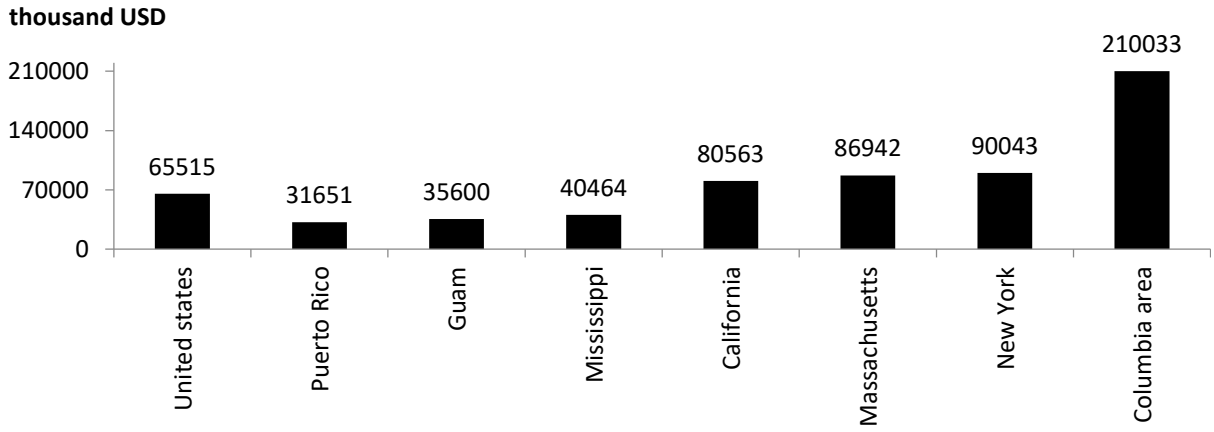

Fig. 2. Share of GRP per capita by US regions (2019) [3].

In China (Fig. 3), in 2019, the GRP of Macau was 8.2 times higher than the national average and 18.6 times higher than the value of Gansu.

[2] Compiled by the authors. URL: https://rosstat.gov.ru/ (accessed 03 September 2021).
[3] Compiled by the authors. Source: List of states and territories of the United States by GDP. URL: https://ru.qaz.wiki/wiki/List_of_U.S._states_and_territories_by_GDP/ (accessed 03 September 2021).

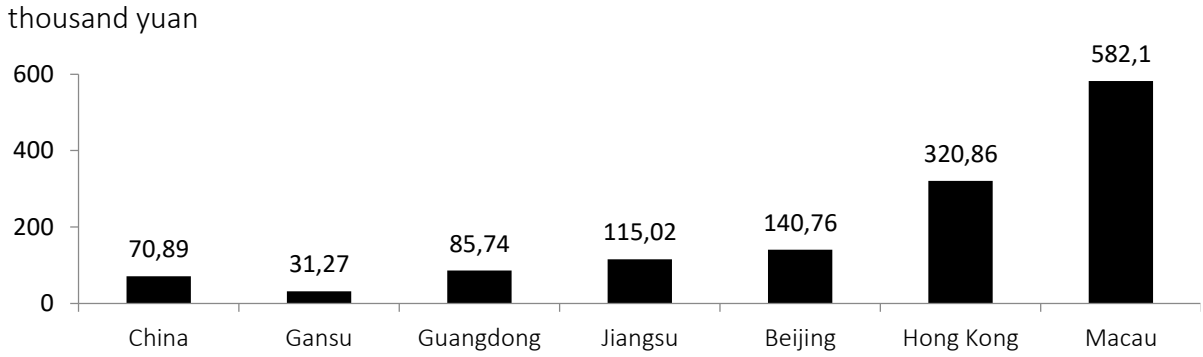

Fig. 3. Share of GRP per capita by regions of China (2019) [4].

Consequently, the problem of differentiation of regional socio-economic development indicators is relevant for the world community and is widely discussed in academic circles.

Approaches to assessing the impact of indicators on the gross regional product

The volume of GRP is influenced by many factors. Many studies have been devoted to their study [6–21, 25].

One approach is to use the classical production function. Baranov S.V. and Skufina T.P. [6, Baranov S.V., Skufina T.P., pp. 57–62] propose to calculate GRP by selecting the value of fixed assets of the regional economy and the average annual number of employed in the economy as influencing factors.

Employees of the Institute of Socio-Economic Research of the USC RAS [7, Gafarova E.A., p. 10] developed a complex simulation model of GRP volume forecasting, where the main indicators include investment in fixed capital, labour costs of employees and costs of research and development. The same factors are chosen by the scientists R.M. Nizhegorodtsev and N.A. Petukhov of the Institute of Management Problems of the RAS [5]. To assess their impact on GRP, scientists propose to use the three-factor Cobb-Douglas model [22, 23].

One of the classic approaches to predicting the GRP volume and assessing the influencing factors is the Box-Jenkins method (ARIMA — Autoregressive Integrated Moving Average), which is a linear statistical model. This approach forms the basis of V.S. Mkhitaryan and O.A. Khokhlova's research [8, p. 53], who used the growth coefficients of the region's development indicators in the model.

Another method that has become widespread is the method of regression equations. On its basis, M.D. Mamedsupiev [9, p. 53] created an economic-mathematical model of the GRP, where he singled out cash income, investments in fixed capital, the number of employed popula-

[4] Compiled by the authors. Source: PRC regions, population and GRP. URL: http://www.russchinatrade.ru/ru/about-china_-new/administrative-territorial-division/ (accessed 06 September 2021).

[5] Nizhegorodtsev R.M., Petukhov N.A. Regressionnyy analiz vliyaniya osnovnykh faktorov na valovoy regional'nyy produkt (na primere Severo-Zapadnogo federal'nogo okruga Rossii) [Regression analysis of the influence of the main factors on the gross regional product (on the example of the Northwestern Federal District of Russia)]. *Elektronnye biblioteki*, 2011. URL: https://www.problecon.com/export_pdf/problems-of-economy-2011-1_0-pages-17_21.pdf (accessed 05 September 2021).

tion and the volume of industrial production as the determinants. A.N. Petrov [10, Petrov A.N., p. 93] also adheres to this method in his research, taking into account the indexes of regional economic indicators (industrial production, investment in fixed capital, the average annual number of employed people, etc.) when calculating GRP.

The model based on the balanced scorecard (BSC) is also well-known. The possibility of its application to a specific subject of the Russian Federation depends on the information capabilities of statistical data. This model is the subject of studies by E.V. Zarova and R.A. Prozhivin [11, p. 59], who developed an algorithm for assessing the impact of 130 statistical indicators on GRP.

Intuitive methods are also of great importance for the analysis of the influence of factors on GRP, for example, a two-sector simulation model of the Energy Research Institute of the Russian Academy of Sciences for assessing an array of variable factors [12, Shapot D.V., Osipov A.V., p. 74].

Another common model is the input-output method. The works of researchers from the Institute of Economic Forecasting of the Russian Academy of Sciences (IEF RAS) and The Institute of Economics and Industrial Engineering of the RAS are devoted to it. They include the RIM model (Russian Interindustry Model) — a macroeconomic intersectoral model. This model was used in the studies of M.N. Uzyakov and G.R. Serebryakova [13, 14] when evaluating the structure of the regional economy using the least squares method, and in the works of M.V. Chistov [15, 24] when predicting trends in the sectoral structure of the region's economy.

In these methodologies, researchers propose different models for assessing the influence of factors on GRP. However, it should be noted that the trends of modern economic and political events are making their own adjustments, and the issue of taking regional specifics into account remains open.

GRP forecasting model

In this study, the authors developed a methodology for assessing the impact of indicators on the gross regional product. All calculations were made on the example of the Arkhangelsk Oblast.

The Arkhangelsk Oblast is a subject of the Russian Federation, which is located in the European North and is part of the Northwestern Federal District. In terms of area, it is the eighth largest constituent entity [6].

The degree of influence of factors on GRP is proposed to be assessed by means of correlation coefficient. The data for the last 11 years from 2009 to 2019 are taken to build a multiple regression equation (Table 1). The following objective indicators were chosen as factors:

- costs of production and sale of products (goods, works and services) of organizations (legal entities) (X_1);

[6] Official website of the Federal State Statistics Service. URL: https://rosstat.gov.ru/ (accessed 06 September 2021).

Table 1

Factors for constructing multiple regression, million rubles [7]

Factor	2009	2010	2011	2012	2013	2014
Y	323606.8	372804.8	439116.8	472470.9	500095.1	542695.3
X_1	212035.6	238969.5	277048.8	294286.6	320081.9	326221.9
X_2	96480.9	98622.3	116293.5	125233.3	148613.1	156717.6
X_3	61504.8	71455.2	87903.1	80406.0	96062.9	94218.0
X_4	204233.4	254095.8	276038.7	297986.1	449366.0	350382.4
X_5	63282.8	73836	122139.6	149210.9	143411.9	138458.2
X_6	38691.3	42421.6	45593.2	45229.6	49687.4	55316.9
X_7	1258.4	787.6	981.2	1168.3	1389.1	1572.6
Factor	2015	2016	2017	2018	2019	
Y	627698.0	680482.0	726004.8	819247.0	897103.4	
X_1	343633.0	364032.0	388306.2	423051.2	454917.1	
X_2	159024.0	161807.0	163041.4	177645.1	174346.8	
X_3	95374.5	101268.0	120777.5	123658.8	131495.7	
X_4	408996.0	425810.0	605666.8	632968.6	393056.9	
X_5	155961.0	154384.0	194847.4	173797.2	169615.9	
X_6	61278.1	68123.5	72179.8	74793.5	83855.3	
X_7	1579.6	1808.8	4989.3	1672.7	1579.6	

- amount of IE proceeds from the sale of goods, products, works, services for all types of economic activity (X_2);
- turnover of small business organizations (X_3);
- volume of shipped goods of own production, works and services performed on their own in the sections “Mining” and “Manufacturing” (X_4);
- investments in fixed assets (X_5);
- labor costs of personnel of organizations (legal entities) (X_6);
- research and development costs (X_7).

The resulting indicator (Y) is the gross regional product.

The estimation of the parameters of the multiple regression equation is carried out by means of the least squares method and takes the form of (1):

$$Y = -0.382 * X_1 - 1.179 * X_2 - 1.173 * X_3 + 0.401 * X_4 + 1.472 * X_5 + 12.647 * X_6 - 33.607 * X_7, \quad (1)$$

Let us analyze the impact of the regression coefficients in equation (1) on the resulting indicator. A direct comparison of the regression coefficients in equation (1) is justified, since the factors are expressed in identical units — million rubles — and have the same variability, which is estimated by means of the coefficient of variation of factor characteristics (Table 2). It should be noted that only factor X7 has a coefficient of variation different from the others and corresponds to 0.199; for other factors, the variance ranges from 0.061 to 0.119.

[7] Compiled by the authors. URL: https://rosstat.gov.ru/ (accessed 03 September 2021).

Table 2

Coefficients of variation of factors [8]

Factor	Coefficient of variation
X_1	0.067
X_2	0.061
X_3	0.068
X_4	0.119
X_5	0.086
X_6	0.078
X_7	0.199

The coefficients of the multiple regression equation (1) show the size of the influence of factors X_1, X_2, X_3, X_4, X_5, X_6, X_7 on the level of the resulting indicator in absolute terms. The greatest influence is exerted on GRP when factors are fixed: X_3, X_6, X_7 (Table 3).

For comparative assessments of the role of factors in the GRP formation, absolute values should be supplemented with relative, in particular, normalized regression coefficients. This will make it possible to identify the factors that contain the largest reserves for changing the performance indicator (GRP) (Table 3). The analysis of the values of the normalized regression coefficients shows that, taking into account the degree of variation of factors, the largest reserves in the GRP change lie in the increase of factors X_4, X_6, X_5, X_1.

Table 3 shows that the ranks of factors in terms of the regression coefficient (absolute values) and in terms of the normalized regression coefficient (relative values) coincide or are close in terms of factors X_2, X_5, X_6. The discrepancy in the assessment is observed for factors X_1, X_3, X_4, X_7.

Table 3

Analysis of regression coefficients [9]

Factor	Regression Coefficient	Rank of factors by the regression coefficient	Normalized regression coefficients	Rank of factors by the normalized regression coefficient
X_1	-0.382	7	-0.00052	4
X_2	-1.179	5	-0.00024	5
X_3	-1.723	3	-0.00020	6
X_4	0.401	6	0.00219	1
X_5	1.472	4	0.00058	3
X_6	12.647	2	0.00070	2
X_7	-33.607	1	-0.00001	7

Let us turn to the assessment of the quality of the regression equation (1). The multiple correlation coefficient is 0.999. According to the Chaddock table, the qualitative assessment of the relationship between the effective attribute (GRP) and factor attributes is very high. The parameters of the regression model reflect the effectiveness of the included indicators. The coefficient of multiple determination corresponds to 0.998. The adjusted multiple regression coefficient, which determines the tightness of the connection, taking into account the degrees of freedom of the total variance and residual variance, is 0.999. It allows evaluating the closeness of the relationship,

[8] Authors' calculations.
[9] Authors' calculations.

which does not depend on the number of indicators. Both coefficients indicate a high level of correlation (over 98%).

In the paper, the reliability of the indicator of closeness of correlation was assessed according to F — Fisher's criterion. The actual value of the criterion was 1812.4 and does not exceed the permissible significance level of 5% (Fcrit = 6.09).

So, the obtained value is not accidental, it was formed under the influence of significant indicators. The statistical significance of both the regression equation and the closeness of the correlation is confirmed. The standard error of the regression equation is 17.9 billion rubles.

Table 4 shows the matrix of paired coefficients of the multiple regression model.

Table 4

Matrix of paired coefficients of multiple regression model [10]

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	Y
X_1	1							
X_2	0.964	1						
X_3	0.971	0.911	1					
X_4	0.942	0.877	0.964	1				
X_5	0.924	0.891	0.906	0.85	1			
X_6	0.959	0.913	0.934	0.915	0.839	1		
X_7	0.554	0.489	0.638	0.665	0.638	0.635	1	
Y	0.986	0.935	0.951	0.930	0.881	0.987	0.569	1

As seen from Table 4, there is a direct correlation with all factors in GRP, indicating that the growth of each of them causes an increase in GRP. The strongest influence is exerted by the following factors: the costs of production and sale of products (goods, works and services) of organizations (legal entities) (X_1), the correlation coefficient is 0.986, the costs of remuneration of personnel of organizations (legal entities) (X_6). The least influence of the factors under consideration is the costs of research and development (X_7) — 0.569.

According to Table 4, there is a high dependence between the factors. This suggests that one of the factors should be excluded from consideration, but the task of the study is to predict GRP. The coefficient of multiple determination is greater than 0.9, so the presence of multicollinearity does not affect the quality of the developed model. To reduce multicollinearity, it is sufficient to increase the sample size.

Thus, the model is reliable and can be used for further forecasting.

On the basis of the average annual growth rates, the values of the factors for the forecast period were calculated (Table 5). Using the model (1), the values of GRP (Y) for 3 planning years are determined.

[10] Authors' calculations.

Table 5

Forecasting the values of objective factors and GRP [11]

Factor	Average annual growth rate	Value for the forecast period, million rubles		
		1 year	2 year	3 year
x1	1.079	491003.5	529952.5	571991.1
x2	1.061	184974.2	196249.5	208212.0
x3	1.079	141876.9	153077.7	165162.8
x4	1.111	653317.8	726161.9	807128.0
x5	1.104	187190.9	206586.9	227992.6
x6	1.080	90598.8	97884.6	105756.2
x7	1.023	1747.2	1787.4	1828.5
y	-	974477.6	1075555.8	1186713.3

In addition to objective factors affecting GRP, it is advisable to consider the impact of subjective factors (political, climatic, environmental) [26]. The choice of these indicators is justified by the fact that the political situation is of great importance for the development of the region's economy, especially in recent times. Consideration of climatic and environmental conditions in the Arkhangelsk Oblast is associated with the geographical location of the RF subject. It is proposed to evaluate these factors using the method of expert assessments. Let us consider the ratings of influential agencies.

In July 2020, the Petersburg Politics Foundation presented a rating of socio-political sustainability of Russian regions. According to the data, the Arkhangelsk Oblast was among the regions with low socio-political stability [12].

According to the experts of the CROS analytical department on the National Anxiety Index, calculated as a weighted average coefficient, the Arkhangelsk Oblast was in the top 10 “anxious regions” in 2019. The main reasons are the following: political changes in the country (change of the Government, amendments to the Constitution), environmental situation, coronavirus infection [13]. The work of the head of the region has a significant impact on the level of anxiety.

In 2020, the Centre for Information Communications “Rating” within the framework of the “National Rating” project, has conducted a research, based on an absentee survey of experts, aimed to evaluate the performance of heads of subjects of the Russian Federation, according to which the Arkhangelsk Oblast ranked 70th place among other regions [14].

According to the results of the study “Rating of influence of the heads of subjects of the Russian Federation” by the Agency for Political and Economic Communications, the head of the Arkhangelsk Oblast moved down from 48th to 52nd place, leaving the group of strong influence. The assessment took into account the results of the implementation of major projects in the field

[11] Authors' calculations.
[12] Rating of the Petersburg Politics Foundation for June 2020. URL: https://fpp.spb.ru/fpp-rating-2020-06 (accessed 03 September 2021).
[13] KROS predstavil reyting trevozhnykh regionov Rossii [CROS presented a rating of disturbing regions of Russia]. URL: https://www.cros.ru/ru/exploration/research/1602/ (accessed 20 August 2021).
[14] National Rating of Governors (Results of 2020). URL: http://russia-rating.ru/info/18784.html (accessed 20 August 2021).

of transport and social infrastructure, anti-corruption investigations, as well as the consequences of negative events with public resonance [15].

The indicator of the quality of life is of great importance among the factors influencing GRP. According to the RIA Agency, the Arkhangelsk Oblast ranked 74th by this indicator in 2019, and 75th — in 2020, entering the top ten outsiders [16]. The rating was calculated according to 70 indicators combined into 11 groups, among which attention is paid to environmental and climatic conditions.

The Arkhangelsk Oblast is located in the northern part of European Russia, has unfavorable climatic conditions for living and development of many sectors of the national economy (agriculture, housing and communal services). This leads to negative trends in demographic and environmental indicators.

According to the All-Russian public organization "Green Patrol", the Arkhangelsk Oblast took 51st place in the sphere of environmental security and protection ("National ecological rating of regions") [17].

The study of the Analytical Credit Rating Agency (ACRA) is based on the relative indicators of the negative impact obtained as the ratio of the absolute value of the factor in the analyzed entity to the size of its GRP (for example, the volume of emissions or wastewater discharge) [18]. As of February 2021, the Arkhangelsk Oblast ranked 53rd among the regions of the Russian Federation.

Thus, the analysis of the ratings of the leading agencies showed that the Arkhangelsk Oblast is in 51–75 places among 85 regions of the Russian Federation according to the selected factors, which indicates an unstable situation. As a result the GRP volume projected with the help of the presented model (1) should be adjusted for the future period, taking into account the impact of adverse subjective factors.

To do this, we introduce the correction factor presented in Table 6 into our model (1).

Table 6

GRP volume correction factor [19]

Place of the region in the ratings of leading agencies	Value of the correction factor
1–25	1.05
26–50	1.0
51–75	0.95
76–100	0.9

[15] Rating of the influence of the heads of subjects of the Russian Federation. Russian regions and regional policy in June 2020.
[16] Quality of life in Russian regions Rating 2020. URL: https://riarating.ru/infografika/20210216/630194637.html (accessed 20 August 2021).
[17] National ecological rating of regions. URL: https://greenpatrol.ru/ru/stranica-dlya-obshchego-reytinga/ekologicheskiy-reyting-subektov-rf?tid=405&order=field_soc_econom&sort=desc (accessed 20 August 2021).
[18] Ecological ranking of subjects of the Russian Federation. URL: https://www.acra-ratings.ru/research/2328 (accessed 03 September 2021).
[19] Authors' calculations.

The regions ranked from 1st to 25th place are among the leaders that have favorable subjective factors that contribute to the development of the region's economy and the growth of GRP. Therefore, the value of the correction factor is greater than 1.

The subjects that fell into the third and fourth groups are the outsiders; therefore, the impact of subjective factors in these regions slows down the growth of GRP. The stronger the negative impact, the lower the value of the correction factor.

The Arkhangelsk Oblast, according to our methodology, falls into the third group, for which a coefficient of 0.95 is applied. Let us correct the value of the predicted GRP (Y) (Table 7).

Table 7

GRP forecast with correction factor [20]

Indicator	Value for the forecast period, million rubles		
	1 year	2 year	3 year
Y	974 477.6	1 075 555.8	1 186 713.3
$Y_{updated}$	925 753.7	1 021 778.0	1 127 377.7

As can be seen, the values of the gross regional product will decrease by 5%. Thus, the influence of the most significant subjective factors for the given region is taken into account.

Conclusion

It should be noted that this paper represents the authors' approach to assessing the impact of regional indicators on the gross regional product and only partially illuminates the complex and multifaceted problem of differentiation of the socio-economic development of the constituent entities of the Russian Federation.

The study substantiates the necessity to take into account the influence of factors on GRP, based on the characteristics of each region. This is caused by the territorial differentiation of many indicators, typical both for the economy of the Russian Federation and for foreign countries.

These factors in the paper are divided into objective and subjective. All the calculations were carried out on the indicators of the Arkhangelsk Oblast.

The evaluation of the first group was made using a multifactorial model, which is a multiple regression equation. Seven factors were selected that have a close correlation with the gross regional product. The sample of initial data was carried out for 11 years. The reliability of the model was confirmed statistically. The result is the calculation of GRP for the forecast period.

The influence of factors of the second group was taken into account on the basis of the method of expert assessments of leading agencies. Significant subjective factors for the northern region were taken for the research. Based on the study of the ratings, a scale of the GRP adjustment coefficient was developed and its significance for the Arkhangelsk Oblast was taken into account.

Thus, the advantage of this methodology is an integrated approach based on the use of statistical methods and the method of expert assessments of objective and subjective factors. The

[20] Authors' calculations.

developed model can be used in medium-term forecasting of regional development. It should be noted that the result of its application to data from other subjects of the Russian Federation will depend on the representativeness of the sample of initial indicators of objective factors and the list of subjective ones.

A promising direction for further research on this issue is to increase the list of assessed factors and test this methodology on statistical indicators of other regions.

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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).

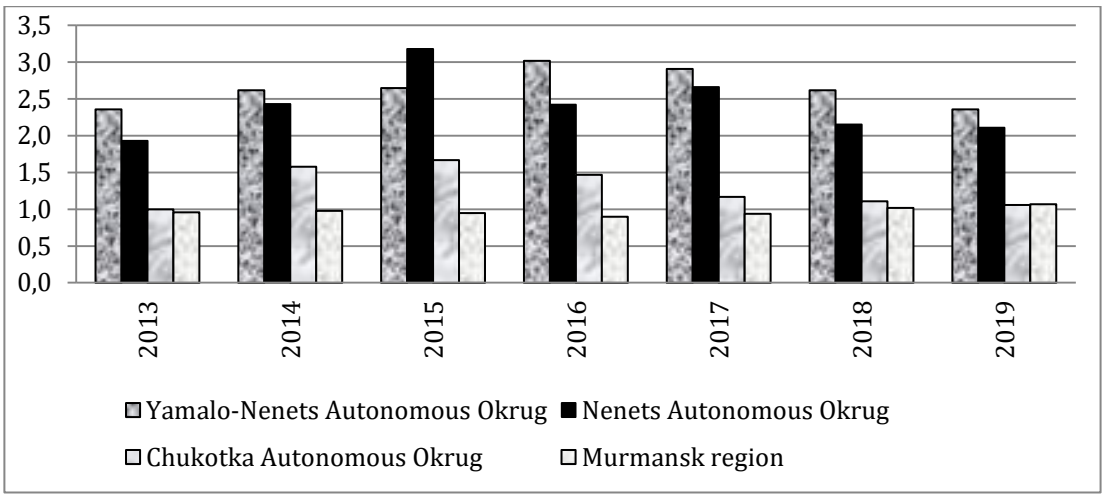

Fig. 1. Assessment of the resource potential for innovation development of the Arctic regions.

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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Economical and Legal Barriers and Its Potential Overcoming During the Northern Sea Route Exploitation in the Context of Pan-Asian Trade *

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Abstract. The article provides a systematic analysis of the critical economic and legal factors affecting the current state of cargo flow in the Northern Sea Route in the convergence of the Asian and European markets. First of all, these are legal norms, environmental standards, economic efficiency and organizational and managerial motives, and the development of transport and port infrastructure along the route of the "historically developed national unified transport communication of Russia in the Arctic". The authors propose specific steps and recommendations to overcome obstacles that create an unfavorable barrier environment for logistics companies to strengthen cooperation and interaction on an equal and mutually beneficial basis with Russia and counterparty partners in the market. These include irregular deliveries due to the seasonal functioning of the transport route and ice conditions, a high level of tariffs due to low cargo flow, and the inability to transport return goods. Particular attention is paid to the need for international cooperation to implement large infrastructure projects for the development of the NSR and the industrial and economic development of the Arctic territories. The authors propose specific steps and recommendations to overcome obstacles that create an unfavorable barrier environment for logistics, stevedoring and insurance companies, infrastructure operators, ship-owners and regulatory authorities to enhance cooperation and interaction on Russia's equal and mutually beneficial basis and counterparty partners in the international market.
Keywords: *Russian Arctic, Northern Sea Route, logistics, international trade, barrier, environmental standard*

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Introduction

The Arctic zone is currently a prime example of heterogeneity in the context of territorial exploitation and development. The main problem of this macroregion is the discrepancy between its potential opportunities due to its favorable economic and geographical position, for example, in terms of the Northern Sea Route possibilities, high natural, resource and investment potential, very low level of infrastructure development and sparsely populated territory [1, Chikinova M.S.].

The article attempts a system analysis of the key economic and legal factors influencing the current state of cargo traffic in the waters of the Northern Sea Route in the context of convergence of Asian and European markets, namely, legal regulations, environmental standards, economic efficiency and organizational and managerial motives, as well as the level of development of transport and port infrastructure along the NSR route. The paper is divided into four paragraphs that outline the above-mentioned factors, as well as recommendations for overcoming obstacles that create unfavorable barrier environment for developing the potential of the NSR.

Materials and methods

First of all, it should be noted that a sufficient number of publications have been written on the development of the NSR as a transport route. Certainly, these are such authoritative researchers in the scientific and educational world as Vylegzhanin A.N., Skaridov A.S., Gutsulyak V.N. and others. We should also mention the works of such authors as Smirnova O.O., Lipina S.A., Kudryashova E.V., Kreydenko T.F., Bogdanova Yu.N. (formation of supporting zones), Bhagwat D. (safety in the NSR), Zalyvskiy N.P. (comparative potential of the NSR), Voronenko A.L., Greyzik S.V. (international cooperation with Northeast Asia within the framework of the NSR), Gudev P.A. (international cooperation in the field of maritime transit in general). Besides, a massive block of articles has been published in 2021–2022 on geoinformation support in the field of digitalization of the NSR during the period of climate change and the COVID-19 epidemic [2, Istomin E. et al.], internationalization of external costs for cabotage transportation [3, Ramalho M.M., Santos T.A.], digitalization of the NSR in general [4, Vicentiy A.V.], digital risk management of oil companies operating in the NSR [5, Bianco I. et al.], mathematical modeling of port management systems failure [6, Khripko T.], ICT solutions for ports [7, Fiorini M., Gupta N.], etc.

This article, in addition to the system analysis of the NSR economy, included the study and review of international agreements and Russian regulatory documents on the protection of the

marine environment during navigation in the Arctic. The texts of these documents were taken from official websites of, for example, the United Nations (UN), the International Maritime Organization (IMO), the Government of the Russian Federation, the Administration of the Northern Sea Route, the ConsultantPlus legal reference system, etc.

The research is also based on published works of specialists in international law, maritime law, environmental law, political science, ecology and other fields of knowledge. The authors studied the law enforcement practice, as well as some of the political processes on which shipping along the Northern Sea Route is based today.

General scientific methods, methods of data grouping and systematization, comparative analysis were used to analyze the infrastructural development of the Northern Sea Route.

Data from federal legal acts, strategic documents on the Arctic, federal ministries and the main economic entities of the transport route — Rosatom, Atomflot and Hydrographic Enterprise — were used as an information base.

Results

Legal aspects

The study presented in this article was based on the idea of the NSR status, specified in Article 5.1 of the Merchant Shipping Code of the Russian Federation, namely:

"The water area of the Northern Sea Route is understood as the water space adjacent to the northern coast of the Russian Federation, covering the internal sea waters, the territorial sea, the contiguous zone and the exclusive economic zone of the Russian Federation, and bounded by the line of delimitation of maritime spaces with the United States of America and the parallel of Cape Dezhnev in the Bering Strait on the east, by the meridian of Cape Zhelaniya to the Novaya Zemlya archipelago, the eastern coastline of the Novaya Zemlya archipelago and the western borders of the Matochkin Shar, Kara Gates, Yugorskiy Shar straits on the west. The rules of navigation in the waters of the Northern Sea Route are approved by the Government of the Russian Federation and are applied in order to ensure the safety of navigation, as well as to prevent, reduce and control pollution of the marine environment from ships..." [1].

Many works of Russian and foreign specialists have already been devoted to the legal status of the Northern Sea Route, in this regard, we will not dwell on this in detail, but will analyze only the legal barriers to the development of navigation along the NSR routes.

The key factor in the development of commercial navigation in the NSR waters is "navigation safety". A lot of international and national legal acts refer to the concepts of "safety", "transport safety", "safe place", "safe facilities", "safety of maritime navigation", "safe crewing", "ensuring transport security", etc. For example, the procedure for radiotelephone conversations

[1] Merchant Shipping Code of the Russian Federation (as amended on June 11, 2021)]. URL: https://docs.cntd.ru/document/901732423 (accessed 25 September 2021).

related to ensuring the safety of navigation on ships defines a number of concepts related to navigation safety issues: “distress” (MEDE), “urgency” (PAN), “safety” (SECURITE).

Neither the Polar Code, nor other international documents that relate to the law of the sea, provide a universal definition of navigation safety. The IMO only makes recommendations on key security issues, and there are quite a lot of them, not only emergencies, but also piracy and armed robbery, terrorism, smuggling and drug trafficking, unsafe mixed migration at sea, port security, war , cybersecurity [2].

That is why the lack of a universal international legal definition of maritime security leads to a situation where each shipping company’s commanders have their own understanding of the concept. The surveys conducted among the crews show that there can be up to 30 different answers, each of which does not coincide with the others. However, general criteria have been identified as a result of summarizing the responses:

1) set of measures aimed at preventing emergency situations at sea;
2) organization and training of the crew in ship damage control;
3) knowledge of theory: navigation, safety, regulatory legal acts, ship systems, etc.;
4) practice: work experience, proven qualifications; crew knowledge testing; first aid, training, etc.;
5) adherence to and compliance with all rules and regulations of safety;
6) protection of human life at sea;
7) provision of vessel with all the necessary ship equipment and supplies, ship documentation for safe navigation.

Ensuring maritime safety in the Russian Federation is the prerogative of the state. State supervision over the safety of navigation, as well as over a number of other types of activities in the field of maritime transport, is carried out by the relevant government bodies in the form of administrative monitoring, control over compliance with the requirements of laws, regulations and international treaties in which Russia participates [8, Kolodkin A.L., Gutsulyak V.N., Bobrova Yu.V.].

The Russian Federation is a party to many international treaties (according to the IMO list, Russia has ratified over 35 conventions [3]). However, it should be noted that ratification of international maritime conventions in itself does not prove proper compliance with their provisions.

Nevertheless, according to the data of the International Chamber of Shipping, presented in the summary table by country for the period 2018–2019, the assessment of the Russian Federation’s — “flag state” — compliance with certain international requirements for the shipping industry is one of the highest compared to other states. With regard to Russia, the International Chamber of Shipping’s report presents extremely positive performance indicators, except for one single

[2] Maritime security. IMO. URL: https://www.imo.org/en/OurWork/Security/Pages/GuideMaritimeSecurityDefault.aspx (accessed 18 January 2022).
[3] Status of Conventions. Official website of the International Maritime Organization. IMO. URL: http://www.imo.org/en/About/Conventions/StatusOfConventions/Pages/Default.aspx (accessed 25 September 2021).

indicator regarding "port state control" in the category "Paris Memorandum of Understanding on Port State Control of Ships" [4].

For example, referring to the ratified international treaties adopted to promote the safety of navigation, in accordance with the Order of the Ministry of transport of the Russian Federation [5], Russia has enacted the International Code for Safety Management (ISM Code).

As Skorokhodov D.A., Borisova L.F. and Borisov Z.D. point out, "Certain issues of security in maritime transport are reflected in a number of legislative acts: the Maritime Doctrine of Russia up to 2020 (current, relevant) [6], as well as the new Maritime Doctrine of 2015 [7], the Merchant Shipping Code [8], the Inland Water Transport Code [9], as well as in regulations such as the Technical Regulations on the Safety of Maritime Transport Facilities [10]. The system for ensuring the safety of navigation in Russia is formed by legislative, executive and judicial authorities and specialized organizations in the field of maritime transport safety, state centers for training specialists in this field" [9, Skorokhodov D.A., Borisova L.F., Borisov Z.D.].

There are also a number of strategic documents that contain certain types and priorities of maritime safety, including those on the NSR. These are documents such as the still valid Arctic Strategy of Russia 2020 (current, relevant) [11], as well as the new Arctic Strategy of Russia 2035 [12], Shipbuilding Strategy of Russia 2020 (current, relevant) [13], Transport Strategy of Russia 2030 [14].

[4] Shipping Industry Flag State Performance Table 2018/2019. URL: http://www.ics-shipping.org/docs/default-source/Flag-State-Performance-Table/flag-state-table-2019.pdf (accessed 25 September 2021).
[5] Prikaz Ministerstva transporta Rossiyskoy Federatsii ot 26.07.1994 № 63 «O merakh po povysheniyu bezopasnosti moreplavaniya» (s izmeneniyami na 26 noyabrya 2002 goda) [Order of the Ministry of Transport of the Russian Federation of July 26, 1994 No. 63 "On measures to improve the safety of navigation" (as amended on November 26, 2002)]. URL: http://docs.cntd.ru/document/9008566/ (accessed 25 September 2021).
[6] Maritime Doctrine of the Russian Federation for the period up to 2020. URL: http://docs.cntd.ru/document/902010411 (accessed 25 September 2021).
[7] Maritime Doctrine of the Russian Federation. URL: https://docs.cntd.ru/document/555631869?section=text (accessed 18 January 2022).
[8] Merchant Shipping Code of the Russian Federation (as amended on June 11, 2021). URL: https://docs.cntd.ru/document/901732423 (accessed 25 September 2021).
[9] Inland Water Transport Code of the Russian Federation (as amended on July 2, 2021). URL: http://docs.cntd.ru/document/901782478/ (accessed 25 September 2021).
[10] Decree of the Government of the Russian Federation No. 620 dated August 12, 2010 "On approval of the technical regulations on the safety of maritime transport facilities". URL: http://docs.cntd.ru/document/902230358 (accessed 25 September 2021).
[11] Strategy for the development of the Arctic zone of the Russian Federation and ensuring national security for the period up to 2020. URL: http://docs.cntd.ru/document/499002465 (accessed 25 September 2021).
[12] Strategy for the development of the Arctic zone of the Russian Federation and ensuring national security for the period up to 2035. URL: https://docs.cntd.ru/document/566091182 (accessed 18 January 2022).
[13] Strategy for the development of the shipbuilding industry for the period up to 2020 and beyond. URL: http://docs.cntd.ru/document/902071488 (accessed 25 September 2021).
[14] Decree of the Government of the Russian Federation dated November 22, 2008 No. 1734-r "On approval of the Transport Strategy of the Russian Federation for the period up to 2030". URL: http://docs.cntd.ru/document/902132678 (accessed 25 September 2021).

At the international level, the Agreement on Cooperation in Aviation and Maritime Search and Rescue in the Arctic [15], as well as the bilateral agreement between Russia and Norway on cooperation in search and rescue of persons in distress in the Barents Sea are worth mentioning [16].

Thus, at the legal level, Russia is trying to fully ensure the safety of sea traffic in the waters of the NSR, based on the international obligations taken while respecting the rights of the coastal state and sovereignty over the "national maritime transport route" in the Arctic.

The "permissive procedure for navigation" in the NSR seems to be an unavoidable necessity and cannot be considered as discriminating against foreign carriers. The positive economic impact of using the route should not outweigh the need to maintain high environmental standards in the Arctic.

Environmental standards and principles

Before considering economic and infrastructural barriers to development of the NSR, it is necessary to identify the environmental standards that are in force in Russia in relation to commercial shipping in the waters of the Northern Sea Route.

Shipping, like any human activity, has a negative impact on the environment. This is particularly pronounced in the Arctic, as the northern ecosystem is extremely vulnerable in the face of increasing anthropogenic pressure.

The development of shipping in the Arctic is associated with the following types of harmful impacts:

- chemical pollution (includes oil and petroleum product spills);
- physical impact (temperature, light, noise, vibration);
- microbiological (closely related to climate change and permafrost thawing, which make it possible for new to the Arctic microorganisms to survive);
- increase in all types of waste.

The increase in the volume of shipping traffic in the Northern Sea Route requires the development of port infrastructure. This implies that negative anthropogenic impacts occur both on the Arctic Ocean marine environment and on the Arctic terrestrial environment.

In order to protect the fragile ecosystem when navigating the NSR, environmental legal regulations have been developed, which include both international and national ones. Most of the international legal acts do not have a specific focus on the Arctic, but regulate the protection of the marine environment when using the World Ocean.

Such international acts contain, for example, prohibitions on the pollution of marine ecosystems with toxic pollutants (radioactive substances, oil, etc.). Thus, the Convention on the Pre-

[15] Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (2001). URL: https://www.ifrc.org/docs/idrl/N813EN.pdf (accessed 25 September 2021).
[16] Treaty between the Kingdom of Norway and the Russian Federation concerning Maritime Delimitation and Cooperation in the Barents Sea and the Arctic Ocean (1995). URL: https://www.regjeringen.no/globalassets/upload/ud/vedlegg/folkerett/avtale_engelsk.pdf (accessed 25 September 2021).

vention of Marine Pollution by Dumping of Wastes and Other Matter 1972 [17] establishes the illegality of any flooding of ships, aircraft, platforms or other artificial structures located at sea, deliberate dumping into the marine environment of highly hazardous waste containing, in particular, radioactive substances, organohalogen components, mercury, cadmium, oil and oil products, stable plastics and other synthetic materials.

The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) [18] was developed and adopted by the International Maritime Organization (IMO). This Convention is considered as the basic document aimed at prevention of pollution of the marine environment from ships in the course of operational activity and in case of emergencies [10, Djadjev I.]. Prohibiting norms apply to intentional and accidental discharges of oil and other harmful substances from ships, fixed and other floating platforms. The convention contains six technical annexes:

- Annex I Regulations for the Prevention of Pollution by Oil (entered into force 2 October 1983);
- Annex II Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (entered into force 2 October 1983);
- Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (entered into force 1 July 1992);
- Annex IV Prevention of Pollution by Sewage from Ships (entered into force 27 September 2003);
- Annex V Prevention of Pollution by Garbage from Ships (entered into force 31 December 1988);
- Annex VI Prevention of Air Pollution from Ships (entered into force 19 May 2005).

In 2014, the IMO Marine Environment Protection Committee approved draft amendments to MARPOL 73/78, namely Annexes I, II, IV, V in terms of their compliance with the new international document specifically dedicated to the regulation of navigation in Polar waters.

The new international legal document, which essentially clarifies the legal regime of navigation in Arctic and Antarctic waters, entered into force on 1 January 2017. This refers to the International Code for Ships Operating in Polar Waters (Polar Code) [19]. Its creation was carried out for more than 20 years and began back in 1993. “The Polar Code is an international legal response to the key environmental risks associated with navigation in polar waters: in terms of structural safety of ships allowed to navigate in such waters, in terms of ensuring a full range of measures to

[17] Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972. URL: https://docs.cntd.ru/document/1901638 (accessed 25 September 2021).
[18] The International Convention for the Prevention of pollution from Ships (MARPOL 73/78, 1972/1978). URL: https://treaties.un.org/doc/Publication/UNTS/Volume%201340/volume-1340-A-22484-English.pdf (accessed 25 September 2021).
[19] International Code for Ships Operating in Polar Waters (Polar Code, 2017). URL: http://www.imo.org/en/MediaCentre/HotTopics/polar/Pages/default.aspx (accessed 25 September 2021).

protect the marine environment in these environmentally sensitive areas" [11, Vylegzhanin A., Dudykina I., pp. 90–100].

The scope of the Polar Code is limited to polar waters, i.e. the Arctic waters and the Antarctic sea area.

Part II of the Polar Code contains provisions for the protection of the environment. "It is prescribed that any oil operations conducted by a ship's crew in polar waters must be properly recorded in the Oil Record Book, the Shipboard Oil Pollution Emergency Plan and the Shipboard Marine Pollution Emergency Plan. Such accounting is carried out in accordance with the rules established in Annex I to MARPOL 73/78. The Polar Code contains special conditions for the transport of liquid toxic substances harmful to the environment, measures to prevent pollution by sewage, and prescribes procedures for dumping waste from ships. The waters of the Northern Sea Route are classified as "ice-covered area" in accordance with Article 234 of the 1982 UN Convention on the Law of the Sea (UNCLOS 1982). For Article 234 of UNCLOS 1982 to be applicable, the water area must satisfy two conditions:

- presence of particularly severe climatic conditions;
- presence of ice covering during most of the year.

Such conditions "create obstacles or increased danger to navigation, and pollution of the marine environment could seriously harm the ecological balance or irreversibly disrupt it", as follows from the text of the Convention [12, Vylegzhanin A.N., Ivanov G.G., Dudykina I.P.].

The ongoing climate and ice cover changes in the NSR water area, on the one hand, create favorable conditions for the development of navigation, on the other hand, cause debate about the applicability of Article 234 of UNCLOS 1982. In particular, experts from the USA point out: "In a place like the Arctic where there's less and less ice, will Article 234 still be a valid justification for what Russia and Canada are trying to do, with respect to their portions of the Arctic? The answer is probably no" [13, Dremliuga R., pp. 128–135].

Of course, one cannot agree with this point of view. Anyone who has ever lived in the North or had experience of navigation in Arctic waters knows that in addition to ice, "obstacles or increased danger to navigation" are also created by especially severe climatic conditions. Navigation through the NSR will never be similar to navigation in the southern seas. Many experts, including Russian ones, have repeatedly drawn attention to this. The literature describes in detail those factors that determine the particular severity of the Arctic climate [20]. For example, short daylight hours in winter severely limit the ability to search and rescue, as well as eliminate the consequences of marine pollution. There is no doubt that the failure to take timely measures will necessarily cause "serious harm to the ecological balance or irreversibly disrupt it" [14, Grigoriev M.N.].

[20] The New Arctic: Navigating the Realities, Possibilities, and Challenges. Wilson Center. URL: https://www.wilsoncenter.org/event/the-new-arctic-navigating-the-realities-possibilities-and-challenges (accessed 25 September 2021).

Therefore, it is completely justified that the Russian Federation, as a coastal state, has assumed the obligation to organize navigation in the NSR to protect the marine environment. They are the environmental issues and tasks to ensure the safety of ships and people that determine the permissive procedure for navigation, mandatory icebreaking and ice pilotage [21].

The rules of navigation in the waters of the Northern Sea Route [22] are the main specialized Arctic document in the field of navigation. These Rules were developed in accordance with Article 5.1 of the Merchant Shipping Code of the Russian Federation [23]. They contain, among other things, "requirements for ships regarding safety of navigation and protection of the marine environment from pollution from ships". The following environmental requirements must be complied with by the vessel when navigating in the waters of the Northern Sea Route:

- the capacity of tanks for collecting oil residues (oily sediments) should be sufficient, taking into account the type of ship's propulsion system and the duration of the voyage in the NSR waters. Discharge of oil residues (oily sediments) in the waters of the Northern Sea Route is prohibited;
- containers with sufficient capacity for collecting waste (sludge) generated during the vessel's operation should be available onboard, taking into account the duration of the voyage in the waters of the Northern Sea Route. The document does not contain an explicit prohibition on waste discharge, but it follows from the meaning of the legislation [24].

The environmental requirements also include the obligation of the captain, when the vessel follows the route in the water area of the Northern Sea Route after crossing the Western or Eastern boundary and before leaving the water area of the NSR. In case of detection of environmental pollution, the NSR Administration must be immediately informed about this. The detection of pollution should be facilitated by the fulfillment of the requirement that the captain of the vessel or the senior assistant to the captain ought to be on the navigation bridge of the vessel in the NSR waters in ice conditions with an ice concentration of more than three points [15, Polar Law].

Thus, there are not many exclusively environmental provisions in the text of the document. It follows that anything not regulated by the norms of this act is regulated either by the national environmental legislation or by international agreements.

[21] Prikaz Ministerstva transporta Rossiyskoy Federatsii ot 17.01.2013 № 7 «Ob utverzhdenii Pravil plavaniya v akvatorii Severnogo morskogo puti» [Order of the Ministry of Transport of the Russian Federation dated January 17, 2013 No. 7 "On Approval of the Rules for Navigation in the Waters of the Northern Sea Route"]. URL: http://docs.cntd.ru/document/902396546 (accessed 25 September 2021).
[22] Ibid.
[23] Merchant Shipping Code of the Russian Federation (as amended on June 11, 2021). URL: https://docs.cntd.ru/document/901732423 (accessed 25 September 2021).
[24] Prikaz Ministerstva transporta Rossiyskoy Federatsii ot 17.01.2013 № 7 «Ob utverzhdenii Pravil plavaniya v akvatorii Severnogo morskogo puti» [Order of the Ministry of Transport of the Russian Federation dated January 17, 2013 No. 7 "On Approval of the Rules for Navigation in the Water Area of the Northern Sea Route"]. URL: http://docs.cntd.ru/document/902396546 (accessed 25 September 2021).

There are no other special acts regulating environmental protection in the course of navigation along the NSR routes in the Russian national legislation. Environmental protection (including marine) in the Arctic is regulated by general Russian environmental regulations.

The basic act is the Federal Law "On environmental protection" of 2002 [25]. This law contains general provisions on:

- environmental quality standards, standards for permissible environmental impact, standards for permissible emissions and discharges;
- ecological expertise;
- state environmental monitoring;
- state environmental supervision, etc.

These provisions are disclosed in more detail in other special federal laws and regulations. The Law on environmental protection also establishes 23 principles of environmental protection (Article 3).

Let us analyze some of them from the point of their applicability to navigation in the Arctic.

1) Payment for natural resources use and compensation for environmental damage [26]

Natural resources use in this context refers to any use of nature or its individual components, such as the use of the marine environment for the purposes of navigation. In this context, this principle means that navigation in the waters of the NSR, as well as the construction and operation of the necessary infrastructure, are carried out on a paid basis. Payment may be expressed in the form of fees for permits and licenses, lease payments for the use of land plots, etc. If environmental damage is caused during the use of natural resources, it must be fully compensated.

2) Presumption of environmental hazard of planned economic and other activities

This means that even at the planning stage of any project related to the development and/or use of the NSR, it must be assumed that its implementation will or may harm the environment.

3) Obligatory environmental impact assessment in decision-making on the implementation of economic and other activities

This principle is related to the previous one. It means that the degree of impact of the planned project on the Arctic environment must be assessed. This procedure is regulated by the Federal Law of November 23, 1995 No. 174-FZ "On environmental expertise" [27]. The nuances of

[25] Federal'nyy zakon ot 10.01.2002 № 7-FZ «Ob okhrane okruzhayushchey sredy» (s izmeneniyami na 2 iyulya 2021 goda) [Federal Law No. 7-FZ of January 10, 2002 "On Environmental Protection" (as amended on July 2, 2021)]. URL: http://docs.cntd.ru/document/901808297/ (accessed 25 September 2021).
[26] Comment on the Federal Law of January 10, 2002 No. 7-FZ "On Environmental Protection" (edited by O.L. Dubovik). Especially for the GARANT system, 2010
[27] Federal'nyy zakon ot 23.11.1995 № 174-FZ «Ob ekologicheskoy ekspertize» (s izmeneniyami na 2 iyulya 2021 goda) [Federal Law No. 174-FZ of November 23, 1995 "On Environmental Expertise" (as amended on July 2, 2021)]. URL: http://docs.cntd.ru/document/9014668/ (accessed 25 September 2021).

these procedures have already been repeatedly covered in the literature [28, 29, 30] [16, Environmental Assessment…, pp. 114–125].

4) Consideration of natural and socio-economic peculiarities of territories when planning and carrying out economic and other activities

This principle seems to be the "most Arctic" among those mentioned above. It means the need to take into account the natural, climatic and socio-economic features of the region when planning and implementing Arctic projects, shipping in "ice-covered areas". This applies to the planning stage, the project implementation stage and the stage of compensation for environmental damage, if any.

5) Ensuring the reduction of the negative impact of economic and other activities on the environment

This principle means that, while mastering and developing the NSR, it is necessary to minimize environmental risks as much as possible. For that purpose it is necessary to use the best available technologies and to constantly implement new and well-proven technologies in the field of environmental protection.

6) Prohibition of economic and other activities leading to degradation of the ecosystem

This principle seems to be very intriguing. On the one hand, it is enshrined in Russian legislation. On the other hand, both Russia and other states have actively taken up the development of the Arctic territories and the waters of the Arctic Ocean. In the Arctic, as is well known, the consequences of some human activities are difficult to predict. This is due to the poor knowledge of the region, the particular vulnerability of the Arctic ecosystems, as well as the ongoing climate change, which, with enviable constancy, presents us with new surprises. So far, this has not stopped anyone. However, perhaps in the future, it will be possible to see examples of the implementation of a ban on any type of activity in the Arctic based on this principle. Even today, some financial institutions refuse to support projects related to CO2 emissions.

7) Responsibility for violation of environmental legislation

This principle means that legal liability for violations of environmental regulations is unavoidable. We have already outlined that the environmental requirements to be complied with when navigating in the NSR waters are contained in both international legal acts and Russian national legislation.

However, problems may arise in determining the so-called "applicable law", when the issue of bringing to one or another type of legal liability is being decided. This is partially regulated in the Merchant Shipping Code of the Russian Federation (MSC) [31].

[28] Information on the Russian Environmental Impact Assessment. Arctic Center. URL: https://www.arcticcentre.org/RussianEIA (accessed 25 September 2021).
[29] Environmental Assessment in Countries in Transition. Ed. by Bellinger E., Lee N., George C., Paduret A. Central European University Press, 2000, pp. 114–125.
[30] Environmental Policy and Regulation in Russia: The Implementation Challenge (OECD, 2006). URL: https://www.oecd.org/env/outreach/38118149.pdf (accessed 25 September 2021).

As a general rule, the law applicable to relations arising from merchant shipping with the participation of foreign citizens or foreign legal entities, or complicated by a foreign element, is determined in accordance with the international treaties of the Russian Federation, this Code, other laws and merchant shipping customs recognized in Russia. The parties to the contract may choose the law to be applied to their rights and obligations under the contract. If the parties fail to agree on the law to be applied, the rules of this Code should be applied. In case of environmental damage in the territorial sea of the Russian Federation or its exclusive economic zone, the MSC is applied. The Code specifically regulates relations arising from damage caused by:

- oil pollution from ships;
- maritime transport of hazardous and harmful substances;
- pollution by bunker fuel [17, Law of the Sea].

8) International cooperation of the Russian Federation in the field of environmental protection

Environmental problems are not local, especially in the Arctic. Any pollution can acquire a transboundary character. In the era of globalization, it is difficult to imagine that any state alone will be able to deal with negative environmental changes, especially those caused by global factors. In this regard, Russia relies on international cooperation in the field of environmental protection in the Arctic. This is evidenced by numerous international projects that are currently being implemented in the Russian Arctic and funded by the state [18, Sorokina T.Y., pp. 341–355].

Not all international and national standards and principles of organizing navigation in the waters of the NSR have been listed in this part, but the most important ones.

As Vylegzhanin A. and Dudykina I. note, the Polar Code offers international legal ways to respond to the main risks associated with navigation in polar waters, in terms of the structural safety of a vessel allowed to sail in such waters, and to ensure the full range of measures to protect the marine environment in these ecologically sensitive areas. Thus, both the Polar Code and Article 234 UNCLOS 1982 are now applicable. On their basis, as well as on historical legal grounds, Russia retains the right to regulate navigation along the Northern Sea Route [11, ibid.].

Consequently, in the waters of the Northern Sea Route within the territorial waters of Russia and its exclusive economic zone, Russian national standards and principles in the field of marine environment protection are valid and applied. They must be taken into account.

Russian legislation, which enshrined these standards and principles, is characterized by the following features:

- compliance of the initial principles of the Russian legislation with the universally recognized norms of international law;
- environmental protection as a priority in the regulation of navigation organization in the water area of the NSR by the coastal state (Russia);

[31] Merchant Shipping Code of the Russian Federation (as amended on June 11, 2021). URL: https://docs.cntd.ru/document/901732423 (accessed 25 September 2021).

- compliance of the principles of regulation of environmental protection and nature management activities in the Russian Federation with the basic principles of international environmental law.

Economics, management and cooperation in the NSR

NSR cargo traffic: current state

The evolution of cargo traffic along the NSR can be traced in the following years: the increase in cargo turnover along the NSR began only in the late 2000s, and in 2016 its volumes exceeded the record figures of 1987, amounting to 7.5 million tons. In 2017, the indicators continued to grow, reaching 10.7 million tons (including 0.8 million tons by river vessels). At the same time, it should be noted that the increase in volumes is directly and almost completely associated with the expansion of Russia's activity in the Arctic, and, to a lesser extent, with the transit of goods in the Arctic. Thus, only 194 thousand tons (less than 2%) were in transit out of 10.7 million tons transported in 2017 [32].

In 2018, 18 million tons of cargo passed along the Arctic coast of Russia, which is 4 times more than in 2013 and 80% more than in 2017. Just five years ago, there was almost no traffic on the route for several months (December to May).

Currently, on average, up to 20 ships are active every day during the entire winter season. Despite an increase in cargo volume compared to 2017, the number of vessels operating on the route year-round has decreased by about 20%, especially during the summer months. This indicates that larger ships, used primarily to transport hydrocarbon resources, are now visiting this route more frequently than smaller cargo ships used to supply building materials in previous years. In 2018, all Russian Arctic seaports handled 92.7 million tons of cargo, 70% of which was liquefied natural gas and oil. Murmansk remains the largest port in the region, with a cargo turnover of more than 60.7 million tons. One of the promising ports along the NSR is Sabetta, where the Yamal LNG plant for the production of liquefied natural gas (LNG) is located, the volume of exported cargo (liquefied natural gas and gas condensate) through this port is growing annually and reached 19.7 million tons in 2020 [33].

By 2018, the route was already used by 164 companies, including 45 foreign ones. Transit traffic was also at its highest level since 2013 — 491 thousand tons and 26 trips between Europe and Asia. This compares with 194 thousand tons on 27 transit shipments in the previous year [34].

[32] Severnyy morskoy put' protiv Suetskogo kanala. Plyusy i minusy nazrevayushchey konkurentsii mezhdu Moskvoy i Kairom [Northern Sea Route against the Suez Canal. Pros and cons of the brewing competition between Moscow and Cairo]. URL: http://www.ng.ru/energy/2018-06-19/11_7247_nord.html (accessed 25 September 2021).

[33] Ob"em vyvezennykh cherez port Sabetta v 2020 godu gruzov sostavil 19,7 mln tonn [The volume of cargo exported through the port of Sabetta in 2020 amounted to 19.7 million tons]. URL: https://www.korabel.ru/news/comments/obem_vyvezennyh_cherez_port_sabetta_v_2020_godu_gruzov_sostavil_19_7_mln_tonn.html (accessed 29 December 2021).

[34] Russia's Northern Sea Route sees record cargo volume in 2018, by Malte Humpert, High North News, February 20, 2019, Arctic today. URL: https://www.arctictoday.com/russias-northern-sea-route-sees-record-cargo-volume-in-2018/ (accessed 25 September 2021).

If we take the most recent statistics, according to the Department of Communications of the State Corporation Rosatom, with reference to the FSBI "Administration of the NSR" of the Ministry of Transport of the Russian Federation, as of September 30, 2021, the volume of transit traffic on the Northern Sea Route amounted to more than 1.440 million tons. This is almost 160 thousand tons more than in 2020, when 1.280 million tons were transported.

The bulk of the cargo was iron concentrate and coal transported through the NSR in the eastern direction. The largest number of voyages of cargo vessels was made under the flags of China (12), Portugal (10), Liberia (9), Marshall Islands (8). Containerized cargo was carried on three trips and amounted to just over 22 thousand tons.

In accordance with the passport of the federal project "Development of the Northern Sea Route", the target figure for 2021 is 31 million tons. According to the instructions of the President of the Russian Federation, the volume of traffic along the Northern Sea Route must be increased to 80 million tons per year by 2024 [35].

Not only the private sector is engaged in and interested in cargo transportation along the NSR. For example, the share of the Russian Ministry of Defense accounts for more than 1/3 of government orders in the Arctic. According to the relevant order of the Government of Russia, Oboronlogistika was determined as the sole contractor for the delivery of military cargo to the Arctic zone. Since 2018, the company has been participating in the Northern Delivery. In 2018, Oboronlogistika delivered more than 11 thousand tons of cargo to Arctic locations. In the navigation of 2019, ships operated by Oboronlogistika performed 13 voyages to Arctic locations and transported more than 40 thousand tons of various military cargo, weapons and military equipment, as well as cargo of the Russian Defense Ministry's military construction complex, including: airfield slabs, building materials for modular housing, school equipment. In the opposite direction, as part of the program to clean up the Arctic, 3.5 thousand tons of scrap metal and obsolete equipment were transported to the mainland [36].

However, despite the growth in cargo traffic along the NSR, all of Russia's Arctic seaports do not operate at full capacity, and many pan-Asian shipments are being routed through the Suez Canal.

The factors that constrain the development of the NSR as a "Pan-Asian transport hub" will be discussed below.

[35] Ob"em tranzitnykh gruzoperevozok po Sevmorputi po sostoyaniyu na 30 sentyabrya 2021 goda prevysil pokazatel' za ves' 2020 god [The volume of transit cargo transportation along the Northern Sea Route as of September 30, 2021 exceeded the figure for the entire 2020]. URL: https://www.rosatom.ru/journalist/news/obem-tranzitnykh-gruzoperevozok-po-sevmorputi-po-sostoyaniyu-na-30-sentyabrya-2021-goda-prevysil-pok/ (accessed 21 January 2022).

[36] Razvitie effektivnoy transportno-logisticheskoy sistemy v Arktike [Development of an efficient transport and logistics system in the Arctic]. URL: http://oboronlogistika.ru/pressa/smi/513/ (accessed 25 September 2021).

Constraint factors

Logistics companies operating beyond the Arctic Circle face certain barriers and risks that do not allow organizing the service for international merchant shipping:

- Customs escort of cargoes. Customs escort of cargo is a highly bureaucratic process in many Arctic ports. The customs clearance process itself can take longer than the unloading and loading operations. Vessels can simply stand idle waiting for long bureaucratic decisions. Besides, complicated processes of obtaining permission for passage through the route and icebreaking assistance should be mentioned here;
- The problem of so-called "returning" cargo. The economic feasibility of carrying out cargo transportation along the NSR in one direction does not cover the cost of returning the vessel to the original point of departure. This is due to the lack of integrated infrastructure development of the Arctic regions. First of all, this is the development of transport infrastructure. This problem could be solved by launching the Belkomur project, which would create an export base for the Pan-Asian market and partially solve the problem of "returning" cargo;
- Unresolved issue of insurance in the NSR waters. The issue of insurance in the NSR waters remains unresolved at the moment, which affects the activities of logistics companies. Standard maritime insurance contracts exclude or partially limit insurance coverage by introducing geographic restrictions on navigation routes in the Arctic. The solution of this problem would accelerate the growth of cargo traffic along the NSR;
- Seasonality of transportation. Ice conditions create risks of inability to meet the transit window [37]. Although the average annual (monthly) temperature in the Arctic is rising every year (according to the National Snow and Ice Data Center, the average monthly temperature in December from 1980 to 2020 drops by 3.6% every decade), ice conditions are the obstacles that are difficult to predict. More precisely, it is difficult to predict ice movement and thickness. It is worth noting that the constant melting of ice opens up various little-studied coastal routes, which require special attention;
- High and low tides. Many Arctic coastal regions are known for their high tides. They can reach several meters, which can lead to the vessel waiting for the required water level, leading to its downtime and increase in the expenditure component;
- Currency fluctuations and icebreaking base.

Forecasts

The Russian Federal Atomic Energy Agency (Rosatom) plans to increase the volume of cargo transported along the Northern Sea Route to 92.6 million tons by 2024. Liquefied natural gas and gas condensate are expected to become the main types of cargo shipped in 2024 with 41 mil-

[37] National Snow and Ice Data Center. Arctic Sea Ice News & Analysis. Average Monthly Arctic Sea Ice Extent (December 1979–2019). URL: http://nsidc.org/arcticseaicenews/files/2020/01/Figure3.png (accessed 25 September 2021).

lion tons. In addition, shipment volumes of 23 million tons of coal and more than 17 million tons of oil are planned [38].

Infrastructure

The realization of the infrastructure potential of the Arctic territories of Russia is possible through the construction of industrial infrastructure, roads, airports, power plants and other facilities, which becomes in many ways a decisive factor in overcoming the heterogeneity of the development of the northern territories of the Arctic states, the sustainable development of the Arctic [39].

In the context of accelerating scientific and technological progress, the differentiation and complication of production structure makes the problems of infrastructure development as the main driving force for ensuring exchange and implementation of spatial socio-economic ties relevant. Accordingly, as Chikinova M.S. notes, constant and continuous monitoring of new factors in the development of the infrastructure of the territory is currently an urgent issue of great scientific and practical importance [1, ibid.]. One of these factors at the present stage of development of the world economy is international cooperation in the implementation of major infrastructure projects. An example of such interaction is the transport and logistics development of the Northern Sea Route.

The scientific problem is the mismatch between the potential capabilities of the Arctic and its current level of infrastructure provision. At the same time, objective prerequisites for the creation of centers that are able to perform certain functions, for example, in the distribution and redistribution of transport, information and financial flows, have now been formed on the territory of the Arctic zone of Russia [1, ibid.].

The famous scientist Shlichter S.B. notes that transport is widely used as a means of regional policy and indicates that at present, advanced infrastructure development is the most important trend in the development of the world economy [19, pp. 115–122].

According to Pchelintsev O.S., infrastructure is of paramount importance for the territorial development of the state: in an ideal model of a market economic system, the state manages socio-economic development, primarily through the construction of housing stock, roads, ports, gas pipelines and other infrastructure [20, Pchelintsev O.S.].

It should be noted that the study of infrastructure development is carried out by representatives of various sciences. Thus, the researches of geographical scientists are distinguished by a spatial approach to the objects under study, in which the territory is often considered as a resource base, a kind of “carrier” of infrastructure. For example, Maergoyz I.M. defines infrastructure as “the general fund base of the territory, that is, a system of spatially expressed elements of

[38] Business data platform Statista Forecasted cargo volume via the Northern Sea Route in Russia by 2024, by type (in million metric tons). URL: https://www.statista.com/statistics/1063330/northern-sea-route-cargo-volume-by-type/ (accessed 25 September 2021).
[39] Speech at an expanded meeting of the State Council "On the development strategy of Russia up to 2020". URL: http://www.kremlin.ru/events/president/transcripts/24825 (accessed 25 September 2021).

material and technical nature, which together form the most general prerequisites for managing in any region" [21, pp. 9–17].

NSR infrastructure management

In accordance with the Federal Law of the Russian Federation No. 525-FZ of December 27, 2018, which amended the Federal Law "On inland sea waters, territorial sea and contiguous zone of the Russian Federation" and the Merchant Shipping Code of the Russian Federation, the NSR is managed on the basis of the "two keys" principle, held by the Russian Ministry of Transport and Rosatom State Corporation.

In terms of managing the transport corridor, the Ministry of Transport regulates the navigation of the NSR, implements Russia's international obligations, carries out the federal state supervision in the field of transport and state port control over the ships and the safety of navigation. The relevant ministry also manages seaport captains and approves the list of port charges.

According to the regulation, Rosatom is recognized as a single infrastructure operator of the NSR, the purpose of which is to ensure the needs of users in safe, uninterrupted, cost-effective and year-round navigation. In order to achieve this goal, the corporation manages the state Arctic icebreaker fleet, prepares proposals for the formation of state policy on the NSR, the creation of NSR seaports and infrastructure facilities, and manages state property. The most important function of Rosatom is to ensure safety in terms of organizing maritime traffic.

For the purpose of effective performance of these functions, two federal state unitary enterprises, Atomflot and Hydrographic Enterprise, were established under the Directorate of the Northern Sea Route.

Atomflot deals with the organization of shipping, including information support for Arctic shipping and icebreaker assistance, as well as the construction of the Arctic fleet (nuclear icebreakers, LNG icebreakers, auxiliary fleet). The company also provides support services (port and pilotage services, rescue preparedness).

The tasks of the Hydrographic Enterprise are navigation and hydrographic support, involving route recommendations and positioning system for ships, as well as construction and management of the NSR infrastructure (sea channels, hydraulic structures and ship traffic control systems).

"Rules of navigation in the waters of the Northern Sea Route" and "Transport artery infrastructure development plan" are approved by the Russian government on the basis of proposals from the Ministry of Transport and Rosatom [40].

At the end of December 2019, a plan for the infrastructure development of the Northern Sea Route for the period up to 2035 was approved by the Russian Government [41].

[40] Federal'nyy zakon ot 27.12.2018 № 525-FZ «O vnesenii izmeneniy v otdel'nye zakonodatel'nye akty Rossiyskoy Federatsii» [Federal Law No. 525-FZ dated December 27, 2018 "On amendments to certain legislative acts of the Russian Federation"]. URL: http://docs.cntd.ru/document/552045960 (accessed 25 September 2021).
[41] Rasporyazhenie Pravitel'stva Rossiyskoy Federatsii ot 21.12.2019 № 3120-r «Ob utverzhdenii plana razvitiya infrastruktury Severnogo morskogo puti na period do 2035 goda» [Decree of the Government of the Russian Federation of

The plan was formed on the basis of forecasts of all existing and prospective groups of cargo flows, including export-import and transit cargo flows passing through the seaports of Murmansk and Arkhangelsk in the direction of the Asia-Pacific region [42].

In May 2020, the Ministry for the development of the Russian Far East, together with Rosatom, the Ministry of energy and regional governments, presented a list of projects planned for implementation as part of the development of the Northern Sea Route.

Analysis of the current state of the NSR infrastructure: maritime transport and ports

In the autumn of 2018, the Russian Government approved the "Comprehensive plan for the modernization and expansion of the main infrastructure for the period up to 2024", the source of financing for the plan is mixed, the budget is 6.348.061.474.000 rubles. The objectives of the comprehensive plan are:

- development of transport corridors "West-East" and "North-South" for the transportation of goods;
- increasing the level of economic connectivity in the Russian Federation through the expansion and modernization of railway, aviation, road, sea and river infrastructure.

Of all the tasks of the Comprehensive plan, solving the logistical problems of the Arctic, it is possible to include:

- increasing the capacity of seaports of the Russian Federation (up to 1.3 billion tons); development of the Northern Sea Route; increasing cargo traffic along the Northern Sea Route up to 80 million tons;
- formation of multi-modal transport and logistics hubs.

The planned development of the Northern Sea Route is aimed at building port infrastructure, equipping it with a modern icebreaker fleet, developing and improving all transport routes associated with it, including pipelines, river and automobile routes, and railway lines.

The existing traffic flows of the Arctic shipping in the NSR solve various problems. According to their purpose, they can be divided in the following way:

- international transit;
- cabotage;
- delivery to ports and points of the NSR water area;
- export of products from the NSR water area;
- interport transportation in the NSR water area.

For the purposes of this research, it is especially important to study in detail the international transit that ensures cargo traffic between the markets of the North Atlantic Ocean (mainly European)

December 21, 2019 No. 3120-r "On approval of the Northern Sea Route infrastructure development plan for the period up to 2035"]. URL: http://docs.cntd.ru/document/564069513 (accessed 25 September 2021).

[42] Utverzhden plan razvitiya infrastruktury Severnogo morskogo puti do 2035 goda [Plan for the development of the infrastructure of the Northern Sea Route up to 2035 was approved]. URL: https://portnews.ru/news/289357/ (accessed 25 September 2021).

and the Asia-Pacific region (mainly Asian countries).

In order to analyze the current state of the NSR infrastructure development in the context of pan-Asian trade, it is necessary to consider the availability of transport that provides maritime cargo traffic, as well as the qualitative and quantitative composition of ports, transport and logistics complexes in the NSR water area.

As Balmasov S.A. notes, the main element of the NSR infrastructure is the nuclear icebreaker fleet, without which the safe and efficient organization of transit voyages is impossible even in light ice conditions.

The geographical location of the NSR routes necessitates comprehensive support for vessels when operating in remote areas. In fact, the icebreaking fleet provides not only the physical assistance of the ship in the ice, but, no less important, the safety of the passage in general. Insurance companies usually do not approve independent transit voyages on the NSR.

Availability and accessibility of icebreaking services will continue to be one of the key elements in the organization of transit navigation on the NSR. In this regard, the timely construction and commissioning of new nuclear icebreakers is a prerequisite for the growth of traffic in the foreseeable future [22, Balmasov S.A., pp. 60–64].

Currently, the icebreaking fleet of Russia consists of 38 ships, 5 of which are nuclear-powered (Table 1), and it is the largest in the world.

Table 1

Information on operating nuclear-powered vessels [43]

No.		Reactor facility project	Main facility capacity	Start date	End date
1	Nuclear icebreaker "50 Years of Victory"	2 reactors of OK-900A type	55 MW (75 000 hp)	23.03.2007	2039
2	"Yamal"	2 reactors of OK-900A type	55 MW (75 000 hp)	28.10.1992	2028
3	"Taimyr"	reactor of KLT 40 type	37 MW (50 000 hp)	30.06.1989	2025*
4	"Vaigach"	reactor of KLT 40 type	37 MW (50 000 hp)	25.07.1990	2027*
5	"Sevmorput"	reactor of KLT 40 type	29 MW (40 000 hp)	30.12.1988	2023
* Work to further extend the resource is underway					

In the next few years, Rosatomflot will include three universal nuclear icebreakers (UNI), designed to guide large vessels independently and to lead caravans year-round in the Western Arctic region. These icebreakers will be able to conduct convoys of ships in arctic conditions, breaking through ice up to 3 meters thick. The deadline for the delivery of the lead UNI “Arktika” has already been completed in 2019, for the first serial UNI “Siberia” — November 2020, for the second serial UNI “Ural” —

[43] Source: Compiled by the team of authors based on open data from the Internet, ROSATOM official website. URL: https://rosatom.ru/ (accessed 25 September 2021).

November 2021. Six diesel-electric icebreakers were also put into operation [44].

International transit requires a developed system of ports and other transport and logistics facilities. At present, there are over 70 transhipment bases and ports located along the NSR. The main points of the Northern Sea Route are the ports located in Sabetta, Igarka, Dudinka, Tiksi and Pevek.

The authors believes that it is necessary to amend the Merchant Shipping Code of the Russian Federation (Article 5.1) and to expand the established boundaries of the NSR water area by adding the seaports of Arkhangelsk and Murmansk to it as the most important transport and logistics centers of the Arctic Basin.

The largest share in the total cargo turnover of the Arctic basin ports is held by Murmansk (60–65%) and Sabetta (about 25%), while the remaining ports provide only 10–15%. Transshipment volumes by ports in the Arctic basin are growing every year. Thus, in 2016, the total volume of cargo turnover of all Arctic ports was 49.7 million tons, and by 2018 it had already reached 92.7 million tons, including 60.7 million tons in the port of Murmansk and 17.4 million tons in Sabetta (the port increased its cargo turnover by 234.7% compared to the previous year) [23, Serova N.A., Serova V.A., pp. 42–56].

According to the NSR infrastructure development plan for the period up to 2035, the reconstruction of facilities in the seaport of Pevek in the Chukotka Autonomous Okrug was completed in 2020, and by the beginning of 2022, the reconstruction of the Sabetta sea channel is to be completed. Comprehensive development of the Murmansk transport hub is also envisaged.

In October 2021, Yu.P. Trutnev, Deputy Prime Minister and Presidential Plenipotentiary Envoy to the Russian Far Eastern Federal District, made a report on the implementation of the AZRF strategy at the Council of Federations of the Federal Assembly of the Russian Federation. The report focused a great deal of attention on the development of infrastructure in the Arctic. For the purposes of this study, information concerning the problems and prospects for the development of the NSR infrastructure, as well as the measures taken and being implemented at the moment, are of the greatest interest.

Among the main challenges limiting infrastructure development in the Arctic are the severity of the climate, the spatial remoteness from major land transport routes, and the long-term underfunding of infrastructure projects.

These and other factors have affected the current state of the NSR infrastructure, the development of which is impossible without the construction of an additional ice fleet (including cargo ships of a high Arctic class), the improvement of port infrastructure and connecting transport arteries, and the creation of hydrographic infrastructure. Besides, to improve the safety of cargo transit along the NSR, it is necessary to develop a rescue system and to create an Arctic satellite constellation. Particular attention should be paid to improving the quality of life of people in settlements along the NSR and participating in the efficient functioning of the transport corridor (social infrastructure).

Currently, an institutional environment is being formed that contributes to the development of the NSR infrastructure. A legislative framework has been created to increase the investment attrac-

[44] Nuclear icebreaker fleet. URL: https://www.rosatom.ru/production/fleet/ (accessed 25 September 2021).

tiveness of the studied areas. Differentiated system of preferences has been introduced to ensure accelerated economic development of the macroregion. For example, mechanisms are used to subsidize the construction of infrastructure in the amount of 30% of the total declared level of investment. There are tax preferences for shippers to stimulate export traffic (0% VAT, etc. State support is provided in the creation of related infrastructure for the implementation of investment projects (floating nuclear power plants, power lines, access roads).

The icebreaking fleet has impressive development prospects. In addition to the construction of new nuclear icebreakers, projects for LNG-powered icebreakers are being developed. The cargo fleet will be more than tripleb by 2030. To achieve this, subsidies have been allocated for construction of 18 ships at the Zvezda shipbuilding complex with a total volume of 59 billion rubles. Active implementation of digital and space technologies is planned to improve the quality of navigation [45].

Discussion and conclusions

Currently, it becomes evident that it is impossible to bring the transport and logistics infrastructure of the Northern Sea Route to a high level, which would allow it to compete with alternative transport routes, primarily the route through the Suez Canal, only by the existing economic entities in the Arctic (mainly oil and gas companies).

At the same time, all countries interested in the NSR understand the economic efficiency of using the Arctic transport maritime corridor in international trade.

The main focus of corporations involved in the resource development of the Arctic is aimed at building infrastructure to meet their own needs and to sell the minerals extracted. Therefore, it is necessary to look for new mechanisms and approaches to the development of the NSR infrastructure in the context of international transit. Such an approach will require a change in the development strategy of the Arctic in the countries concerned.

Based on the analysis of existing political, legal and infrastructural barriers, the following general recommendatory positions have been formulated that will contribute to infrastructure development and increase in international transit along the NSR:

1. International cooperation and pooling of resources from different countries for the development of the NSR transit infrastructure.
2. Project-based approach to the development of the NSR infrastructure on the principles of public-private partnerships and the economic feasibility of investments.
3. Development of a crewless navigation system (development and implementation of digital systems in transport and logistics facilities) to offset the impact of negative factors on human health in the Arctic.
4. Introduction of the latest scientific and technological achievements in the development of the NSR infrastructure.

[45] 509 Meeting of the Federation Council. URL: http://council.gov.ru/events/multimedia/video/167784/ (accessed 25 September 2021).

5. Improvement of navigation and hydrographic support in the NSR water area.
6. Creation of a network of rescue coordination centers (land and sea) along the NSR route for the safety of transport and logistics operations.
7. Increasing the icebreaking base and improving the port infrastructure of the NSR.
8. Application of the caravan-based cargo transportation system to optimize the costs of different countries.
9. Creation of a single international transport and logistics operator of the NSR.
10. Admission of international Arctic carriers to work on the NSR (change in the regulatory framework).
11. Creation of a transparent and profitable tariff system for cargo transportation along the NSR.
12. Correction of the strategic and tactical plans of the Arctic countries for the development of the NSR. Focus on mutually beneficial cooperation and development of the global economy, taking into account national interests.
13. Implementation of a set of measures to reduce bureaucratic barriers in the customs escort of goods.
14. Creation and ongoing support of a unified system of interaction between all stakeholders (logistics companies, shippers, consignees, port authorities). This system should solve the problem of "return" cargo.
15. Starting point in solving the problems of the unsettled issue of insurance is the consolidation of the countries of the Arctic Eight in the creation of a universal convention that would contain the rules of insurance in the NSR waters, namely:
    - cargo insurance;
    - hull and machinery insurance;
    - liability insurance for losses caused to third parties.

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Regional State Programs as an Energy Supply Development Tool in the Russian Arctic *

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Abstract. Organizing reliable and affordable energy supply for consumers in the Arctic area is an important and difficult task. An effective solution of this task requires taking into account many factors. This paper analyzes how various factors are taken into account in the state programs of the Arctic regions of the Russian Federation, aimed at regional energy development. Natural resource, economic, social, technological, environmental, legal factors of energy supply are considered. The study is conducted on the example of four subjects of the Russian Federation, fully assigned to the Arctic zone (Murmansk Oblast, Nenets Autonomous Okrug, Yamalo-Nenets Autonomous Okrug, Chukotka Autonomous Okrug). The main research method is content analysis of the relevant information sources. The role of regional state programs in regulation of regional energy development is specified. A review of the main state programs of the considered Arctic subjects of the Russian Federation is carried out. It was revealed that the tasks of energy supply development are unevenly distributed in the state programs of the constituent entities of the Federation, and program measures are differently detailed. The content of the analyzed state programs is compared with the factors of energy supply. It is shown that regional state programs are primarily compared with economic factors. As instruments of regional policy, the state programs of the regions act as legal factors. Factors of other groups are taken into account in state programs to a lesser extent.
Keywords: *energy supply, region, Arctic zone, factor, state program*

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Introduction

This article was prepared as part of a research work on the topic “Interaction of global, national and regional factors in the economic development of the North and the Arctic zone of the Russian Federation”. At the previous stages of the study, the factors influencing the development of energy supply were identified and systematized, the basics of energy supply regulation in the constituent entities of the Russian Federation (regions) were studied, the tasks and powers of re-

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gional state authorities in the field of energy supply regulation were analyzed using the example of several Arctic regions.

The study examines the natural resource, economic, social, technological, environmental, legal factors of energy supply to consumers in the Arctic zone of the Russian Federation (AZRF). These factors were described at the first stage of the study and clarified in [1, Gasnikova A.A., pp. 132–133]. It is important to note that the factors under consideration are interrelated, often influence each other and should be considered comprehensively. A brief description of the energy supply factors of the Arctic regions is given below.

Natural resource factors of energy supply imply the availability of energy resources in the region, as well as climatic features that may affect the organisation of energy supply. Energy resources include fossil fuel reserves, hydropower from water reservoirs, as well as non-traditional renewable energy resources (NRES), primarily wind energy. Climatic features of the Arctic are manifested by low temperatures, high humidity, permafrost, strong winds [2, Popel O.S., pp. 48–49]. Severe climate, firstly, causes increased demand for electricity and heat energy, and secondly, it leads to higher production costs. In [3, Bogoyavlenskiy V.I., pp. 63–64] it is noted that the main hydrocarbon deposits and resources in Russia are located precisely in the Arctic, but permafrost complicates the construction and operation of fuel and energy complex (FEC) facilities, including coal mines, wells, oil and gas pipelines. It should be noted that for the energy supply of small dispersed consumers in the Arctic, the creation of power plants based on local renewable energy sources, as well as hybrid power plants using both traditional fuel and non-traditional renewable energy resources is promising.

Economic factors are related to objectively high production costs, the need for “northern delivery” of fuel, geographical remoteness and dispersion of energy consumers. The dispersal of consumers and their remoteness from the main roads complicate the creation and operation of the energy infrastructure. Energy capacities in remote settlements are often not connected to the regional energy systems (and even less — to the Unified Energy System of Russia). In fact, remote consumers are often dependent on local generation facilities and have no possibility to receive electricity from other areas by means of transmission lines. At the same time, the main source of energy for such consumers is expensive imported diesel fuel. As a result, tariffs for electricity and heat in the Arctic are high. The use of local NRES can help to reduce energy prices and increase energy security of remote consumers. In [4, Witt M. de, Stefánsson H., Valfells A., Larsen J.N., p. 154], it is noted that the share of renewable energy among all energy sources in the Arctic is somewhat higher compared to other territories, but in order to increase their use significantly, more cost-competitive technologies are needed.

Social factors are related to the importance of energy supply for ensuring normal life conditions in the harsh cold climate, as well as protecting the rights of indigenous peoples of the North, Siberia and the Far East when implementing industrial energy projects in their areas of residence. In recent years, more and more attention has been paid to the social aspects of economic devel-

opment, and the development of the fuel and energy complex has not become an exception. In [5, Sidortsov R.], a review of articles by professional researchers in the field of social sciences, devoted to energy development in the Arctic, is made. The author of this paper notes that, despite the diversity of views, modern researchers agree that the Arctic is more than just a storehouse of energy resources. Some of them emphasize the importance of the social responsibility of fuel and energy companies and point out that even after the implementation of hydrocarbon projects, the Arctic will remain home to many people. Others call attention to the energy efficiency and energy saving solutions that have been developed over the years of Arctic exploration. The researchers also criticise the perception of the Arctic as a zone of confrontation and argue that local, regional, national and international cooperation is possible and necessary in this macro-region.

Technological factors of energy supply imply increased requirements for energy generation and transmission technologies used in the Arctic climate. Low temperatures, high temperature fluctuations throughout the year, strong winds, high humidity can have an adverse effect on equipment performance and must be taken into account when designing power supply options. Another technological factor is the low efficiency of small power plants, which are characterised by high specific fuel consumption for energy production. In the future, with the expansion of NRES use, new, more efficient technologies and energy equipment should come to the Arctic regions: wind power plants, solar power plants, tidal power plants, generators based on biomass or biogas may also appear in some areas. [6, Lombardi P., Sokolnikova T., Suslov K., Voropai N., Styczynski Z.A., pp. 532–533]. It should be mentioned that non-traditional renewable energy resources can be used not only for electricity, but also for heat supply [7, Bezhan A.V.].

Environmental factors determine the requirements for energy technologies and equipment, which should not cause irreparable harm to the Arctic nature, which is sensitive to anthropogenic impact. In this regard, it is important to note that the enterprises of the fuel and energy complex are sources of pollutant emissions into the air and water bodies, and contribute to thermal pollution. The environment may be harmed by economic activities related to geological exploration and extraction of fuel energy resources, drilling works, construction of oil, gas and product pipelines, hydrocarbon storages and other facilities, etc.

Legal factors imply the legal framework within which activities related to energy supply are carried out. At the level of the RF subject, it is necessary to take into account the legal documents adopted at the federal level, and the legislation of the RF subject itself, developed, adopted and implemented within the framework of its authorities.

The study of energy supply factors is carried out on the example of four subjects of the Russian Federation: the Murmansk Oblast, the Nenets Autonomous Okrug, the Yamalo-Nenets Autonomous Okrug, the Chukotka Autonomous Okrug (AO). The choice of these regions is explained by the following:

- the territories of these regions are fully attributed to the Arctic zone by the Decree of the President of the Russian Federation of May 2, 2014 No. 296. Since the state admin-

istration is implemented within the administrative-territorial boundaries, this makes it possible to analyze regional state programs as a tool for developing energy supply in the regions. In addition, information on programs for socio-economic development and the development of individual sectors of the economy is more accessible in relation to the RF subject as a whole, and not to its individual districts;

- the selected regions, having common features for the Russian Arctic (cold climate, peripherality, etc.), have differences and, in general, sufficiently represent the diversity of conditions for socio-economic development in the Arctic. Thus, the Murmansk Oblast is a settled region with a developed industry and large power plants. The Nenets Autonomous Okrug is characterized by a decentralized energy supply in most of the territory; hydrocarbon production is carried out in the region. In the Yamalo-Nenets Autonomous Okrug, there are zones of centralized and decentralized power supply, the basis of the region's economy is oil and gas production. The basis of the economy of the Chukotka Autonomous Okrug is the mining industry, the region has a technologically isolated energy system, but there is also decentralized energy.

In [1, Gasnikova A.A.], the structure, tasks, functions and full powers of the state executive authorities of the four Arctic regions in the sphere of energy supply were analyzed. This analysis showed that state regulation of energy supply in one way or another takes into account all the factors under consideration, although there is a different concentration of functions or powers assigned to the authorities in the regions. “The activities of all executive authorities are related to legal and economic factors in one way or another, directly or indirectly. The activities of relevant ministries, departments, directorates or committees established in different federal entities are linked to energy supply factors according to their areas of responsibility. At the same time, there are differences in the structure of authorities in the regions, which are explained by the specifics of different territories” [1, Gasnikova A.A., p. 141].

Further work involves the study of regional policy aimed at the regulation and development of energy supply in the Arctic regions. This article describes the results of the stage of the work aimed at analyzing the regional state programs as a tool to ensure the reliability of energy supply and its development in the subjects of the Russian Arctic.

The tasks aimed at achieving this goal include:

- clarification of the essence of regional state programs;
- review of the main state programs of the considered subjects of the Russian Federation, aimed at the development of the energy sector;
- comparison of the content of state programs of the considered AZRF subjects with the factors of energy supply.

Research methods and information base

The Arctic subjects of the Russian Federation are considered from a systemic viewpoint, they are presented as socio-economic systems, which are at the same time subsystems of the macrosystem — AZRF. Having some common goals and partially similar characteristics, the Arctic subjects solve specific tasks, the content of which is related to the specifics of the territories of the regions. An important research method is the content analysis of scientific literature, legal documents of the federal and regional levels, and other information on the subject of research from open sources. Particular attention is paid to the content analysis of state programs of the constituent entities of the Russian Federation aimed at socio-economic development, analysis of the structure of these programs, the content of their subprograms and envisaged activities. Information is interpreted using the tabular presentation method, which allows you to present data compactly and systematically, facilitates their comparison and identification of relationships. The study uses the method of logical analysis and the method of comparison.

The information base for the study includes scientific periodicals on the topic of research, legal acts of the Russian Federation and the Arctic regions of the Russian Federation. The source of the texts of the state programs of the RF constituent entities was the official Internet portal of the electronic fund of legal and regulatory and technical documentation of the Consortium "Kodeks" (https://docs.cntd.ru).

Results

The Arctic is a complex territory to manage, with many interests of various entities, intertwined in the Arctic regions — enterprises, organizations, population (including indigenous peoples of the North, Siberia and the Far East), the state (the Russian Federation and the constituent entities of the Russian Federation). Taking into account the geopolitical significance of the Arctic, the vastness and diversity of its territory, the difficulties of its development and habitation, Russian scientists substantiated the position of the dominance of state interests in the development and implementation of the development policy of the Russian Arctic [8, Leksin V.N., p. 75].

State interests are reflected in the documents that make up the legal framework for the development of the Russian Arctic. The most significant of these documents include: "Fundamentals of the state policy of the Russian Federation in the Arctic for the period up to 2035" (approved by Decree of the President of the Russian Federation of March 5, 2020 No. 164) [1], "Strategy for the development of the Arctic zone of the Russian Federation and ensuring national security for the period up to 2035" (approved by Decree of the President of the Russian Federation of October 26, 2020 No. 645) [2]; The State Program of the Russian Federation "Socio-economic development of the Arctic zone of the Russian Federation" (approved by Decree of the Government of the Russian

[1] GARANT.RU portal. URL: https://www.garant.ru/products/ipo/prime/doc/73606526 (accessed 17 February 2021).
[2] GARANT.RU portal. URL: https://www.garant.ru/products/ipo/prime/doc/74710556 (accessed 17 February 2021).

Federation of March 30, 2021 No. 484) [3]. "Fundamentals…" and "Strategy…" determine the general directions of the development of the Russian Arctic, although the "Strategy…" is a more detailed document, which includes criteria for the effectiveness of public policy, key measures to improve the system of state management of socio-economic development. The main legal source that determines the state policy in the Russian Arctic is the state programs of the Russian Federation [9, Mankulova Zh.A., p. 130].

According to the Federal Law No. 172-FZ dated June 28, 2014 "On strategic planning in the Russian Federation", state programs contain a set of measures interconnected in terms of time, performers and resources aimed at solving certain tasks. According to researchers, the role of state planning and forecasting is currently strengthening [10, Maltseva A.A., Klyushnikova E.V., p. 5, 9; 11, Vlasyuk L.I., p. 108, 110–111; 12, Shvedov D.L., pp. 22–25, 28–29]. The chronology of the development of program tools used at the federal level is given in [13, Kalinin A.M.], which notes that since 1995 up to the present time, "the methodological support of state policy has gone from insufficiently formalized target programs to system of state programs developed according to the established form" [13, Kalinin A.M., p. 44]. State programs of the constituent entities are developed on the basis of documents of the federal level, taking into account the specifics of the regions. According to [14, Vopilovskiy S.S., p. 23], regional state programs are to some extent subprograms of federal projects, thus acting as conductors of program-targeted state administration. State programs aimed at the development of energy supply specify measures in the area under consideration, taking into account industry regulatory and technical requirements for the reliability of power equipment, energy security and efficiency, the admissibility of impact on the environment and human health.

Most of the state programs of the Arctic subjects of the Russian Federation analyzed in the course of the study are designed for a period starting in 2014–2015 and finishing in 2022–2024. Tables 1–4 present information on the state programs of the four Arctic regions of the Russian Federation, including the correlation of the program activities with energy supply factors.

It should be noted that the study considered only those regional state programs that are aimed at maintaining or developing energy supply to consumers. According to the same principle, tables 1–4 include selective information about subprograms, as well as the main events aimed at their implementation or individual regional measures. It should also be noted that state programs may be revised and extended. Thus, the state program of the Yamalo-Nenets Autonomous Okrug "Energy efficiency and energy development, providing high-quality housing and communal services to the population for 2014–2020", approved in 2013, revised and its updated version will be implemented in 2014–2024.

[3] Electronic fund of normative-technical and normative-legal information of the Consortium "Kodeks". URL: https://docs.cntd.ru/document/603154509 (accessed 17 February 2021).

Table 1

State programs of Murmansk Oblast and energy supply factors[4]

State programs and their components (subprograms, program measures – selectively, in brief from)	Energy supply factors
Economic potential (implementation period: 2021-2025)	
Subprogram 1. Providing conditions for raising investments, development and modernization of the industrial complex, increasing the competitiveness of production (activities)	
Supporting investment activities. Providing conditions for the implementation of investment projects by residents of the Russian Arctic and the territory of advanced socio-economic development "Capital of the Arctic".	L, Econ
Subprogram 5. Assurance of the state program implementation	
Ensuring the implementation of government functions of strategic planning, tax regulation, and supporting social sphere	L, Econ, S
Ensuring the tariff regulation in the Murmansk oblast	Econ, S
Comfortable housing and urban environment (implementation period: 2021-2025)	
Subprogram 4. Ensuring the sustainability of the fuel and energy complex and improving energy efficiency in the Murmansk region	
Modernization of heat and electric power supply facilities. Subsidies to resource-supplying organizations. Ensuring the stable functioning and improving the energy efficiency of facilities and life support systems in municipal districts. Ensuring the implementation of government functions in the sphere of energy, energy saving and energy efficiency, housing and communal services	T, Econ, S, L
Environmental protection and reproduction of natural resources (implementation period: 2014-2020)	
Subprogram 1. Ensuring environmental safety	
Atmospheric air monitoring	Env
Subprogram 3. Protection and rational use of water resources	
Prevention of pollution and contamination of water bodies	Env
Subprogram 4. Assurance of the state program implementation	
Implementation of the government functions in the sphere of environmental protection and restoration of natural resources	L
Subprogram 5. Elimination of accumulated environmental damage	
Elimination of nuclear and radiation hazardous facilities	Env

Table 2

State programs of Nenets Autonomous Okrug and energy supply factors

State programs and their components (subprograms, program measures – selectively, in brief from)	Energy supply factors
Modernization of housing and communal services of Nenets Autonomous Okrug (implementation period: 2015-2025)	
Selected activity 7. Implementation of a centralized system of accounting for consumers of housing and communal services, pricing of housing and communal services and the formation of unified payment documents	L, Econ
Subprogram 1. Modernization of communal infrastructure facilities	
Preparation of communal infrastructure facilities for operation in the autumn-winter period	Econ, S, T
Subprogram 2. Ensuring the availability of communal services	
Public support for organizations of the housing and communal complex providing communal resources, taking into account the maximum indices of changes in the amount of citizens ' payment for utilities	Econ, S
Subprogram 6. Development of the energy complex Nenets Autonomous Okrug (2018-2022)	

[4] In this and the following tables abbreviations are used to denote energy supply factors: natural resource factors — NR, economic factors — Econ, social factors — S, technological factors — T, environmental factors — Env, legal factors — L.

Construction and reconstruction of heat and electric energy power supply facilities	Econ, T
Improving the safety of the energy system of the Nenets Autonomous Okrug	T, Econ
Providing affordable and comfortable housing and public services for citizens living in Nenets Autonomous Okrug (implementation period: 2014-2035)	
Particular measure 7. Implementation of the public policy in the sphere of construction, housing and communal services, energy industry and transport	L
Environmental protection, reproduction and use of natural resources (implementation period: 2015-2024)	
Particular measure "Expenses for the maintenance of state bodies and ensuring their functions"	L
Subprogram 1. Environmental protection and ensuring environmental safety of Nenets Autonomous Okrug	
Elimination of objects of accumulated environmental damage	Env
Subprogram 3. Protection and use of water bodies	
Ensuring the environmental safety of water bodies	Env
Preservation and development of the Indigenous Minorities of the North in the Nenets Autonomous Okrug (implementation period: 2014-2022)	
Subprogram 2. Saving and protection of primordial living environment of the low-numbered indigenous peoples of the North in Nenets Autonomous Okrug	
Ensuring the implementation of the reindeer herders' and raw-hide tent keepers' right for purchasing firewood for heating nomadic housing at preferential prices	S

Table 3

State programs of Yamalo-Nenets Autonomous Okrug and energy supply factors

State programs and their components (subprograms, program measures – selectively, in brief from)	Energy supply factors
Energy efficiency and energy development, providing high-quality housing and communal services to the population for 2014-2024	
Subprogram 1. Energy saving and improving energy efficiency	
Determining requirements for organizations programs in the sphere of energy saving and improving the energy efficiency. The exercise of regional powers in the sphere of jurisdiction	L, Econ, T
Subprogram 2. Development of energy industry and housing and communal services	
Development of a scheme and program for the long-term development of the electric power industry. Public support for energy sector, gas supply and housing and communal services. Public regulation and control of prices (tariffs) in the fuel and energy sector and the communal complex	L, Econ, T, S
Economic development and innovative economy for 2014-2024	
Subprogram 1. Development and operation of an integrated system of strategic planning of socio-economic development	
Development of regional strategic documents. Monitoring and control of socio-economic development targets	L, Econ, S
Subprogram 3. Development of small and medium-sized businesses	
Public support for entrepreneurship (including supporting improving the energy efficiency of production, partial compensation of the energy resources cost)	Econ
Development of the mineral resource base (implementation period: 2014-2024)	
Subprogram 1. Geological study of subsurface resources and geoinformation support of natural resources management	
Works on geological study of subsurface resources (including monitoring of the proven hydrocarbon reserves; government grants for research on the topic "Development of a unified geological model of the structure and oil-and-gas potential of the southern part of the Kara Sea")	Econ, NR
Subprogram 2. Licensing and monitoring of subsurface resources use and the activities of fuel and energy companies	
Management of natural and subsurface use	Econ
Subprogram 3. Assurance of the state program implementation	
Governance and management in the sphere of designated functions	L
Social support of citizens and labor protection (implementation period: 2014-2022)	

Subprogram 1. Development of social support measures for certain categories of citizens	
Support measures (including payment for housing and communal services)	S
Environmental protection (implementation period: 2014-2024)	
Subprogram 1. Maintaining an ecological balance and a favorable environment	
Environmental protection and environmental safety (including environmental monitoring, establishing specially protected natural reservation)	Env, S
Subprogram 2. Implementation of the public policy in the sphere environmental protection, atmospheric air, management of production and consumption wastes, as well as organizing and convening public environmental impact assessment at the regional level	
Consideration of plans for the prevention and elimination of accidental oil and oil products spill. Ecological monitoring and environmental impact assessment	Env, L

Table 4

State programs of Chukotka Autonomous Okrug and energy supply factors

State programs and their components (subprograms, program measures – selectively, in brief from)	Energy supply factors
Energy sector development of the Chukotka Autonomous Okrug (implementation period: 2016-2024)	
Subprogram. Energy saving and energy efficiency improvement	
Development and implementation of energy saving projects	T, Econ
Subprogram. Development and modernization of the electric power industry	
Construction, reconstruction and design and survey work (including development of design and survey documentation, commissioning of generating reserve capacities, refurbishment and reconstruction of power transmission lines and transformer substations)	T, Econ
Public support of energy supply organizations (including compensation of economically justified expenditures for the guaranteeing supplier in certain cases)	Econ, S
Development of industrial infrastructure (including construction of power transmission lines)	T, Econ
Subprogram. Development of the gas industry	
Public support of gas supply organizations (including construction of gas distribution pipelines, increasing the capacity of the automatic gas distribution station)	Econ, T, Env
Subprogram. Development of the coal industry	
Public support of the coal industry companies (including coal mining)	Econ, NR, T
Development of housing and communal services and the water management complex of the Chukotka Autonomous Okrug (implementation period: 2016-2024)	
Subprogram. Public support for housing and communal services	
Subsidies to housing and communal companies for upgrading and equipping their facilities	Econ, S, T
Subsidies to resource-supplying companies for partial compensation of the costs related to the provision of communal resources (services) to the population	Econ, S
Subprogram. Providing conditions for the development of the communal complex	
Energy saving measures	T, Econ
Construction, reconstruction and thorough repairs of engineering infrastructure facilities	T
Subprogram. Implementation of measures for the development of communal infrastructure	
Development of infrastructure providing uninterrupted supply of heat and electric energy to residents of city of Bilibino and city of Pevek	T, S
Environmental protection and and ensuring rational use of natural resources in Chukotka Autonomous Okrug (implementation period: 2015-2024)	
Subprogram. Prevention of negative impact on the environment and elimination of the consequences of such impact	
Prevention of negative impact on the environment and elimination of environmental damage associated with economic activities	Env

Discussion

Each of the AZRF subjects under consideration has its own set of regional state programs. The structure of the state program presents the program passport, information about the program, followed by data on subprograms (passports of state programs, information about subprograms), data on targets, program activities, etc. in tabular form, by subprograms. Sometimes the order of presentation is different — for example, the state programs of the Chukotka Autonomous Okrug first present the program passport, then the subprogram passports, the program data, target indicators, etc., and the subprograms are not numbered. The state programs of the Nenets Autonomous Okrug, in addition to the presence of subprograms, are characterised by the inclusion of selected activities, and sometimes their number exceeds the number of subprograms. However, these differences are not an obstacle to comparing the state programs of various subjects of the Russian Federation.

The tasks of energy supply development are distributed unevenly in the subjects' state programs. Some regions have developed large programs with a developed structure of subprograms, while others have adopted programs aimed at solving a narrower range of tasks. For example, Yamalo-Nenets Autonomous Okrug has developed a regional program with energy efficiency in its title, but in Murmansk Oblast and Chukotka Autonomous Okrug, energy efficiency issues are included in subprograms of larger programs.

Examination of the content of state programs reveals some similar areas and measures for the development of energy supply in the regions. Thus, the regions pay attention to the development of energy infrastructure, energy efficiency, quality of housing and communal services, environmental pollution by energy enterprises. They provide support for energy enterprises, for example, in the form of subsidies to compensate for lost income due to state regulation of prices (tariffs), in some cases — subsidies to recover part of the costs of capital repair of utility infrastructure systems, to organize energy supply to the population, sometimes budgetary investments in capital construction projects are provided. State programs in the field of environmental protection include reduction of the negative impact of energy enterprises' activities on the natural environment; such programs are included in the consideration.

When comparing the list and content of the state programs of the regions, differences can be identified.

For example, the Murmansk Oblast does not have an active state program focused on energy development in the region at the time of writing this paper. However, significant attention to these issues is paid in one of the subprograms of the regional state program "Comfortable housing and urban environment". It should be noted that the earlier state program of the Murmansk Oblast (2014–2020) "Providing a comfortable living environment for the population of the region" initially did not contain materials of significant interest for the study. However, later it was supplemented by the subprogram "Ensuring the sustainable operation of the fuel and energy complex of the Murmansk Oblast and increasing energy efficiency". A subprogram with the same name is

present in the current regional state program “Comfortable housing and urban environment”. It should be noted that the state programs of other RF subjects, aimed at providing the population with comfortable housing, pay more attention to housing construction and development of housing and communal services, the inclusion of subprograms, aimed at the development of the fuel and energy sector, is atypical.

The state program of the Murmansk Oblast “Environmental protection and reproduction of natural resources” includes a subprogram aimed at the protection of water resources. In this regard, it is worth noting that the lake and river system of the Oblast is favourable for the development of hydropower — the natural regime of most large lakes and rivers is regulated by six cascades of hydroelectric power stations. The subprogram “Liquidation of accumulated environmental damage” of the specified state program should also be mentioned. The reason for special attention to this subprogram was the concentration of nuclear power facilities in the territory of the Murmansk Oblast, which appeared over a long (more than 40 years) period of operation of the military and icebreaking nuclear fleets of the USSR and Russia.

In the Nenets Autonomous Okrug, a state program has been developed aimed at modernizing the housing and communal services. This is a large program that includes a complex of separate measures and subprograms. It covers a wide range of issues, including modernization of communal infrastructure, ensuring the availability of utilities and the safety of the housing stock, development of a waste management system, etc. Its subprogram, aimed at developing the energy complex of the region, is of interest for research. For comparison, in other regions, measures for the development of housing and communal services are usually provided for in the subprograms of larger programs. Perhaps more attention to the modernization of housing and communal services and consideration of the development of the energy complex at the nested level of the state program is due to the fact that decentralized energy supply to consumers prevails on the territory of the Nenets Autonomous Okrug (with the exception of the urban district of Naryan-Mar), and oil and gas enterprises in the region use their own power plants.

In the Nenets Autonomous Okrug, such specific features of the Arctic regions as the residence of representatives of indigenous minorities leading a traditional way of life are evident. The energy supply for this category of the population has specific features, such as the use of firewood for heating nomadic housing. The manifestation of this specificity is reflected in the state program “Preservation and development of the Indigenous Minorities of the North in the Nenets Autonomous Okrug”.

In the Yamalo-Nenets Autonomous Okrug, the regional state program “Energy efficiency and energy development, providing high-quality housing and communal services for the population for 2014–2024” is dedicated to various aspects of the development of energy supply. In addition, energy supply issues are also discussed in other state programs of the Okrug. In recent years, there has been an active industrial development of the territory of the Yamalo-Nenets Autonomous Okrug, associated with the extraction of oil and gas condensate. This specificity is reflected

in the state program of the Okrug "Development of the mineral resource base". Its subprogram 1 "Geological study of subsurface resources and geoinformation support of natural resources management" is aimed at strengthening the raw material base for the production of local building materials, filling the fund of geological information. At the same time, the text of the program notes that common minerals (sand, sand-gravel mixtures, peat) are required in large quantities for the implementation of large investment projects for the development of hydrocarbon deposits on the Yamal Peninsula, the construction of the Bovanenkovo-Ukhta gas pipeline, the main oil pipeline, the building of the plant for the liquefaction of natural gas. Subprogram 1 also provides for monitoring the state and use of the mineral resource base of the region, industries of the fuel and energy complex, which will provide information allowing the Government of the Yamalo-Nenets Autonomous Okrug to interact with oil and gas companies and federal authorities in resolving issues related to natural resource regulation.

The state program "Environmental protection of the Yamalo-Nenets Autonomous Okrug for 2014–2024" notes that the intensification of industrial development associated with the extraction of oil and gas condensate leads to the appearance of additional anthropogenic loads, and sometimes this happens on territories of traditional economic activity of the indigenous peoples of the North. Additional anthropogenic pressures require extra measures to protect the natural environment and preserve the traditional way of life of indigenous peoples. An acute problem of the Autonomous Okrug is the intensive negative impact of associated petroleum gas (APG) emissions. In order to solve this problem, actions of both oil producers and state authorities are needed.

The state program "Energy sector development of the Chukotka Autonomous Okrug" covers a wide range of issues, including energy saving, modernization of the electric power industry, development of the gas and coal industries. A separate state program of the region is devoted to the development of housing and communal and water management complexes — probably because these complexes are close to the consumer (unlike fuel and energy enterprises). The state program "Development of housing and communal services and the water management complex of the Chukotka Autonomous Okrug" is aimed at improving the reliability and efficiency of the region's communal infrastructure, providing the population with high-quality affordable communal services, and ensuring uninterrupted heat and power supply. This program provides for curbing the growth of utility bills, replacing the retired capacities of the Bilibino NPP with the capacities of a new generation facility; modernization of public infrastructure.

The factors of energy supply considered in the study are taken into account to a greater or lesser extent in regional state programs. In most cases, state programs, their subprograms and activities can be compared with several groups of factors, as shown in Tables 1–4.

Natural resource factors at the regional level can be taken into account to a limited extent. This group of factors is associated with activities aimed at studying the natural resource potential that can be realized for the purposes of energy supply. This is relevant for regions where hydrocarbon deposits are being developed. Thus, in the Yamalo-Nenets Autonomous Okrug, a state

program “Development of the mineral resource base” has been introduced, which involves the geological study of the subsoil and the licensing of subsoil use activities. The implementation of program measures should ensure the improvement of mineral resources, primarily energy security of Russia and the region and, in general, give a positive socio-economic effect. However, the actual organization of large-scale hydrocarbon production is one of the tasks that are solved at the highest level. In the Chukotka Autonomous Okrug, the subprograms “Development of the gas industry” and “Development of the coal industry” can be noted, which provide for state support for enterprises in the relevant sectors.

Economic factors are reflected in state programs aimed at the economic development of the region, increasing its economic potential, and creating a favorable investment climate. One means of doing this is to increase the availability of energy infrastructure. It may be noted that more attention to economic development is paid in the programs of the Murmansk Oblast (which has a relatively diversified economy) and the Yamalo-Nenets Autonomous Okrug (which has an active industrial development).

Social factors are connected with state regulation of prices (tariffs) in the energy sector, control of housing and communal services quality — these issues are addressed in the state programs of all regions. The conservation of land and the protection of the traditional way of life of the indigenous peoples of the North are the tasks of the state, and this is also reflected in the state programs of the Arctic regions. One of the programs of the Nenets Autonomous Okrug provides for such a specific measure as providing reindeer herders and raw-hide tent keepers with firewood for heating nomadic housing at a reduced price. In regions where industrial development is taking place, the interests of the indigenous population are to be taken into account in the creation of industrial facilities.

Technological factors at the regional level are manifested through the implementation of measures to simplify the technological connection of consumers to the energy infrastructure, construction, modernization and reconstruction of energy facilities, as well as measures to develop energy saving and to improve energy efficiency.

Environmental factors are reflected in programs aimed at protecting the environment — such programs have been developed in all regions. Researchers point out the high sensitivity of Arctic ecosystems to changes. As noted in [4, Witt M. de, Stefánsson H., Valfells A., Larsen J.N., p. 144], climate change has a significant impact on the Arctic environment, with temperatures rising two to three times faster than anywhere else on the planet. Although climatic features have an impact on the demand for energy resources and the operation of power equipment, it is more correct to consider climate change issues among environmental rather than natural resource factors of energy supply. Natural resource factors imply the possibilities and limitations of organizing energy supply, while the environmental factors primarily mean the environmental impact of the energy sector enterprises. No objectives related to global climate change impacts are set at the level of constituent entities of the Russian Federation. Such tasks are set at the national, interstate

and global levels, and individual regions can serve as conductors of the tasks set above. It is important that there is a need to preserve and ensure the protection of the natural environment of the Arctic in each RF subject. The analyzed state programs provide for measures to protect the environment of the regions (in particular, the prevention of excess emissions of pollutants by energy enterprises), taking into account the specifics of the regions. Regional peculiarities are reflected in the specification of tasks and the list of program measures. For example, the state program in Murmansk Oblast specifically mentions the need to eliminate radiation hazardous facilities. In the Yamalo-Nenets Autonomous Okrug, plans for prevention and elimination of oil and petroleum product spills are being developed.

The legal factors of energy supply are related to the fact that the state programs of the constituent entities of the Russian Federation are conductors and instruments for implementing energy policy. Each state program contains a subprogram and measures aimed at the implementation of state functions in the area of its action.

Conclusion

State programs of the constituent entities of the Russian Federation are an instrument of regional policy. Each state program has goals, objectives and provides for a set of measures to solve the set tasks. The study analyzes the content of state programs of four Arctic regions of the Russian Federation (Murmansk Oblast, Nenets, Yamalo-Nenets and Chukotka Autonomous okrugs), which are directly or indirectly aimed at developing energy supply to consumers. Each of the considered regions has its own set of state programs. Their structure does not differ much (the differences are usually related to the order of presentation of the content of the program, the presence or absence of selected activities along with subprograms).

The tasks of energy supply development are distributed unevenly in the state programs of the constituent entities of Russia, the measures have different details. However, each region provides support for the development of energy infrastructure (including those related to general economic development), measures to save energy and improve energy efficiency, provide consumers with high-quality housing and communal services, reduce the negative impact of energy enterprises on the environment. Lists and details of state programs and activities, level of attention to any issues of energy supply can be explained by the peculiarities of the regions. For example, the presence of significant reserves of hydrocarbon resources, the widespread use of hydropower resources, and the residence of the indigenous peoples of the North in the region are among such features.

Various factors of energy supply are taken into account to a greater or lesser extent in regional state programs. The prevailing factors are economic and legal. As an instrument of regional energy policy, the state programs of the RF subjects act as legal factors. Economic factors can be correlated with most state programs, since each state program is aimed at solving problems in any sector of the economy or social sphere, or at creating conditions for favorable socio-economic de-

velopment of the region as a whole. Social factors are reflected in measures aimed at protecting the interests of the population, primarily through the regulation of prices (tariffs) in the energy sector, as well as measures to protect the interests of the indigenous peoples of the North in the implementation of projects for the development of energy resources on their territories.

Technological and environmental factors in regional state programs are manifested, as a rule, through the inclusion of measures that implement the requirements of the legislation in the relevant areas. Regional state programs aimed at environmental protection may, if necessary, pay attention to the solution of specific problems (a typical example: plans for the prevention and elimination of oil spills in the Yamal-Nenets Autonomous Okrug where large-scale hydrocarbon extraction operations are being carried out). Natural resource factors may be taken into account on the regional level to a limited extent, and this group of factors may be compared with activities aimed at studying the potential of local energy resources, which can be used for energy supply to consumers in the regions.

The results outlined in the article may be useful to researchers of the regional economy and energy, as well as employees of public authorities in the Arctic regions of Russia. Despite the fact that all state programs of the RF subjects are developed in accordance with the requirements defined at the federal level, the programs vary somewhat in different regions. The review of regional state programs, on the one hand, shows the general directions for supporting the development of energy supply in the Russian Arctic, on the other hand, allows to see that different regions have their own tasks in the field of energy supply development and own approaches of their solution. The latter is manifested in the choice and specification of measures provided for by regional state programs. The study of the system of state programs and activities aimed at the development of energy supply makes it possible to assess the comprehensiveness of energy supply issues and the best practices in addressing these issues in the regions. Thus, the results presented in the article can be used to develop new state programs, or amend the current ones.

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Features of the Arctic Policy of the United States and Canada and the Contribution of Their Northern Universities in Its Implementation *

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Abstract. The United States and Canada, along with Russia, Denmark, Iceland, Norway, Finland and Sweden, are the so-called "official" Arctic countries. In the 21st century, The United States and Canada have begun to implement national Arctic strategies and updated them. The accepted documents have both similarities and differences. The United States and Canada are active members of the Arctic Council and view it as a platform for negotiations on a wide range of issues related to the development of the Arctic. The United States has come a long way in the Arctic, including in terms of regulation. Unlike other Arctic countries, the United States has a minimal area of access to the Arctic Ocean, their strategy as a whole is turned "outward". The first Canadian strategy for the development of the Northern Territories (2013) is addressed directly to the development of the northern periphery of the country, formulates tasks for its sustainable socio-economic development, the development of indigenous peoples, and the support of sovereignty. In 2019, the updated strategy presented already combined national and international goals for the development of the Arctic and the North. To advance national interests in the Arctic, the US and Canada have developed and funded a geographically, infrastructure, stakeholder, and thematically differentiated Arctic research policy in which higher education institutions play an important role and are used to reinforce their geopolitical aspirations. The purpose of the article is to characterize the features of the Arctic strategies of the USA and Canada, as well as to analyze the contribution of universities and colleges in Alaska (USA) and the northern territories and provinces of Canada to the implementation of research policy in the Far North and the Arctic. The practical significance of the paper is in the possibility of its use in the educational process, as well as for the analysis and updating of international aspects of research activities by universities in the Arctic zone of Russia.
Keywords: *Arctic, development strategy, research policy, university*

Introduction

In the 21st century, leading foreign countries have shown an increasing interest in the Arctic region by formulating strategies and programs for the development of national areas of the High North and Arctic zones. Each country independently determines the boundaries of the Far North (Arctic zones) and the concept of the Arctic. Such "free" approaches make it difficult to develop a coherent policy for managing the vast and unconventional Arctic region in the interests of balanced environmental management and comprehensive human security.

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There are many similarities in the adopted in 2010–2014 strategies for the development of the territories of the Arctic (USA) [1] and the Far North (Canada) [2] [1]. In the context of this article, it should be noted that both countries, when implementing policy documents, recognize the need to develop science and education in the Far North and the Arctic, extend expeditionary activities, and fill the Arctic information and statistical center (arcticstat.org) with relevant content. In order to implement the provisions of the Arctic strategies, the meteorological services of the United States and Canada operate national Arctic Regional Climate Centers, where information (temperature, precipitation, sea ice condition) is updated 2–3 times a year and then provided to users (governments , shipping, cruise, fishing companies, scientific organizations) [3].

Despite similar historical and socio-economic development, the educational systems in the northern regions of the US and Canada are different. The North American model is characterized by minimal interference of state authorities in the development of higher education, a high share of responsibility of provinces and regions, and a diversity of funding sources for research and educational activities of universities. It should be noted that in Russia, including the subjects of the Arctic zone, the modernization of higher education is based on the principles of a unified educational space, which implies a significant role of federal authorities in determining the quality standards of personnel training, the desire to link them with professional industry standards.

As shown in figure 1, the number of universities in the Arctic region (in the regions of the Far North) differs in each Arctic country. Their maximum number is in the countries of Northern Europe, as well as in the Far North of Russia, especially in the Murmansk Oblast. The least scientific and educational space is formed among foreign countries with Arctic areas — in Greenland and in the Far North of Canada, which can be explained by the historical features of the development of these territories. The peculiarity of the Canadian experience is the use of tools for interdisciplinary research cooperation at both national and international levels, including in the Arctic Council and using the thematic networks of the University of the Arctic [4].

[1] National Strategy for the Arctic Region. May 2013. USA, Washington D.C. 13 p., United States Coast Guard. Arctic Strategy. May 2013. USA, Washington D.C. 48 p.
[2] Canada's Northern Strategy. Our North, Our Heritage, Our Future / Government of Canada, Ottawa, 2009, 48 p.; Canada's Arctic and Northern Policy Framework. URL: https://www.rcaanc-cirnac.gc.ca/eng/1560523306861/1560523330587 (accessed 10 May 2021).
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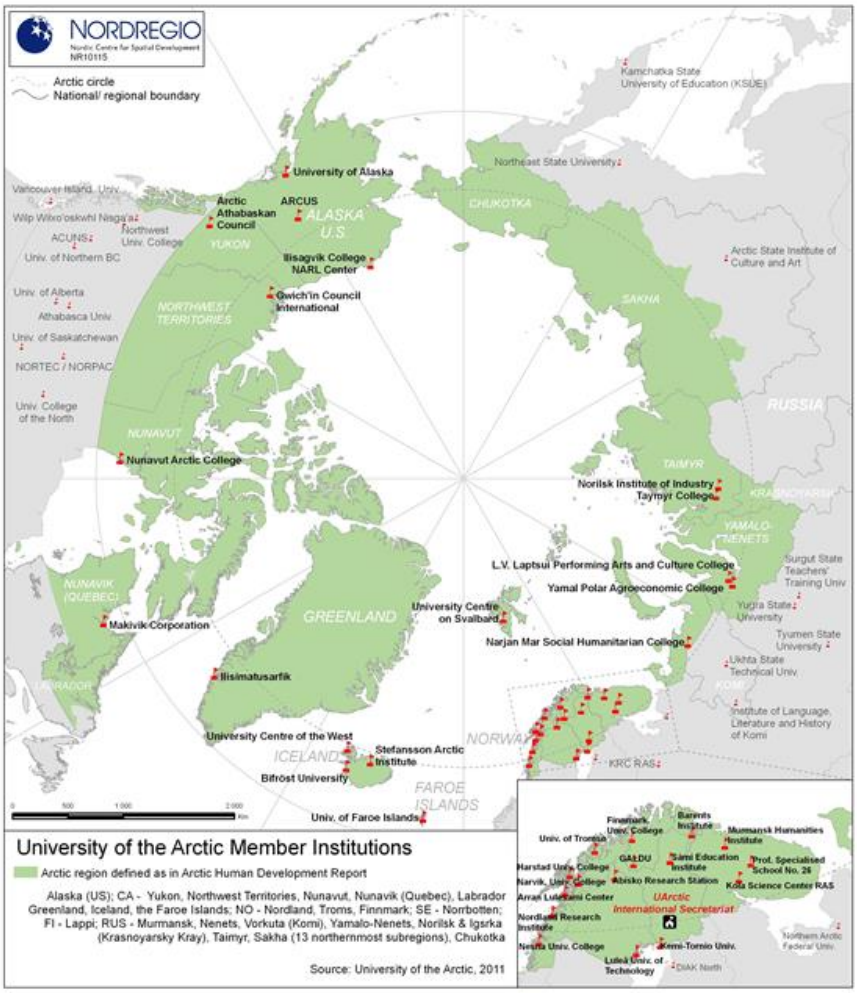

Fig. 1. Universities of the Arctic region, 2011 [5]

The analysis of Russian-language literature revealed an information vacuum on the topic of the article. The Arctic Human Development Report 2014 of the Arctic Council hardly discusses the topic of research and education space and topics of research in the northern territories of Canada and Alaska.

Robards M.D., Huntigton H.P. and others view knowledge from a philosophical perspective, characterizing patterns of "co-production of knowledge" in indigenous communities as a response to global climate change, which entails changes in communications and trade. "Attention to local needs, perspectives and cultures is seen as essential to promote effective adaptation planning, or, more broadly, sustainability of indigenous peoples…". "The field of the 'science-policy interface' goes beyond observing or evaluating changes at different scales and perspectives, and identifying conditions conducive to the co-production of practical knowledge. This approach requires the development of response tools that can take into account the dynamic relationships between people, wildlife, and habitats that span across cultures, timeframes, and sometimes national borders" [2, p. 205].

[5] Nordregio. Maps. Research. URL: https://archive.nordregio.se/en/Nordregio-Research/index.html (accessed 19 April 2021).

We have found that rural and remote communities within the circumpolar world face the challenge of providing any kind of education, from secondary to post-higher, at the student's location due to geographical barriers and a lack of available resources. Significant experience has been accumulated around the world to overcome such isolation. For example, Butler L., Bullin C. et al., using the nursing education program as an example, show that education in the Canadian North can go beyond traditional teaching methods and include a student-centered approach based on distance learning. “Distributed learning not only mitigates geographical and resource challenges but, most importantly, it provides learning experiences that are context relevant”. This “novel educational approach supports the educator to be in two places at one time in a synchronous, face-to-face delivery in which students are taught from a distance rather than having to relocate. The authors advise that there is no normative preference for a particular type of technology”. [3, p. 42].

Petrov A.N. examines the socio-economic development and resettlement of the Inuvialuit (no more than 5000 people) in the North-West of Canada (the region of their residence was established by the government in 1984 on an area of more than 900 thousand km^2) from the perspective of the spread of education in their environment, as well as such “Arctic social indicators under the Arctic Council as health and population, material well-being, cultural vitality, closeness to nature, fate management... The analysis revealed considerable internal differences within the Inuvialuit settlement region, especially between the Inuviks and other communities in the Northwest Territories (except for the capital city of Yellowknife)... Residents still face significant social problems and are forced to deal with inter-regional inequalities...” [4, p. 171].

Zashikhina I. and Postnikova M. consider “...the social implications that determine the use of media in contemporary education. Features of a new post-industrial society advance the necessity to redefine professional competences, taught within all kinds of curricula. Students receive the opportunity to enjoy a rich assortment of media, which is profoundly used as a learning source by most teachers today. The authors point to a dependency of modern education participants on their understanding of the mechanism and impact of media...” [5, p. 612].

Anderson K.L., Kaden U. and others state: Alaska faces challenges in the fields of science, technology, engineering and mathematics, including limited availability of resources and learning opportunities, as well as a lack of teachers and local educational resources. Museum education programs, traditionally focused on public outreach through docent-led tours, are playing an increasingly important role in both formal and informal aspects of STEM education. The authors focused on the possibilities of using museum practices in the scientific and educational process in the Arctic region on the example of the Museum of the University of Alaska and its collections of natural history [6, p. 641].

Lipatov V.A. considers the specifics of organizing distance education of students with disabilities. Many North American universities, in particular, Alaska (USA) have experience of such activities. The author notes that Arctic International University uses information and communication technologies and open educational resources (for example, Black-board). In 2008, the University

of the Arctic launched a thematic network on distance education and e-learning. This article attempts to find an answer to the question: does distance education in Alaska, as well as, by analogy, in the northern and Siberian regions of the Russian Federation, contribute to solving educational problems of people with disabilities? The basis of the study was research work on distance learning for people with disabilities in the Arctic, legal acts created by international organizations, American and Russian agencies, Internet resources of information and communication network on educational policy issues [7].

Features of research policy in the Arctic with the participation of foreign states

The development of education and research in the Arctic is regularly discussed at meetings of the ministers of education and science of the Arctic countries. According to the statement from the Tokyo Summit on May 9, 2021 (the first one was held in Washington in 2016), "science-based policy measures are becoming increasingly relevant in the Arctic due to the current pace of climate change, and they are relevant for all Arctic residents, including indigenous peoples, and for the global community" [6]. **Knowledge for a sustainable Arctic** is the main theme of the Arctic Science Forum. Four sub-themes that can be adopted in the framework of international cooperation were formulated there:

- *Observing:* establishing observation platforms and networks, sharing data through the Sustainable Arctic Observing Networks (SAON) initiative, the International Arctic Science Committee, Arctic Council working groups, developing mapping and remote sensing techniques for studying the Arctic;
- *Understanding:* increasing the ability to understand and predict changes in the climatic, ecological and social systems of the Arctic in relation to the global impacts of these changes;
- *Responding:* operational sustainability, assessment of vulnerability, resilience and application of knowledge;
- *Strengthening:* training the next generation of researchers and educators through training, networking within existing Arctic education frameworks such as Associated Polar Early Career Scientists (APECS), Polar Educators International (PEI), University of the Arctic (UArctic). Support for multinational participation in research at field stations and on ships through the Forum of Arctic Research Operators (FARO), the Pacific Arctic Group (PAG), the Svalbard Integrated Arctic Earth Observing System (SIOS), the International Network for Terrestrial Research and Monitoring in the Arctic (INTERACT), Arctic Research Icebreaker Consortium (ARICE).

In order to implement these measures, it is proposed to:

- strengthen the involvement of indigenous communities to use their traditional knowledge and co-produce new knowledge through research programs and projects.

[6] Joint Statement of Ministers on the occasion of the Third Arctic Science Ministerial, 9 May 2021, Tokyo, Japan, 11 p.

Such cooperation is essential to improve the effectiveness and usefulness of research for Arctic indigenous peoples, governments and other stakeholders;

- intensify the collection, analysis and modelling of meteorological data to enable timely responses to climate change.

The Arctic countries, within the framework of the international research community, are participating in the preparation of the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC), the IPBES Global Assessment Report on Biodiversity and Ecosystem Services. Arctic states take part in the Decade of Ocean Science for Sustainable Development (2021–2030), the Seabed 2030 global initiative, support the 2030 Agenda for Sustainable Development, the 2015 Paris Agreement (under the UN Framework Convention on Climate Change), the Global Biodiversity Framework and the Arctic Council Agreement to Strengthen Scientific Cooperation in the Arctic. During the Second Arctic Science Ministerial on March 30, 2020, the Forum of Arctic Science Funding Organizations was established [7].

The purpose of this article is to describe the features of the Arctic strategies of the USA and Canada, as well as to examine the contribution of universities and colleges in Alaska (USA) and the northern territories and provinces of Canada to the implementation of research policy in the Far North and the Arctic. At the same time, the analysis of the US Arctic strategy and the development strategy of the northern territories of Canada is not a goal in itself for the authors. We have used our review of published policy documents to outline the role of education and research in their implementation. In particular, for this purpose, the article considers the main scientific programs and institutions that form the research and educational space of the American North.

US Arctic strategy and approaches to its implementation in the research sphere

The reason to consider the USA as an Arctic state is the state of Alaska. The +10°C isotherm of July, which is recognized by the USA (and the Arctic Council) as the southern boundary of the Arctic, runs through its territory. It is the northernmost, largest and most sparsely populated US state. The area of the state is 1.7 million km^2, the population is 740 thousand people. In 1867, after signing the treaty, Alaska was sold (at a price of about $7 million, about $4 per km^2, which is about two times less than, for example, the price of acquiring Louisiana from France) by the Russian Empire to the North American United States. Alaska for a long time was called “okrug”, “territory”; only in 1959 it received the status of state [8].

Alaska generates 0.27% of the country’s GDP, but is characterized by high per capita income — over $70.000 per capita (the national average in 2019 is $55.000) [9]. Alaska’s economy has historically been based on the extraction of raw materials and fuel. The largest field is located on the North Slope of Alaska (Pradhoe Bay), and it has already production peak. Therefore, the rele-

[7] Joint Statement of Ministers on the occasion of the Third Arctic Science Ministerial, 9 May 2021, Tokyo, Japan, 11 p.
[8] Information about the USA and Alaska. URL: http://infoamerica.ru (accessed 10 April 2021).
[9] Statistical data about Alaska. URL: https://arcticstat.org/research (accessed 10 March 2021).

vance for the government is to find new development paths that do not involve the extraction of natural resources.

The interdepartmental body is responsible for the development of the Arctic policy in the United States, assuming the interests of state agencies responsible for various areas of US policy in the Arctic and the federal government [8]. The first version of the US Arctic strategy was drafted in 1971 in Memorandum 144 submitted by President R. Nixon. This document identified three priorities: reducing environmental risks, developing international cooperation and ensuring the region's security. In 1984, the US Congress passed the "Arctic and Policy Act", which added to the list of priorities the provision of national defense, fisheries development, environmental and climate research.

The US National Arctic Strategy (2013) assumes that the US has fundamental interests in the Arctic and is "ready to act independently or in alliance with other states to protect these interests" [10]. The list of US strategic interests, drawn up with consideration the interests of other Arctic countries, includes ensuring national and security, environmental protection, climate change study, responsible environmental management, consideration of indigenous interests, scientific research and international cooperation [11]. In 2015, President B. Obama created the Arctic Executive Steering Committee (AESC), responsible for facilitating communication, emergence and interaction between federal departments, agencies and offices in charge of activities in the Arctic region. The 2016 State Department Arctic Policy Report outlined the need to maintain the dominant role of the US in addressing Arctic issues, taking into account Russia's growing policy in the region. The authors also draw the attention of the US government to the development of Chinese interests in the Arctic, especially in Iceland and Greenland [12]. In 2020, President D. Trump signed the Memorandum on Safeguarding U.S. National Interests in the Arctic and Antarctic Regions. It outlines the need for an icebreaker fleet (at least three ships) to work in polar waters [13]. However, experts believe that the real terms of implementation may be significantly delayed (2035–2040 instead of 2024) due to the lack of experience in building heavy icebreakers and irregular funding [14].

A significant place in the US Arctic policy is occupied by military issues. It can be noted that in a non-strategic respect, the Arctic has long been a peripheral area of military activity, and the lack of military risks in the region is recognized at the state level. However, in 2014, U.S. Navy Arc-

[10] US Arctic Strategy. URL: https://russiancouncil.ru/analytics-and-comments/analytics/arkticheskaya-strategiya-ssha/?sphrase_id=57176163 (accessed 10 February 2018).
[11] US: National Strategy for the Arctic region (May 2013). https://polarconnection.org/us-national-strategy-arctic-region-may-2013/ (accessed 10 April 2021).
[12] New US Arctic Policy. URL: https://icds.ee/ru/novaja-arkticheskaja-politika-ssha/ (accessed 10 May 2021).
[13] Tramp rasporyadilsya militarizirovat' prisutstvie SShA v Arktike i Antarktike [Trump ordered to militarize the US presence in the Arctic and Antarctic]. URL: https://rg.ru/2020/06/10/tramp-rasporiadilsia-militarizirovat-prisutstvie-ssha-v-arktike-i-antarktike.html (accessed 10 May 2021).
[14] Polyarnyy dedlayn: udastsya li SShA sozdat' ledokol'nyy flot k 2029 g. dlya postoyannogo prisutstviya v Arktike? [Polar Deadline: Will the US manage to create an icebreaking fleet by 2029 for a permanent presence in the Arctic?]. URL: https://russian.rt.com/world/article/754138-ledokol-ssha-tramp-arktika (accessed 10 September 2020).

tic Roadmap 2014–2030 was developed [15]. Its development involved assessing the Navy's capabilities that may be needed in the Arctic against the backdrop of increased shipping activity (such studies were initiated in 2009). In 2019, for the first time since 2013, an updated strategy for the US Coast Guard in the Arctic was presented. It focuses on the changes taking place in the Arctic: from the environment and geopolitics to socio-economic development and shipping [16]. In 2020, the United States published a new Arctic strategy, for the air forces [17]. In March 2021, the first Arctic strategy for the land forces was published, in which Russia and China were named the main competitors of the United States in the Arctic region [18]. The main goal of the strategy, according to the US Armed Forces, is that the military service can "quickly create and project its forces around the world, including with the help of soldier, specially trained and equipped to work in extremely cold weather conditions for a long time" [19]. The document declares three key goals that the country's Armed Forces plan to solve in the Arctic: protecting national interests and US territory, defending allied territory, and projecting power on a global scale. The USA pays great attention to the development of anti-missile, anti-aircraft and anti-submarine defense. There is a joint North American Aerospace Defense Command (NORAD) with Canada. Greenland (Tula) hosts the American military's missile warning infrastructure. American military personnel (as well as Canadian, Norwegian, Danish) participate in NATO tactical exercises, often at a considerable distance from the US Arctic zone (for example, Trident Juncture, Arctic Challenge, Cold Response Exercises, Arctic Edge, Bold Quest) [20]. At the same time, in the US Arctic strategy, much attention is paid to issues of "soft" security, for example, the participation of non-Arctic states in Arctic cooperation [8].

The United States, like other Arctic countries, is working to determine the outer limits of its continental shelf in the Arctic Ocean beyond the 200-mile exclusive economic zone. In particular, ideas are being put forward to expand the boundaries of the shelf to 600 nautical miles from the coast of Alaska (obviously, for the purpose of exploration and production of hydrocarbons, which is currently technologically unrealizable), as well as the construction of pipelines from Alaskan (North Slope of Alaska) fields across the Canadian territory [8]. Konyshev V.N. and Sergunin A.A., considering the evolution of US national interests in the Arctic, their economic and military interests, note: "... the Trump administration lifted Obama's ban on the development of oil and gas

[15] US Navy Arctic Roadmap. 2014–2030. URL: https://www.uaf.edu/caps/resources/policy-documents/us-navy-arctic-roadmap-2014-2030.pdf (accessed 31 July 2021).
[16] The US Coast Guard's new Arctic strategy highlights geopolitics and security. URL: https://www.arctictoday.com/the-us-coast-guards-new-arctic-strategy-highlights-geopolitics-and-security/ (accessed 12 April 2021).
[17] US Air Force, Space Force: Here Is Your New Arctic Strategy America's most active services in the region have a four-part plan to support the National Defense Strategy. URL: https://www.defenseone.com/ideas/2020/07/us-air-force-space-force-introduce-new-arctic-strategy/167088/ (accessed 25 April 2021).
[18] New US Arctic Strategy. URL: https://topwar.ru/181150-novaja-arkticheskaja-strategija-ssha.html (accessed 13 April 2021).
[19] US Army's first Arctic strategy looks to "regain dominance" in extreme cold conditions. URL: https://www.arctictoday.com/us-armys-first-arctic-strategy-looks-to-regain-dominance-in-extreme-cold-conditions/ (accessed 25 April 2021).
[20] US Arctic Strategy. URL: https://russiancouncil.ru/analytics-and-comments/analytics/arkticheskaya-strategiya-ssha/?sphrase_id=57176163 (accessed 10 February 2018).

fields in the Alaska National Petroleum Reserve and the Arctic National Wildlife Refuge, as well as offshore fields in the Chukchi and Beaufort Seas. President D. Trump also decided to withdraw from the 2015 Paris Agreement on climate change, which undermined one of the most important pillars of Obama's Arctic strategy…" [9]. At the beginning of 2021, one of the first decrees by President J. Biden returned the United States to the Paris climate agreement [21]. In the same year, the Office of the Special Envoy for Climate Change was established, and a person responsible for cooperation in this area was appointed. President Biden ordered to prepare a report on the impact of climate change on US security. J. Biden signed decrees prohibiting issuing new licenses for oil and gas drilling on federal land, and doubling the amount of electricity produced from offshore wind turbines by 2030 [22].

The United States supports freedom of navigation in the Arctic Ocean, including the Northern Sea Route (NSR). It considers the Northwest Passage (NWP) to be an international strait, since it connects two parts of the high seas (the Arctic and Atlantic oceans). From this point of view, the waterway is considered Canadian territory, but foreign ships have the right of peaceful transit through it. According to Canada, the NWP is an inland waterway (this statement causes disagreement among experts in different countries), and all foreign vessels are therefore required to request permission to pass through it. Canada also takes into account Article 234 of Section 8 "Ice-covered areas" of the UN Convention on the Law of the Sea in determining the status of the NWP. Non-participation in the procedures of this Convention damages the image of the USA, does not meet the interests of Russia (in the context of the NSR) and Canada, creates inconsistency in the position of the USA and its partners in the Arctic Council, increases the risks of unpredictable state behavior in any issue on the Arctic topic [8].

The "weak link" of the US Arctic policy, in addition to lack of awareness about the processes taking place in the Arctic, is the scarcity of icebreakers capable of operating year-round with scientific expeditionary (and military) purposes in the Arctic Ocean. It reduces the ability of the US to respond quickly to arising emergencies in the Arctic, especially anthropogenic accidents and disasters, search and rescue people and ships in distress [8].

In 2015–2017, the United States chaired the Arctic Council. Since 2014, all countries of the Arctic region have established sanctions against Russia, which, in turn, responded to them with counter-sanctions [10]. As a result, cooperation in the Arctic between states has been curtailed in many areas, especially in the development of minerals and fuels, and the development of transport infrastructure. Against the backdrop of continuing sanctions, the US government remains interested in supplying liquefied natural gas from the Russian Arctic, especially during the winter. Russia and the US promote cooperation between the Coast Guard to prevent poaching and

[21] SShA vozvrashchayutsya k obyazatel'stvam Parizhskogo soglasheniya po klimatu [The United States is returning to the obligations of the Paris climate agreement]. URL: https://tass.ru/mezhdunarodnaya-panorama/10510151 (accessed 13 June 2021).
[22] Klimaticheskiy den' v Belom dome [Climate Day at the White House]. URL: https://www.bbc.com/russian/news-55836074 (accessed 13 June 2021).

improve navigational safety in the Bering Sea and the Bering Strait. In 2015, a Joint Agreement of Intention was signed to develop multilateral cooperation in a standard Arctic forum on protection, which assumes an important role in resolving important issues and national security. The United States and Russia maintain mutual interest in joint research and development of education in the Arctic, including in indigenous communities, in climate research, and in predicting dangerous weather events, such as flooding of northern rivers. A telecommunication infrastructure assessment of the Arctic has been carried out for the first time at the initiative of the USA. The Agreement to prevent Unregulated High Seas Fisheries in the central Arctic Ocean extends to the high seas, i.e. beyond the exclusive economic zones of the circumpolar states [10, 11].

The US Arctic Strategy defines scientific research as the basis for solving the strategic problems of the Arctic development. During the US chairmanship of the Arctic Council, an Agreement on the development of international Arctic scientific cooperation was developed. This refers to the facilitation of international scientific research, which will contribute to the dissemination of research among scientists, the free exchange of scientific results, the facilitation of border crossing and the unification of statistics. The document identifies geographic areas where the parties to the agreement, in accordance with international law, will provide assistance in obtaining permits to conduct research, access to areas for research, etc. [10].

The Arctic Research and Policy Act (1984), the Arctic Policy Directive (2009), and the Arctic Research Plan for 2017–2021 may be considered the main documents that guide US research policy in the Arctic. According to the general documents, the research priorities are to "improve understanding" of the health of Arctic residents, opportunities to improve their well-being, climatic and atmospheric changes in the Arctic and their consequences, predicting changes in sea ice cover, cryosphere, ice caps, including the Greenland Ice Shelf, and their impact on climate, infrastructure, marine and freshwater ecosystems in the Arctic and their role in the climate system [23].

A distinctive feature of the US polar research structure is the multilevel integration of personnel, equipment and systems from federal services, agencies and councils (National Geological Survey, National Aerospace Agency, National Oceanographic and Geophysical Data Centers), the National Academy of Sciences and numerous universities which form research consortia with foreign partners [12]. Transnational corporations, the National Council for Science and Technology, the Department of State, the Ministry of Agriculture, the Ministry of National Security (Coast Guard), the Ministry of Transport, the Ministry of the Environment take part in the development of research topics. There are advisory councils under the President and the US Congress. US Department of Defense's Arctic-focused research programs include Marine Biology Research Program, Naval Research Office program that combines civilian and military initiatives in the Arctic. The goal of the programs of the Department of Oceanography and Cartography of the Navy is the

[23] Co-operation in the Arctic Science – Challenges and Joint Actions / Report of the 2nd Arctic Science Ministerial, 25-26 October 2018, Berlin, Germany, p. 84.

development of innovative tools, devices that provide the possibility of performing applied research in Arctic conditions [24].

The Science Initiative of the National Science Foundation "Navigating the New Arctic" contributes to the understanding of the nature of changes in biological, physical, chemical and human systems by creating a network of observations from mobile and stationary platforms using mathematical tools [25]. The Department of Energy is implementing the Next-Generation Ecosystem Experiments (NGEE-A) project [26], which aims to improve the prediction of climate change and understanding of related processes in Arctic ecosystems. The Regional Science Initiative of the Office of Naval Research Stratified Ocean Dynamics of the Arctic [27] (SODA) aims to study temperature fluctuations and water circulation in the Beaufort Sea Basin to better understand their role in sea ice behavior and radio wave propagation. The US Department of the Interior, within the framework of public-private US-Canadian programs, is conducting expeditionary studies of the Beaufort Sea and the Chukchi Sea [28].

The National Aeronautics and Space Administration (NASA) runs a program in the field of geosciences. It includes global research and modelling of the Arctic Ocean, polar atmosphere, ice, permafrost, carbon and ecosystems, which helps to understand trends in changes of the Arctic systems and the role of the Arctic in the global system. The NASA ICESat-2 mission aims to measure ice height, land topography, and vegetation characteristics to quantify changes in ice sheet mass balance, sea ice thickness, and large-scale changes in biomass [29].

Arctic research is managed and coordinated by the US Arctic Research Commission (USARC), which was created by the Arctic Research and Policy Act of 1984 [30] [12]. It participates in the development of a research strategy, organizes interaction on the implementation of the strategy with federal and municipal authorities, as well as with foreign partners, contributes to updating Arctic research programs, as well as to the exchange of information between participants. The Commission determines the goals and objectives of research in the Arctic, including the development of knowledge about natural resources, observation and forecasting of environmental changes, improving human health, developing infrastructure, including renewable energy sources, studying the sustainability of local communities, their language and culture [31]. The Commission supports fundamental research that "contributes to understanding" of engineering, physical, biologi-

[24] Co-operation in the Arctic Science – Challenges and Joint Actions / Report of the 2nd Arctic Science Ministerial, 25-26 October 2018, Berlin, Germany, p. 84.
[25] National Science Foundation. URL: https://www.nsf.gov/news/special_reports/big_ideas/arctic.jsp (accessed 10 April 2021).
[26] NGEE-A project. URL: https://ngee-arctic.ornl.gov/ (accessed 10 April 2021).
[27] SODA Science Initiative. URL: http://www.apl.washington.edu/project/ (accessed 10 April 2021).
[28] Bureau of Ocean Energy management. URL: https://www.boem.gov/ (accessed 10 April 2021).
[29] Co-operation in the Arctic Science – Challenges and Joint Actions / Report of the 2nd Arctic Science Ministerial, 25-26 October 2018, Berlin, Germany, p. 84.
[30] United States Arctic Research Commission. Report on the Goals and Objectives for Arctic Research 2015-2016, May 2015, p. 3.
[31] United States Arctic Research Commission. URL: https://www.arctic.gov/reports_goals.html (accessed 10 April 2021).

cal, geological, chemical, educational, social and cultural processes in the Arctic, as well as interactions and linkages among ocean, terrestrial, atmospheric, biological and human systems between Arctic and global systems. The USARC is made up of president-appointed representatives of the academic scientific community (4 members), corporations (2 members), and one representative of the Alaska Native people [13].

The National Oceanic and Atmospheric Administration (NOAA) supports research in weather forecasting and warning, sea ice extent and thickness, basic science to improve understanding and early detection of climate and ecosystem change, recommendations to improve marine and coastal resource management, and strengthening national and international cooperation [32].

Several universities are located in Alaska. The University of Alaska was founded in 1917 (more than 31.000 students, 7.000 employees, over 400 training programs from undergraduate to doctoral studies), it has campuses thousands of miles away from each other — the University of Anchorage (UAA), University of Fairbanks (UAF) and the University of Alaska Southeast (UAS) in Juneau. Each university includes colleges [33]. Their courses of study include engineering, the humanities and pedagogy, business, journalism, mass communication, aviation, philology, television and film, medicine, agriculture, climatology, biology, oceanography, geophysics and energy. The university receives federal subsidies, which are spent on research and academic projects, including the “UA Scholars scholarship program”. The Alaska Sea Grant program is operated in conjunction with NOAA. It promotes development of coastal communities and provides research and educational services through the Marine Advisory Program. Together with NASA, the Space Research Support Program in the field of aerospace sciences and geosciences is being implemented.

The University of Alaska Anchorage, founded in 1954, has over 18.000 students in the humanities, aviation technology, civil engineering, health sciences, social work, seismic engineering, ocean exploration technology, and graduate programs in biology and clinical psychology. The university has institutes and research centers that carry out studies on the northern (Arctic) topics: the Center for Educational Policy and Research of Alaska, the Institute for Social and Economic Research, the Center for the Study and Response to Health Problems, the Institute of Natural Resources and the Environment, the Law Center [34].

The University of Alaska Fairbanks (UAF) was founded in 1917 and has about 9.000 students and 2.500 employees [35]. The university consists of the Schools of Engineering and Mining, Fisheries and Ocean Sciences, Liberal Arts, Science and Mathematics, Rural and Local Development, Management, Natural Resources, and the College of Engineering. This is the main university in Alaska, which provides training for doctoral programs under the guidance of world-famous sci-

[32] National Oceanic and Atmospheric Administration. URL: https://www.noaa.gov/ (accessed 10 April 2021).
[33] University of Alaska. URL: https://www.alaska.edu/shapingalaskasfuture/about/ (accessed 10 April 2021).
[34] Research centers and institutes of the University of Anchorage. URL: https://www.uaa.alaska.edu/academics/departments/justice-center/ (accessed 10 April 2021).
[35] University of Alaska Fairbanks. URL: https://uaf.edu/facts/index.php (accessed 10 April 2021).

entists. Arctic research is conducted in the fields of climate, geography, geophysics, seismology and volcanology, supercomputing, marine research, biology, northern engineering, energy, transportation, Alaska Native languages and health, Arctic politics, security, emergency response, planning and forecasting of regional development. Outside of Fairbanks, the university's research infrastructure includes the Poker Flat test site, Toolik Lake station, the Juneau Fisheries Center, the Center for the Study of Marine Products and Oceanology on Kodiak Island.

The University of Alaska Southeast (UAS) was established in 1987 and has over 5.000 students. This division of the University consists of the School of Arts and Sciences, the College of Education, the School of Professional Training, the Alaska Maritime Training Center [36]. UAS conducts research activities with the Alaska Coastal Forest Center, the Alaska Pilot Program to Incentivize Competitive Research, the Pacific Northwest Division of Ecosystem Research, and the University of Fairbanks School of Fisheries and Ocean Sciences.

Alaska Pacific University was founded in 1957 in Anchorage and is a member of the Eco League, which brings together liberal arts colleges that implement programs in the field of humanities, human sciences, environmental protection and sustainable development [37].

The Alaska Vocational Technical Center — Institute of Technology (about 1.600 students) offers professional education programs in health care, business, accounting, information and communication technology, construction, energy and transportation [38].

The uniqueness of Ilisarvik College (founded in 1996, 1.700 students, 110 employees) is in the preservation of the cultural heritage of the Iñupiat [39]. The college implements educational programs in business, medicine, information and communication technology, emergency services, plumbing and construction, teacher education in the Arctic, and the film industry.

Prince William College Valdez [40] offers pre-university training and vocational programs in art, industrial technology, oil spill response and safety management, education and social services for the disabled, tourism management, information and communication technologies.

As other Arctic states, the United States focuses on supporting research infrastructure for expeditionary and field research. Biological and physical studies of the ecosystem of the Beaufort Sea lagoon and the North Gulf of Alaska are carried out at Toolik Station. The Utqiavik station measures atmospheric radiation, conducts research in astrophysics and atmospheric air monitoring. Similar tasks are solved by the Summit station in Greenland, managed jointly with the government of the island.

[36] University of Alaska Southeast. URL: http://uas.alaska.edu/about/index.html (accessed 10 April 2021).
[37] Alaska Pacific University. URL: http://www.thebestcolleges.org/schools/alaska/alaska-pacific-university/ (accessed 10 April 2021).
[38] Alaska Vocational Technical Center — Institute of Technology URL: https://avtec.edu/avtec-information/about-us (accessed 10 April 2021).
[39] Ilisarvik College. URL: http://www.ilisagvik.edu/recognition-for-growing-enrollment/ (accessed 10 April 2021).
[40] Prince William College Valdez. URL: https://pwsc.alaska.edu/about/index.cshtml (accessed 10 April 2021).

The US has vessels capable of performing a wide range of research in the Arctic: the Sikuliaq, a survey ship that facilitates ice research, is owned by the National Science Foundation. The US Coast Guard operates the icebreakers Healy and Polar Star [41].

Thus, the strategic goal of the US research policy in the Arctic region derives from its Arctic strategy and is to ensure comprehensive national security and sustainable economic and social development in Alaska and throughout the Arctic. For this, long-term interdepartmental and interdisciplinary research projects have been developed, which are implemented in synergy between the state, private corporations, universities, civil and military scientists, international scientific groups and associations of countries. Priority research in the Arctic in the United States covers a wide range of areas of fundamental and applied science: from the study of processes of climatology, ecology, geoecology, glaciology, biology, medicine, inclusive education, history and rights of indigenous peoples to issues of ensuring national and global military and economic security [12, 14].

Canada's Arctic strategy and approaches to implementing it in research and development

In Canada, the concept of "North" is broader than the concept of "Arctic". The concept of "Northerness" is relatively deeply grounded and researched in Canadian geography. The main criterion for the southern border of the North in Canada is the isotherm of the warmest month — 10°, and the average annual temperature — not higher than 0°. The Canadian geographer R. Gaida divides the country into zones with varying degrees of development and determines the boundaries of the North on this basis. According to G. A. Agranat, the undeveloped areas in Canada extend into mid-latitude forest, steppe and mountainous regions in the South, and that is why their boundaries cannot be used as boundaries of the North [15, p. 27].

In 1967, R. Philips, recognizing that "it is difficult to define the North", proposed to return to the administrative-political criterion and to accept only the Yukon and the Northwest Territories as the North. In 1970, C.J. Rea's monograph "The Political Economy of the North" was published, where the author analyzes the development of the North as an economy of undeveloped areas. Rea proposes a zoning of the North of Canada based on the administrative-territorial division, as a result of which the northern regions of the provinces and territories located above 60° N were assigned to the North — Yukon and northwest territories [15, p. 28].

In 1948, Canadian geographer L.E. Hamelin made an attempt to zone the North using a scoring system. He identified several physical-geographical and economic-geographical features of peripheral territories: geographical latitude, summer and winter temperatures, the duration of seasonal soil freezing, precipitation, forest cover, transport accessibility (by land and air), population density, economic development. Basic calculations were made in 1965, and in 1968, he refined his work by dividing Canada into the Middle, Great and Far North according to the degree of "northerness". An attempt to solve the problem of zoning the North on the basis of combining

[41] Co-operation in the Arctic Science – Challenges and Joint Actions / Report of the 2nd Arctic Science Ministerial, 25-26 October 2018, Berlin, Germany, p. 85.

qualitative and quantitative indicators was made, but it was not widely implemented and was not used in national legislation. One of the reasons is the use of signs that characterize not only the zone of the North, but also other areas that are not very favorable for the permanent life of the population. The methods used indicate the arbitrariness and insufficient justification of the calculation of points. As a result, the St. Lawrence River region, and the mountainous regions of Asia can also be assigned to the zone of the North, despite the lack of a specific "northern" score. Hamelin considers the North to be more of a historical-geographical concept than a physical or economic-geographical one, he believes that the higher the degree of development of the territory, the less "northern" it is. As a result, Hamelin concludes that some areas may lose their "northerness" as they are developed, which threatens all the northern regions of the Earth and is difficult to agree with [15, pp. 39–41].

The polar sector of Canada is formed by the federal territories of Yukon, Nunavut, the Northwest Territories, Newfoundland and Labrador, and partially by the provinces of British Columbia, Alberta, Saskatchewan, Manitoba, Quebec and Ontario, all lands north of 60° N and the coastal area of Hudson Bay and James Bay, the northeast cape on Ellesmere Island, and the Beaufort landfall of the Canada-US border. The area of the northern territories is 4.3 million km^2 (21% of the Arctic), which is the second largest area in the world after Russia [8, p. 87]. The Canadian North has been developed to a much lesser extent than the Arctic zone of the Russian Federation, both in socio-economic and military terms. About 110 thousand people live in the territories of the Canadian North [42] (against 2.5 million people in the subjects of the Russian Arctic).

In 2004, the "Fundamentals of the Northern Strategy" were developed, in 2009 it was updated under the new name "Canada's Northern Strategy: Our North, Our Heritage, Our Future", which determined the long-term goals for the development of the country's Far North and, according to some researchers, had more of an "inward" than an "outward" (as an example — the United States) focus on the Arctic region [43]. Canadian policy in the North has been implemented for a long time under the slogan "Develop or lose", which implies the need for comprehensive development of the peripheral territories with regular and mixed, public-private funding [8, p. 88]. In 2013, Canada's northern policy was determined by the following goals: protecting the country's sovereignty in its polar sector; ensuring the socio-economic development of the North; taking measures to protect the environment and to adapt to climate change; development of self-government, economic and political activity of the northern territories.

When developing a new Arctic strategy, in September 2019, the Canadian government published a framework document defining the state's policy in the Arctic and the northern regions of the country up to 2030 [44]. It emphasizes international cooperation, although at present it "has

[42] Statistics about the Canadian North. URL: https://arcticstat.org/research (accessed 10 May 2020).
[43] Canada's Northern Strategy. Our North, Our Heritage, Our Future / Government of Canada, Ottawa, 2009. 48 p.
[44] Canada's Arctic and Northern Policy Framework. URL: https://www.rcaanc-cirnac.gc.ca/eng/1560523306861/1560523330587 (accessed 10 May 2020).

an impulsive character, and the authorities do not have clear development plans for the region" [45]. Canada's Arctic and Northern Policy 2019 contains statements about the need to address the strategic challenges facing the northern regions of the country. At the same time, the document does not outline a specific plan with a list of measures and their funding to resolve these challenges. The Strategy identifies eight priorities for federal government policy up to 2030: health and social well-being of northern and indigenous people; development of energy, transport and communication infrastructure; a strong, sustainable, diversified and inclusive northern economy; knowledge-oriented approach in decision making; sustainability and health of the Arctic environment; harmonization of relations between indigenous and non-indigenous peoples; a law-based international order in the region that effectively responds to new challenges and opportunities; ensuring the safety and security of the Canadian Arctic and its inhabitants.

Priority areas for Canada in the Arctic at the global level include strengthening sovereignty over the Canadian Arctic Archipelago and adjacent water areas; determination and consolidation of the outer boundaries of the country's continental shelf in the Arctic Ocean and the search for legal opportunities to solve the remaining border problems; development of cooperation with the Arctic and non-Arctic states in accordance with the 2030 Agenda for Sustainable Development [46].

Since the beginning of the 21st century, Canada's foreign policy in the North and the Arctic relied on its neighbor and historical ally — the United States. There is a desire to finally overcome differences over the use of the NWP and the drawing of a demarcation line in the southern Beaufort Sea, as well as disputes with Denmark over the uninhabited island of Hans in the Kennedy Channel in northern Greenland ("the intelligent war of whiskey and schnapps" almost "ended" in 2012, when Denmark adjusted its baseline defining approach). In May 2019, Canada (and previously Denmark, Russia) filed a 2100-page application ("submission") to the UN Commission on the expansion of the continental shelf in the Arctic Ocean around the Lomonosov and Mendeleev ridges over an area of more than 1.2 million km^2 [47].

During its chairmanship of the Arctic Council (2013–2015), Canada supported its work, and at the ministerial session in Kiruna in 2013, it was decided to expand the observer countries of the Arctic Council [48]. With the participation of Canadian experts in Kiruna, an Agreement on cooperation in the field of preparedness and response to marine oil pollution in the Arctic was signed, an agreement on the creation of the Arctic Economic Council and a collective fund for financing environmental projects was reached. The second Arctic Human Dimension Report was prepared, which is of interest for Arctic socio-economic policymaking and promoting the interests of indigenous peoples in environmental management in the northern and arctic regions [16].

[45] Igra na vtorykh rolyakh: kuda vedet arkticheskaya politika Kanady [Playing a sideline: where Canada's Arctic policy leads]. URL: https://goarctic.ru/abroad/igra-na-vtorykh-rolyakh-kuda-vedyet-arkticheskaya-politika-kanady/ (accessed 15 May 2021).
[46] Arctic and Northern Policy Framework International chapter. URL: https://www.rcaanc-cirnac.gc.ca/eng/1562867415721/1562867459588 (accessed 10 May 2021).
[47] Ibid.
[48] Arctic Council (observer countries). URL: https://arctic-council.org/ru/about/observers/(accessed 10 May 2021).

Scientific research in Canada is considered as one of the tools for the implementation of the northern (Arctic) policy. In this sense, there are similarities with the organization of US research activities in the Arctic. The Canadian Arctic Research Program 2030 includes significantly more social science research for the development of indigenous peoples than ever before. Traditional knowledge of local communities and modern scientific knowledge will be equally taken into account when making government and corporate decisions. International cooperation plays a major role in closing gaps in knowledge about a changing environment and how to adapt to it, especially given the complexities associated with Arctic and northern science. At the international level, Canada will "intensify its efforts to protect indigenous knowledge" and "promote stronger international research collaboration" by 2030 [49].

In 2014, the Science, Technology and Innovation Strategy was adopted in Canada, which focuses research on priorities of health and life sciences, natural resources and clean energy, information and communication technologies, research and environmental protection [10] . In the same year, the Canadian Research Council developed the Arctic Research Program. The document formulates priority research areas: the use of natural resources, the development of transport and social infrastructure, the sustainable development of the northern region, the adaptation to climate change, the creation of highly qualified jobs, and the improvement of the population's well-being. In 2009, a Science Development Strategy was adopted in the Northwest Territories, with priorities including sustainable development, management of natural resources, cultural diversity, and public health and welfare [50].

Established in 1991, the Canadian Polar Commission (CPC) is mandated to monitor research activities, provide interface between national research centres and universities and foreign scientific organizations, including for mutual access to research infrastructure. The Commission ensures the interaction of research and educational organizations with the Sustaining Arctic Observing Network (SAON), established at the initiative of the Arctic Council in 2007 as part of the International Polar Year 2007–2008, by the Association of Canadian Universities for Northern Studies (42 educational institutions) and the Network of Canadian Competence Centers (ArcticNet), which unites about 150 scientists from universities, experts from federal and regional departments [12]. The prerequisite for the creation of SAON was the need to combine the resources of different countries to perform long-term observations in the Arctic and obtain open, free and timely access to data to ensure the solution of pan-Arctic and global problems [51].

In 2015, the Canadian Polar Research Agency (POLAR) [52] was established on the basis of the CPC. It is a member of the International Arctic Science Committee and the Scientific Committee of

[49] Canada's Arctic and Northern Policy Framework. URL: https://www.rcaanc-cirnac.gc.ca/eng/1560523306861/1560523330587 (accessed 10 May 2021).
[50] Canada's Northwest Territories Science Development Strategy (2009). URL: http://nwtresearch.com/sites/default/files/nwt_science_agenda.pdf (accessed 01 November 2019).
[51] Sustaining Arctic Observing Network (SAON). URL: http://www.arcticobserving.org/ (accessed 11 November 2019).
[52] Canadian Polar Research Agency (POLAR). URL: http://www.canada.ca/en/polar-knowledgel (accessed 01 November 2019).

Antarctic Research. The focus of the Agency's scientific research is formed by tasks, including the accumulation and dissemination of new knowledge about the Arctic, the development of the Canadian Arctic Research Station (CHARS). POLAR activities include environmental monitoring, modeling and forecasting of environmental changes, educational activities.

With the CPC support, the Canadian Northern Studies Trust (CNST) annually provides targeted funding for training in the natural sciences, social sciences, humanities and engineering disciplines for about 300 students from 35 universities [10].

The backbone of Canada's Arctic scientific infrastructure is the Canadian Network of Northern Research Operators (CNNRO), which includes a research station in Cambridge Bay, stations of McGill University, the University of Calgary, the universities of La Val, Alberta, British Columbia, technical resources of federal services and national space agency. The main goal of CNNRO is contribution to the sustainable development of northern territories and local communities by supporting research and creating a knowledge agency in the North of Canada [53] [12].

Laval, Quebec, hosts the headquarters of the Network of Centres of Excellence of Canada (ArcticNet) [54]. It is an international association for Arctic scientists and managers working together with partners, especially from indigenous communities, on research, health, social sciences and humanities. The task of the network is to accumulate knowledge in the field of climate change, adaptation to it and the industrialization of the coastal regions of the Canadian North. The research program includes projects on key topics: northern policy, maritime systems, Inuit health, education, adaptation and economic development, knowledge transfer in Inuit territories.

The Social Economy Research Network of Northern Canada, consisting of Aurora College, Nunavut Arctic College and Yukon College (University), unites scientists working in the North in the fields of social economics, resource management, public policy, socio-economic development of the region, indigenous peoples [55].

The Department of Natural Resources of Canada operates the Geo-mapping for Energy and Minerals Program, which aims to increase the degree of geological exploration of the Canadian North, enabling the involvement of northern communities in the use of mineral and land resources to preserve the environment and create new economic development opportunities. The Department of Indian Affairs and Northern Canada initiated the Northern Contaminants Program. It includes measures to conduct environmental, social, medical monitoring of indigenous communities, which contributes to the prevention of their health, disturbed as a result of the entry of pollutants into their traditional habitat [56].

[53] Canadian Network of Northern Research Operators (CNNRO). URL: http://cnnro.ca (accessed 10 April 2021).
[54] Network of Centres of Excellence of Canada (ArcticNet). URL: http://www.arcticnet.ulaval.ca/ (accessed 10 April 2021).
[55] Social Economy Research Network of Northern Canada. URL: http://yukonresearch.yukoncollege.yk.ca/sern/aboutsernnoca/ (accessed 10 April 2021).
[56] Co-operation in the Arctic Science – Challenges and Joint Actions / Report of the 2nd Arctic Science Ministerial, 25-26 October 2018, Berlin, Germany, p. 35.

The Association of Canadian Universities for Northern Studies, established in 1978, brings together more than 40 Canadian universities that provide training and research for the development of the North and the Arctic. Its mission is to organize discussions on northern research and education, and to promote northern research and education through international cooperation, including a grant system (using the Canadian Research Support Fund) [57].

As in other northern states, there is a strong emphasis at the national level to support both expeditionary and field research infrastructure. The Canadian High Arctic Research Station (CHARS) has been operating since 2007 in Cambridge Bay, Nunavut, as a world-class, year-round multidisciplinary science and technology hub. CHARS promotes international partnerships between scientists, indigenous peoples, the public and private sectors. The research program is focused on the priorities identified by Canada's northern strategy and is in line with responsible social, economic and environmental policies in the Arctic [58]. Canada uses a constellation of satellites operated by the national government to carry out research activities: RADARSAT-2 (a polar orbiting satellite that collects images in various weather conditions), RADARSAT Constellation Mission (an orbital system of several satellites in geostationary orbit, providing observation of the Arctic region), SCISAT (collects data that provides a view of the stratosphere and the Earth's ozone layer) [59].

Canada uses a fleet of icebreaking vessels for research on natural resources in the North and Arctic zones. The Coast Guard's icebreaker fleet is used for both applied and fundamental tasks in the Arctic, with seven vessels (only two are operational). The 13600 hp diesel-powered icebreaker Amundsen (13600 hp) is owned by the Government of Canada and operated by the Coast Guard, equipped with laboratory and field equipment to support research in the natural, medical and social sciences. During summer operations, scientific activities in the Arctic are supported by the icebreakers Louis S St-Laurent and Sir Wilfrid Laurier Amundsen. Martin Bergmann is a research vessel operated by the Arctic Research Foundation. Nuliajuk is a multi-purpose research vessel of the Government of Nunavut dedicated to study and sustainable development of fisheries in Northern Canada [60]. It should be noted that Canada, like the United States, does not have its own nuclear-powered icebreakers, which underlines the relevance of maintaining and developing relations with the Russian Federation. In 2008, Canada announced plans to build the heavy icebreaker John Diefenbaker, but as of 2020, work has not started yet [61].

The only educational institution in the Northwest Territories of Canada is Aurora College (founded in 1968, 600 students, 400 employees) with campuses in Tebach (in Fort Smith), Yellowknife and Aurora (in Inuvik) and a network of dozens of educational centers throughout the region.

[57] Association of Canadian Universities for Northern Studies. URL: http://acuns.ca/en/ (accessed 10 April 2021).
[58] Canadian High Arctic Research Station. URL: https://www.canada.ca/en/polar-knowledge/constructingstation.html (accessed 10 April 2021).
[59] Co-operation in the Arctic Science – Challenges and Joint Actions / Report of the 2nd Arctic Science Ministerial, 25-26 October 2018, Berlin, Germany, p. 36.
[60] Co-operation in the Arctic Science – Challenges and Joint Actions / Report of the 2nd Arctic Science Ministerial, 25-26 October 2018, Berlin, Germany, p. 37.
[61] Ibid.

The college implements specialist training programs and university-level applied bachelor's programs for business administration, education, healthcare, and social work. The college conducts research and development in the fields of water resources, air quality, permafrost, the use of alternative energy sources, northern building technologies, agriculture, food technology development in order to ensure food security and protect the health of the local population [62]. The college has a research institute responsible for licensing and coordinating research, communication with the scientific community, government and the public. The main areas of research are ecology, geology, biology and atmospheric research [63].

Higher education programs in Nunavut are provided by the College of the Arctic (founded in 1995, over 1500 students and 250 employees), which has campuses in Iqaluit, Cambridge Bay and Rankin Inlet. The college consists of educational centers, a research institute and a specialist training center [64]. The college specializes in the training of personnel for indigenous peoples in undergraduate programs in ecology, biology, management, medicine, pedagogy and social work. These programs are carried out in collaboration with the universities of Canada: the University of Regina (teacher training program) and Dalhousie University (nursing) [65]. The Research Institute is an advisory body under the government of Nunavut, it acts as an information center, provides guidance to scientists working in the area (including supporting expeditionary research) [66].

Yukon offers higher education programs at Yukon College (established in 1963, over 7000 students and 700 employees) [67]. The college promotes education, acts in the interests of indigenous peoples and supports their culture. Educational programs are integrative, with a focus on the study of the North: management of renewable resources, training of teachers and social workers, implemented jointly with the University of Regina, jurisprudence, protection and conservation of the environment, implemented jointly with the University of Alberta, master of business administration, in conjunction with the University of Alaska Southeast. Research at the college is conducted in the following areas: climate change and adaptation, biochar research, water purification, alternative energy sources, cold climate mining technologies, permafrost, food security, information and communication technologies, health and well-being of the population. The structure of the college includes the Yukon Research Center, which deals with issues of climate change, glaciology, hydrology, geology, cryosphere, terrestrial biology and ecology, law, and indigenous traditional knowledge. The college's research infrastructure includes a metal analysis laboratory, water treatment bioreactors, a permafrost assessment laboratory, and a social sciences laboratory [68].

[62] Aurora College. URL: http://www.auroracollege.nt.ca/_live/documents/content/Annual_Report.pdf (accessed 10 April 2021).
[63] Canadian Network of Northern Research Operators (CNNRO). URL: http://cnnro.ca (accessed 10 April 2021).
[64] College of the Arctic. URL: https://www.arcticcollege.ca/about (accessed 10 April 2021).
[65] UArctic University. URL: https://www.uarctic.org/member-profiles/canada/8665/nunavut-arctic-college (accessed 10 April 2021).
[66] Research Institute. URL: https://www.nri.nu.ca/ (accessed 10 April 2021).
[67] Ucon University. URL: https://education.uarctic.org/universities/canada/8940/yukon-university (accessed 10 April 2021).
[68] Yukon College. URL: https://www.yukoncollege.yk.ca/research (accessed 10 May 2020).

Thus, for the scientific and educational space of the provinces and territories of northern Canada, a high degree of integration of science and education in the region, their interconnection and orientation towards international cooperation should be noted. University colleges train specialists in a wide range of disciplines, revealing current areas of Arctic research. They conduct research expertise and organize theoretical and applied research in accordance with the socio-economic needs of the region and the national strategy for the development of the High North.

Conclusion

The relevance of the Arctic issues over the past decades is due to objective factors, primarily the fact that irreversible transformations are currently taking place there. They are determined by two main and interrelated factors — climate change and globalization, followed by geopolitical, technological, organizational and institutional transformations. Rapid changes in the natural environment of the Arctic are reflected at all levels of education and research topics. There is a lack of knowledge of current processes and their consequences for more than 4 million inhabitants near and beyond the Arctic Circle. Therefore, much attention abroad (as well as in Russia) is paid to the organization of applied and fundamental research in the field of studying the impact of climate change (considered in the context of air temperature increase in the Arctic region exceeding the world average by 2–4 times) on the state of ice, ecosystems of the Arctic Ocean and its coasts, environmental pollution, the vital activity of indigenous peoples. The countries of North America are no exception here.

Having considered the features of the research policy of the USA and Canada in the Far North and in the Arctic region, we can conclude that the foundations of such a policy are formulated in the national strategies of both countries. The interest in the Arctic from the US and Canada is due to economic benefits, the strategic geographical position of the Arctic, the passage of transport communications in the Arctic Ocean, the use of natural resources by indigenous peoples, who are the first to feel changes in the climate system of the Arctic and the consequences of these processes. In recent years, the increased activity of Russia and China in the Arctic can be added to this list of reasons. In the 21st century, the United States and Canada have defined a very broad range of research areas and actors in the Arctic. The governments of both countries are inclined to expand international cooperation and involve business and the scientific community in science-based decision-making on the Arctic agenda in order to implement research policies. Cooperation tools include multilateral projects, circumpolar mobility through the Arctic Council, the University of the Arctic and cooperation programs at the national level.

Despite its relevance, the topic remains insufficiently studied. The significance of the article lies in attracting the attention of Russian scientific and educational, research organizations, and the business community to cooperation with partners from the Arctic countries in the field of improving scientific and educational technologies in the interests of sustainable socio-economic development and environmental management in the Arctic territories.

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On the Conceptual Model of Balanced Socio-Economic Development of the Arctic Territories *

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Abstract. The article deals with the key aspects of the formation of the integrated socio-economic development of the Arctic zone of the Russian Federation (AZRF). The main purpose of the study is to create a conceptual model for balanced socio-economic development. The article uses such methods as comparison, analysis, deduction and induction. The importance of the development of these territories for the sustainable development of the country is shown. The main regulatory documents defining the development of this region are highlighted. Threats to the security of the Arctic zone of the Russian Federation are identified. The relations of other countries to the Arctic are considered. The importance of bringing the standard of living in the Arctic region closer to the average in Russia and the importance of this direction of action to reduce the negative demographic trend are outlined. Besides, the need to study the development of the Arctic region of the Russian Federation is determined not by statistical methods, but by new research methods. The importance of creating a megaproject for the development of the Arctic zone of the Russian Federation with specific measurable goals is highlighted. Such risks of this region are described as: population decline, in particular, the decline of the able-bodied population (including highly qualified personnel), the critical state of housing and communal services, the high cost of living and use of resources, the threat to environmental safety, weak diversification of production, long distances from industrial centers. Economic, social and environmental factors affecting the dynamics of the integrated socio-economic development of the Arctic region of the Russian Federation are considered. A conceptual model of balanced socio-economic development of the region was developed on the basis of a set of factors. The conceptual model of integrated development of the Arctic regions of the Russian Federation is a complex of various factors. This model can become a basis for the preparation of strategic planning documents in the regions of the Arctic zone of the Russian Federation and it is possible to compare and compare the development of the regions using this model.
Keywords: *Arctic, Arctic zone of the Russian Federation, integrated socio-economic development, conceptual model*

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Introduction

The basis of the socio-economic balance of the state is the successful policy of the regions as constituent parts of the country. The state economy will be stable and competitive only with a balanced development of all its regions [1, Lundberg H., Pasillas M., Högberg A., pp. 23–40]. This is of particular importance for the Russian Federation with the diversity of its climate, natural resources, culture and population. Each region, with its relative independence from the center, faces a problem: how to distribute resources in the conditions of deficit and uncertainty in the best way, while increasing budget revenues, investment attractiveness of the region, real income of the population, reducing socio-political risks and solving the social problems of the region [2, Ignatova T.V., Pavlyukova A.V., pp. 171–173]. One of the main tasks of the state today is the most efficient redistribution of excess profits from the export of energy resources and the concentration of resources in innovative industries [3, Vaisman E.D., Boos V.O., pp. 130–139]. The Russian Federation has the longest Arctic coast, and the country needs to make great efforts to develop it [4, Sukhareva E.O., pp. 43–45]. Despite the all-Russian policy, each region should pursue a policy taking into account its own peculiarities, since there is no single “recipe” for all the constituent parts of the country.

The aim of the work is to compile a conceptual model of the integrated socio-economic development of the Arctic regions.

For the socio-economic development of the region to be balanced, it is necessary to create a large, comprehensive project for the implementation of favourable conditions of human life in the region, affecting all its aspects. The most effective version of such a project, in our opinion, is a conceptual model that briefly and clearly shows what components are necessary for a balanced socio-economic development of the region and a decent life for each person. This direction is especially important for the Arctic regions of the Russian Federation as for strategically important, but sparsely populated.

Degree of study of the problem

The conceptual model of the integrated socio-economic development of the Arctic regions is poorly developed as a whole, but its separate topics are quite well elaborated. It turns out that we need to compare information about the conceptual models and the socio-economic development of the Arctic regions.

Theory / methodology of research

The Russian Arctic includes territories with natural resource deposits, access to which is currently limited by natural and climatic features. However, over the past 30 years, the area and duration of the ice coverage of these areas has significantly decreased, and they will soon become

the basis of the country's resource supply [1]. That is why it is so important to study the Arctic. The main objective of balanced socio-economic development of the territories is to combine the social, economic and environmental characteristics of the region. The goal of the balanced socio-economic development of the AZRF is to increase the potential of the Arctic regions.

It should be noted that the study of the Russian Arctic using statistical information is difficult, since some of the regions are only partially included there, and the indicators may be distorted. Therefore, in addition to statistical information, it is necessary to introduce observation, comparison, and surveys.

At the moment, the state policy in the Arctic is carried out through:

- Decree of the Government of the Russian Federation of February 13, 2019 No. 207-r "On approval of the spatial development strategy up to 2025" [2];
- Decree of the President of the Russian Federation of May 2, 2014 No. 296 "On land territories of the Arctic zone of the Russian Federation" [3];
- Decree of the President of the Russian Federation of March 5, 2020 No. 164 "On the fundamentals of the state policy of the Russian Federation in the Arctic for the period up to 2035" [4];
- The State Program of the Russian Federation (approved by the Government Decree of April 21, 2014 No. 366) "Socio-economic development of the Arctic zone of the Russian Federation" [5];
- Federal Law of June 28, 2014 N 172-FZ "On strategic planning in the Russian Federation" [6];
- Federal Law of July 13, 2020 N 193-FZ "On state support for entrepreneurship in the Arctic Zone of the Russian Federation" [7].

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[1] Compiled by the authors according to: Regions of Russia 2019. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 07 December 2020).

[2] Rasporyazhenie Pravitel'stva RF ot 13 fevralya 2019 g. № 207-r «Ob utverzhdenii Strategii prostranstvennogo razvitiya do 2025 goda» [Decree of the Government of the Russian Federation of February 13, 2019 No. 207-r "On approval of the Spatial Development Strategy up to 2025"]. URL: http://government.ru/docs/35733/ (accessed 07 September 2020).

[3] Ukaz Prezidenta Rossiyskoy Federatsii ot 02.05.2014 g. № 296 «O sukhoputnykh territoriyakh Arkticheskoy zony Rossiyskoy Federatsii» [Decree of the President of the Russian Federation of 02.05.2014 No. 296 "On land territories of the Arctic zone of the Russian Federation"]. URL: http://www.kremlin.ru/acts/bank/38377 (accessed 07 September 2020).

[4] Ukaz Prezidenta RF ot 5 marta 2020 g. № 164 «Ob Osnovakh gosudarstvennoy politiki Rossiyskoy Federatsii v Arktike na period do 2035 goda» [Decree of the President of the Russian Federation of March 5, 2020 No. 164 "On the Fundamentals of the State Policy of the Russian Federation in the Arctic for the period up to 2035"]. URL: https://www.garant.ru/products/ipo/prime/doc/73606526/ (accessed 07 September 2020).

[5] Gosudarstvennaya programma RF (Utverzhdena postanovleniem Pravitel'stva ot 21 aprelya 2014 goda №366.) «Sotsial'no-ekonomicheskoe razvitie Arkticheskoy zony Rossiyskoy Federatsii» [The State Program of the Russian Federation (Approved by the Government Decree of April 21, 2014 No. 366.) "Socio-economic development of the Arctic zone of the Russian Federation"]. URL: http://government.ru/rugovclassifier/830/events/ (accessed 07 September 2020).

[6] Federal'nyy zakon ot 28.06.2014 N 172-FZ «O strategicheskom planirovanii v Rossiyskoy Federatsii» [Federal Law No. 172-FZ of June 28, 2014 "On strategic planning in the Russian Federation"]. URL: http://www.consultant.ru/document/cons_doc_LAW_164841/ (accessed 07 September 2020).

This list is not exhaustive. But, unfortunately, none of the documents contains a specific action plan with precise figures which can be used to determine whether the goal has been fulfilled or not. As an example let us consider the Decree of the President of the Russian Federation dated March 5, 2020 No. 164 “On the Fundamentals of the State Policy of the Russian Federation in the Arctic for the period up to 2035”. It contains the following goals:

- Improving the quality of life of the AZRF population;
- Acceleration the economic development of the Russian Arctic;
- Preservation of the habitat of small peoples and environmental protection;
- Implementation of cooperation on the principles of mutual benefit and peaceful resolution of all disputes in the Arctic on the basis of international law;
- Protection of the national interests of the Russian Federation in the Arctic.

The importance of these goals is undeniable, and they are certainly priorities, but they do not contain specific numbers. Therefore, it is very difficult to discuss their achievement. That is why it is necessary to draw up a separate document reflecting the complete list of goals that need to be achieved in order for the Russian Arctic to develop in a balanced way. To some extent, the National Projects meet these criteria, but they poorly take into account such ***risks*** as a ***decline in the number of inhabitants***, in particular, loss of the working-age population (especially highly qualified personnel). Let us consider the population and the working-age population in the Arctic regions of the Russian Federation in Fig. 1, 2, 3.

Fig. 1. Population in the Russian Federation, thousand people [8].

[7] Federal'nyy zakon ot 13.07.2020 N 193-FZ «O gosudarstvennoy podderzhke predprinimatel'skoy deyatel'nosti v Arkticheskoy zone Rossiyskoy Federatsii» [Federal Law No. 193-FZ of July 13, 2020 “On state support for entrepreneurial activities in the Arctic Zone of the Russian Federation”]. URL: http://www.consultant.ru/document/cons_doc_LAW_357078/ (accessed 07 September 2020).

[8] Compiled by the authors according to: Regions of Russia 2019. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 07 December 2020).

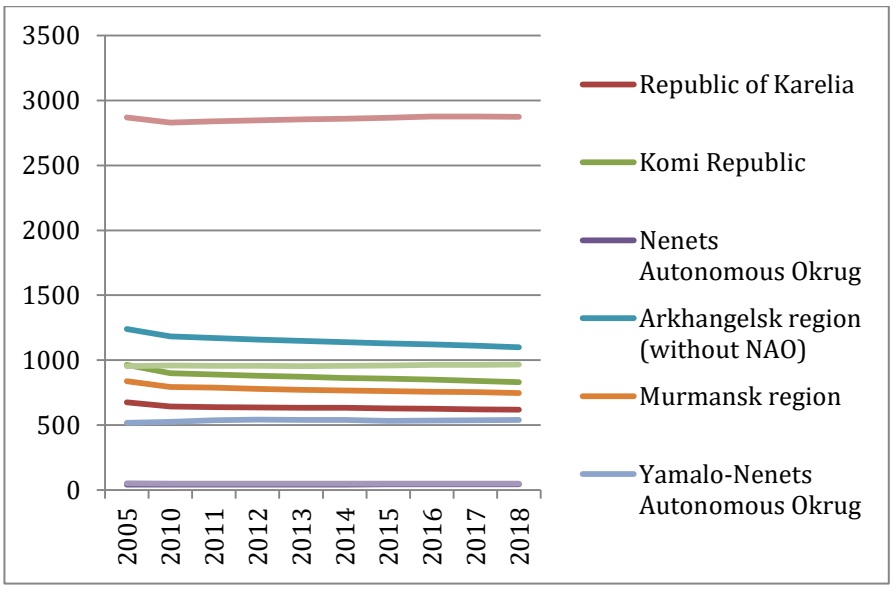

Fig. 2. Population in the Arctic zone of the Russian Federation, thousand people [9].

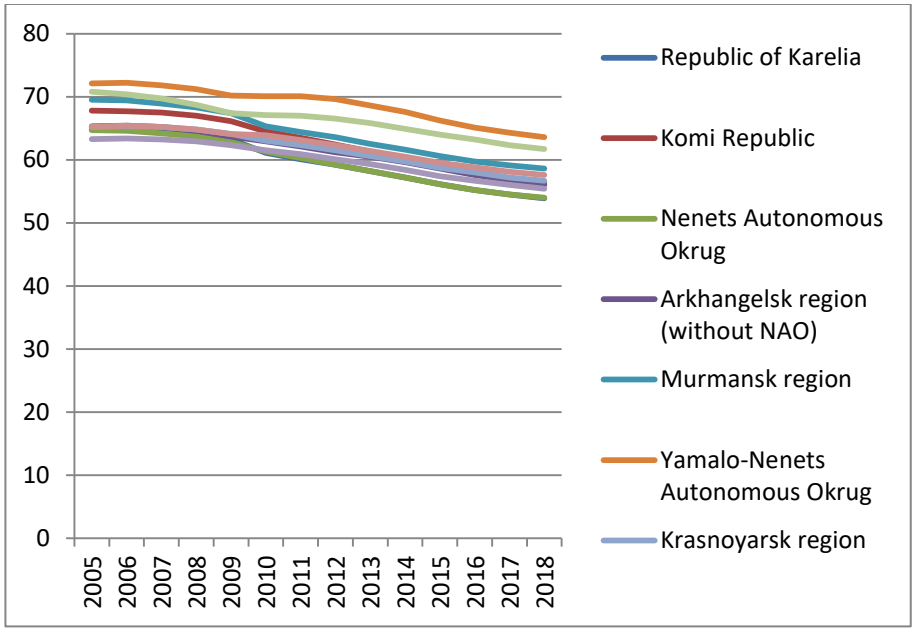

Fig. 3. The percentage of the working-age population in the regions of the Arctic zone, % [10].

As can be seen from Fig. 1, 2, 3, despite the increase in the population in the Russian Federation, most AZRF regions experienced a decline in population over the period under study. Despite the general decrease in population in most regions of the Russian Arctic, all regions of the Arctic Zone have observed a drop in the percentage of the working-age population, which means, in dynamics, a significant decrease in the labor force in these regions. The decline in number of able-bodied population is due to the lack of jobs and the poor state of housing and communal services, etc.

[9] Compiled by the authors according to: Regions of Russia 2019. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 07 December 2020).
[10] Ibid.

In the political area of the Russian Federation in the Arctic zone, there is a prevalence of solutions to the problems of large-scale commercial activities (oil and gas production) over socio-economic development [7, Klimentieva 2017, pp. 4–11].

Critical state of housing and communal services. Let us consider the share of dilapidated housing stock in the total area of the entire housing stock in Fig. 4.

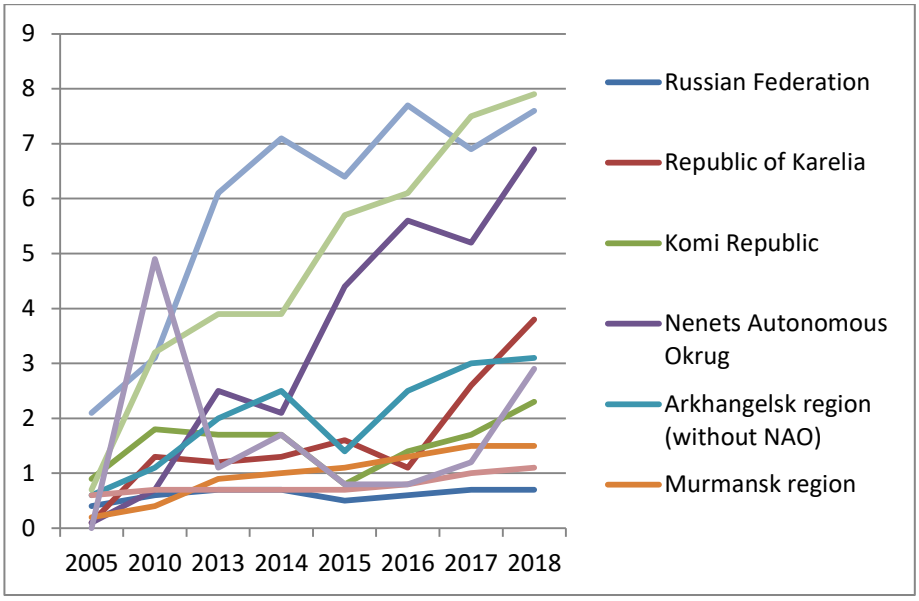

Fig. 4. The share of dilapidated housing stock in the total area of the entire housing stock, % [11].

As shown in Fig. 4, since 2014, the proportion of emergency housing on average in the Russian Federation is less than in the regions of the Arctic zone of the Russian Federation. This is due to the complexity of building, as well as low population density. One of the main factors in the social well-being of citizens is the provision of housing and residential infrastructure.

We also note that there are difficulties with water supply, sanitation and the supply of electrical energy in the Russian Arctic.

High cost of living and resource use. Let us consider the share of various expenses in the total amount of expenses in Fig. 5, 6, 7.

[11] Compiled by the authors according to: Regions of Russia 2019. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 07 December 2020).

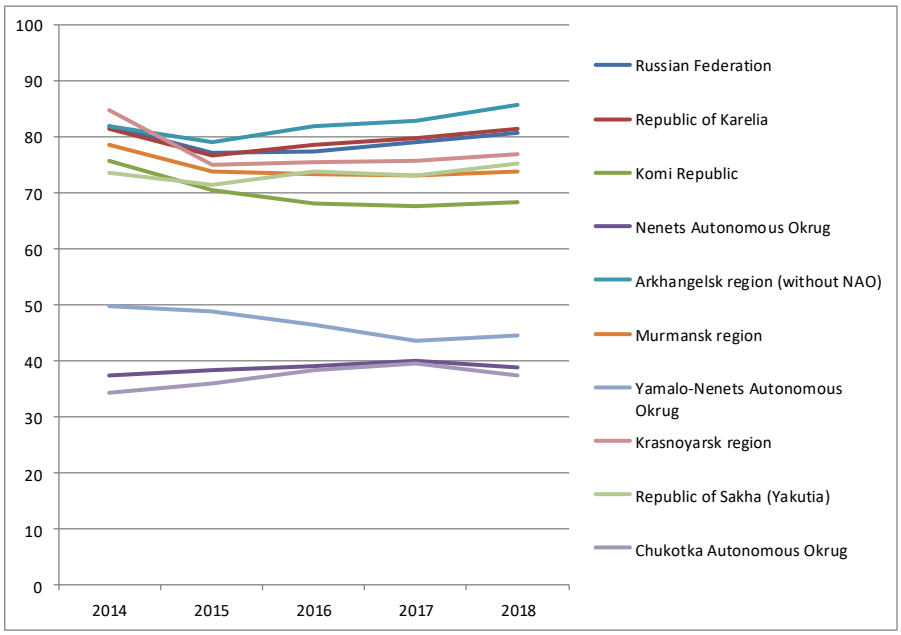

Fig. 5. The share of the purchase of goods and payment for services in the total volume of expenses [12].

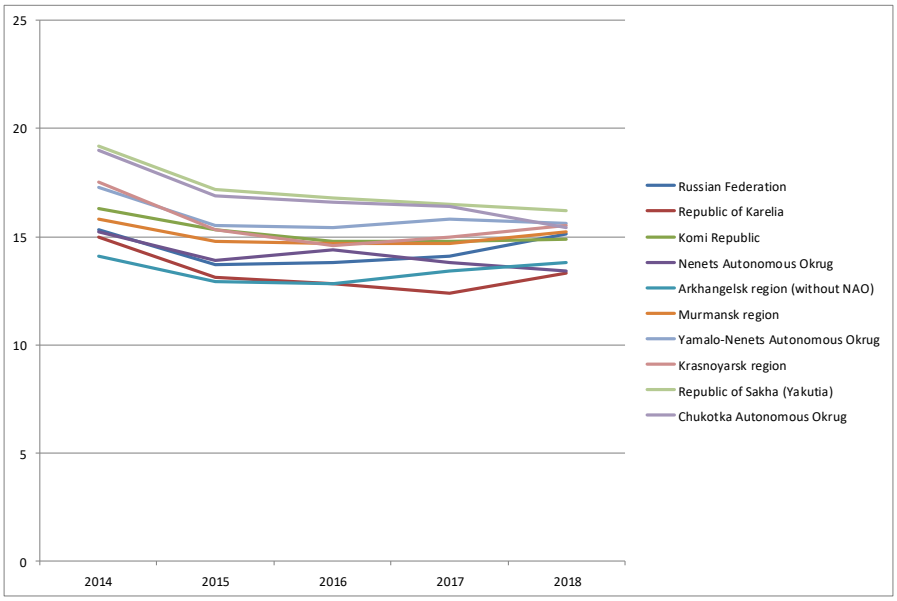

Fig. 6. The share of mandatory payments and various contributions in the total volume of expenditures [13].

[12] Compiled by the authors according to: Regions of Russia 2019. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 07 December 2020).
[13] Ibid.

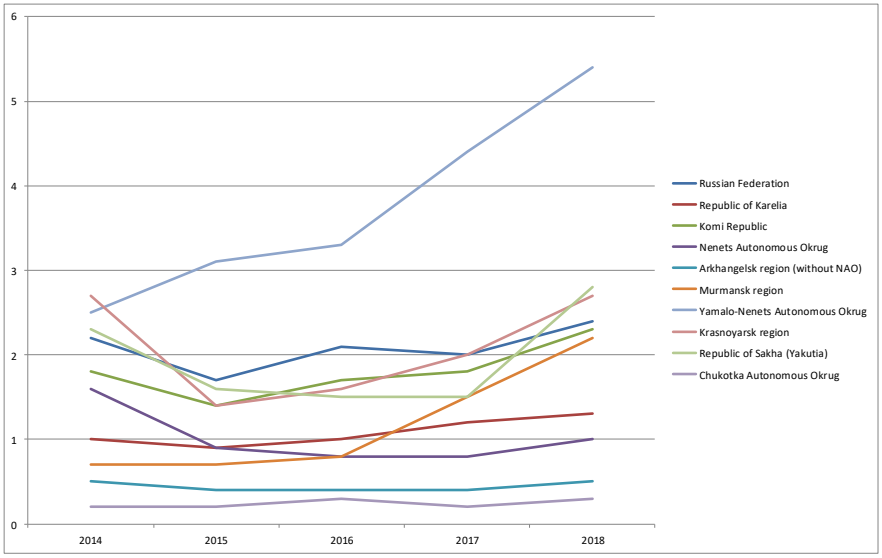

Fig. 7. The share of expenses for the real estate purchase in the total amount of expenses [14].

As shown in Fig. 5, 6, 7, in most regions of the Arctic zone, the share of expenses for the purchase of goods and payment for services is less than in the whole of the Russian Federation, the share of mandatory payments in most regions, on the contrary, is higher than the average for the Russian Federation. The share of expenses for the purchase of real estate in most AZRF regions is lower than the average for Russia.

Higher than the national average costs of production stimulate actions related to the search for solutions and methods leading to cost reduction.

Threats to environmental safety. At the international level, it is possible to note such dangerous ecological trends in the Arctic as the pollution caused by the sea transport wastes, a large number of objects that potentially pose a radiation hazard [8, Sharno O.I., pp. 53–58]. It is necessary to preserve the natural environment of the Arctic for present and future generations, for this purpose it is required to expand the network of protected areas, to dispose toxic waste [9, Knaub R.V., Shamaeva E.F., Popov E.B., pp. 5–37]. AZRF security is discussed mainly in a non-military framework. A significant role is played by the issue of climate change, in a narrower sense — damage to the ice layer and changes in weather conditions. In 2018, a landmark report by the Intergovernmental Panel on Climate Change described a temperature increase of 1.5°C.

State environmental policy in the Arctic zone is part of the national security. It is a set of various measures aimed at protecting the population and the natural environment of the Russian Arctic from negative factors, preventing environmental threats and creating environmental monitoring, risk assessment, and international cooperation in the environmental safety of the Arctic.

Environmental threats in the AZRF are a critical factor not only for the Arctic region of the Russian Federation, but also for the whole world. It is necessary to influence the natural environ-

[14] Compiled by the authors according to: Regions of Russia 2019. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 07 December 2020).

ment of the Arctic with the utmost care so as not to disturb the unique natural balance of this area.

Weak production diversification (emphasis on extractive industries). Let us consider the share of mining, manufacturing, transportation and storage in the total number of enterprises and organizations by type of economic activity in 2018 in Fig.8.

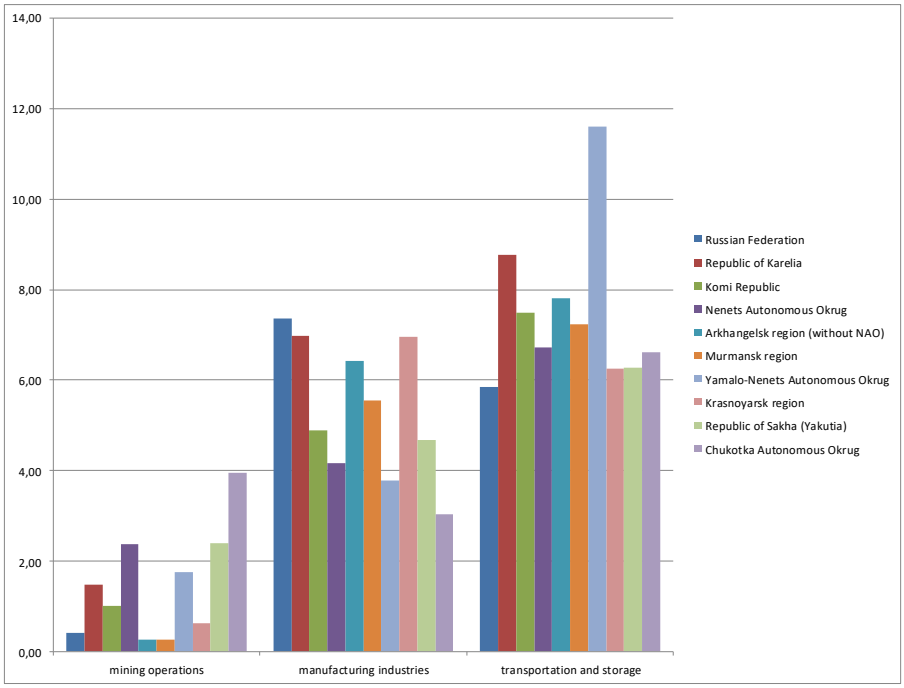

Fig. 8. The share of mining, manufacturing, transportation and storage in the total number of enterprises and organizations by type of economic activity in 2018 [15]

As shown in Fig. 8, the number of enterprises engaged in the extraction of minerals in most AZRF regions is greater than the average for Russia, and the number of manufacturing industries, on the contrary, is higher on average in Russia than in the regions of the Arctic zone. We also note the high proportion of organizations involved in transportation and storage in the AZRF, which means the possibility of processing minerals and creating jobs in the region.

Thus, for the rational activity of the Russian Arctic, it is necessary to develop other areas besides the extraction of resources.

Long distances from industrial centers and low population density. Let us consider the population density in the regions of the Arctic zone of the Russian Federation and in the Russian Federation as a whole for 2019 in Table 1.

[15] Compiled by the authors according to: Regions of Russia 2019. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 07 December 2020).

Table 1

Population density in the regions of the Arctic zone of the Russian Federation and of the Russian Federation in the whole for 2019 [16]

№	Region	Population density
63	Murmansk Oblast	5.12
67	Republic of Karelia	3.4
70–71	Arkhangelsk Oblast without NAO	2.64
75	Komi Republic	1.97
79	Krasnoyarsk Krai	1.21
80	Yamalo-Nenets Autonomous Okrug	0.71
82	The Republic of Sakha (Yakutia)	0.32
84	Nenets Autonomous Okrug	0.25
85	Chukotka Autonomous Okrug	0.07
	RF	8.57

Based on table 1, we reveal that the population density in the AZRF regions is significantly less than the average for the Russian Federation. Of the 85 regions in the ranking, the positions of the Arctic regions do not exceed 63 points.

Due to the large distances between settlements, there is a problem with employment, health care and education in remote areas. Some communities in the Russian Arctic are dying out due to the inability of the population to find work. There are also serious problems with health care and education in these areas, which also causes migration.

With an undeveloped transport infrastructure, small businesses may have problems with sales. Therefore, entrepreneurs are not determined to develop these settlements.

It is necessary to support small settlements by creating jobs, schools and health facilities. At the same time, one should not forget about the transport accessibility of these settlements.

It is worth noting that apart from the Russian Federation, there are other countries claiming the territory of the Arctic. In particular, new opportunities for resource extraction and emerging maritime routes between Europe, North America and Asia have increased the interest of various countries in the Arctic [5, Hawkin, pp. 1–4]. To understand that Russia is not alone in the Arctic, we note that 40% of Canada's territories are located in the Arctic [6, Byers, Lodge, pp. 103–109]. The attitude of other countries towards their Arctic territories also deserves attention; for example, in Finland, the main Arctic development objective is tourism [17]. Successful experience in tourism is shown by such territories as Greenland (Denmark) and Svalbard (Norway) [18].

[16] Population density of the constituent entities of the Russian Federation. URL: https://ru.wikipedia.org/wiki/%D0%9F%D0%BB%D0%BE%D1%82%D0%BD%D0%BE%D1%81%D1%82%D1%8C_%D0%BD%D0%B0%D1%81%D0%B5%D0%BB%D0%B5%D0%BD%D0%B8%D1%8F_%D1%81%D1%83%D0%B1%D1%8A%D0%B5%D0%BA%D1%82%D0%BE%D0%B2_%D0%A0%D0%BE%D1%81%D1%81%D0%B8%D0%B9%D1%81%D0%BA%D0%BE%D0%B9_%D0%A4%D0%B5%D0%B4%D0%B5%D1%80%D0%B0%D1%86%D0%B8%D0%B8 (accessed 12 December 2020).

[17] Finland's Strategy for the Arctic Region. URL: https://arcticportal.org/yar-features/295-finlands-strategy-for-the-arctic-region (accessed 12 December 2020).

[18] Norway's Arctic Strategy — between geopolitics and social development. URL: https://www.regjeringen.no/contentassets/ fad46f0404e14b2a9b551ca7359c1000/arctic-strategy.pdf (accessed 12 December 2020).

Research results

Under the given conditions (the complexity of statistical observation, the lack of clearly defined goals), it becomes necessary to create a conceptual model for the development of the region. A conceptual model of balanced socio-economic development of the region, presented in Figure 1, was built using a set of factors developed under the project No. AAAA-A19-119020490098-1.

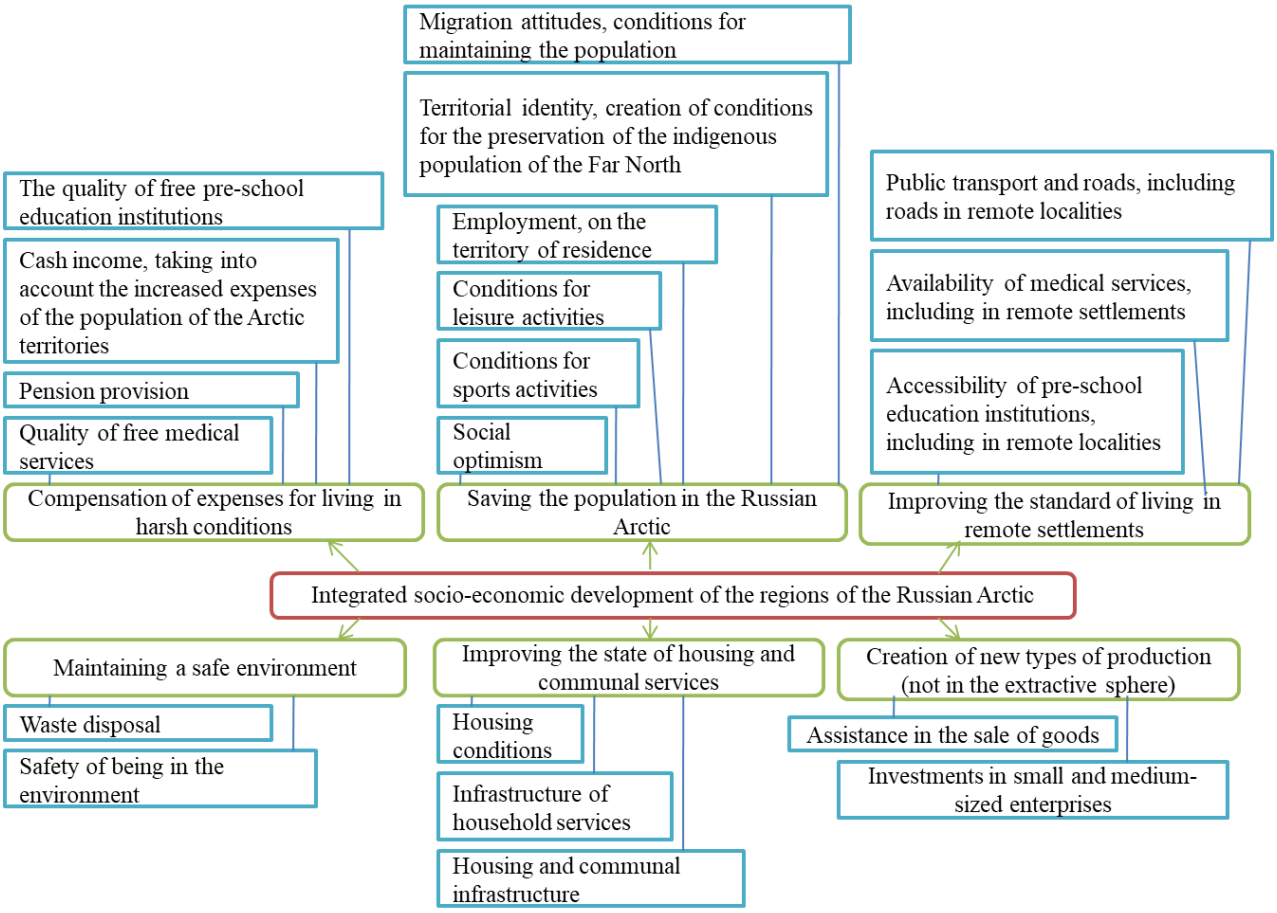

Fig. 9. Conceptual model of integrated socio-economic development of the Arctic regions.

It should be noted that these factors have different significance in influencing the development of the region. In order to assess their significance, it is planned to assign weighting coefficients based on the ranking of factors by experts in the course of regional surveys.

Let us turn to the justification of the choice of specific factors of socio-economic development and sets of indicators for their quantitative measurement. The population health is the basis of the quality of life.

Compensation of expenses for living in difficult conditions is necessary for the life standard of the population of the Russian Arctic to become higher and thus closer to the national average. Maintaining the population size is necessary for the AZRF development, while we note that social capital affects the reduction of transaction costs and, through this, economic growth [9, Milgrom P, Roberts J., p. 60]. The environment has a direct impact on the quality of life and health of the population. It is also necessary to develop remote settlements. The improvement of the housing

and utilities sector affects the standard of living. Besides, new types of production will improve the competitiveness of the region and increase the number of jobs.

Conclusion

The regions of the Russian Arctic have great potential for creating processing industries and jobs in these industries, which can reduce migration and, as a result, population decline. Particular attention should be paid to the housing sector. Due to the harsh climate and low wages in the Arctic regions, mandatory payments have a large share of expenditure, which has a negative impact on the level of socio-economic development. It is also important to solve the problems of remote settlements (transport accessibility, employment, education, healthcare).

The regions of the Arctic zone deserve the most attention, since environmental disruption in these regions can affect the whole world, and it is very important to maintain the natural balance and combine it with a decent standard of living in the region.

It should be noted that numerical indicators are needed to assess the effectiveness of governance. If each of the factors of the conceptual model is assigned its own index, it is a good tool for assessing management effectiveness. At this stage of development, the model can help in determining the necessary directions in the field of socio-economic development of the region. Once again, it is necessary to take into account the multifactorial nature of regional development, where each factor is certainly important, but they are quite interconnected, and without the development of each of them it is impossible to achieve a comprehensive socio-economic development of the region.

The developed conceptual model will help to study the problems of the Arctic zone of the Russian Federation. This area of research is quite promising and understudied.

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Assessment of the Socio-Economic Situation in the Arctic Municipal Districts of the Arkhangelsk Oblast Based on the Target Model *

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Abstract. The relevance of this study is due to the need to develop a fairly understandable and in some sense universal tool for assessing the socio-economic situation in municipalities (districts and settlements) with pronounced territorial specifics, with clearly insufficient statistical and information support. The authors, with references to the results of their own research and to the work of their colleagues, present a detailed analysis of the key problems characteristic of the territories of the Russian Arctic, compare them with a set of main external factors of influence in relation to municipalities. Using the SEER expert procedure scheme and the hierarchy analysis method, according to the two-level model proposed by the authors, complex point estimates of the socio-economic situation in the Arctic settlements and municipal districts of the Arkhangelsk Oblast are calculated. The paper notes that the factors that are directly related to transport accessibility have the greatest impact on the development targets of Arctic municipalities. Therefore, the transport and logistics component should be fundamental in all strategic, program and planning documents aimed at achieving the goals of socio-economic development of the Arctic municipalities — districts and settlements. The obtained estimates are proposed to be used in the development of management decisions that could become the basis of a comprehensive interdepartmental inter-municipal program for the socio-economic development of Arctic municipalities.
Keywords: *Arctic zone of the Russian Federation, municipality, district and settlement, socio-economic situation, expert assessment, target model, management decision-making*

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Introduction

A lot of scientific research has been devoted to the issues of socio-economic development of municipalities, as well as the application of various methods and models for forecasting their development and making balanced management decisions. For example, theoretical and applied aspects of predicting socio-economic development of municipalities are reflected in studies [1, Baeva V.V., Novikov A.I.; 2, Fishman L.I., Ivanov M.Yu.; 3, Stepanova V.V. et al.]. Various approaches to modeling socio-economic processes in municipalities are described in the works [4, Oreshnikov V.V., Aitova Yu.S.; 5, Novoselova A.S. et al.; 6, Fattakhov R.V. et al.; 7, Nizamutdinov M.M. et al.; 8, Chekmareva E.A.]. The adoption of managerial decisions at the municipal level is disclosed in detail in the works [9, Grushin V.A., Baryshova Yu.N.; 10, Tebekina A.V., Tebekina P.A.], etc.

However, despite a large pool of systematic research in this area, at least two serious problems remain unresolved. The first one is associated with the apparent lack, and sometimes complete absence, of statistical and other relevant information necessary for the development, verification and implementation of the appropriate models. The second problem is the lack of universal, easily scalable models that do not require large amounts of information and that correctly take into account the territorial and other specifics that are characteristic of municipalities at the level of districts and their settlements. There are many reasons for this, but we will leave them outside the scope of this work. It should only be noted that municipal districts and settlements located in the territories of the Arctic Zone of the Russian Federation (AZRF) have such distinctive specifics, which will be discussed below.

Conceptual target model for assessing the socio-economic situation and developing management decisions in the Arctic municipalities

Based on the available experience of interaction with the authorities of different levels, heads of enterprises and organizations, the business community, as well as being guided by practical feasibility, the authors propose to solve a number of tasks related to the development, adoption and implementation of managerial decisions aimed at the socio-economic development of municipal areas and settlements, using the following conceptual target model (Fig. 1).

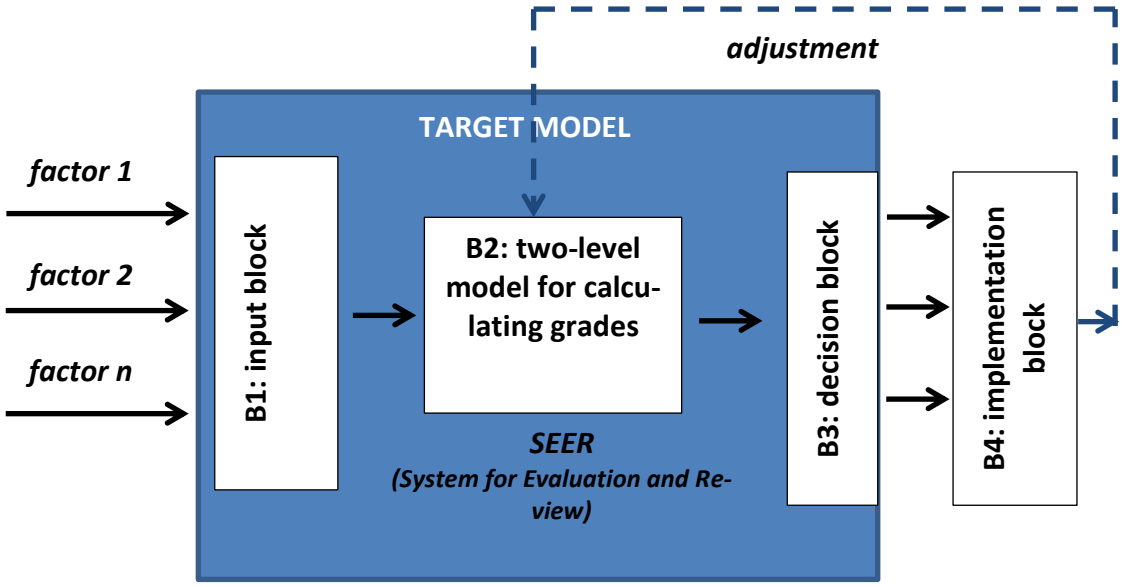

Fig. 1. Conceptual target model.

Before describing the functioning of this model, let us dwell on the specific problems of the object of modeling — the territories that are part of the Russian Arctic. Currently, the managerial problem area responsible for the socio-economic development of the Arctic municipalities is essentially reduced to the dilemma: to maintain an acceptable standard of living in these territories, or to invest certain resources in ensuring socio-economic growth (we do not consider the third possible scenario, which previously appeared in a number of draft strategic documents and is associated with the liquidation of unpromising settlements). Of course, when solving this issue, it is possible to "chase two birds with one stone", but, as long-term practice shows, such a strategy usually does not bring anything good [11, Tutygin A.G., Chizhova L.A.].

This issue is not new and belongs to a number of organizational and economic problems of using limited resources. As noted in [12, Emelyanova E.E., p. 1830], the prospects for the socio-economic development of the Arctic municipalities are associated, first of all, with the successful functioning of industrialized centers: single-industry and "oil and gas" municipalities, as well as regional administrative centers.

In general, the territories of the Arctic zone of the Russian Federation, according to a number of researchers, are characterized by the presence of personnel problems, the development of negative demographic and migration processes, poorly developed social infrastructure, critical disproportions between the contribution of the AZRF to the country's economy and the living and working conditions of employees [13, Rzhanitsyna L.S. ., Kravchenko E.V., p. 78]. Projecting these problems to the level of municipalities only increases their acuteness and demand for a systematic solution. The study of our colleagues showed that the municipal and urban districts of the Arkhangelsk Oblast belong to the group of Arctic municipalities with extremely low values of indicators of both demographic state and economic development. At the same time, they found a direct correlation between the level of economic development and the demographic state of most Arctic territories [14, Ukhanova A.V. et al., p. 189].

Problems specific to the Arctic territories at the regional and municipal levels

It should be noted that all AZRF territories are characterized by a number of problems, both at the regional and municipal levels, described in detail, for example, in the works [15, Tutygin A.G., Chizhova L.A.; 16, Krapivin D.S.]. Let us consider them in more depth.

1. Decrease in production volumes, low share of processing and high-tech industries

The index of physical volume of gross regional product in 2018, according to official statistics, decreased compared to the previous period in the Nenets Autonomous Okrug (NAO), Arkhangelsk and Murmansk oblasts. Compared to 2010, this indicator has decreased significantly in the Krasnoyarsk Krai (-2.5%), the Republics of Karelia and Komi (-3.3% and -4.1%), as well as in the NAO (-3.7%). The share of the manufacturing industry in the NAO and Chukotka Autonomous Okrug does not exceed 0.3%, in the Republic of Sakha (Yakutia) it is 1.1%, in the Yamalo-Nenets Autonomous Okrug — 1.6%, which is connected with the focus of the economy of these territories on the natural resources extraction. The largest share of the manufacturing industry is noted in such Arctic regions as the Krasnoyarsk Krai (31.8%), the Arkhangelsk Oblast (27.4%), the Republic of Karelia (20.8%). As for the share of organizations that carried out technological innovations, it should be said that in all AZRF regions, without exception, this indicator is below the national average. In the NAO it is four times lower than the average Russian value, and in the Republic of Karelia and the Chukotka Autonomous Okrug, it is two times lower. The depletion of the natural resource base, the high cost of production in the Arctic, and sometimes inefficient management led to the disappearance of a number of forestry and coal industries in the Arkhangelsk Oblast, the Republics of Karelia and Komi. Many of these enterprises were city-forming. Along with their disappearance, entire villages and even cities (for example, Vorkuta) turned out to be on the verge of extinction [17, Smirennikova E.V. et al., p. 25].

2. High level of tariffs for electricity and housing and communal services, a large share of dilapidated housing, high deterioration of utility infrastructure

The cold climate and low average annual temperatures lead to large volumes of heat and electricity consumption. At the same time, high tariffs for energy resources in a number of Arctic regions have a significant impact on the cost of products, works and services and negatively affect the structure of household expenses. According to Energoseti Rossii Company, the single-rate electricity tariff for the population living in urban areas of the Arkhangelsk Oblast, the NAO, the Chukotka Autonomous Okrug and the Republic of Sakha (Yakutia) is much higher than, for example, for the population of the Vologda and Leningrad oblasts. It should be noted that in other regions of the Russian Arctic (Murmansk Oblast, Republic of Karelia, Krasnoyarsk Krai), electricity tariffs are low compared to other AZRF territories, but there are other problems there. For example, in the Murmansk Oblast, there is a problem of selling electricity generated by the Kola NPP, which also supplies neighboring Karelia with its electricity.

At the same time, a number of remote, coastal and island territories of the Russian Arctic, which do not have a centralized energy supply, use local energy sources, primarily diesel power

plants (DPP). In turn, the provision of diesel power plants with fuel is associated with a number of transport and logistics difficulties, including the problem of "northern delivery". One of the approaches to solving the transport and energy tangle of problems of the Arctic territories is considered in detail, for example, in [18, Korobov V.B. et al.].

According to statistics, there is an increase in the share of emergency and dilapidated housing in all subjects of the Russian Arctic. For example, in the Arkhangelsk region, the share of emergency housing is 8.2%, in the NAO — more than 5%, in the Republic of Sakha (Yakutia) — 7.5%, in the YaNAO — 6.9% (with an average Russian indicator of 0.8%). The situation with dilapidated housing is similar, its share in the Republic of Sakha (Yakutia) exceeds the average Russian level by 8 times, in the YaNAO — by 6 times, and in the Arkhangelsk Oblast — by 4 times.

The deterioration of communal infrastructure in the Arctic regions is quite high. For example, in the Arkhangelsk Oblast, the depreciation of heating networks is more than 50%, water pipes — more than 60%, and electricity networks — about 30%. Thus, the vast majority of AZRF territories lag behind in the quality of housing conditions, the provision of housing and communal services, and waste management, which, along with the limited scope of labor, stimulates an additional outflow of the population [19, Kutsenko S.Yu. et al., p. 15]. Let us also note that in many territories of the Russian Arctic, communication systems (Internet, mobile connection) are extremely underdeveloped, which significantly limits access to electronic services of various departments and organizations, markets for goods and services implemented through IT infrastructure.

3. High share of transport in the price of products; moral and physical aging of fixed assets in all modes of transport

Inaccessibility of areas without sustainable year-round transport links, quite a lot of which are in the Russian Arctic, is the reason for the low communication and logistics activity. Renovation, modernization and development of transport infrastructure facilities require large capital investments. At the same time, as it is quite reasonably noted, for example, in the monograph [20, Problems of modeling logistics operations…, p. 38], the AZRF transport infrastructure is not sufficient to meet the needs of the real sector of the economy and the needs of the population.

4. Decrease in total population, migration

The decrease in the population of the Russian Arctic, in addition to migration activity, is driven by a declining birth rate. An important feature of fertility dynamics in the Arctic regions of the Russian Federation is the reduction in the birth rate of second and third children in the family, the increase in the average age of mothers, and the level of abortion, higher than the average in the country. The peculiarity of reproductive attitudes of young people under 29 years old is the priority choice of a small family type, which, given the small number of this generation (born in the 1990s), can lead to depopulation and further desertification of the Arctic territories [21, Gubina O.V., Provorova A.A., pp. 540–542].

5. Social problems of the local population and indigenous peoples of the North (SIP): health care, education, employment, housing, etc.

More than half of the indigenous peoples of Russia live on the Arctic territory. The Nenets people are the most numerous among them (about 44 thousand people). Here we also note that the main activity of the Nenets is reindeer breeding; fishing plays an important, but secondary role, being an addition to reindeer breeding [22, Tortsev A.M. et al., p. 273]. The depletion of pastures due to the growth of technogenic and anthropogenic pressure is one of the significant threats to the traditional life of the indigenous peoples. This, in turn, leads to a deterioration in the forage base of reindeer herding and, subsequently, to a change in the health status, which is determined by the natural environment, predominantly the quality of water and traditional foods (reindeer meat and local fish) [23, Pavlenko V.I. et al., p. 30].

6. Problems of the budgetary system and interbudgetary relations

The current mechanisms of interbudgetary relations in Russian regions do not always allow solving the problems associated with the implementation of the powers of state and municipal authorities. The current methodology for distributing subsidies for equalizing budgetary security at the expense of the budget of a constituent entity of the Russian Federation is imperfect. It does not show the principle by which subsidies are directed to municipalities and basically does not take into account their socio-economic development, the stimulating function of interbudgetary relations and the effectiveness of the activities of local governments [24, Finance and interbudgetary relations of the Arkhangelsk Oblast, p. 177]. The study [25, Matvienko I.I. et al., p. 42] carried out a detailed analysis and classified the budgetary powers of municipalities according to the level of their cost. At that, the powers in the spheres of housing and communal services and local transport, where capital investments prevail, which should be accumulated in regional and municipal investment programs, were referred to the high-cost ones.

7. Low investment attractiveness

As noted in [26, Zakharchuk E.A., p. 2], in the Russian Arctic, a significant channel for the outflow of financial resources is the public sector, which withdraws them through the mineral extraction tax. Therefore, the share of funds remaining at the disposal of municipalities depends on the degree of population settlement. The rotational method of attracting workers does not allow the territories to “restart” the financial resources of households in the service sectors. The incomes of employees are used in other regions, which reduces the economic potential of the Arctic municipalities and leads to a decrease in the entrepreneurial activity of small and medium-sized businesses, which are mainly concentrated in the field of trade and public services [27, Chizhova L.A. et al.]. In general, according to the approach proposed in [28, Tutygin A.G. et al., p. 44], investment attractiveness for municipalities can be determined based on the composite rating of investment potential and investment risk by a two-dimensional ranking. According to the calculations of the consolidated rating of investment attractiveness of the municipalities of the Arkhangelsk Oblast, such Arctic regions as Leshukonskiy, Mezenskiy and Onezhskiy fell into the “below average” category, while Pinezhskiy and Primorskiy — into the “average level”. Today, this situation has not changed fundamentally.

Approbation of the target model for the Arctic municipal districts and settlements of the Arkhangelsk Oblast

Based on the above-described problems of the Arctic territories, the key factors influencing the socio-economic situation of the municipalities located there by expert selection included the following: transport accessibility of settlements (X_1), energy supply (sustainable electricity supply) (X_2), availability of sustainable communications (communication, Internet) (X_3), availability of infrastructure facilities for housing and communal services (X_4), medical (X_5) and educational institutions (X_6), cultural institutions (X_7), physical education and sports facilities (X_8), as well as the availability of industrial infrastructure facilities (X_9) [29, Lovdin E.N., Regeta A.I., p. 447].

The question of the inclusion of the environmental component in the key factors of influence has become controversial, from the authors' point of view. However, we decided not to consider it at the level of municipalities, largely appealing to the professional opinion of our colleagues. For example, in [30, Kotova E.I. et al.], it is noted that currently the environmental situation in the Russian Arctic cannot be called acute. There are local zones of pollution and violations of territories directly near the sources of impact. Extreme situations are quite rare. Let us just say that at the municipal level of management, the issues of "household" ecology are largely correlated with the functioning of the housing and communal services infrastructure (factor X_4). In this factor, the environmental component that affects the socio-economic development of municipalities is partially taken into account within the powers of municipalities related to the removal (sorting) of MSW, provision of clean water and water disposal (drainage) services to the local population.

Table 1 correlates the main problems and relevant exogenous factors that have a significant impact on the socio-economic situation in the Arctic municipalities of the Arkhangelsk Oblast.

Table 1

Comparison of problems and factors affecting the socio-economic situation in the Arctic municipalities of the Arkhangelsk Oblast

Problems	Factors
1. Decrease in production volumes, low share of processing and high-tech industries	X_1, X_2, X_9
2. High level of tariffs for electricity and housing and communal services, a large share of dilapidated housing, high deterioration of utility infrastructure	X_1, X_2, X_4
3. High share of transport in the price of products; moral and physical aging of fixed assets in all modes of transport	X_1, X_2
4. Decrease in total population, migration	X_1, X_3, X_4, X_5, X_6, X_7, X_8, X_9
5. Social problems of the local population and indigenous peoples of the North (SIP): health care, education, employment, housing, etc.	X_4, X_5, X_6, X_7, X_8, X_9
6. Problems of the budgetary system and interbudgetary relations	X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9
7. Low investment attractiveness	X_1, X_2, X_9

Returning to the target model (Fig. 1), we note that it corresponds to the two-level expert procedure SEER — one of the modifications of the well-known Delphi method [31, Ostreikovskiy V.A.].

The exogenous factors listed above are input information for B1 block of the target model, which results in assigning appropriate weighting coefficients to them as follows.

Let $X_1, X_2, \dots, X_n$ be a set of factors expressed on a nine-point scale (the highest score is 9, the lowest score is 1), $w_1, w_2, \dots, w_n$ — non-negative weights of these factors, $\sum_{i=1}^{n} w_j = 1$, obtained by using the hierarchy analysis method [32, Classification methods for solving…]. Estimates and pairwise comparisons of factors are made by experts of the second (upper) hierarchy level of the SEER procedure.

Let us proceed to the description of block B2. In [29, Lovdin E.N., Regeta A.I.], the following two-level model was proposed for a comprehensive socio-economic assessment of municipalities. Let us denote v_{ij}- point score of the *i*-th municipality of the first level (settlement) by the *j*-th factor, where $i = 1,2, \dots, m, j = 1,2, \dots, n$. Then a comprehensive assessment of the *i*-th settlement for the entire set of factors will be represented by the formula:

$$V_i = \sum_{i=1}^{n} w_j \cdot v_{ij}, i = 1,2, \dots, m \ (1)$$

Next, we group the settlements $O_1, O_2, \dots, O_m$ by districts (municipalities of the second level). At the same time, the weight coefficients λ_i of the objects-settlements included in the corresponding district will be determined by their share in the total population of the municipal district. Then the integrated assessment for the corresponding area K_p is calculated as:

$$K_p = \sum_{O_i \in K_p} \lambda_i \cdot V_i = \sum_{O_i \in K_p} \lambda_i \cdot \left(\sum_{j=1}^{n} w_j \cdot v_{ij} \right) \ (2)$$

Subsequently, the model can be adjusted with a specified frequency, firstly, by recalculating the weights of factors based on the upper level of the hierarchy of the SEER procedure, secondly, by replicating pairwise comparisons of the lower level, and, thirdly, by making changes to the redistribution population by locality. At the same time, the model template allows to make such adjustments quite easy.

Let us present the calculations performed for the Leshukonskiy, Mezenskiy, Onezhskiy, Pinezhskiy and Primorskiy municipal districts of the Arkhangelsk Oblast, the territories of which are included in the Russian Arctic. As a starting point, we take the results obtained for the Arctic municipalities of the region by one of the authors in [33, Lovdin E.N., Lets O.V., p. 41]. The positioning of municipalities was carried out in it, as a result of which Leshukonskiy, Onezhskiy, and Pinezhskiy districts fell into the most problematic of the matrix sectors. Although the Mezenskiy and Primorskiy districts turned out to be in a more favorable position, they nevertheless have a significant disproportion between the economic and social components, which can lead to an in-

crease in social tension. In view of the above, we combine all five districts into one problematic group that is significantly influenced by a set of factors common to them.

The method of Thomas Saaty [34] was used to conduct a pairwise comparison of the main exogenous factors that, as noted above, have the greatest influence on the socio-economic development of territories (Table 2). The expert group of this level, according to the SEER procedure and taking into account the recommendations given in [35, Korobov V.B. et al.], included seven representatives of the scientific community and public authorities of the region.

Table 2

Matrix of pairwise comparisons of factors by the method of T. Saaty

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
X_1	1.00	5.00	7.00	5.00	4.00	6.00	8.00	9.00	5.00
X_2	0.20	1.00	2.00	1.00	3.00	5.00	6.00	7.00	2.00
X_3	0.14	0.50	1.00	0.33	0.33	1.00	5.00	6.00	0.20
X_4	0.20	1.00	3.00	1.00	2.00	3.00	5.00	6.00	1.00
X_5	0.25	0.33	3.00	0.50	1.00	3.00	4.00	5.00	1.00
X_6	0.17	0.20	1.00	0.33	0.33	1.00	3.00	4.00	0.20
X_7	0.13	0.17	0.20	0.20	0.25	0.33	1.00	2.00	0.17
X_8	0.11	0.14	0.17	0.17	0.20	0.25	0.50	1.00	0.14
X_9	0.20	0.50	5.00	1.00	1.00	5.00	6.00	7.00	1.00

The weight coefficients of the factors were calculated by the hierarchy analysis method (HAM) (Table 3). It should be noted that the consistency ratio of this expert procedure was OS = 8.7%, which does not exceed the recommended level of 10% [36, Tutygin A.G. et al.]. The highest weights were given to the factors of transport availability — 0.38 and energy supply — 0.15.

Table 3

Weight coefficients of factors calculated on the basis of HAM

Factor	Factor description	weight
X_1	Transport accessibility of the settlement	0.377188
X_2	Energy supply (sustainable power supply)	0.148416
X_3	Availability of stable communications: telephone connection, Internet	0.054888
X_4	Availability of housing and communal services infrastructure facilities	0.118872
X_5	Provision with medical institutions	0.091152
X_6	Provision with educational institutions	0.043309
X_7	Provision with cultural institutions	0.022962
X_8	Provision with physical culture and sports facilities	0.017077
X_9	Availability of industrial infrastructure facilities	0.126136

The complex estimations of the settlements, calculated by the formula (1), and their shares in the total population of the districts are presented in Table 4. Point estimates v_ij in the context of settlements were set by experts at the municipal level — deputies, managers and specialists, activists of territorial public self-government, representatives of local business communities. It should be noted that the number of experts involved at this stage of the procedure (taking into account the deviation of extreme and anomalous estimates) for each of the municipalities amounted to 10–12 people.

Table 4

Comprehensive assessments of settlements

Settlements	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	V_i	λ_i
Leshukonskiy district											
Vozhgora	2	5	5	1	2	9	9	2	2	2.95	0.0984
Leshukonskoe	8	5	5	8	9	9	9	5	9	7.62	0.6910
Koinas	3	5	5	1	7	9	9	2	2	3.79	0.0995
Olema	2	5	5	1	2	2	2	2	2	2.49	0.0418
Tsenogora	3	5	5	1	5	9	9	2	2	3.61	0.0693
Mezenskiy district											
Bychye	2	5	3	1	5	9	9	2	2	3.12	0.0512
Dolgoschelye	2	5	5	1	5	9	9	2	2	3.23	0.0795
Dorogorskoye	7	5	5	1	5	9	9	2	3	5.24	0.0525
Kamenka	5	5	9	7	9	9	9	2	5	6.04	0.2490
Koida	3	5	3	1	5	9	9	2	5	3.87	0.0575
Mezen	8	5	9	9	9	9	9	5	9	7.96	0.4497
Ruchyi	3	5	1	1	5	9	2	2	3	3.35	0.0317
Soyana	2	5	3	1	5	2	9	2	2	2.82	0.0288
Onezhskiy district											
Zolotukha	5	9	5	3	5	9	9	2	2	5.19	0.0276
Codino	6	9	6	3	7	9	9	2	5	6.18	0.0690
Maloshuyka	6	9	6	7	7	9	9	2	9	7.16	0.0974
Nimenga	6	9	6	3	5	9	9	2	5	6.00	0.0334
Onega	8	9	9	9	9	9	9	9	9	8.62	0.7181
Pokrovskoe	7	9	6	7	5	2	9	9	2	6.29	0.0545
Pinezhskiy district											
Vercola	5	9	5	1	5	2	9	2	5	5.03	0.0205
Karpogory	6	9	9	6	9	9	9	5	9	7.44	0.3486
Kevrola	4	9	4	1	5	9	2	2	2	4.36	0.0218
Mamonikha	2	9	5	3	2	2	2	2	2	3.32	0.0205
Mezhdurechensky	2	9	5	3	2	9	9	2	2	3.79	0.1246
Nyukhcha	3	9	4	1	5	1	9	2	3	3.92	0.0224
Pinega	6	9	6	6	7	2	9	5	9	6.79	0.2185
Pirinem	2	9	5	3	5	3	9	2	2	3.80	0.0333
Sosnovka	3	9	5	3	7	9	9	2	3	4.75	0.0718
Sura	4	9	4	3	7	9	9	2	4	5.19	0.0814
Yasnyy	5	9	5	6	7	9	9	2	5	6.11	0.0367
Primorskiy district											
Vaskovo	9	9	9	9	5	9	9	2	9	8.52	0.1288
Voznesenye	3	9	9	3	5	9	9	2	3	4.78	0.0427
Zimnyaya Zolotitsa	2	5	2	1	5	9	9	2	2	3.06	0.0297
Lastola	3	9	4	3	5	9	9	2	3	4.51	0.0535
Letnyaya Zolotitsa	2	5	2	1	5	9	2	2	2	2.90	0.0179
Lyavlya	8	9	5	3	5	2	2	2	4	6.11	0.0420
Pertominsk	2	5	2	1	5	9	2	2	2	2.90	0.0365
Pustosh	4	9	4	3	5	9	9	2	4	5.01	0.0560
Pushlakhta	1	5	1	1	5	2	1	2	1	2.02	0.0061
Rikasikha	9	9	9	9	7	9	9	5	5	8.24	0.2824
Solovetskiy	5	5	5	3	7	9	9	5	5	5.21	0.1027
Talagi	9	9	9	9	9	9	9	2	9	8.88	0.2017

Table 5 presents the calculated by the formula (2) complex estimations of K_p of municipal districts, as well as weighted average values of factors in the context of these districts.

Table 5

Comprehensive assessments and average factor values for municipal districts

Municipal districts	Factors									K_p
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	
Leshukonskiy	6.31	5.00	5.00	5.84	7.54	8.71	8.71	4.07	6.84	6.3
Mezenskiy	5.80	5.00	7.39	6.09	7.80	8.80	8.78	3.35	6.15	6.2
Onezhskiy	7.46	9.00	8.13	7.92	8.21	8.62	9.00	7.41	8.02	8.0
Pinezhskiy	4.74	9.00	6.49	4.68	6.78	6.81	8.70	3.70	6.40	6.0
Primorskiy	7.05	8.23	7.24	6.50	6.58	8.66	8.28	3.16	5.76	7.0

The information presented in the penultimate column in Table 4 and in Table 5 is the output for block B2 of the target model, the input for block B3 (Fig. 1) and may serve as a basis for making decisions related to the socio-economic development of the municipality (group of municipalities). It should be noted that in our example, all municipal districts received their comprehensive assessments in the range from 6 to 8 points, which, according to T. Saaty's scale, refers to the “above average” group. At the same time, we should distinguish those factors, the average values of which do not exceed the comprehensive score of the corresponding municipal district (Table 6). They, in our opinion, meet the targets that require the use of priority response measures and resources.

Table 6

Main problematic factors in the context of municipal districts

Districts	Main problematic factors
Leshukonskiy	Transport accessibility; energy supply (sustainable power supply); the presence of sustainable communications: telephone connection, the Internet; availability of housing and communal services infrastructure facilities; provision with physical culture and sports facilities
Mezenskiy	Transport accessibility; energy supply (sustainable power supply); availability of housing and communal services infrastructure facilities; provision with physical culture and sports facilities; availability of industrial infrastructure facilities
Onezhskiy	Transport accessibility; the presence of sustainable communications: telephone connection, the Internet; availability of housing and communal services infrastructure facilities; provision with physical culture and sports facilities
Pinezhskiy	Transport accessibility; availability of housing and communal services infrastructure facilities; provision with physical culture and sports facilities
Primorskiy	Transport accessibility; availability of housing and communal services infrastructure facilities; provision with physical culture and sports facilities; availability of industrial infrastructure facilities

In all the districts included in the study group, transport accessibility is a particularly problematic factor. A detailed description of the situation related to it was given in [29, Lovdin E.N., Regeta A.I.], where, in particular, it is noted that the transport accessibility factors have the greatest impact on development targets. Thus, the transport and logistics component should be fundamental in all strategic, program and planning documents aimed at achieving the goals of the socio-economic development of the Arctic municipalities — regions and settlements. For all munici-

palities, the factors of availability of housing and communal services infrastructure are also in the problem zone. At the same time, the presence (absence) of industrial infrastructure facilities is not critical for the Leshukonskiy, Onezhskiy and Pinezhskiy districts due to the fact that significant, but often unused production facilities with associated infrastructure were left on these territories by the former enterprises of the timber industry complex. The task of efficient use of capital facilities (buildings, structures, access roads, etc.) is inextricably linked with the investment policy pursued in these territories by authorities at all levels. Currently, a set of relevant mechanisms, such as the provision of property, tax and investment benefits, preferential financial and credit products, the creation of priority development areas, etc., is already being widely introduced by the state into economic practice.

Unexpectedly for the authors, a significant problem in all municipalities was the state of provision of physical education and sports facilities, which was uncharacteristic almost ten years ago. Here we rely on the results of sociological research conducted in the territories of the municipalities of the Arkhangelsk Oblast in 2012–2013. [1] It should be noted that the increased attention of the population to the topic of physical culture and sports is directly related to the growing popularity, especially among the youth, of a healthy lifestyle as one of the values of this generation [37, Blynskaya T.A., Malinina K.O.].

The question of the suitability of the proposed target model for assessing the socio-economic development of urban districts can naturally arise. The answer may be as follows: conceptually, yes, but with the use, perhaps, of other factors and weights of influence, determined by the relevant groups of competent experts.

Conclusion

The resulting and periodically updated comprehensive estimates of municipalities at both levels can be used as targets in planning, development and decision-making on the allocation of limited resources (financial, property, etc.). One of the practical applications of the target model is the design of mechanisms containing consumer priority indicators that characterize the expected performance and allow the resource to be distributed in proportion to efficiency [38, Tutygin A.G., Ambrosevich M.A.]. At the same time, as noted in [39, Tutygin A.G. et al.], it is often not possible to unambiguously assess the current situation when making management decisions. For example, a standard situation is when one part of the influencing factors can be assessed quantitatively and

[1] Otchet po Gosudarstvennomu kontraktu №012400000613000728 ot 07.05.2013 na okazanie uslug po provedeniyu sotsiologicheskogo issledovaniya na temu «Otsenka udovletvorennosti naseleniya Arkhangel'skoy oblasti meditsinskoy pomoshch'yu, uslugami v sferakh obrazovaniya, kul'tury, fizicheskoy kul'tury i sporta, zhilishchno-kommunal'nymi uslugami, a takzhe deyatel'nost'yu organov mestnogo samoupravleniya gorodskikh okrugov i munitsipal'nykh rayonov, v tom chisle ikh informatsionnoy otkrytost'yu», v 2-kh t., OOO «LIAS», 2013. 716 s. [Report under the State contract No. 012400000613000728 dated 05/07/2013 for the provision of services for conducting a sociological study on the topic "Assessment of satisfaction of the population of the Arkhangelsk region with medical care, services in the fields of education, culture, physical culture and sports, housing and communal services, as well as the activities of local authorities self-government of urban districts and municipal districts, including their information openness", in 2 volumes, LIAS LLC, 2013. 716 p.].

the other — only qualitatively, even if it is possible to give them a numerical assessment. This is precisely the situation in our case.

The most realistic tool for the socio-economic development of the group of Arctic municipalities described in this article could be a comprehensive inter-municipal program of socio-economic development, which should be based on the creation of a transport and energy framework for these territories. At the same time, such a program should have a multilevel, interdepartmental and interterritorial character. The general supervision over the development and subsequent implementation of the program is proposed to be concentrated in the relevant departments of the Ministry of the Russian Federation for the Development of the Far East and the Arctic, while the executors could be the federal, regional and municipal authorities and agencies.

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Logistic Basis for the Development of Arctic Tourism in Russia *

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Abstract. In our article we analyzed the transport accessibility of the subjects of the Arctic zone of Russian Federation for potential tourists. To do this, we estimated in points the material and time costs of tourists, traveling from the main centers of the formation of tourist flows in Russia (Moscow and St. Petersburg) to various Arctic destinations. For each administrative-territorial subject of the Arctic zone we have selected potential support logistic centers of the development of Arctic tourism, which will receive visiting tourists, provides them with basic services and redistributes them along tourist routes. These are mainly transport centers, connected with Moscow and St. Petersburg and with settlements on this territory. We referred to Murmansk, Apatity, Arkhangelsk, Naryan-Mar, Vorkuta, Salekhard, Norilsk, and Anadyr. As a result of the study, we have found that currently the most promising for the development of Arctic tourism is Murmansk region, its transport infrastructure is convenient for using by tourists and the development of Arctic tourist routes. Arkhangelsk Oblast and Yamalo-Nenets Autonomus Okrug are also promising, their support centers of the development of Arctic tourism are capable of receiving and redistributing tourist flows in Arctic directions. The least developed in terms of transport is the Arctic part of Yakutia, where there are no large transport hubs, capable of taking on the function of tourist distribution centers.
Keywords: *Arctic, Arctic tourism, tourist flow, material and time cost, economic distance*

Introduction

Tourism is one of the ways of socio-economic development of the Arctic territories and areas of international cooperation there [1, Lukin Yu.F., p. 96]. Due to the increased interest in the Arctic at the state level, the planning of Arctic tourism, the creation of a tourist product designed for the mass tourist, is an urgent task. The development of Arctic tourism is envisaged in the state program “Socio-economic development of the Arctic zone of the Russian Federation up to 2020 (with amendments up to 2030)”, in the “Strategy for the development of the Arctic zone of the Russian Federation and national security for the period up to 2020”, in “Strategies for the development of tourism up to 2030” [2, Sevastyanov D.V., p. 24].

The problem of availability of Arctic tours did not arise by chance. It is based on high cost of such travels, which, in particular, influenced the creation of a stereotype about Arctic tourism as entertainment for wealthy foreigners. Indeed, the accessibility of many potential tourist destinations in the Arctic is limited by the complexity of transport logistics. Most of the tourist attractions in the Arctic zone are located in hard-to-reach areas of specially protected natural areas [2, Sevastyanov D.V. p. 30]. The cost of travel from the place of formation of potential tourist flows to

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places of tourist interest makes up a large part of the price of the Arctic tourist product. Usually it is not possible to use regular flights, it is necessary to use custom-made transport, including special ones.

The so-called "pole" Arctic tourism is becoming popular. It involves sea cruises, the main purpose of which is to visit the North Pole. In terms of infrastructure, these cruises need icebreakers able to operate in difficult ice conditions of the Arctic Ocean. Due to high freight costs of nuclear-powered icebreaker cruises to the North Pole, the minimum cost of a trip is about $10.000. Arctic cruises are organized by Russian and foreign companies (Quark Expeditions, Poseidon Expeditions, Aurora Expeditions, Hapag-Lloyd Cruises). However, this is mainly chartered by Russian icebreakers based in Murmansk (50 Years of Victory, Yamal). The season of polar cruises lasts during the period of the best ice conditions from June to September, their average duration is 10–12 days. There were 17 cruises in 2017, 15 in 2018, 23 in 2019, and 15 in 2021 [1]. Cruises usually reach the Franz Josef Land archipelago. Specialists of the Russian Arctic National Park, located on the Franz Josef Land archipelago and Severnyy Island of the Novaya Zemlya archipelago, have developed sea route schemes for cruises and organized landing sites for viewing the main objects of interest. The most popular stops for cruise icebreakers include Hooker Island (Tikhaya Bay), Champa Island (Cape Trieste), Hall Island (Cape Tegetthoff), Northbrook Island (Cape Flora) [3, Kunnikov A.V., p. 43]. Inspectors of the national park control the landing of tourists on the islands.

Cruises to the North Pole, due to the high cost, do not belong to mass tourism; on average, about 1000 people take part in them per season. But the shift from elitist orientation of Arctic tourism to mass one is evidenced by the research of domestic and foreign scientists [4, Zhelnina Z.Yu., Tereshchenko N.V., p. 73]. This can be achieved, among other things, through the rational organization of transport used by tourists. In order to create mass Arctic tour directions, it is necessary to plan transport logistics, to analyze existing regular flights connecting the Arctic territories with potential places for the formation of tourist flows, and to identify the main logistics centers in the Arctic territories that will be used to redistribute tourist flows to routes.

Analysis of experience in tourism development in the foreign Arctic has shown that the formation of tourist clusters should be based, among other things, on the development of transport infrastructure [2, Sevastyanov D.V., p. 33]. Reducing the time that tourists spend on a trip to the Arctic and the cost of travel will help make Arctic tourism more widespread. The purpose of this work is to analyze the time and economic distances between the centers of tourist flows formation and the Arctic regions that offer different types of Arctic tourism product; to identify the most promising current trends and possible ways of further planning of Arctic tourism in terms of logistical advantages.

Materials and methods

The problem of the development of Arctic tourism is widely covered in modern literature [1, Lukin Yu.F.; 2, Sevastyanov D.V.; 3, Kunnikov A.V.; 4, Zhelnina Z.Yu., Tereshchenko N.V.; 5,

[1] URL: http://www.rus-arc.ru/ru/Tourism/Statistics (accessed 19 November 2021).

Stewart E. J., Ligget D., Dawson J.; 6, Bayaskalova T.A., Kuklina M.V., Bogdanov V.N.; 7, Pashkevich A., Stjernström O., Lundmark L. et al.]. Approaches to the definition of Arctic tourism are conditional; it includes any type of tourism in the territories that are attributed to the Arctic zone of the Russian Federation. We believe that tourists' expectations should be used as the main criterion when planning Arctic tours, although they are usually stereotyped. Marketing research conducted in St. Petersburg and Murmansk among students showed that 80% of respondents want to go on an Arctic trip, which they see as an active or ecological type of tourism (for 50% and 40% of respondents, respectively). At the same time, potential tourists see icebergs, northern lights, polar bears, icebreakers, unique landscapes, Arctic plein-air, environmental volunteering, Arctic competencies in the images of their impressions [4, Zhelnina Z.Yu., Tereshchenko N.V., p. 75]. Consequently, we should consider the territories, where it is possible to see all this, as places for organizing the Arctic tours. They are located beyond the Arctic Circle, in the tundra zone, on the coast of the Arctic Ocean, on the Arctic islands.

If we consider the Arctic boundaries, the southern extension of the tundra is taken as the southern ecological boundary. Potential tourists can justify their expectations regarding the Arctic images within this natural area and to the north of it, which will facilitate their return there in the future. Therefore, the Arctic routes will bring income to their organizers.

In order to develop logistics schemes for the delivery of tourists, it is necessary to know the start and end points of the proposed Arctic tours. The most reasonable starting points for routes seem to be large cities — transport hubs that are places of tourist flows formation in any direction. Such cities are either places of residence for potential tourists, or serve as transportation hubs through which they can reach the final destination of their interest. In our opinion, the main places for the formation of tourist flows in Russia are Moscow and St. Petersburg — the most populated cities and the largest transport hubs. Another potential center for the formation of tourist flows are big cities — transport hubs that are connected by regular flights both with places of tourist interest in the Arctic and with other cities, which can redistribute the flow of tourists to the Arctic routes from the regions of Russia and from abroad. Novosibirsk, Ekaterinburg, Ufa, Omsk, etc. meet such criteria, in addition to those already mentioned. Of course, the list could be expanded after establishing appropriate regular flights to connect other potential transportation distribution centers to places of interest for tourists in the Arctic

Another side of the issue of logistics of Arctic tourist destinations is the choice of final logistics support centers in the Arctic territories, which will receive tourists, provide the necessary services and redistribute them according to tourist destinations ("supporting logistics centers for the development of Arctic tourism"). The criteria for choosing such centers is the availability of transport links with the places of tourist flows formation, their location in transport accessibility to potential places of tourist interest and the availability of necessary infrastructure. For areas of the Russian Arctic zone, such places can be Murmansk, Kirovsk, Apatity, Arkhangelsk, Naryan-Mar, Vorkuta, Salekhard, Labytnangi, Norilsk, Anadyr. There are airports in all these cities or their vicini-

ty, and in some cities there are railway, river and sea stations. There are regular flights from places of tourist flows formation and to the places of potential tourist interest in the Arctic.

The factors influencing the formation of the price and attractiveness of the tourist product are the time and cost of travel to the place of rest. As a criterion for the profitability of the transport and geographical position of the touristic supporting centers, we used the material and time costs when moving from the places of formation of tourist flows to them (economic distances). The measurement of the benefits of transport and geographical position of the objects is discussed in the work of L.A. Bezrukov, Ts.B. Dashpilov [8, Bezrukov L.A., Dashpilov Ts.B.]. The works of I.A. Potapov [9, Potapov I.A.] are devoted to the study of assessment of economic distance between the places of tourist flows formation and the centers of tourist interest. The authors see the choice of evaluation criteria in the priorities of tourists when moving. This is primarily the speed of travel.

We estimated the time and cost of travel to the place of rest based on data on ticket prices, travel time and regularity of flights available on the official websites of airports and railway stations. In order to compare different options for transport accessibility, we expressed these data in points according to the method proposed by I.A. Potapov [9, Potapov I.A.] (Table 1). The sum of points, in which the time and cost of travel when using regular flights were estimated, is a generalized indicator of the material and temporal costs for tourists. Additional criteria (corrections) for evaluating the profitability of certain destinations in relation to potential centers for the formation of tourist flows are the number of modes of transport that can be used to get to the supporting center in the Arctic and the regularity of flights (per week, per day) (Table 2).

Table 1

Assessment of the material and time costs (points) [9, Potapov I.A.]

Travel time	Point	Travel cost	Point
up to 2 hours	1	up to 1000 rubles	1
up to 3 hours	2	up to 2000 rubles	2
up to 4 hours	3	up to 3000 rubles	3
up to 5 hours	4	up to 4000 rubles	4
up to 6 hours	5	up to 5000 rubles	5
up to 7 hours	6	up to 6000 rubles	6
up to 8 hours	7	up to 7000 rubles	7
up to 9 hours	8	up to 8000 rubles	8
up to 10 hours	9	up to 9000 rubles	9
more than 10 hours	10	more than 9000 rubles	10

Table 2

Evaluation of regularity of flights (points)

Points						
1	2	3	4	5	6	7
The number of regular flights from the places of formation of tourist flows						
1 or more times per day	6 times per week	5 times per week	4 times per week	3 times per week	2 times per week	1 time per week
Number of modes of transport that can be used to reach a supporting center in the Arctic						
2 or more	-	-	-	-	-	1

The integral assessment of the advantages of the transport and geographical position of potential supporting tourist centers in the Arctic is calculated as the sum of points obtained for each of the listed criteria: the higher the total score, the greater the material and time costs of tourists.

Results and discussion

Let us consider each of the proposed supporting centers for Arctic tourism in the constituent entities of the Russian Federation, fully or partially included in the Arctic zone. Let us present them as transport hubs that redistribute tourist flows along the routes, identify their advantages and disadvantages that hinder the development of Arctic tourism in these territories.

The Murmansk Oblast occupies an advantageous geographical position in terms of opportunities for the development of Arctic tourism. Its border position, relative proximity to the centers of formation of tourist flows, as well as the availability of transport infrastructure make it accessible to tourists. Murmansk is an important logistics center for the development of Arctic tourism, as land, air and water transport routes converge here. This is facilitated by a railway connection to other regions of Russia, an airport, through which there is a regular connection to Moscow and St. Petersburg, and a sea port, which is used for cruise tourism purposes. The nuclear icebreaker fleet of Russia is based here, which is used for convoying ships in the Arctic Ocean and for Arctic cruises. Due to the compact network of settlements in the Murmansk Oblast, the dispersion of tourist facilities throughout its territory and the presence of several transport centers, other potential tourist centers can be identified. In particular, there is an airport “Khibiny” in the area of the cities of Apatity and Kirovsk, used by tourists-skiers, receiving flights from Moscow and St. Petersburg, and a railway station. We determined the economic distances and estimated the material and time costs of potential tourists in points (Table 3). For each center of tourist flows formation, a correction for the number of modes of transport that are available for these destinations for tourists was made. If they are accessible by one mode of transport, the correction is 2, if by two modes — correction is 1.

Table 3

Estimation of the material and time costs of tourists when traveling to Murmansk and Apatity from the centers of tourist flows formation (points)

Centers	Moscow		Saint Petersburg	
Criteria / transport	Train	Plane	Train	Plane
Murmansk				
Travel time	10	2	10	1
Travel cost	3	2	2	3
Flight frequency	1	1	1	1
Correction for the number of modes of transport	1		1	
Total	15	6	14	6
Apatity				
Travel time	10	2	10	1
Travel cost	3	4	2	6
Flight frequency	1	1	1	1

Correction for the number of modes of transport	1		1	
Total	15	8	14	9

One can see that the supporting center Murmansk has approximately the same values of material and time costs and economic distances relative to Moscow and St. Petersburg when using two modes of transport. Apatity has a less favorable transport and geographical position when tourists use an airplane, since the cost of tickets from Moscow and St. Petersburg to the Khibiny airport is higher, as its workload is less.

The Arkhangelsk Oblast is administratively part of the Arctic zone. The northern districts of the region can serve as tourist arrival points on Arctic routes. Land, air and water routes converge in Arkhangelsk, which is why it is a center for the redistribution of tourists, an intermediate point for Arctic cruises and a starting point for polar expeditions. Arkhangelsk airport receives flights both from the main centers of tourist flows (Moscow, St. Petersburg), and from other large cities (Kazan, etc.). Local airlines operate flights across the region, including to settlements on the coast of the White Sea. Estimation of material and time costs of tourists is presented in Table 4.

Table 4

Estimation of the material and time costs of tourists when traveling to Arkhangelsk from the centers of tourist flows (points)

Centers	Moscow		Saint Petersburg	
Criteria / transport	Train	Plane	Train	Plane
Travel time	10	1	10	1
Travel cost	2	4	2	3
Flight frequency	1	1	5	1
Correction for the number of modes of transport	1		1	
Total	14	7	18	6

As the analysis results show, the position of Arkhangelsk relative to St. Petersburg is less advantageous when using the cheapest railway transport. In this case, the reason for the increase in the material and time costs is the regularity of the Arkhangelsk-St. Petersburg train (2–3 times a week). The use of air transport from the places where tourist flows are formed to Arkhangelsk as a distribution center requires approximately the same amount of time and money.

Naryan-Mar is the only city, the largest settlement and the transport and distribution center of the Nenets Autonomous Okrug. It is represented mainly by air and water transport. Naryan-Mar airport receives regular flights from Moscow and St. Petersburg, connects settlements scattered over the vast territory of the district, which may be of potential interest to tourists. There is a river port on the Pechora, which serves cargo transportation and local passenger lines. There is no railway transport; road transport is limited to a small number of roads. Estimation of material and time costs and economic distance is presented in Table 5.

Table 5

Estimation of the material and time costs of tourists when traveling to Naryan-Mar from the centers of tourist flows (points)

Centers	Moscow		Saint Petersburg	
Criteria / transport	Train	Plane	Train	Plane
Travel time	-	2	-	2

Travel cost	-	7	-	5
Flight frequency	-	1	-	5
Correction for the number of modes of transport	2		2	
Total	-	12	-	14

Thus, the accessibility of Naryan-Mar for tourists from the main centers of tourist flows formation is limited to one mode of transport. The probable reason for this is the lack of land roads and the small population size in Naryan-Mar and the Nenets Autonomous Okrug, which makes the profitability of regular flights low. For the same reason, the number of flights from St. Petersburg to Naryan-Mar is 3 times a week, which worsens the transport accessibility of the district's capital in this direction.

For the northern regions of the Komi Republic, referred to the Arctic zone, the main center for the development of Arctic tourism can be the largest city of Vorkuta. It has the necessary tourist infrastructure. One can use land and air transport to come there; there is a railway station and an airport. However, direct air communication with the centers of tourist flows formation is present only with Moscow. The estimation data of economic distances and material and time costs of tourists are presented in Table 6.

Table 6

Estimation of the material and time costs of tourists when traveling to Vorkuta from the centers of tourist flows (points)

Centers	Moscow		Saint Petersburg	
Criteria / transport	Train	Plane	Train	Plane
Travel time	10	3	10	-
Travel cost	4	10	5	-
Flight frequency	3	6	5	-
Correction for the number of modes of transport	1		2	
Total	18	20	22	-

The analysis of the table shows relatively high values of the material and time costs of travel to Vorkuta as a supporting center for the development of Arctic tourism in the north of the Komi Republic. Moreover, the position of Vorkuta relative to St. Petersburg is the least favorable. Another identified feature is approximately equal values of the total scores obtained when using a plane and a train. This indicates the unfavourable transport and geographical position of Vorkuta in the current organization of transport links with the regions of Russia. However, Vorkuta is located 130–150 kilometers from the proposed supporting centers of Arctic tourism in the neighboring Yamalo-Nenets Autonomous Okrug (the cities of Salekhard and Labytnangi) and is connected to the latter by railway, which can be used to organize joint tours and infrastructure development.

The Yamal-Nenets Autonomous Okrug is located almost entirely to the north of the Arctic ecological border and can offer ethnic and ecological tours to the tundra and the Kara Sea coast, which corresponds to the stereotypes of potential visitors about Arctic tourism. Two nearby cities may become supporting centers of tourism development — Salekhard, the capital of the Okrug (there is an airport and a river port), and Labytnangi, located 20 kilometres away on the opposite bank of the Ob River (with a railway station). One can get from Salekhard to Moscow and St. Pe-

tersburg by plane, as well as to other major transport hubs — Ekaterinburg, Novosibirsk, Omsk, Ufa. It provides a link to the district's population centers. Only a train from Moscow comes to Labytnangi on a regular basis. Due to the close location of Salekhard and Labytnangi, we will consider them as a single logistics center for Arctic tourism. The values of the assessment of economic distances and material and time costs are presented in Table 7.

Table 7

Estimation of the material and time costs of tourists when traveling to Salekhard and Labytnangi from the centers of tourist flows (points)

Centers	Moscow		Saint Petersburg	
Criteria / transport	Train	Plane	Train	Plane
Travel time	10	2	-	2
Travel cost	3	10	-	8
Flight frequency	2	1	-	4
Correction for the number of modes of transport	1		2	
Total	16	14	-	16

Thus, the total points obtained for the assessment of material and time costs of tourists traveling from Moscow and St. Petersburg are approximately the same, which indicates an equal position of this reference center in relation to the hubs of tourist flows formation. Tourists traveling via Moscow have an advantage, as they can choose from two modes of transport, including the cheapest train travel. The position relative to St. Petersburg may become more favorable with an increase in regular flights and the implementation of trains. The availability of regular flights from Novosibirsk and Ufa (once a week), Omsk (2 times a week), Yekaterinburg (3 times a week) expands the geography of potential centers of tourist flows formation in the Yamalo-Nenets Autonomous Okrug.

For the vast sparsely populated areas of Taimyr in the north of the Krasnoyarsk Krai, Norilsk could be a reference center for the development of Arctic tourism. It is the largest city that has an airport with flights not only to the centers of tourist flows (Moscow and St. Petersburg), but also to other potential hubs (Novosibirsk, Ufa, Krasnoyarsk). Rail transport is not involved in transportation of tourists from other cities; it is represented only by a short local line connecting Norilsk with Dudinka, a river port on the Yenisei River. In fact, the most populated area with transport infrastructure is the eighty-kilometer vicinity of Norilsk. Separate settlements of Taimyr are located at a considerable distance from it and are accessible only by air. The results of scoring the economic distances and material and time costs of potential tourists intending to visit Taimyr are presented in Table 8.

Table 8

Estimation of the material and time costs of tourists when traveling to Norilsk from the centers of tourist flows (points)

Centers	Moscow		Saint Petersburg	
Criteria / transport	Train	Plane	Train	Plane
Travel time	-	4	-	4
Travel cost	-	10	-	10
Flight frequency	-	1	-	6
Correction for the number of modes of	2		2	

transport				
Total	-	17	-	22

The analysis of the data in the table shows that Norilsk has the most favorable position relative to Moscow. The position relative to St. Petersburg is complicated by the regularity of flights (2 times a week). In general, the overall scores obtained when assessing economic distances are high. There are opportunities to expand the tourist market in the northern districts of Krasnoyarsk Krai due to the availability of regular flights to other cities of Siberia and the Urals. According to the criteria of transport, social infrastructure and recreation cost, some authors consider the Krasnoyarsk Krai as the most suitable for Arctic tourism [6, Bayaskalova T.A., Kuklina M.V., Bogdanov V.N., p. 117].

For the Arctic regions of the Chukotka Autonomous Okrug, the only suitable base for the development of Arctic tourism is its capital, Anadyr. Anadyr airport provides an air link of the entire district to the "mainland"; Chukotka cannot be reached by regular land transport. Of the considered centers of tourist flows formation, Chukotka is connected only with Moscow. Other potential centers, connected by regular flights to the Anadyr airport, include Vladivostok and Khabarovsk. The seaport of Anadyr can be used for Arctic cruises. Estimation of economic distances and material and time costs is presented in Table 9.

Table 9

Estimation of the material and time costs of tourists when traveling to Anadyr from the centers of tourist flows (points)

Centers	Moscow		Saint Petersburg	
Criteria / transport	Train	Plane	Train	Plane
Travel time	-	8	-	-
Travel cost	-	10	-	-
Flight frequency	-	4	-	-
Correction for the number of modes of transport	1		0	
Total	-	23	-	-

The point estimation of the material and time costs shows a relatively high result, indicating the unfavorable transport and geographical location of Anadyr in relation to Moscow. Its disadvantages are the regularity of flights (from 2 to 4 per week) and the high ticket price. The lack of regular flights to St. Petersburg narrows the potential tourist market for this destination. However, due to the presence of regular flights to Khabarovsk and Vladivostok, it is possible to expand the market by including not only the south of the Russian Far East, but also neighboring China and Japan.

Vast areas of the Arctic part of Yakutia lack large settlements that could become strongholds for the development of Arctic tourism. They are not connected to the "mainland" by regular land transport and there are no airports. Communication with other regions is possible via Yakutsk or along the Lena River during navigation. The latter circumstance makes it possible to develop river cruising, which can mitigate the lack of tourist infrastructure and regular transport links in the Arctic zone of Yakutia. The development of the settlement of Tiksi as a transport center serv-

ing the coast of Yakutia, the creation of a tourist infrastructure there can become the basis for the formation of a supporting center of Arctic tourism.

The results obtained in assessing the material and time costs of tourists traveling to the regions of the Arctic zone of Russia make it possible to compare and identify the supporting centers for the development of Arctic tourism, which can already successfully serve tourist flows. The analysis of the components of this assessment reveals the existing problems that reduce the transport accessibility of supporting centers and increase economic distances. Table 10 presents the final results of the study.

Table 10

Summary table of the results of estimation of the material and time costs of tourists and determining the economic distances between the hubs of tourist flows formation and potential supporting centers for the development of Arctic tourism (points)

Support centers / centers of tourist flows formation	Moscow		Saint Petersburg		Other cities with regular flights
Kind of transport	Train	Plane	Train	Plane	Any
Murmansk	15	6	14	6	Kazan, Kaliningrad, Krasnodar, Perm, Nizhniy Novgorod, Chelyabinsk
Apatity	15	8	14	9	Anapa
Arkhangelsk	14	7	18	6	Kazan, Krasnodar, Kaliningrad
Naryan-Mar	-	12	-	6	Arkhangelsk
Vorkuta	18	20	22	-	Syktyvkar, Nizhniy Novgorod
Salekhard – Labytnangi	16	14	-	16	Ekaterinburg, Novosibirsk, Omsk, Ufa, Tyumen
Norilsk	-	17	-	22	Novosibirsk, Krasnoyarsk, Ufa
Anadyr	-	23	-	-	Khabarovsk, Vladivostok

As shown in Table 10, the lowest material and time costs are for tourists visiting the European part of the Russian Arctic zone, especially the Murmansk and Arkhangelsk oblasts. Against the general background of this Arctic sector, the potential supporting center of Vorkuta stands out: it has the worst transport and geographical position due to the low regularity of transport flights, high ticket prices and the lack of direct air communication with St. Petersburg. In the Asian part of the Arctic zone, the total score for assessing material and time costs is expected to increase, which indicates a less favorable transport and geographical position of these areas. A common feature of this zone is the lack of railway communication between the supporting centers for the development of Arctic tourism and potential centers of tourist flows formation, a great distance from them, which affects the price of tickets and the increase in economic distances between them. Against the general background in this Arctic sector, the supporting center of Salekhard stands out, having a relatively lower score of the total cost assessment. Besides, higher points are given to the costs of air communication with the centers of tourist flows formation. The Murmansk Oblast, Yamalo-Nenets Autonomous Okrug, the north of the Krasnoyarsk Krai (Taymyr) have prospects of expanding the tourist market. The

introduction of new regular flights and an increase in their regularity will give impetus to the development of Arctic tourism in other areas.

Conclusion

As a result of the study, we assessed the material and time costs of tourists and compared the economic distances between the potential centers of tourist flows formation in Russia (Moscow, St. Petersburg), identified the potential logistics supporting centers for the tourism development within the Arctic zone of Russia. Studies have shown that the Murmansk Oblast is currently the most promising region for the development of Arctic tourism. Favorable transport and geographical location, availability of diverse recreational resources able to meet stereotypical expectations of tourists traveling to the Arctic, proximity of potential centers of tourist flows formation both in Russia and abroad, transport infrastructure (including for Arctic cruises), two potential supporting centers for Arctic tourism development make this region the most attractive for planning of tourist projects

In general, the Arctic regions of the European part of Russia have the best estimates of economic distances. The exception is the potential supporting center of Vorkuta in the north of the Komi Republic: its transport and geographical positions are the worst due to the low regularity of flights, the high cost of tickets and poor transport connectivity with the centers of tourist flows formation. However, the proximity of Vorkuta to the supporting logistics center for the development of Arctic tourism in the neighboring Yamalo-Nenets Autonomous Okrug may contribute to the creation of joint tourist routes.

In the Asian part of the Arctic zone of Russia, the Yamalo-Nenets Autonomous Okrug is the most promising region in terms of transport infrastructure. This is facilitated by the availability of an extensive geography of regular flights between the hubs of tourist flows formation and the potential supporting center for the development of Arctic tourism Salekhard – Labytnangi. The advantage is its location on the banks of the Ob River, which expands the opportunities for tourism development. The least favorable is the transport and geographical position of the Chukotka Autonomous Okrug. Communication between the potential supporting center in Anadyr is carried out by regular flights only to Moscow. At the same time, there is a low regularity of flights and a high cost of tickets. This destination received the highest total points of material and time costs among all the centers considered. However, the southern regions of Siberia and the Far East may be the potential tourist market for the regions of the Asian sector of the Russian Arctic, as well as China and Japan. River cruising is promising, as great rivers (Ob, Yenisei, Lena) flow into the Arctic Ocean in the Arctic. This may reduce the need for transport infrastructure.

The most problematic in terms of transport connectivity to places of tourist flows formation is the Arctic part of Yakutia. This territory has regular communication only with Yakutsk. But the development of the settlement of Tiksi as a center of Arctic tourism development and as a transport center can mitigate this problem.

The general direction for increasing the prospects of Arctic tourism development is seen in the organization of regular transport links and increasing the number of flights on the existing routes between the supporting centers in the Arctic territories and potential centers of tourist flows formation.

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Is the Extraction of Fossil Mammoth Bone a Form of Traditional Nature Management? *

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Abstract. This article is devoted to solving the question of whether it is possible to consider the extraction of mammoth bone as one of the types of traditional nature management of the indigenous peoples of the North. The solution to the problem is considered on the part of three criteria — the formation of a tradition of economic activity within an ethnic group, the focus of economic activity on use for their own needs, a balanced approach ensuring sustainable environmental management. As a result, the author concludes that the extraction of mammoth bone is a type of activity that cannot be called fully consistent with the criteria for traditional nature management. At the same time, in the article, the author proposes to consider broader the concept of traditional nature management in the modern capitalist world, supplementing it with a view from the world-system analysis of the dichotomy of traditional and capitalist society.
Keywords: *extraction of fossil mammoth bone, Yakutia, traditional nature management, indigenous peoples of the North*

Is it possible to consider mammoth bones gathering as a type of traditional nature management? The question is ambiguous and, moreover, it raises a wide range of topics for discussion. In this article, we aim not only to explore this aspect of life in northern communities and come to a certain conclusion, how reasonable is the opinion that mammoth bones gathering should be attributed to one of the traditional types of nature management, but also to clarify what is the traditional use of nature in the modern capitalist society.

The relevance of this issue is undoubtedly associated with both applied and fundamental scientific problems. On the one hand, there is a need for the authorities to provide a scientific basis for the managerial decisions regarding national policies as well as the development of the Arctic, affecting the life of the population, and this concerns first of all the sphere of applied ethnology. Broader theoretical points concern the need to solve fundamental questions about the prospects for traditional forms of nature management of indigenous peoples, the optimal pathways for human development and for halting the degradation of the natural environment, as well as about approaches to analysing the evolution of societies. Thus, a seemingly applied topic opens up a wide field for discussion.

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In order to understand the issue, we started by clarifying the modern institutional framework of the concept of traditional nature management, first of all, by determining the position of the state, as reflected in the Russian legislation. Thus, the Federal Law No. 49-FZ dated May 7, 2001 "On the territories of traditional nature management of indigenous peoples of the North, Siberia and the Far East of the Russian Federation" states that traditional nature management is historically established and ensures sustainable nature management methods of using objects of flora and fauna, other natural resources of the indigenous peoples of the North, Siberia and the Far East of the Russian Federation [1].

In our opinion, this wording is rather vague and emphasizes that traditional use of natural resources is ethnic — it is typical only for a certain category of peoples. It should be noted that, in contrast to this interpretation, there is a concept of traditional nature management, which emphasizes its economic and territorial component. However, the law already states that ethnicity is one of the criteria, on the basis of which an activity can be classified as traditional. Further, we will notice that such an approach causes some problems in determining the prospects for the development of the indigenous peoples of the North. In addition, this definition leaves the possibility for different interpretations when trying to classify mammoth bones gathering as a traditional activity.

Ethnic definitions are based on several theoretical premises. Firstly, this is the principle of the staged development of societies, and, secondly, the idea of the homogeneity of an ethnic group in its cultural manifestations. The foregoing gives rise to certain attitudes with regard to traditional nature management. Thus, there is an opinion in the scientific discourse, such as in the work of Klimova D.S. and Belyaeva L.M. [1], the essence of which is reduced to the fact that in the past there were certain mechanisms of interaction in the system "man — the natural environment", allowing to avoid crisis phenomena in it. At the same time, people from the past and modern representatives of ethnic groups belonging to the indigenous peoples of the North of the Russian Federation are identified. In our view, this is due to the tradition of defining these peoples as backward and at an earlier stage of the development of society. The argument therefore is that, being "backward", indigenous peoples still reproduce the mechanism of interaction between "man and the natural environment", which is characterized by a respectful attitude toward the latter. They are supposed to be the keepers of certain knowledge of how to use the land and nature properly. Developing this theme, however, one sooner or later comes to a certain cul-de-sac related to the fact that in Russia, the small-numbered indigenous peoples of the North are not fully excluded from the dominant society. Moreover, much was done during the Soviet era to integrate them into the social structure, to eradicate the signs of so-called "backwardness" — the no-

[1] O territoriyakh traditsionnogo prirodopol'zovaniya korennykh malochislennykh narodov Severa, Sibiri i Dal'nego Vostoka Rossiyskoy Federatsii (s izmeneniyami i dopolneniyami) [On the territories of traditional nature management of the indigenous peoples of the North, Siberia and the Far East of the Russian Federation (with amendments and additions)]. URL: http://base.garant.ru/12122856/#ixzz6Qp4mv6Bu (accessed 18 August 2020).

madic way of life, the traditional economy as a basis of life, and to perform the professionalization of labor. Much has been written about this, in particular, by S.V. Sokolovskiy [2].

Many people continue to romanticise the image of small-numbered indigenous peoples of the North, giving a mystical character to the ecological knowledge that has been developed in the course of human adaptation to the natural environment. At the same time, there is an idea that these peoples would not exist without certain economic practices. There is also a tendency to consider any economic activities of indigenous peoples as traditional use of natural resources, even if they are of a purely commercial nature.

It should be mentioned that at present, the traditional economic activities include the following activities:

- livestock husbandry, including nomadic one (reindeer breeding, horse breeding, yak breeding, sheep breeding);
- processing of livestock products, including gathering, preparation and dressing of skins, wool, hair, ossified horns, hooves, antlers, bones, endocrine glands, meat and by-products;
- dog breeding (breeding reindeer, sled and hunting dogs);
- breeding, processing and realization of products of fur-farming;
- beekeeping;
- fishing (including sea fur hunting) and sale of aquatic biological resources;
- commercial hunting, processing and sale of hunting products;
- farming (gardening), as well as cultivation and processing of medicinal plants;
- harvesting timber and non-timber forest resources for own needs;
- gathering (procurement, processing and sale of food forest resources, collection of medicinal plants);
- extraction and processing of minerals for own needs;
- handicrafts and folk crafts (blacksmithing and ironworking, production of utensils, inventory, boats, sleds, other traditional vehicles, musical instruments, birch bark products, stuffed animals and birds, souvenirs from deer furs, hunted animals and birds and other materials, weaving from herbs and other plants, knitting nets, bone carving, wood carving, tailoring of national clothes and other types of trades and crafts related to the processing of fur, leather, bone and other materials);
- construction of national traditional dwellings and other buildings necessary for the implementation of traditional types of economic activity [2].

[2] Rasporyazhenie Pravitel'stva RF ot 8 maya 2009 goda N 631-r «Ob utverzhdenii perechnya mest traditsionnogo prozhivaniya i traditsionnoy khozyaystvennoy deyatel'nosti korennykh malochislennykh narodov Rossiyskoy Federatsii i perechnya vidov traditsionnoy khozyaystvennoy deyatel'nosti korennykh malochislennykh narodov Rossiyskoy Federatsii» (s izmeneniyami na 29 dekabrya 2017 goda) [Decree of the Government of the Russian Federation of May 8, 2009 N 631-r "On approval of the list of places of traditional residence and traditional economic activities of the indigenous peoples of the Russian Federation and the list of types of traditional economic activities of the indigenous peo-

The list of these activities suggests an idea that is often already presented in scientific papers on traditional nature management. According to it, the cultural and economic adaptation of a person to the natural environment proceeds in two directions: a person either adapts to natural conditions, or changes them for himself. It is believed that traditional nature management is associated primarily with the first direction. It is therefore harmoniously intertwined with the natural landscapes.

Thus, if not emphasizing the ethnic character of the economic activity, it can be noted that when determining traditional nature management, the following main criteria are distinguished: 1) the historical nature of the formation of nature management practices within the ethnic group, 2) the sustainable nature of the exploitation of natural resources. The third criterion of orientation towards own needs rather than towards the market is more controversial. However, the last two points have a strong connection with each other, so in this case we consider it important to note.

In the following step, let us consider sequentially which criteria of traditional nature management are satisfied when it comes to the extraction of mammoth bones.

Gathering mammoth bones is currently one of the most important sources of income in the North of Yakutia. This informal business is a seasonal work, when men in groups of 10–15 people, without formal labour relations, go to the tundra in the summer to collect mammoth bones.

According to the legislation of the Russian Federation, gathering of mammoth ivory can be carried out exclusively for scientific, educational and informative purposes. This means that only single samples can be collected without mining and other types of special work. Limiting the collection of fossil mammoth bones to “single samples” has resulted in the collector applying for 10–20 licenses over 10–20 small sites, on which the declared volume can't be gathered. Licenses are issued for some areas, but raw materials are extracted in other ones.

Since the commercial collection of paleontological material is not regulated, there are no tax payments from this type of activity. More than 100 tons are extracted annually, estimated at 1.5 billion rubles, not including smuggling. In addition, as mentioned above, the use of technology is not allowed. Collectors, however, often use it to extract tusks outside licensed areas. Soil erosion with powerful water pumps is a very common practice. Thus, despite the fact that the legislation regulated the collection of mammoth fauna, its individual points are at odds with current practice. Since the collectors can dispose of the remains at their discretion only if the state does not buy them back as of scientific and cultural interest, sawing tusks have become frequent.

As a result, during the raids of the environmental and law enforcement agencies of the Republic, numerous violations of the law are constantly being established. It entails both administrative and criminal penalties. Nevertheless, the number of persons requesting licences to collect mammoth fauna is increasing year by year.

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ples of the Russian Federation" (as amended on December 29, 2017)]. URL: http://docs.cntd.ru/document/902156317 (accessed 13 December 2020).

The lack of legal compliance, as well as the unregulated labour relations entered into by business participants (labour contracts are not formalised), result in the development of this type of activity as part of the informal economy. The basis for this is also the former social experience of the population. Business in the Arctic settlements is largely based on informal personalized relationships, where kinship and mutual assistance play an important role. Both villagers and reindeer herders are engaged in gathering mammoth bones. For reindeer herders, who wander a lot and are well oriented in the tundra, the opportunity to earn money on mammoth tusks is also attractive, while a relatively small number of reindeer owned by a reindeer family (on average 20–70 pieces) minimizes commercial use of this resource [3, Kaduk E.V.].

Currently, it is possible to hear the opinion that the collection of mammoth bones for sale can also be considered a traditional economic activity. This opinion is expressed both by some representatives of regional authorities and in the scientific community. At the same time, the main justification for this is the duration of this type of economic activity.

A number of researchers place this type of activity back in the depths of centuries and claim that the indigenous population of Eastern Siberia mined and sold mammoth tusks long before the development of the northern lands by Russian industrialists [4, Potravniy I.M., Protopopov A.V., Gassiy V.V.]. Researchers tend to draw such conclusions on the assumption of the text by A.F. Middendorf, who, based on the opinion of Olferst that the throne of the Tatar Khan of the Golden Horde, seen in 1246 and described by Plano Carpini, made of ivory and decorated with carvings, gold and precious stones, the work of the Russian goldsmith Kozma, makes an assumption that it was made of mammoth bone [5, Middendorf A.F.].

Is it possible, on the basis of this thesis, to say that the indigenous peoples of the North of Yakutia were also involved in trade? It would seem that they were not. In fact, the text reports nothing about the role of the indigenous peoples of the North in the social life of the material from which the throne was made.

Furthermore, one should probably not equate the economic relations that exist today with those of the past. As ethnographers convincingly show in their works, the meaning of the Cossack and Indigenous interactions in Siberia was originally ambiguous for both sides. On the part of the indigenous peoples of Siberia, offering of a gift in the form of available resources symbolised the establishment of peaceful relations with a stronger opponent on terms of equal partnership, rather than trade relations or even tribute obligations [6, N.V. Ssorin-Chaikov].

As I. Wallerstein notes, we do not get into the trap of identifying any exchange activity with the system of trade relations, if we consider that the components of the capitalist world-system (whether it is a mini-system or a world-system) can be associated with limited exchanges with elements located outside the system, in the “outer zone”. At the same time, the forms of such exchange are very limited, and the exchange of “luxury goods” is above all. In this case, each of the parties can export to others what is socially assessed in its system as having little value, importing in exchange something that is considered very valuable [7, Wallerstein I.]. If the exchange takes

the form of tribute relations, as it happened to the indigenous peoples of Yakutia quite soon after the reclamation of Siberia and the North by the Cossacks, one can talk about their involvement in the world economy as a peripheral, resource zone.

In this regard, a more moderate interpretation of the tradition of conducting economic activities for the extraction of mammoth bones, which is available in the "Concept for the development of gathering, study, use, processing and sale of paleontological mammoth fauna materials in the Republic of Sakha (Yakutia)", approved on August 13, 2018 No. 649-RG, looks more adequate. It states that "these resources (mammoth bones) have been the object of traditional nature management for 300 years by the indigenous peoples of the North of Yakutia, who, in the course of historical economic activity, collected tusks for delivery to merchants and industrialists" [3].

Indeed, active mining of mammoth tusk in Yakutia is associated with the events of the second half of the 18th century. However, as G.P. Basharin specifies, mammoth ivory was originally procured mainly by Ustyansk and Nizhne-Indigirsk Russian and Yakut industrialists on the shores of the Arctic Ocean, especially on the Lyakhovskiy and Novosibirsk Islands [8]. The state encouraged fishermen and merchants to extract mammoth bones and trade, which was not the subject of a poll tax charge. At the same time, the state pursued a restrictive policy with regard to fur trade with the yasak population.

However, as the share of yasak in the treasury revenue decreases, the state policy in the sphere of trade changes from prohibitive to free, which provokes penetration of trading capital into the local economy, involving the "foreign" population into the mammoth ivory trade. Most of them were in gathering mammoth bones in the coastal part of tundra. References to this can be found in the works of V.M. Zenzinova [9] A.F. Middendorf [5]. The fact is that in the conditions of the exchange nature of trade, the clerks of trading houses, carrying out trading activities in the Northern regions, sold goods to the local population almost exclusively for furs and bones [10, Gogolev, p. 259], which forced the indigenous population to collect mammoth bones.

Thus, for some period of time, the indigenous peoples were really engaged in gathering of mammoth bones, but this is rather a fact of forcing the population to certain types of activities. The indigenous peoples, faced with the world-system, were involved in a global division of labour, in which their specialisation became fur trade and mammoth ivory extraction. Tributary acted as a form of labour control.

The development of the global fur market had a considerable impact on drawing indigenous peoples into the capitalist world system. At the same time, the state acted as both capitalist in foreign markets and as exploiter and collector of taxes within its borders. Using non-market

[3] Rasporyazhenie Glavy Respubliki Sakha (Yakutiya) ot13 avgusta 2018 goda №649-RG «Kontseptsiya razvitiya sbora, izucheniya, ispol'zovaniya, pererabotki, i realizatsii paleontologicheskikh materialov mamontovoy fauny na territorii Respubliki Sakha (Yakutiya)» [Decree of the Head of the Republic of Sakha (Yakutia) dated August 13, 2018 No. 649-RG "The concept for the development of the collection, study, use, processing, and sale of paleontological materials of the mammoth fauna in the Republic of Sakha (Yakutia)"]. URL: http://docs.cntd.ru/document/550166534 (accessed 13 November 2020).

ways of exploitation, the state gained super profits, and in the best years, income from fur filled up to a third of the Russian state's treasury. Mammoth ivory was one of the three commodities exported from the region, along with furs. Being drawn into the capitalist world-system as an exploited periphery, indigenous peoples were already changing their practices of social interactions and nature management. Thus, Z.V. Gogolev points out that the exchange trade in furs and mammoth ivory had a significant impact on the transformation of social relations in the North. Instead of collective hunting, individual hunting and extraction of mammoth ivory appeared, old tribal customs and traditional tribal economic unity were losing their force [10, p. 121]. Thus, even then, the extraction of mammoth ivory not only coexisted with traditional economic activity, but rather transformed it. It cannot be said that the collection of mammoth bones was a tradition that originated within some ethnic group. It was rather a trade imposed by external circumstances on the entire population of the north-east of Russia.

Thus, if we consider the centuries-old, historical origin of the traditions of economic activity within an ethnic group as a criterion for attributing gathering of mammoth ivory to traditional nature management, then the extraction of a mammoth tusk does not apply to it.

The second criterion is that traditional nature management is finely balanced with the resource that it uses and does not lead to its destruction or reduction [4]. It is believed that the traditions of nature management of various indigenous ethnic groups are united by a common property — careful attitude to nature [1, Klimova D.S., Belyaeva L.N., p. 138].

If we talk about the sustainable use of the natural environment, it seems to us that J. Scott was close to the correct assessment of the relationship between man and the natural environment in traditional society. He studied the motives of the peasants' behavior and came to the conclusion that most of the specific manifestations of the agrarian organization, as well as the direct manifestations of the mechanism of interaction between "man and the natural environment" are based on the principle "safety – first" [11, Nikulin A.M.]. We believe that these principles are also applicable to the traditional economic activities of the indigenous peoples of the North, which are highly dependent on extreme climatic conditions, the value of collective action in which increases dramatically. The dependence of human life on the animal world creates a sacred attitude towards it.

K. Polanyi also provides historical and anthropological evidence of this practice, almost universal in traditional society, which is the main difference between it and the modern market economy. He concludes that "the absence of the threat of individual hunger in a certain sense makes a primitive society more humane in comparison with the market economy, but at the same time, less economically efficient". It also determines the careful attitude to the natural environment [12, Nureev R.M.].

[4] Goryashko A. Traditsionnoe prirodopol'zovanie: mify i real'nost' (na primere gagi obyknovennoy) [Traditional nature management: myths and reality (on the example of the common eider)]. URL: https://goarctic.ru/society/traditsionnoe-prirodopolzovanie-mify-i-realnost-na-primere-gagi-obyknovennoy/ (accessed 20 March 2021).

The capitalist society is somewhat different. Its peculiarity is the presence of a center and a periphery. People of the periphery find themselves in difficult conditions of the need to produce those goods that are in demand by the world-system, while the manufacture or extraction of goods for sale in a market economy is determined by the motive of profit, income from this activity. The connection of a person with the goods he makes is no longer regulated by a myth, as in a traditional society, the place of the myth gradually begins to be occupied by the culture of consumption, and accordingly, the attitude towards the biosphere also changes.

In modern Russia, difficult economic conditions, a high level of unemployment, as well as the operation of the laws of capitalism are changing the attitude of the population to the biosphere. The practice of soil erosion with the help of motor pumps has become widespread. Despite the legal prohibition, miners deliberately destroy soils with the help of powerful water pumps. This can cause rockslides, environmental pollution of water courses with mud, fuel, and destruction of the fertile soil layer. The constant noise of the engines scares away fish, birds and mammals [13, Keremyasov N.V., p. 15]. Certainly, not all mammoth ivory miners are engaged in fishing using prohibited equipment. However, the ban on the commercial collection of paleontological materials, which is contrary to reality, the inability to comply with the law, as well as unregulated labour relations (employment contracts are not registered) lead to the fact that this type of activity develops as part of the informal economy.

It is worth noting that the development of such non-respectful nature management practices is a collision course with the development of the capitalist world-system, in which nature is only a source of economic profit.

Let us use the following examples to illustrate this statement. It is known that the motive of the rapid rush through Siberia, when 4 thousand km from the Urals to the Pacific Ocean were covered in half a century (Okhotsk was founded on its coast in 1647, 56 years earlier then St. Petersburg), was Russia's participation in the development of the global fur market [14, Savchenko A.B., Treyvish A.I.]. Yasak, a tribute that was imposed on the local population, had to be paid in sable furs. Since then, sable hunting has firmly entered the economic activity of the indigenous population of Siberia. The systematic overhunting of sable under pressure of tribute payment led to the formation of mosaic habitat, and to the almost complete extermination of this species in some places. The sable gave the Russian treasury up to a third of its income, until the systematic extermination reduced hunting of it. In the 18th century, Russia's fur exports were supported by the hunting of sea animals, arctic foxes, and squirrels [14, Savchenko A.B., Treyvish A.I.]. Thus, the global fur market led to such ecological disasters already in the 16th–17th centuries.

More recent consequences of the inclusion of indigenous peoples of the North in capitalist relations are new trends in reindeer husbandry in Yamal, where because of profit from the sale of antlers, the number of deer is increasing, exceeding the reindeer capacity of pastures, which leads to the exhaustion of scarce Arctic landscapes, which simply have no time to recover.

In areas, where reindeer herding does not bring any commercial benefit, the development trends of the indigenous peoples of the North have been characterized by the lack of interest among young people in this economic activity. Thus, O.N. Gurova explains this phenomenon by the fact that the ancestral labour culture and ethnic norms of economic behaviour have been lost. Children and grandchildren of reindeer herders, hunters and fishermen have partly abandoned traditional occupations and are affected by the syndrome of indifference, contempt for the tedious, labour-intensive and economically unprofitable occupation of their ancestors. At the same time, they desperately strive to survive as free children of the tundra and taiga, living off the gifts of their native land [15, Gurova O.N.]. Of course, it is possible that all these radical transformations in the labour culture and ethnic norms of economic behaviour are related to the above-mentioned circumstances and the loss of fishing skills, but it is also important to mention the increasing involvement of people in the capitalist system. It transformed traditional society, in which people's lives were in retrospect, back to the days of creation, when the world was perceived as created in one act and existed without any changes from its beginning. Capitalism has transformed human attitude to life. A person is no longer turned to his past, once already created, he begins to live his indefinite future, which he has to create independently and together with the co-creation of people united by the common life plan of the national state [16, Fedotova V.G., Kolpakov V.A., Fedotova N.N., p. 150]. Thus, the transition from a traditional to a capitalist society also has sociocultural consequences.

In a traditional society, nature management is regulated by a myth; in a capitalist society, the place of myth is gradually replaced by the culture of consumption. In a traditional society, goods (deer meat, skins, wild plants, antlers) are rather a part of nature, borrowed from its circulation in order to return to it again, but in a different form. After all, the environment of a person living a myth is always alive and full of mythical meanings. When people ate plants or animals, they received their power, but they had to follow complicated rituals in order not to disturb the cycles of nature that produced their food. By contrast, under capitalism, things made by nature become commodities, since they are produced within the framework of agriculture, organised as a commercial enterprise. A person loses the connection between what he consumes and the place where all these products are produced [16, Fedotova V.G., Kolpakov V.A., Fedotova N.N., p. 150]. Thus, capitalist development, aimed at extracting the maximum benefit, expansion of capital, cannot be sustainable a priori.

Finally, the third condition for classifying an activity as traditional nature management says that the vast majority of production should be used for own needs. As R. Sulyandziga points out, “The Law on the Fauna allows traditional peoples to carry out their traditional activities without any restriction in order to support their families, not for commercial purposes” [5]. However, it is

[5] Teplyakov S. Russkim nel'zya, vepsam mozhno, evenkam ne dayut: kak rabotayut l'goty dlya malochislennykh korennykh narodov [Russians are not allowed, Vepsians are allowed, Evenks are not given: how benefits work for small in-

quite clear that mammoth ivory is not a resource extracted for their own use, but solely for the purpose of sale. The business has a pronounced export character. The resource is in demand in the segment of the elite economy. 80% of the materials found in Yakutia go abroad, mainly to China, Hong Kong, and the USA.

If we are talking about the population of the Far East, its orientation towards those resources that are demanded by the world market is gradually taking place. This includes activities that intersect with traditional types of economic activity — gathering of wild-growing plants. This activity is not ethnic in nature. In the Far East, berry picking is predominantly carried out by the unorganised population. Seasonal work in this area has become an opportunity for the population to replenish household income. Ethnic boundaries do not allow people to understand that the commonality of their social status is more important.

Thus, we can say that gathering of mammoth bones only partially meets the criteria of economic activities that can be classified as traditional nature use. It is clear that supporters of the opinion that the collection of mammoth ivory is one of the types of traditional nature management are well-intentioned due to the fact that in post-Soviet Russia the state is increasingly reducing its social functions and practically "leaving" the North and countryside. Centrifugal forces in migration cause more and more people to move to the cities. Jobs are being eliminated, which raises the question of finding new sources of livelihood for the local population. The combination of this with the spread of industry to the North and Arctic, and the threatening removal of parts of the land from traditional agriculture, forms the protective position of a number of ethnologists. It is assumed that if the collection of mammoth ivory is included in the list of traditional activities, then in the case of industrial development of territories, indigenous peoples could receive larger compensation through the Institute of Ethnological Expertise. Perhaps, this would indeed increase the amount of payments in some special cases. However, it is unclear how else its inclusion in the list of traditional economic activities would have affected the traditional way of life.

On a practical level, there is another important point to be made. Currently, there is no tax on the collection of mammoth ivory, as it is forbidden to collect it commercially, which is completely at odds with the realities of the extraction of this resource. However, in case of legalisation of this type of activity, the situation will change. In this case, the indigenous peoples of the North could be used as a kind of cover for people to avoid tax liability. As noted above, in accordance with the current version of Article 217 of Chapter 23 of the Tax Code of the Russian Federation, the incomes that are not liable to the personal income tax, include only the incomes (with the exception of the wages for the hired labour) received by the members of duly registered clan, family communities of small northern peoples practicing traditional economic activities, from the sale of products obtained in the result of traditional trades [6]. Classifying mammoth ivory extraction as a

digenous peoples]. URL: https://mbk-news.appspot.com/suzhet/kak-rabotayut-lgoty-dlya-korennyx-narodov/ (accessed 22 December 2020).

[6] Tax Code of the Russian Federation. URL: https://nalog.garant.ru/fns/nk/ (accessed 15 November 2020).

traditional activity would result in tusk mining not being taxed. Consequently, it may lead to abuses with regard to the registration of the communities of indigenous minorities of the North. The latter could trigger a new wave of identity change. After all, group rights make intergroup boundaries more rigid, forcing people with multiple identities to make a choice in favor of one of them when interacting with the state. It is no coincidence that, according to the latest Russian population censuses, the number of some groups of indigenous peoples of the North has grown so much that it was no longer possible to talk about natural or migration growth. This is how the identity change manifested itself under the influence of the new legislation.

Another, more theoretically profound question is how to study the social evolution of different societies. We believe that traditional societies of the non-capitalist past should never be equated with contemporary indigenous societies of the North. Modern indigenous people are culturally and socially well integrated in the Russian society, and now it is not correct to emphasize their cultural differences by adding the features of biological predetermination to certain activities. The traditional society cannot be reproduced at the present time, when these people are surrounded by the dominant capitalist society and are dependent on it. The development problems of indigenous peoples lie precisely in this; youth do not want to continue the economic traditions of their ancestors.

In these circumstances, the main object of protection should be the way of life of people involved in these economic practices; at the same time, all their other rights and specifics (language, religion, culture) are protected by the legislation on minorities and the norms of general civil law.

Based on the above, it should be noted that mammoth ivory mining is an activity that cannot be considered fully compliant with the criteria of traditional nature management. In addition, the consequences of the decision to consider mammoth tusk collection as a type of traditional nature use are unknown, both in terms of the organization of this business and in relation to the transformation of the identities and lifestyles of the indigenous population of the North of Yakutia. However, given the gaps in legislation, as well as the high level of corruption in this sector, it is predictable that abuses in the sphere of registration of communities of indigenous peoples of the North. However, the question of whether gathering of mammoth bones is one of the types of traditional nature management raises more important and broader questions about what traditional nature management is in the modern capitalist world.

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The Arctic Council: Main Development Milestones (To the Twenty-Fifth Anniversary of the Council's Founding) *

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Abstract. The article examines the formation and development of the Arctic Council (AC; Council) from 1996 to 2021. It is noted that the Council was created as an intergovernmental "high-level forum" for the development of cooperation between the Arctic states, coordination of their actions in the interests of ensuring sustainable development of the region, protecting the environment, preserving the culture, traditions, and languages of the indigenous peoples of the North. The status, structure, and organisation of the Council's activities are characterised. It is emphasised that the Arctic Council does not deal with military security issues. There are six indigenous peoples' organisations and 13 observer states that participate permanently in AC. In the second part of the article, the author analyses Canada, the USA, Finland, Iceland, Russia, Norway, Denmark, and Sweden chairmanship results in the Arctic Council (from 1996 to the present day). Revealing the issues of continuity in the chairmanship of the AC founding states, the author focuses on new approaches of countries in the exploration and development of the Arctic through the activities of working groups. In contrast, joining the AC of intergovernmental and non-governmental organisations is investigated for the first time. The author notes the growth of the authority and prestige of the Arctic Council in the Arctic arena of international relations. The preparation of the Russian Federation for the chairmanship of the AC (2021–2023), its program, and main events are analysed.
Keywords: *Arctic, Arctic Council, Russia, Denmark, Iceland, Canada, Norway, USA, Finland, Sweden, chairmanship, international cooperation, ministerial meeting, sustainable development*

Introduction

The history of the Arctic Council (AC, Council) began in 1989, when representatives of eight Arctic countries, at the initiative of the Finnish government, met in Rovaniemi (Finland) to discuss issues of environmental protection in the Arctic. In 1991, they adopted the Arctic Environmental Protection Strategy. The unification of these states was facilitated by the meetings of the Conference of Parliamentarians of the Arctic Region, which brought together delegations from the legislative bodies of the AC founding countries, as well as representatives of the European Parliament and delegates from the indigenous peoples of the Arctic region. As cooperation between these states developed, it became necessary to create their own organization. Officially, the Arctic Council was established on the basis of a declaration signed in Ottawa (Canada) on September 19, 1996 [1, Vylegzhanin A.N.].

It should be noted that the Ottawa Declaration is not a fundamental international treaty; it was not submitted for ratification by the national parliaments of the participating states and was

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not registered with the UN as an international treaty. Its text outlines the main parameters for the functioning of the Arctic Council, in particular, an alternate two-year cycle of chairmanships of the participating countries is defined, a circle of permanent participant organisations is outlined, a decision-making method is fixed by consensus, which allows to combine efforts in solving common problems without imposing one's will on the others. It is specifically stated that the AC does not deal with military security issues [1].

The AC is an international regional structure designed to promote cooperation in the Arctic in the field of environmental protection and sustainable development of the circumpolar areas.

Status, structure and organisation of activities

The member states of the Arctic Council are Canada, Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, the Russian Federation, Sweden and the United States of America.

The founding members are five Arctic coastal states located on the coast of the Arctic Ocean (Denmark through self-governing Greenland, Canada, Norway, the Russian Federation and the United States) and the three Arctic states with territories (Finland and Sweden) or territorial waters (Iceland) crossing the Arctic Circle. Five member states of the Arctic Council (Denmark, Iceland, Canada, Norway and the United States) are members of the North Atlantic Treaty Organisation (NATO), three member states (Denmark, Finland and Sweden) are members of the European Union, and Norway and Iceland are members of the European Economic Area created by the EU and EFTA.

It is important to emphasize that the five Nordic countries — Denmark, Iceland, Norway, Finland and Sweden — have close regional cooperation in both domestic and foreign policy within the Nordic Council and the Nordic Council of Ministers. All five Nordic countries are also members of the Council of the Baltic Sea States (CBSS), the Barents Euro-Arctic Council (BEAC), of which the Russian Federation is also a member.

Six organisations of indigenous peoples take part in the work of the AC on a permanent basis: the Arctic Athabaskan Council, the Aleut International Association, the International Gwich'in Council, the Inuit Circumpolar Council, the Saami Council, the Russian Association of Indigenous Peoples of the North, Siberia and the Far East [2]. These organizations are authorized to participate in the negotiations and decision-making process within the Council. The Permanent Participants category was created to ensure the active participation and enhanced consultations with representatives of the Arctic indigenous peoples within the framework of the Arctic Council.

[1] Declaration on the Establishment of the Arctic Council 1996. Ottawa Declaration. Arctic Council. Ottawa, Canada. Sept. 19, 1996. URL: http://library.arcticportal.org/1270/1/ottawa_decl_1996-3..pdf (accessed 26 May 2021).
[2] Since 2014, the President of the Association of Indigenous Peoples of the North, Siberia and the Far East of the Russian Federation has been a deputy of the State Duma of the VI and VII convocations, Senator of the Russian Federation G.P. Ledkov.

There is an observer status in the Council for non-Arctic countries, international intergovernmental organisations and non-governmental organisations. Currently, 13 states are AC observers: Great Britain, the Netherlands, Poland, Germany, France, Spain, Italy, China, India, Japan, the Republic of Korea, Singapore, Switzerland; 12 intergovernmental organisations; one interparliamentary organisation; 12 non-governmental organisations. Observers may attend plenary meetings of the AC Senior Officials, as well as other events — upon invitation of the current Chairman of the AC. The list of observers is constantly growing.

Interest in obtaining observer status in the Arctic Council comes from states and organisations with a desire to influence its activities and decisions. Some have seen the expansion of observer status as a means of internationalising the management of Arctic affairs and limiting the sovereign rights of the Arctic states in their areas of national jurisdiction in the Arctic Ocean.

In fact, the main function of the observers is to monitor the work of the Arctic Council. They contribute to the work of the Council through participation in the activities of its working groups, at the meetings of which they have the opportunity to make statements after the member states and permanent participants, to submit written statements, and to introduce various documents for consideration. Observers may only propose projects for discussion through an AC member state or a permanent participant, and the amount of funding for any of the projects of the Arctic Council by an observer may not exceed that of the Arctic states.

The European Union is the “pending” observer state. At a ministerial meeting in Kiruna (Sweden, 2013), the Arctic Council “approved” the status of the European Union as an observer, but postponed the final decision because Canada opposed it. At the ninth AC ministerial meeting on 24 April 2015 in the Canadian city of Iqaluit, the European Union was again not granted observer status. It was decided that until the ministers of the Arctic states make a final decision, the European Union can only observe the work of the Arctic Council [2, Dudin M.N., Ivashchenko N.P.]. Currently, about 20 more organisations and countries are seeking observer status.

The Arctic Council is the most significant institution of international environmental cooperation in the Arctic. Its competences include obtaining reliable information about the state of the Arctic environment; conducting environmental monitoring; developing proposals and recommendations on pollution prevention and control for the subarctic states and observer countries.

Currently, the AC has the legal attributes of an intergovernmental international organisation: a permanent Secretariat of the Arctic Council, which has organisational and technical authority and, under a special agreement with the Norwegian government, is located in the Norwegian city of Tromsø (until 2013, it was located in the country holding the chairmanship). Member States agree to make regular contributions to the functioning of the Council. In 2016, it included the Secretariat of Indigenous Peoples (previously located in Copenhagen), established to support the activities of permanent participants in the AC. The co-location of the two Secretariats has contributed to closer contacts between them, enhancing the efficiency and capacity of each of them and streamlining the work of the AC as a whole.

The chairmanship in the AC: plans, achievements and failures

The chairmanship of the Arctic Council is carried out on a rotational basis. Each of chairing countries puts forward its own program of priorities in the Arctic policy. The working groups of the Arctic Council are created on the basis of consensus, and its projects are implemented jointly by all member states only in cases where their issues are in the common interests of all member states.

There are currently six such groups: Arctic Contaminants Action Program (ACAP); Arctic Monitoring and Assessment Program (AMAP); Conservation of Arctic Flora and Fauna (CAFF); Emergency Prevention, Preparedness and Response (EPPR); Protection of the Arctic Marine Environment (PAME); Sustainable Development Working Group (SDWG). Through their scientific activities, the governments of the Arctic countries have joined forces for full-scale environmental control. Their reports draw attention to the problems of the Arctic environment. The Council maintains a dialogue among scientists, politicians, indigenous peoples of the region.

The Arctic Council has task forces with time-limited activities that last until the desired results are achieved.

The highest body of the Council is the Ministerial meeting (usually at the level of the Ministers of Foreign Affairs), which is held every two years. It decides on the organisation's activities, signs documents, and rotates the chairmanship among its member countries.

Ministerial meetings are prepared and held by the presiding country; it reports on the results of its work for a 2-year period [3, Zhuravel V.P.; 4, Lyapchev D.Yu.].

Current issues of the Council's activities and the preparation of ministerial meetings are handled by the Senior Officials of the AC (official representatives of the AC member states, usually from foreign policy departments), who meet at least twice a year.

The first chairmanship of the AC was held by **Canada** from 1996 to 1998. The Iqaluit meeting in September 1998 approved the Council's Rules of Procedure, decided to develop an Arctic Council Action Plan to eliminate Arctic pollution and announced the establishment of the University of the Arctic, an international network of higher education institutions and Arctic research centres dedicated to research on northern issues. It was agreed that pollution management issues would always be at the top of the countries' chairmanship agendas. Two intergovernmental organisations (the United Nations Environment Programme (UNEP) and the International Arctic Science Committee (IASC)) as well as four non-governmental organisations were admitted to the AC at the Iqaluit Ministerial Meeting: the Standing Committee of Parliamentarians of the Arctic Region (SCPAR), the International Union for Circumpolar Health (IUCH), the Northern Forum and the World Wildlife Fund.

Under the **US** Chairmanship (1998–2000), the AC Action Plan to Eliminate Pollution of the Arctic and the Framework Document for Sustainable Development in the Arctic were prepared and approved. A joint project on assessing the impact of human activities on the Arctic climate was also prepared for launch, calling on representatives of the Arctic states to highlight in research

not only the climatic, but also the social, cultural and economic impacts of their activities in the Arctic region. Attention was drawn to the provision of remote medical services (telemedicine), co-operation between children and youth of the Arctic states, cultural and ecological tourism, and support for coastal fisheries. At the ministerial session in Barrow in 2000, 4 intergovernmental organisations were admitted to the AC: the International Federation of Red Cross and Red Crescent Societies (IFRC), the International Union for Conservation of Nature (IUCN), the Nordic Council of Ministers (NCM), the North Atlantic Marine Mammal Commission (NAMMCO) and 3 non-governmental organizations: the Advisory Committee for the Protection of the Seas (ACOPS), the Circumpolar Conservation Union (CCU) and the International Arctic Social Science Association (IASSA).

The main directions of the **Finnish** Chairmanship (2000–2002) were sustainable development, developing the competence of Arctic residents on issues of concern to the region, and applying the traditional knowledge of indigenous peoples of the North. For the first time, the topic of gender equality was addressed. At the ministerial session in Inari in 2002, one intergovernmental organisation was admitted to the AC: the United Nations Development Program (UNDP) and 2 non-governmental ones: the University of the Arctic (UArctic) and the International Work Group for Indigenous Affairs (IWGIA).

During the **Icelandic** Chairmanship (2002–2004), work was carried out to expand scientific and educational cooperation between the Arctic countries, develop information and communication technologies, and intensify interaction between the Arctic Council and the European Union within the framework of the EU Northern Dimension project. At the Reykjavik ministerial session in 2004, an intergovernmental organisation, the Nordic Environment Finance Corporation (NEFCO) and a non-governmental organisation, the Arctic Institute of North America (AINA), were admitted to the AC.

During the **Russian** Chairmanship (2004–2006), special attention was paid to sustainable development, pollution control, human capital development, climate change, and preparations for the International Polar Year (2007–2008). Energy issues were discussed for the first time.

During the **Norwegian** Chairmanship (2007–2009), the priority issues were the following: climate change, biodiversity conservation, human capital development, cooperation in disaster relief, study of the ocean environment, combating contaminants, joint monitoring programs in the Arctic region, as well as the results and legacy of the past International Polar Year.

During the **Danish** Chairmanship (2009–2011) in May 2011 in Nuuk (Greenland), the first ever “Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic” was signed in Nuuk, Greenland in May 2011, to create a unified regional search and rescue system in the Arctic, including coordination of rescue forces. A set of criteria has also been developed for the admission of countries as observers to the Arctic Council.

During the **Swedish** Chairmanship (2011–2013), an “Agreement on cooperation in the field of preparedness for responding to marine oil pollution in the Arctic” was adopted in May 2013 in

Kiruna. In 2011, Sweden presented its Arctic strategy. It justified the need to overcome gaps in knowledge of the Arctic natural systems, the need to expand expeditionary activities, to strengthen institutions for the transfer of experience and technology, networking and academic mobility (University of the Arctic), and to establish a regional information centre for environmental monitoring [5, Sweden's Strategy for the Arctic region…].

In 2013, **Canada** opened its second two-year AC Chairmanship. The permanent secretariat of the AC (Tromsø, Norway) was formed, the rules of its work were agreed; in 2014, the Arctic Economic Council was established as an independent organisation of the Arctic states' business communities [3]; a decision was made to establish a collective fund for joint financing of environmental projects — the Arctic Council Project Support Instrument; the composition of observer countries in the Council was expanded on the basis of previously developed criteria for the admission of new members to the Arctic Council as permanent observers [6, Zhuravel V.P., Antyushina N.M.]. It should also be noted that in April 2015, Iqaluit adopted a framework cooperation plan to prevent oil pollution from hydrocarbon production and shipping intensification in the Arctic and a framework document on the reduction of soot and methane emissions.

During the **US** Chairmanship (2015–2017), the Agreement on the Development of International Arctic Scientific Cooperation was adopted (entered into force in May 2018). A joint statement of intent to develop multilateral cooperation in the format of the Arctic Coast Guard Forum was also signed. Russia, the United States, Norway, Canada and Denmark signed, on the basis of consultations, an agreement to ban fishing in the international Arctic waters. The state and challenges of communication networks in the Arctic region were explored for the first time. At the Fairbanks ministerial session in 2017, 4 intergovernmental organisations were admitted to the AC: the International Council for the Exploration of the Sea (ICES), the OSPAR Commission, the World Meteorological Organization (WMO) and the Western Nordic Council, as well as a non-governmental organisation — International Organization for Ocean Protection. It is important to note that, unlike Canada, the United States did not transfer the existing contradictions between the US and Russia on the issue of Ukraine and Syria to the work of the AC itself, which largely contributed to the positive results of their chairmanship [7, Zhuravel V.P.].

Finland's main areas of work (2017–2019) in the Arctic Council were: environmental protection, including the conservation of biodiversity in the northern polar zone; development of communication networks in the region; increasing the number of weather stations for monitoring the state of ice, the ocean and the atmosphere; educational programs for indigenous youth [8, Härkönen A.]. However, a joint declaration was not adopted, which was the first time in the AC history. This was an unprecedented case and the first public acknowledgement of the contradictions among the countries of the Council, especially the US, which blocked the draft document due

[3] It consists of up to 3 representatives from the Member States and Permanent Participants of the AC. From Russia, representatives of Rosatom, PAO NOVATEK and PAO Sovcomflot participate in the NPP. Since September 2015, the NPP Secretariat has been operating in Tromsø (Norway).

to its mention in the text of the need to work together on climate issues. At the Rovaniemi ministerial session in 2019, the International Maritime Organisation (IMO) was admitted to the AC.

Iceland's Arctic Council Chairmanship (2019–2021) has focused on protecting the Arctic marine environment; sustainable development of the fishing sector; reducing ocean pollution, combating marine debris; climate change, continuing work to improve the quality of weather forecasts in the Arctic region, further exploring the possibilities of increasing the efficiency of using marine resources; creating conditions for improving the lives of indigenous peoples; continuing activities to strengthen and enhance the role of the Arctic Council. Due to the COVID-19 coronavirus pandemic, some of the planned activities were canceled or not fully implemented [9, Krasnopolskiy B.Kh.]. The achievement of the chairmanship is the adoption of the Arctic Council Strategic Plan 2021–2030 [4], which could not be approved in 2019 due to the negative position of the United States.

On May 20, 2021, the AC ministerial session was held in Reykjavik, at which the chairmanship of the Council for 2021–2023 passed from Iceland to **Russia** [10, Zhuravel V.P.]. The priorities of the Russian chairmanship are: the Arctic population, including indigenous peoples; environmental interaction, including climate change; socio-economic development of the region; strengthening the Arctic Council as the main platform for multilateral cooperation in high latitudes. The Russian Federation intends to continue the search for a balance between the three main areas of sustainable development in the AC format: economic growth, social integration and environmental protection.

Russian Prime Minister Mikhail Mishustin has approved the Concept of the Chairmanship and the Plan of its main events [5], which includes 116 events grouped into 11 sections. The events will be devoted to discussing climate change and the ecology of the Arctic, indigenous peoples, emergency prevention, infrastructure development and sustainable shipping, economic cooperation, international scientific cooperation, youth, Arctic tourism, and cultural events. Yu.P. Trutnev, Deputy Prime Minister of the Russian Federation and Plenipotentiary Representative of the President of the Russian Federation in the Far Eastern Federal District, was appointed Chairman of the Organising Committee to prepare and ensure the Russian Federation's chairmanship of the Arctic Council in 2021-2023. To date, about 20 events have been held. Every month, the activities of the Arctic Council under the Russian chairmanship are intensified, enriched in terms of content and forms of its implementation.

Russia's special responsibility for the AC chairmanship is manifested in the fact that it owns the largest Arctic territory and, most importantly, it has the longest coastline among the countries

[4] Speech and answers to media questions by the Minister of Foreign Affairs of the Russian Federation S.V. Lavrov during a joint press conference with the Minister of Foreign Affairs of Iceland G.T. Thordarson following the talks, Reykjavik, May 20, 2021. URL: https://www.mid.ru/ru/foreign_policy/news/-/asset_publisher/cKNonkJE02Bw/content/id/4739617 (accessed 26 May 2021).

[5] Plan of main events in connection with the chairmanship of the Russian Federation in the Arctic Council in 2021–2023 dated April 30, 2021, No. 4161p-P2. URL: http://www.arcticandnorth.ru/upload/medialibrary/7f7/Plan-osnmerporiyatii_Arkticheskii_-sovet-2021_2023-godakh.pdf (accessed 20 May 2021).

of the Arctic "Five". The Russian Federation has 22.600 km, Denmark — 5.958 km, Canada — 5.363 km, the USA —3.272 km, Norway — 1.609 km [11, Baklanov P.Ya., Moshkov A.V., Romanov M.T.].

The amount of funding for events has been determined: in 2021, with the agreement of the Ministry of Finance of Russia and the Chairman of the Government of the Russian Federation, money will be allocated from the reserve fund. For 2022–2023, the Ministry for the Development of the Russian Far East will provide the necessary funds in the federal budget in the prescribed manner.

It should be noted that the COVID-19 coronavirus pandemic may have an impact on the scale and decrease the number of planned mass events. The ongoing political tension in relations with the West may affect the meetings of the Committee of Senior Officials, the activities of the working and expert groups of the Arctic Council. There are still fears that sanctions pressure and accusations of Russia militarising the Arctic, violating environmental requirements and oppressing the rights of indigenous peoples of the North will increase on the part of some AC countries, which could affect the rhythm and timetable of its work.

Conclusion

During the period of its activity, the Arctic Council has carried out significant work on the study of the Arctic, adopting three important Agreements and organising work on 80 projects.

The capacity and effectiveness of the AC is evidenced by its contribution to the drafting and approval of the International Code for Ships Operating in Polar Waters, which has been developed for more than twenty years (entered into force on January 1, 2017), the Minamata Convention on Mercury, adopted on October 10, 2013 of the Stockholm Convention on Persistent Organic Pollutants of May 22, 2001, the formation of the University of the Arctic in 2001, which includes universities, research institutions and other organisations with expertise in the field of development of education and science about the North.

The Arctic Council has acquired the status of a unique international platform for interaction between the Arctic states and coordination of their policies in the region.

Russia takes an active part in the activities of the AC throughout its operation [12, Chater E.], representatives of ministries and departments (Ministry of Foreign Affairs of the Russian Federation, Ministry of Education and Science of the Russian Federation, Russian Academy of Sciences, Ministry of Transport of the Russian Federation, Ministry of Natural Resources of the Russian Federation, Ministry of Health of the Russian Federation, Ministry of Energy of the Russian Federation, Ministry of Emergency Situations of the Russian Federation and etc.), as well as educational and scientific institutions: Northern (Arctic) Federal University named after M.V. Lomonosov, Arctic and Antarctic Research Institute of Roshydromet, North-Eastern Federal University named after M.K. Ammosov, the Kola Scientific Center of the Russian Academy of Sciences, the Federal Research Center for the Integrated Study of the Arctic of the Russian Academy of Sciences, the Insti-

tute of Oil and Gas Problems of the Russian Academy of Sciences, the Institute of Oceanology named after P.P. Shirshov, Russian State University of Oil and Gas (NRU) named after I.M. Gubkin, St. Petersburg Polytechnic University, the Institute of Arctic Technologies of the Murmansk State Technical University, etc.

The main result of Arctic cooperation is that the mutual interest in its strengthening and development has not allowed its activities to be frozen, despite the environmental risks arising here, military and political threats, and the actions of anti-Russian sanctions. Cooperation continues to develop, and the Arctic remains a zone of peace, international cooperation and political stability.

The accumulated experience of the Arctic Council demonstrates the effectiveness and productivity of cooperation among all the Arctic states within the limits established by its work, which can be considered optimal in the current international environment. This does not exclude the possibility of making certain changes to the established algorithm of the Arctic Council; however, these changes should not affect its fundamental foundations and principles [13, Voronkov L.S.].

In 1996–2013, the main efforts were aimed at solving organisational issues, identifying and consolidating the main priorities in its activities: issues of ecology, environmental protection, support for the indigenous peoples of the North. Great attention was paid to the creation and organisation of the AC working groups, as well as the establishment and development of international cooperation between the Arctic states. From 2014 onwards, each new chairmanship introduced new challenges into the Arctic issues caused by climate change, advances in science and technology, and the desire to improve the lives of the indigenous peoples of the North. Their agendas have combined the national characteristics of the states more clearly and proportionately with traditional and new trends in Arctic development and exploration.

Actual problems of the Arctic and the AC activities are reflected in a number of works by Yu.F. Lukin [14; 15; 16; 17], monograph by L.S. Voronkov [18] and the work of N.M. Antyushina [19]. Since 2015, the issues of the chairmanship of the Arctic countries in the AC have been constantly covered by the author in the journals “Modern Europe”, “Arctic and North”, “Scientific and Analytical Herald of the Institute of Europe RAS”, as well as at international and all-Russian scientific forums.

The decisive contribution to the activities of the Arctic Council, the growth of the authority and prestige of the Russian Federation in the Arctic direction was made by senior officials from Russia in the AC [6]. In the second half of the 1990s, these are representatives of the State Committee of the Russian Federation for the Development of the North (1995–1998), the State Committee of the Russian Federation for Northern Affairs (1999–2000), diplomats V.I. Churkin (2003–2006), A.A. Ignatiev (2006–2008), A.V. Vasiliev (2008–2014), V.V. Barbin (2014–2018). Since 2018, this position has been held by N.V. Korchunov. It should be noted that during the chairmanship of

[6] Determined by the author during a conversation with A.A. Ignatyev, Ambassador Extraordinary and Plenipotentiary and Editor-in-Chief of the journal “Arctic Vedomosti”.

the Russian Federation in the AC from 2004 to 2006, V.I. Churkin and A.A. Ignatiev were the chairmen of the Committee of Senior Officials of the AC; since 2021, N.V. Korchunov has been holding this position.

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A Linguosemiotic Study of Nominations of Northern Lights in Russian and German*

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Abstract. The article studies lexical designations of the natural phenomenon of the Northern lights in scientific, literary, journalistic and advertising texts of German- and Russian-speaking authors. The purpose is to compare and contrast their implementation in German and Russian Arctic discourses. The study of semantics, syntactics and pragmatics of lexical designations of the phenomenon allows authors to comprehensively assess the views of German and Russian scientists, writers, poets, journalists, representatives of tourism and advertising business on the northern lights. A comparative study of lexical designations of the northern Lights in the focus of German and Russian Arctic discourses shows the similarity in the presentation of the lexical categories under consideration according to the existing universal (scientific) world picture and the differences in the implementation of lexical designations of northern lights, explained by the national world picture of the representatives of two compared linguistic cultures.

Keywords: *northern lights, Arctic discourse, linguo-semiotics, language sign, speech sign*

Introduction

The purpose of the present study is a comparative analysis of the lexical designations of the natural phenomenon of the northern lights in the German-speaking and Russian-speaking Arctic discourses from the standpoint of linguosemiotics.

The main research methods used are the continuous sampling method, the definitional analysis method, the component analysis method, the distributive analysis method, the cognitive-discursive analysis method, contextual analysis, the method of linguistic description, which

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includes observation, comparison, systematization and generalization techniques, as well as the verification method.

The complex of standard techniques and methods of research made it possible to comprehensively approach the description of the unique natural phenomenon of the northern lights in relationship of its types, forms, sources of origin with a description of a person's attitude to it. Using the method of continuous sampling, the authors of the study ensured the creation of a corpus of studied units, indicating the variability in the use of lexical designations of the northern lights. Due to the continuous sampling method, representative reliable data on the semantics, syntactics and pragmatics of language signs were obtained, reflecting the real picture of the distribution of linguistic text units of the Arctic content, as well as data on the act of reference, the indication of this atmospheric natural phenomenon by the sender of the studied language and speech signs. Component analysis has allowed to present, on the material of two languages (Russian and German), in diachrony and synchrony, the semantic evolution of the development of the prototypical nominations “Northern / polar lights” and “Nordlicht / Polarlicht” by decomposing their meanings into constituent elementary parts, the combination of which gives a complete picture of the use of the relevant terms and lexical designations. Based on the method of component analysis, this study defines the paradigmatics and syntagmatics of lexemes, combinations of lexemes and their individual meanings, which have a common integral semantic feature – a reference to the nomination of the northern lights. As differential features, this study describes the assignment to different functional styles (scientific, publicist, literary) and traces the history of the nomination in different time periods. With the help of definitional and component analysis, the statement that the most general categorical semantic features have universal significance is proved. Of particular importance is the fact that the general categorical features of the designations of the northern lights can be presented differently in Russian and German languages and the corresponding lexicographic sources (dictionaries and glossaries).

The distributive analysis used in the study allowed us to discover a number of patterns in the functioning of words in speech: the rules of selection restrictions, the rules for adding lexical meanings, and the rules for semantic agreement of the studied speech signs. The study of the environment of linguistic units acting as a signifier to the signified — the northern lights — made it possible to comment on these designations in a syntagmatic perspective. Syntagmatic relations that are similar for the two studied languages within a certain genre of text (for example, scientific) demonstrate a difference in style register within a particular language. Such a language description “from the inside” from the perspective of linguosemiotics made it possible to focus on linguistic phenomena with regularly recurring features. In this turn, unlike the distributive method, which makes it possible to study only the structure of the expression plan (texture of speech signs) in abstraction from the content plan, the method of cognitive discourse analysis contributed to the description of the cognitive and communicative properties of the studied nominations of the northern lights and the possibility of extracting textual and non-textual information about the

Arctic discursive situation. This method also provided an understanding of the Arctic discourse from the perspective of linguocultural studies.

The pragmatically important understanding of the generation and comprehension of meaning in the context as a factor in the generation and transformation of meanings served as the cognitive basis for the interpretation of semiosis. The combination of traditional (communicative-pragmatic) and cognitive-discursive theories of the study of precedent names allows us to analyze the lexical nominations of the northern lights as representatives of precedent concepts, to comment on their place in the general continuum of precedence. Discursive analysis, being an equal component of the theory of language, complements the cognitive approach, which belongs to the class of functional ones.

The finding of linguistic conditions and means that draw boundaries between individual lexical and semantic variants of the nomination of the northern lights is also relevant for this study. Propositional, intentional, evaluative, emotional, modal and occasional types of meaning are clearly visible only in the context. The contextual analysis used in the process of research makes it possible to define the context as a coherent linguistic whole that determines the meaning (grammatical, lexical, phraseological) of a separately included word, phrase, or segment of an Arctic-oriented text. The contextual analysis used in the present study makes it possible to study the functional specifics of words, phrases, sentences and superphrasal units that nominate the phenomenon of the northern lights, to reveal the usual and occasional meanings of the studied linguistic units, to trace the dependence of the development of a specific meaning of a word on a multi-genre context: in a scientific text, in publicist texts style (in an essay, in an advertising text), as well as in different types of artistic text (in fairy tales, in novels, in poetry). The validity of the obtained scientific results is ensured by the verification method in the work. The main goal of verification in this study is the irrefutability of the asserted factuality, commenting on both linguistic factors (the linguistic status of the units that make up the corpus of examples, in particular, the stylistic register, phonetic and grammatical refractions, changes, increment of meaning), and extralinguistic data: the historical background of the study of this phenomena in diachronic and synchronic aspects.

The method of linguistic description of the nominations of the northern lights used in the course of work on the language material consists in identifying specific linguistic units and describing their functioning in different genres and styles, taking into account their integral and differential properties, features and rules of embodiment in an Arctic-oriented text.

Theoretical background

As the theoretical prerequisites for the present study, one can consider the scientific works of domestic and foreign scientists on the sign theory of language — linguosemiotics, the main purpose of which is to study the sign nature of language. Exploring the phenomenon of the northern lights through the prism of its lexical nomination, it is important to turn to the semiotic

aspect of the study of the lexical designations of this natural phenomenon, since it is the linguosemiotic theory that makes it possible to establish a connection between the sign system of a language and social and natural semiotics.

When conducting a linguosemiotic study of the nominations of the northern lights, one should proceed from two forms of verbal signs used for communication purposes: linguistic (units of linguistic consciousness of communicants) and speech (signs implemented in discourse). At the same time, it should be borne in mind that linguistic and speech signs are inextricably linked to each other. Speaking about the semantics of the lexical designations of the northern lights as one of the aspects of semiotics, we will proceed from the fact that these nominations, as linguistic signs, express a certain meaning, indicate the usual component of their content plan. In the process of communication, in our case — in the texts of the Arctic orientation, these nominations as speech signs receive a very specific meaning, which, in contrast to the usual meaning of a linguistic unit, associated with an objective reflection of the system of connections and relationships, can be interpreted as “the individual meaning of the word”. It should be agreed that “individual meaning” makes it possible to identify subjective aspects that “are relevant to this moment and to this situation” [1, Trofimova N.A., p. 8].

When studying the lexical nominations of the northern lights from the perspective of semantics, it is really important to distinguish between the meaning as “the most stable part of the sign's semantics, associated with the reflection of the socially significant experience of a given ethno-linguistic community” and the meaning as a variable part of the sign's semantics, “associated with the discursive interpretation and actualization of one of the aspects of the linguistic values” [2, Alefirenko N.F., p. 95].

If the semantics of the lexical designations of the northern lights as linguistic signs can be studied by using the definitions presented in lexicographic sources, then the meaning of these lexical nominations in the Arctic discourse as speech signs can be revealed only by analyzing the semantic components in the relevant specific texts. It is necessary to agree that the lexical designation of the northern lights, like any other linguistic sign, “represents a socially established interpretation of the content accepted in a given linguocultural community” [3, Pisanova T.V., p. 105]. This explains the possibility of revealing the significative meaning of a linguistic sign. A comparative study of the lexical designations of the northern lights as linguistic signs allows us to trace whether there is a difference between the interpretation of the northern lights in German and Russian linguistic cultures.

We will research the syntax of the studied linguistic and speech signs by studying their relations with other signs. It is advisable to distinguish two types of relations within syntactic: paradigmatic (existing between linguistic signs, for example, synonymy) and syntagmatic (observed in the compatibility of speech signs with each other) [4, Krongauz M.A., p. 22]. Due to the identification of the former, it is possible to establish the variability in the use of lexical designations that reflect the essence of the natural phenomenon of the northern lights, and the

study of the second type allows us to trace combinatorial possibilities of lexical nominations of northern lights closely.

When studying the pragmatic aspect of the use of lexical designations of the northern lights in the German-speaking and Russian-speaking Arctic discourses, it is important to take into account that the language or speech sign does not name and point to the natural phenomenon of the northern lights. The act of reference is carried out by the sender of this sign through the choice and use of one or another lexical designation of the northern lights. The lexical designation of the northern lights, chosen in a certain situation in order to achieve very specific goals, as a speech sign informs, within the framework of the Arctic discourse, about the attitude of the author of the Arctic-oriented text to the recipient of the text, to the situation of communication and to the most natural phenomenon of the northern lights. By pragmatics we mean, following R. Finkbeiner, not only the choice of one or another language sign and its use, but also "the generation and comprehension of meaning in the context" [5, Finkbeiner R., p. 7].

Overview

The study reveals that there is no single definition of the northern lights (aurora borealis) either in Russian or in German. The existing definitions can be conditionally divided into two groups: 1) definitions based on the scientific ideas of their time, and 2) definitions based on everyday ideas, often external signs of a phenomenon. At the same time, it can be stated that the boundary between these types of definitions is very conventional. The definitions of the first type (natural-scientific nature) are approximately the same, they contain indications of the causes and nature of the phenomenon: "Aurora borealis is the glow of the upper layers of the atmosphere observed in the polar regions, which is caused by the action of particle flows invading the atmosphere from space"; "Aurora Borealis is a sporadic phenomenon in the ionosphere, expressed in the luminescence (glow) of rarefied air at altitudes from several tens (sometimes from 60) to several hundred (sometimes over 1000) kilometers"; Polarlichter sind Leuchterscheinungen am Himmel, die hauptsächlich in polaren Gegenden beobachtet werden. Am Nordpol heißen sie Nordlicht (aurora borealis). Polarlichter entstehen in 70 bis 800 km Höhe durch elektrisch geladene Teilchen (meist Elektronen oder Protonen) des Sonnenwindes. Diese werden durch das Magnetfeld der Erde zu den Polen hin abgelenkt. Dort dringen sie in die Erdatmosphäre ein und regen je nach Höhe unterschiedliche Atom-/Molekülarten an, Licht einer bestimmten Wellenlänge zu emittieren" [1].

As a comprehensive analysis of the linguistic material has shown, in the definitions of the second type (in our case, linguistic) there are, as a rule, external features: "Polar or northern lights is a phenomenon observed in the polar countries, beginning with the fact that a bright arc appears on the northern part of the horizon, from which columns of white light rise, constantly worrying,

[1] Deutscher Wetterdienst. Wetterlexikon. URL: https://www.dwd.de/DE/service/lexikon/Functions/glossar.html?lv2=101996&lv3=102084 (accessed 23 July 2020).

changing colours"; "Polarlicht, das — in den Polargebieten zu beobachtendes, nächtliches Leuchten in der hohen Erdatmosphäre" [2].

If we turn to the history of the origin of the terms for the northern lights, then the German dictionaries of the 18th–19th centuries list the words "Nordflut", "Nordschein", "Nordscheinlicht" as synonyms to "Nordlicht". In Russian, the word "pazori" used to denote the northern lights, the meaning and use of which is commented on by the Russian writer, publicist and ethnographer P.I. Melnikov-Pecherskiy in his novel "In the Forests". He notes that "pazori is a folk designation, in contrast to the artificial, invented by Lomonosov, phrase "northern lights" — a literal translation from the German Nordlicht". The work of P.I. Melnikov-Pecherskiy is unique in reference to the rich nuance of the lexical meanings of the radiance by the natives (otbel — the beginning of the phenomenon / bel — continuation / zori — takes on a pink hue / zorniki —gradually turns purple / rays — spreads across the sky in milky streaks / rainbow pillars — rainbow coloured streaks / bagrets — increasingly red / playing pillars — bands converge and separate / sporch — pillars with a rolling thunder crackle) [3].

Further, it was found that the lexical designations of the polar (northern) lights / Polarlicht (Nordlicht) are used both in scientific terms and in a more ordinary sense. In the studied scientific texts of the Arctic orientation, there are no differences between the content of the linguistic sign and its representation in speech, since the differences between the denotative and significative meaning of the term, in principle, cannot be identified. The characteristics of the aurora given in strictly scientific definitions are visibility (Sichtbarkeit), frequency (Häufigkeit), brightness (Helligkeit), intensity (Intensität), direction (Richtung), color (Farbe), shape: rays, stripes, crown, curtain, arc (Form: Strahlen; Streifen / Bänder, Krone / Corona, Vorhang, Bogen) — can be considered as components of the scientific concept "aurora borealis". In modern Russian-language scientific texts of the Arctic orientation, the terms "polar lights" (combining the northern and southern lights), "northern lights", as well as the Latin term Aurora Borealis, sometimes in Russian transliteration — "Aurora Borealis / Aurora" are used. In German arctic-oriented scientific texts, the terms Polarlicht, Nordlicht, Aurora Borealis, Aurora are used. This shows the similarity of the studied lexical designations in the scientific Arctic discourse of the linguistic cultures under consideration. There is a certain parallelism in the use of the singular and plural forms of the analogous terms under consideration. The singular forms are used to denote both the phenomenon itself in general terms and its specific manifestations; plural forms — to refer to specific phenomena. According to our assumptions, plural forms are used more often in German texts. In German, compound words are used to refer to various aspects of the natural phenomenon under consideration: Polarlichthelle Nordlichtbogen, Nordlichtkrone, Nordlichtschein, Nordlichthäufigkeit, Lichtschimmer, nordlichterhellt. In Russian they usually

[2] Duden. URL: https://archiv.duden.de/node/698061/revisions/698066/view (accessed 23 July 2020).
[3] Melnikov-Pecherskiy P.I. V lesakh [In the Forests]. URL: https://www.litmir.me/br/?b=134601&p=53 (accessed 23 July 2020).

correspond to the following word combinations: aurora borealis brightness, arc-shaped arch, corona (of northern lights), aurora borealis oval, aurora borealis frequency, illuminated by northern lights etc. Modern scientific texts use the adjective “auroral”: auroral flare, auroral arc, auroral oval.

The aurora borealis became a subject of scientific description quite early. A special stage in the study of this phenomenon is associated with the Swiss scientist Hermann Fritz (1830–1893), who summarized the materials of studies of the aurora for the period from 1700 to 1870 in the second half of the 19th century. [6, Fritz H., p. 188]. Herman Fritz, followed by the American geophysicist and meteorologist E.H. Vestine, established, on the basis of a large number of observations in the Arctic, the geographical patterns of the occurrence of auroras, characterized their relative frequency at each specific point as the average number of days of their occurrence per year. H. Fritz uses purely scientific terminology in his scientific work “Das Polarlicht” to refer to the northern lights, avoiding any figurative expressions. Most often, for the scientific description of this natural phenomenon, the term “Polarlicht” is implemented. In this book one can also find the terms “Nordlicht” and “Aurora borealis”. Since the above German-language scientific work explores the nature and functioning of the northern lights, scientists describe in detail such characteristics of the aurora as Sichtbarkeit (visibility), Häufigkeit (frequency), Intensität (intensity), Richtung (direction), Farbe (color), Fluoreszenz (radiation), Geräusch (sound/noise), Geruch (smell), and related natural phenomena: Erdmagnetismus (terrestrial magnetism/geomagnetism), Sonnenflecke (sun spots), synodischer Mondumlauf (synodic rotation of the moon), Elektrizität der Luft und der Erde (air and earth electricity). H. Fritz introduced the term “isochasm” (Isochasme) into scientific use to designate a line on a geographical map connecting points with the same frequency of polar lights (Kurve gleicher Polarlichthäufigkeit).

In Russian science, the earliest description of the northern lights is most often associated with the name of M.V. Lomonosov, with his unfinished monograph “Testing the cause of the northern lights and other similar phenomena”, written, presumably, between the end of 1763 and May 1764 and first published in 1869. Lomonosov was interested in the northern lights from a young age; he began to carry out scientific observations systematically since 1743. In this scientific work, Lomonosov uses the term “northern lights” in the plural, most likely by analogy with the German term “Nordlichter”. In addition, to designate the studied natural phenomenon, he uses the words “arc”, “flashes”, “pillars”, “rays”. Color names are used to describe the external properties of a natural phenomenon [4].

In the Russian-language scientific texts of the Arctic at the end of the 19th – beginning of the 20th centuries, the Latin term “aurora borealis”, as well as the terms “polar lights” and “nothern lights” and simply “aurora” are used to designate the natural phenomenon under study,

[4] Lomonosov M.V. Ispytanie prichiny severnogo siyaniya i drugikh podobnykh yavleniy [Testing the cause of the northern lights and other similar phenomena]. URL: http://lomonosov.niv.ru/lomonosov/nauka/po-fizike-i-himii-1753-1765/science-28.htm (accessed 27 July 2020).

the results of observations and specific aspects of the considered phenomenon are described, in particular: (arc) shape, position, luminous intensity, color, direction of movement of the rays [7, Byalynitsky-Birulya B.A., pp. 1–2]. The terms for the designation of the northern lights are used in this case for the purpose of examination and argumentation.

The Scot V. Brus, whose work was published in Russian, describes his observations on Aurora Borealis, referring to H. Fritz and other authors. In contrast, he uses not only scientific terminology, but also describes the northern lights metaphorically as "a fantastic ballet in the sky, where the figures are in unusually fast movement, and where one row of dancers intertwines with another, and rows of sparkling lights of unusual colors quickly pass through sequined muslin drapery" [8, Brus V., pp. 73-76]. The scientist notes that the most frequent form of the northern lights is a low arch of more or less elliptical shape, rising a few degrees above the horizon. The scientist uses the term "corona" in his book, considering the phenomenon of an optical effect. Following A. Humboldt, he proceeds from the fact that there is a relationship between the magnetic force and the northern lights [8, Brus V., pp. 73–76].

A.A. Zhilinskiy, a researcher of the European North and a northerner himself, in his book "The Far North of European Russia. Arkhangelsk Province", written on the basis of a scientific analysis of the literature and based on the results of the author's long-term observations, along with the terms "polar lights", "northern lights", mentions the English terms "Northern light", "Streamers", the French version of the terminological phrase "aurore boreale", as well as the popular expression "flashlights", used, according to the scientist, by the population of the Arkhangelsk province. Since the book is a popular scientific text, the northern lights are quite reasonably called by the researcher a "majestic phenomenon" [9, Zhilinskiy A.A., p. 100]. The scientist describes various hypotheses of the appearance of the northern lights, in particular about its electrical origin, a theory that was substantiated and developed in the second half of the 19th century. A.A. Zhilinskiy's nomination of northern lights is used in this case not so much for registration and argumentation, but for the purpose of problematization, "examination" of the term [9, Zhilinskiy A.A., p. 100].

The scientific nomination of the natural phenomenon of the northern lights differs significantly from its nomination in a literary text, in particular, in lyrics. The literary representation of the phenomenon of the northern lights is replete with images of a metaphorical, metonymic, periphrastic and clearly expressed anthropomorphic character. Everything is evaluated and presented from the point of view of a person, in terms of their assessment and emotions. The person is presented as an author admiring the beauty of a natural phenomenon, as a scientist distinguished by perspicacity, as a native of the north, who, despite the harsh nature, has mastered the Arctic region for living. The authors comment on the heterogeneous ethnic group of the indigenous northern peoples. In Eulalia Lyudmila Bodnya, one can find both general references ("the Aryan clan that took the cold into the local house" / "sons of a long winter" / "a man with a secret squint" / "everyone living in radiance"), and a well-rhymed enumeration of

tribes and the peoples of the Far North ("Koryaks, Komi, Nganasans, Yakuts, Chukchis and Dolgans, Evenks, Nenets, Eskimos, Khanty, Mansi, Itelmans — everyone living in the north") [5].

Only in a literary text does a contrasting picture of the greatness of a natural phenomenon appear before the smallness of the significance of the human personality itself. In the lyrics, a person (an author, sometimes a reader, a scientist, an interlocutor) is explicated as an observer of the unique phenomenon of the northern lights according to the principle of contrast: a person is negligible compared to the greatness of a natural phenomenon. M.V. Lomonosov emphasizes this in his "Evening Meditation" with a dimensional opposition: "There is no number for the stars, there is no bottom for the abyss" [6]. The man is described periphrastically in images of contrasting opposition, repeated three times in different pictures: a grain of sand is opposed to sea waves; spark to eternal ice; thin dust to a strong whirlwind. Thanks to the selection of several rows of contextual antonymous pairs, a large-scale complex picture emerges with an emphasis on the greatness and mystery of the phenomenon of the northern lights.

A literary text, especially a poetic work, reflects in the described phenomenon what is relevant to human perception: the unusual manifestation, the beauty of a natural phenomenon. The description is dominated by the picture of multiple presence. There is a lot of light, color, and secret in the northern lights, which means, as a conclusion: a lot of vivid emotions when it is perceived. With E.L. Bodnya the seme of "multitude" is embodied not as with M.V.Lomonosov, as a synonym for the word "many" ("There are many different lights, uncountable suns burning there"), but as the seme of "organised multitude", as the melody of a song, the melody of an organ, consisting of notes, breaking up into its component notes ("The organ plays above me, a great secret song sings. And the sound, disintegrating over the earth, like arrows, enters the snow and ice"). The carriers of the seme of the set are the most unexpected words, in which this seme is not even a supporting semantic, but rather potential and even hidden ("field of light" / "field of rainbows"). E.L. Bodnya multiplies the expression of the verse, endowing the words with a new contextual environment similar to the stylistic device of catachresis. Violation of the usual combination of words ("the phenomenon of beauty sings"), the creation of words through epidigmatic word formation ("beams") are interesting author's solutions that create a complex characteristic of a radiant, luminous, igniting natural phenomenon. With enviable regularity, there are lexemes in the text that have the semes 'light' and 'see' as a supporting seme ("star / radiance / radiates / candle / fire / ignite / solar / ray"), as potential or secretive ("seeing / heavenly / open your eyes"). As a result of such a complex "attack" of the light-emitting action, an idea arises of the power of brightness and beauty of this natural phenomenon. Let us show a similar principle of reflecting the light range of the northern lights for the purpose of comparison in German lyrics

[5] Bodnya Ye.L. Pesn' o severnom siyanii [Song of the Northern Lights]. URL: https://www.youtube.com/watch?v=xKlTS8tE2Gc (accessed 23 July 2020).
[6] Lomonosov M.V. Vechernee razmyshlenie o Bozhiem velichestve [Evening reflection on God's majesty at the occasion of the great northern lights]. URL: https://www.culture.ru/poems/37587/vechernee-razmyshlenie-o-bozhiem-velichestve (accessed 23 July 2020).

using the example of Heidi Schmitt-Lermann's poem “Nordlicht”: a special light (ein über Ländern im hohen Norden oft leuchtendes besond'res Licht); color-breaking light (Farben brechendes Licht); phosphorescent green light (wogendes phosphoreszierendes Grün); magical mysterious light (magisch' lichter Geisterschein); light dancing in the sky (am Himmel tanzendes Licht [7].

Comparison of the nomination series of the natural phenomenon of the northern lights in the Russian and German lyrics emphasizes the relevant characteristics of the northern lights: the dynamics of movement, the color register, the color palette and the speed of saturation change turns into an appeal to the divine, secret, mysterious, fabulous. It appears in the same poem by Heidi Schmitt-Lerman as a fairy tale, an unreal fantasy, a light sent by an angel to help travelers: “vom Engel auf die Reise geschicktes Licht / wie im Märchen keine echte Fantasie” [8]. The authors of poetic works richly use the expression of contextual antonyms, echoing the contrast of the night and the light of the northern lights (hell is a charge of beautiful forms as opposed to death and life / the night sky is a field of rainbows / God is a man). The idea of the eternity of the phenomenon of the northern lights, which has been exciting human curiosity for centuries, the idea of the victorious mastering of the laws of the universe by man is embodied in the life-affirming final lines of the poetic work of E.L. Bodnya.

M.V. Lomonosov, in his poem “Evening Reflection”, admires the colors of the northern lights in contrast to the night, which he specifically describes as a dark background, acting as a master of total expression, using both the expression of paraphrase and personification (“The day hides its face / The dark night covered the fields / Ascended to the mountains have a black shadow / Rays leaned away from us”). To describe the blackness of the night and to emphasize the beauty of the northern lights then, the author uses synesthesia, combining the actual synesthetic image (moral plan and color (gloomy night)) and personification (gloomy night, cf.: gloomy person). In the following lines, M.V. Lomonosov, reflecting on the nature of the occurrence of this phenomenon, makes an unscientific assumption, stating by paraphrase and a metaphor that the sun sets its throne in the North. In fact, the scientist gives real scientific messages that directly explain the emergence and manifestation of the northern lights: the northern lights are associated with the state and activity of the sun. The fabric of the poem is woven with the most advanced theories at that time about the occurrence of the northern lights (in the penultimate stanza, M.V. Lomonosov’s own hypothesis about the electrical nature of the phenomenon: “waves hit the ether”).

The accentuation of the cosmic nature of this phenomenon is common to all Russian and German poetic descriptions of the northern lights: a stream born in the stars somewhere by E.L. Bodney; “fatal games of cosmic forces” by Victoria Serdyukova [9]. From author to author, the idea of the royalty of the northern lights is repeated, metaphorically veiled: “a crown for the Queen in

[7] Schmitt-Lerman H. Nordlicht. URL: https://www.e-stories.de/gedichte-lesen.phtml?163096 (accessed 23 July 2020).
[8] Ibid.
[9] Serdyukova V. Severnoye siyaniye [Northern Lights]. URL: https://yablor.ru/blogs/severnoe-siyanie/514775 (accessed 23 July 2020).

the sky" by Galina Smolenkova [10], "the throne of the sun" by M.V. Lomonosov [11]. The most frequent comparison is an appeal to the image of paints, frost, to a palette of colors: "a shining orange stroke / a slightly greenish shining brushstroke moving to the east / frost paints with lilac paint" by Galina Smolenkova; "the sky painted like flowers / a green-red-blue flash rushing over the earth / a play of colors that cuts the darkness" by Galina Sotnikova [12]; "Farben brechendes Licht (light of refracting colors) / wogendes phosphoreszierendes Grün" (phosphorescent green) by Heidi Schmit-Lerman [13]. A more rare metaphorical designation is a comparison with a theater, a theatrical performance: "the swaying curtain of the theater of the Universe / a drama that replaced the tragedy of the Worlds and the Galaxy" by Victoria Serdyukova; metaphorical-synaesthetic representation of the northern lights in the form of musical instruments: the organ by E.L. Bodnya: "an organ that sounds between heaven and earth / an organ plays over me / an organ sings a song of great mystery"; "As if a multi-colored accordion, The three-row furs parted" by G. Smolenkova. Only E.L. Bodnya meets the metaphorical designation of the northern lights with the lexemes "field", "field of light": "field of light from the night sky / field of light in the night sky / field of rainbows in the night sky" [14]. Universal, but metaphorically commented in different ways, is the description of the vector movement of the flow of light of the northern lights: "it flies up, then it pours down, then it disappears like a whim!" by Galina Sotnikova; "leads a strip from top to bottom" / repeating both in breadth and along the length of the "stripe" by Galina Smolenkova; "am Himmel tanzendes Licht (light dancing in the sky) / schwelgende, raunende, hinterm Wald verschanzte Farben" (smoldering, iridescent colors hiding behind the forest) by Heidi Schmit-Lerman [15].

A universal characteristic of the northern lights for all the authors of the studied poetic works is its mysteriousness and uniqueness: "action, the comprehension of which is beyond the limit" by Victoria Serdyukova; "im magisch' lichten Geisterschein (in the magical light of ghosts / nur schöne Fantasie (only a beautiful fantasy) / So wie im Märchen ist sie nicht (she is not real, just like in a fairy tale)"; by Heidi Schmit-Lerman; "eternal riddle" by Galina Smolenkova, "the phenomenon of miracle-beauty / nature's wondrous phenomenon / wonderful pillars" by E.L. Bodnya.

The linguosemiotic reflection of the amazing phenomenon of the northern lights through the metaphorical representation of the signified is widely used in other genres of literary text: in

[10] Smolenkova G. Severnoye siyaniye (zapolyarnaya skazka) [Northern lights (polar fairy tale)]. URL: https://stihi.ru/2011/11/28/11150 (accessed 23 July 2020).
[11] Lomonosov M.V. Vechernee razmyshlenie o Bozhiem velichestve [Evening reflection on God's majesty at the occasion of the great northern lights]. URL: https://www.culture.ru/poems/37587/vechernee-razmyshlenie-o-bozhiem-velichestve (accessed 23 July 2020).
[12] Sotnikova G. Severnoye siyaniye [Northern Lights]. URL: http://parnasse.ru/poetry/lyrics/landscape/severnoe-sijanie.html (accessed 23 July 2020).
[13] Schmitt-Lerman H. Nordlicht. URL: https://www.e-stories.de/gedichte-lesen.phtml?163096 (accessed 23 July 2020).
[14] Bodnya Ye.L. Pesn' o severnom siyanii [Song of the Northern Lights]. URL: https://www.youtube.com/watch?v=xKlTS8tE2Gc (accessed 23 July 2020).
[15] Schmitt-Lerman H. Nordlicht. URL: https://www.e-stories.de/gedichte-lesen.phtml?163096 (accessed 23 July 2020).

fairy tales, myths, legends. It is noteworthy that fairy tales on the theme of the northern lights are not presented in German literature, which is explained by the geographical remoteness of the German-speaking countries from the Arctic region. Fairy tales make a natural attempt to explain this phenomenon. From generation to generation, storytellers represent the northern lights as amazing, beautiful, formidable, inexplicable, and therefore use personification, endowing a natural phenomenon with anthropomorphic features. In the Russian-language version of the legends of the Finno-Ugric peoples about the origin of the northern lights, this phenomenon is explained by the merger of a girl named Vecherina with a white deer she saved. The party calls on the deer, touches its horns, illuminating the entire sky with "bright, vibrant colors of the northern lights" [16].

Keeping in mind the parable "a lie lies in a tale, but there is a hint in it", it can be said with confidence that fairy tales in their own way, metaphorically paraphrasing, reflect the real signs of the signified. So, the reflections of the northern lights are, according to the legend of the inhabitants of the tundra, a fire that an eagle lit to help his grandfather and grandson when searching for a dog that had disappeared while hunting. The storytellers did not escape the attention of the fact that the northern lights have a synesthetic basis, that is, they are accompanied by a sound, a hum that has a strange effect on some people. The northern tribes have long noticed – when the sky is painted with colorful lights, some people begin to behave strangely: they talk to non-existent interlocutors, they can move like sleepwalkers, they completely renounce the outside world. In myths, fairy tales and legends of the indigenous peoples of the North, this phenomenon is referred to as the call of the ancestors. During the northern lights, sounds are made that form low-frequency electromagnetic waves, similar to the alpha and beta rhythms of the brain. From time immemorial, people inhabiting our planet, not being able to explain any natural phenomenon, called it the features of a creature that brings evil and punishment. We observe such a blind taboo of the formidable element of the northern lights in Russian-language fairy tales, northern legends, myths about the northern lights, which in them appears like a fiery snake or a fiery river. In Russian fairy tales, the Serpent Gorynych or the serpent-fighter Hero is often mentioned. The fire-breathing serpent is Veles, and the bogatyr, Volkh Vseslavovich, was born from the serpent and Princess Marfa Vseslavievna [17]. Here, the seme "burning" is important for understanding the image. Everything inexplicable is subject to taboo, linguo-semiotic paraphrasing and, as a behavioral line, to veneration. The sky with the different colors of the northern lights, due to the misunderstanding of the phenomenon and the remoteness of the heavens, is automatically understood as another world, from which the living must hide. In Northern Eurasia, a belief still persists: children need to be hidden as soon as

[16] Otkuda severnoye siyaniye poshlo [Where did the northern lights come from]. URL: http://www.finnougoria.ru/logos/child_lit/1379/13703/) (accessed 23 July 2020).
[17] Alekseeva L.M. Polyarnyye siyaniya v mifologii slavyan: tema Zmeya i Zmeyebortsa [Polar lights in the mythology of the Slavs: the theme of the serpent and the snake fighter]. URL: http://www.delphis.ru/journal/article/polyarnye-siyaniya-v-mifologii-slavyan-tema-zmeya-i-zmeebortsa (accessed 23 July 2020).

possible, as soon as the radiance begins [18]. To a large extent, this understanding of the natural phenomenon is facilitated by the visual picture of the phenomenon, which really echoes the image of a fire-breathing snake.

The linguosemiotic representation of the properties of the signified northern lights can be conveniently traced in the genre of the author's fairy tale, also known as the “artificial fairy tale”. The authors of fairy tales emphasize in an individual manner the signs of the signified phenomenon. The signifier for the northern lights, according to Boris Shergin, is, for example, the rapidity of the appearance, renewal and disappearance of the northern lights [10, Shergin B.]. As evidence of the renewal of the form of the phenomenon, B. Shergin uses verbs and verbal phrases “renew”, “get up”, “start to fall”, “bow”, “flow like a river”, “stand”, “curl up”; the substantive lexemes “pillars”, “wall”, “blue river”, “scroll” as signifiers determine, in addition to the verbal description, the possibility of northern lights to acquire different forms.

Contemporary authors of fairy tales are not burdened with painful gloomy associations implicated with the inexplicability of the phenomenon. The feeling of anxiety, fear of the phenomenon of the northern lights is replaced by the desire to present it as a harmless, simply beautiful, desirable event. Therefore, according to Ivan Danilov, a well-known northern bell ringer and storyteller, the northern lights are the “queen of lights”, which “crosses the sky and runs between the huts and bath-houses”. The local people are “fond of her”. She even flirts with the locals. Describing the episode when one of the young men tried to touch her, but she rolled away and became a laughing stock for the local people, reflects the real relationship between people, between a young man and a girl who rejects her groom [19].

The degree of departure of reality from the narrative is most of all observed in the fairy tales by Stepan Pisakhov. The characters of his tales treat the northern lights quite frivolously. They “dry” it, “pull it up” (gather it by pulling it down), “knit it in bundles”, “hang it up on a mat”, let it dry out so that it doesn't spoil (literally: so that it doesn't die), “light it”, using it as candles. Fantasizing about the practical application of northern lights, Stepan Pisakhov follows everyday logic. In the harsh northern land everything must help a man. Logically, albeit with a clearly evident fantasy element, the author notes in fairy-tale style that one can collect northern lights only in the initial phase of their appearance, while they “are not shining high”. The apogee of the description of fantasy applications of northern lights in everyday life is the author's idea that northerners “wear radiance in their braids, braid stars from the radiance and put it on their foreheads” [20].

[18] Alekseeva L.M. Polyarnyye siyaniya v mifologii slavyan: tema Zmeya i Zmeyebortsa [Polar lights in the mythology of the Slavs: the theme of the serpent and the snake fighter]. URL: http://www.delphis.ru/journal/article/polyarnye-siyaniya-v-mifologii-slavyan-tema-zmeya-i-zmeebortsa (accessed 23 July 2020).
[19] Danilov I.V. Spolokhi. Skazka [Flashes. Fairy tale]. URL: http://ekb.aonb.ru/index.php?id=2662 (accessed 23 July 2020).
[20] Pisakhov S. Severno siyanie [Northern lights]. URL: https://skazki.rustih.ru/stepan-pisaxov-severno-ciyanie/ (accessed 23 July 2020).

Publicistic texts reflect the signs of the northern lights in a more thorough and formal way. In her essay “Spolokh above Kholmogory”, published in the collection “Polar Circle”, Lilia Mikhailovna Alekseeva actively uses the techniques of publicistic style: she argues, resorting to quoting the Norwegian scientist Fridtjof Nansen, the national cosmonaut G.M. Grechko [11, Alekseeva L.M.]. Both famous figures describe “an absolutely amazing sight”, which seems to Nansen as “a bright flame”, and G.M. Grechko as “lights of a thousand searchlights”. Following the logic of the journalistic style to reflect phenomena in diachrony, L.M. Alexeeva compares and analyses the perception and understanding of northern lights from ancient times to the present, with special emphasis on the opinions of famous scientists such as Aristotle and M.V. Lomonosov. Thanks to the author's detailed description, one can see the northern lights as a “silent fire of the heavens”, “polar lights”, “sparks”, “a game of fireballs”. Moving in diachrony of designations of northern lights and stopping at the nominations of natural phenomenon in the Middle Ages, L.M. Alexeeva correlates appropriate signs of the signifier with predicative signifiers, names it, remaining faithful to the style of previous centuries: “a sign of heaven”, “fiery fingers”, “fiery crosses”, “fire swords”, “fire glow”, “cold flame of heaven” [11, Alekseeva L.M.]. One wants to believe the facts about northern lights because it is described with a variety of dynamics: both as an “instant portrait” and in a recurring long time span.

Texts on the theme of the northern lights in Russian and German-language journalism reveal a lot in common. They are characterized by the input of scientific data, followed by dictation and removal of the complexity of understanding the scientific term. For L.M. Alekseeva, such a lexeme is, for example, “substorm”. Markus Bütikofer, the author of a diary traveling to the aurora, has such terms as Elektrometeor (electrometeor), Sonneneruptionen (solar flares), Magnetfeld (magnetic field), die freigesetzte Energie (released energy) [12, Bütikofer M.]. The synonymic rows of predicating lexemes make it possible to emphasize the specific features of the described natural phenomenon and the relationship of a person to it. For Markus Butikofer, the northern lights are ein lange schon gehegter Traum (a long-awaited dream); eine einmalige Gelegenheit (one-of-a-kind opportunity to comprehend the world); Nordlicht (Northern Lights); Polarlicht (polar lights); Aurora Borealis (scientifically: northern lights); kein Südlicht / kein Aurora australis (not the southern lights); eine Leuchterscheinung (light phenomenon); ein Elektrometeor (a meteor charged with electrical particles). Markus Bütikofer supports the reader's interest with a message of incredible factuality, arguing about the power of the beauty of the northern lights, contemplating which people who do not believe in higher powers begin to join faith in God [12, Bütikofer M.].

Thanks to the unique natural phenomenon of the northern lights, the Arctic region has recently become an object of increased attention in the field of tourism, which is reflected in the Internet advertising discourse. At the same time, the ways of presenting relevant information in advertising texts and the peculiarities of nominating the phenomenon of the aurora borealis are relevant in terms of linguistic research. In this aspect, a curious example of the Russian-speaking

Arctic discourse can be the advertising text "Northern Lights Hunting Tour", posted on the website of one of the Russian travel companies [21]. It is characteristic that already in its name, the nomination "Northern Lights", highlighted at the graphic level in capital letters in each of its components, acquires a contextual figurative meaning and begins to referentially correlate with some active, fast moving living creature that can be hunted. As a result, this title becomes a means of creating a certain linguo-pragmatic effect, which consists in stimulating the "waiting mode", thrills and vivid emotional experiences from the advertised trip in the potential consumer of travel services. In the advertising text, the phrase "Northern Lights" functions as a key meaning-generating lexeme, contributing to the structuring of all textual information.

Along with the traditional use of this language unit in the global singular in the tour advertisement, the plural form "Northern Lights" is also found, which emphasizes the diversity and periodicity of the magnificent natural phenomenon: "The appearance of the Northern Lights is monitored by us on special resources ... Get the most accurate indicators we were taught by scientists from the Lovozero Geophysical Observatory, the only station in Russia that studies the Northern Lights!"; "The best places for observing and filming the Northern Lights are selected by our guide, a professional photographer with many years of experience..." [22]. In the closing sections of the ad copy, subtitled "How to Dress for the Glitter Hunt?" and "What are the chances of seeing the radiance?", there is a change in the lexical designation of the implied phenomenon, i.e. reduction of the key nomination as a result of replacing the phrase "Northern Lights" with one basic lexeme "radiance", which can be explained by the pragmatic redundancy of the definition at this stage of information presentation: "The hunt for the radiance occurs in winter, autumn or spring ..."; "Most often our guests see the radiance…"; "Aurora has infrared radiation in its composition" [23]. For a similar reason, this lexeme is used in one of these sections in the plural with the key phrase: "In order to improve the accuracy of predictions of the appearance of the Northern Lights for our guests in March 2015, we received advice from scientists ... who study the nature of the aurora" [24]. It should be noted that the text of the article uses the only color designation "red (radiance)", which has a referential correlation with the described natural phenomenon, which occurs quite rarely in this form: usually, in the polar sky, a person can observe green or, sometimes, purple glow without special technical means. The commentary on this circumstance is given by the compilers of the advertising text from a scientific point of view in order to warn the reader about the extremely low degree of probability of contemplating the red radiance: "The radiance contains infrared radiation. The digital camera sees it better than the human eye. But the human eye sees ultraviolet color better. Thus, we will see the red light only when it is strong enough [25].

[21] Northern Lights Hunting Tour. URL: https://nordtours.ru/tur-ohota-za-severnym-siyaniem (accessed 20 May 2020).
[22] Northern Lights Hunting Tour. URL: https://nordtours.ru/tur-ohota-za-severnym-siyaniem (accessed 20 May 2020).
[23] Ibid.
[24] Ibid.
[25] Ibid.

A different linguistic picture is observed in the German-language advertising discourse in the Arctic, an example of which is, in particular, the advertising text of the German travel company "Hurtigruten", which offers potential consumers of its services to enjoy the spectacle of the northern lights as part of tours to Norway and Svalbard [26]. The title of this advertisement contains the plural noun "Nordlichter" to accentuate the fact of the variety of forms of manifestation of radiance, and then throughout the text, numerous poetic paraphrases of the original nomination, which are its contextual synonyms, function as key lexemes. A direct semantic parallel between the usual nomination and its individual author's lexical designation appears already in the second sentence, which is the subtitle of this text. The expressiveness of the implied paraphrase is emphasized by the superlative degree of participle I "beeindruckend" (impressive) and the composite, which combines the meaning-forming component "Licht" and the popular Anglicism show in the subtitle of the advertising text: "Erfahren Sie alles über die beeindruckendste Lichtshow der Natur – die Nordlichter!" [27] (Learn all about the most impressive light show, the Northern Lights!). Increased figurativeness is also inherent in the beginning of the advertising text, which can be considered as a kind of "lyrical intermezzo", focused not on the transfer of business information, but on the direct immersion of a fictitious reader, explicated by the pronoun "Sie", into the fabulous atmosphere of a quiet polar night with the northern sky emerging in the dark sky shining: "Es ist dunkel, Sie sind draußen und es herrscht Stille. Plotzlich erregt ein flackerndes Licht am Himmel Ihre Aufmerksamkeit. Zunächst blaß und zaghaft, doch schon bald intensiv und strahlend verwandelt es den dunklen Himmel in eine Leinwand für die unglaublichen Mächte der Natur. Es ist so hypnotisch, dass Sie sich nicht abwenden können. Eines ist aber besonders seltsam: Es herrscht völlige Stille, während das grüne und gelbe, violette und rote Feuerwerk in ruhiger Harmonie über den Himmel tanzt. Die Bewegungen wirken wie ein großartiges symphonisches Ballett ohne Ton" [28] (It is dark, you are outside, there is silence. Suddenly, a light flickering in the sky catches your attention. Pale and timid at first, but soon intense and radiant, it turns the dark sky into a canvas for incredible powers nature. It's so mesmerizing that you can't turn your back. But one thing is especially strange: there is complete silence while green and yellow, purple and red fireworks dance across the sky in calm harmony. The movements look like a grand symphonic ballet without sound).

Obviously, in this text fragment, the nature of the lexical content of the paraphrases of the key nomination reflects the intensity of the described process: the flickering light (ein flackerndes Licht), at first pale (blaß) and timid (zaghaft), quickly turns into a shining embodiment of "incredible natural forces" (die unglaublichen Mächte der Natur). The play of green, yellow, purple and red colors contributes to the formation of another nominative unit – "das Feuerwerk" (fireworks), which functions as personification, since this fireworks harmoniously "dances" in the

[26] Nordlichter. URL: https://www.hurtigruten.de/inspiration/erlebnisse/nordlicht/ (accessed 20 May 2020).
[27] Nordlichter. URL: https://www.hurtigruten.de/inspiration/erlebnisse/nordlicht/ (accessed 20 May 2020).
[28] Ibid.

night sky. The next lexical designation of the northern lights, which completes the transition from the introduction to the purely informational space of the advertising text, is the metaphorical phrase “ein großartiges symphonisches Ballett ohne Ton” (a grandiose symphonic ballet without sound) used in the form of comparison. In the links accompanying the thematic sections of the analyzed advertising text, there is a nomination of the northern lights, which is strictly terminological in nature: we are talking about the Latin name “die Aurora / die Aurora Borealis”, which should confirm the scientific validity of the information presented and at the same time contribute to the lexical diversity of the text structure. In the section “Wie entstehen die Nordlichter?”, advertisers use the philosophical paraphrase “eine Konstante unserer Welt” (the constant of our world) to emphasize the enduring nature of the northern lights, which are an organic component of the nature of the Arctic region.

Conclusion

The main results of the study include the semantic, syntactic and communicative-pragmatic parameters of the semiotics of the northern lights lexical designations in the German-speaking and Russian-speaking Arctic discourses identified by comparison. A comparative study of the semantics of the considered lexical nominations allows us to state that, when distinguishing between the scientific and ordinary worldviews in German and Russian linguistic cultures, there is a coincidence of scientific ideas of scientists and meteorologists about the northern lights, and a discrepancy between everyday ideas of the carriers of German and Russian cultures about this natural phenomenon. While the scientists of Germany and Russia have similar ideas about the atmospheric natural phenomenon of the northern lights, other representatives of Russia as an Arctic state, especially the inhabitants of the north, who describe the northern lights in folk art, invest in the semantics of the lexical designations of this natural phenomenon a variety of meanings, depending on style, type and genre of the text of the Arctic orientation. In Russian linguistic culture, there is a deeper and more nuanced view of the phenomenon of the northern lights. Ordinary representatives of Germany, as a non-Arctic state, do not have a clear idea of the northern lights, since this natural phenomenon is not observed in their latitudes. This fact is reflected in the implementation of a very limited number of lexical nominations for the northern lights.

As for the syntax of the lexical designations of the northern lights in the Russian Arctic discourse, in contrast to the German Arctic discourse, there are more active paradigmatic connections of the lexical nominations of the northern lights as linguistic signs (in particular, synonymy) and extensive syntagmatic connections of the studied lexical designations with others speech marks. Combinatorics of lexical nominations of the northern lights in Russian-language fiction, journalistic and advertising texts of the Arctic orientation, due to their great creative potential, seems to be almost limitless.

A comparative study of the pragmatic parameters of the implementation of the lexical designations of the northern lights in the German-speaking and Russian-speaking Arctic discourses made it possible to identify a number of similar communicative and pragmatic schemes for the implementation of the studied lexical nominations in the compared types and genres of texts of the Arctic orientation. So, in Russian-language and German-language scientific texts, the terms for designating the northern lights are implemented for the purpose of registration, argumentation. In publicist texts in Russian and German languages, the lexical designations of the northern lights are used to clarify and supplement the previous content, as well as for the purpose of approximation. In poetic and advertising texts, which more clearly reflect the everyday picture of the world, both simplification and complication of the process of decoding information for hedonistic and aesthetic purposes are realized. In the legends and fairy tales, related to the Russian-speaking Arctic discourse, the implementation of such communicative and pragmatic schemes as symbolization and warning is observed. The use of this pragmatic setting in the description of the northern lights represents the specifics of the Russian Arctic discourse.

The obtained scientific results show the prospects of linguosemiotic consideration of lexical nominations in texts focused on a particular event. They provide an opportunity to look at the Arctic discourse as a fragment of the linguocultural reality of a particular language community. For further research of the Arctic discourse, other natural phenomena that are characteristic of the Arctic region (white nights, white haze, ice sky, etc.) and play an important role in the life of the peoples of the North are of interest. The results obtained are important for understanding the similarities and differences in the views of representatives of different cultural communities regarding the same phenomena and events. Comparative studies of a linguosemiotic nature help to understand the mechanisms of formation of lexical nominations in a language and take a closer look at the specifics of the use of speech signs in a text, depending on its type and genre. It should be emphasized that the study of the linguosemiotic aspects of the lexical designations of the northern lights can make a certain contribution to the study of the Arctic discourse, since it is they that allow us to see and describe in the texts of the Arctic orientation both objectively existing ideas about the northern lights in two different linguistic cultures, and subjective factors affecting the choice of one or another lexical designation of a given natural phenomenon in a text of a certain style.

The results of the study contribute to the development of both theoretical and practical discourse studies, to the study of aspects of the Arctic identity and natural phenomena observed in the Arctic region, allows constructing the Arctic space through a semiotic (sign) rather than a noematic (purely mental) algorithm of human actions. The results obtained contribute to the testing of the linguosemiotic model of comparative consideration of lexical nomination, and therefore, they can show the prospects for the use of linguosemiotics both for applied purposes and for the further development of lexical semantics. The limited volume of the article does not permit to cover a number of issues concerning the ontology and classification of northern lights

and the relationship of linguosemiotics with natural and social semiotics, which makes it possible to obtain a more complete semiotic picture of the lexical designations of the northern lights in two nationally oriented Arctic discourses.

The research presented in this article may contribute to increasing interest in the study of the Arctic discourse from comparative, linguo-semiotic and linguo-culturological positions. The interdisciplinarity of the scientific approach to the description of linguistic and speech phenomena related to the Arctic enables us to show the similarities and differences in communication associated with social and natural semiotics, helps to look at the relationship between the picture of the world and the linguistic picture of the world and the cognitive aspects of communication between representatives of different cultures regarding vital natural conditions of their existence.

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Study and Development of the Northern Sea Route: Analysis of the Document Corpus of "Scientific Sibirica" Database *

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Abstract. The article traces main trends in research progress on the topic "Study and development of the Northern Sea Route" using the bibliographic database "Scientific Sibirica" generated by the State Public Scientific Technological Library of the Siberian Branch of the Russian Academy of Sciences. A document corpus on the topic was identified using key words and subject heading, the scientometric analysis was carried out. The paper shows the temporal, linguistic, type-specific and thematic structures of the document corpus. It presents the most productive periodicals, authors with high publication activity, scientific events held on the topic. It's noted that the Northern Sea Route development is an urgent problem of the entire world community, not only of the northern countries. The above-mentioned database can serve as an information basis for further research on various aspects of the Northern Sea Route development. The purpose is to analyze the document corpus devoted to studying the Northern Sea Route retrieved the database "Scientific Sibirica". The method is scientometric analysis. The results are the following: the dynamics and structure of the information array are presented, productive periodicals and authors with high publication activity and main research topics are identified. The study can serve as an information basis for further research on various aspects of the Northern Sea Route development by scientists and specialists.
Keywords: *Northern Sea Route, scientometric analysis, "Scientific Sibirica", research information support*

Introduction

Decree of the President of the Russian Federation dated March 5, 2020 No. 164 "On the fundamentals of the state policy of the Russian Federation in the Arctic for the period up to 2035" defines the goals, objectives and mechanisms for implementing state policy in the Arctic regions to ensure the national interests of the country [1]. The document highlights the role of the Northern Sea Route as a tool for the socio-economic development of the Arctic zone. The incident with the container ship Ever Given, which ran aground and blocked the Suez Canal, demonstrated the need to develop logistics routes in the Arctic not only for the Nordic countries, but for the entire world community. The aim of this work is to scientometrically analyse a corpus of documents (CD) devoted to multidimensional studies of the Northern Sea Route (NSR).

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[1] Ukaz Prezidenta RF ot 5 marta 2020 g. N 164 "Ob Osnovakh gosudarstvennoy politiki Rossiyskoy Federatsii v Arktike na period do 2035 goda" [Decree of the President of the Russian Federation of March 5, 2020 N 164 "On the Fundamentals of the State Policy of the Russian Federation in the Arctic for the period up to 2035"]. URL: https://www.garant.ru/products/ipo/prime/doc/73606526/ (accessed 01 August 2021).

Materials and methods

For the identification of the corpus of documents, the bibliographic database (DB) "Scientific Sibirica" was used, generated by the employees of the State Public Scientific and Technological Library of the Siberian Branch of the Russian Academy of Sciences (SPSTL SB RAS) for information support of scientific research [1], the documents of which are structured according to the thematic rubricator. Using keywords and Boolean operators, we have formulated a search query and identified a corpus of documents related to the study of NSR. As of August 2021, its volume amounted to more than 1200 documents for the period 1990–2020.

Scientometric analysis of the corpus

The dynamics of the document corpus over a 30-year period is presented in the diagram (Fig. 1), which clearly demonstrates the growth in the volume of publications, especially in the last two decades. It should be noted that the publications of the 2020 edition are still being received by the library, so the volume of documents of the last decade will increase. Papers of the 2021 are excluded from the analysis, since they are only partially indexed in the database.

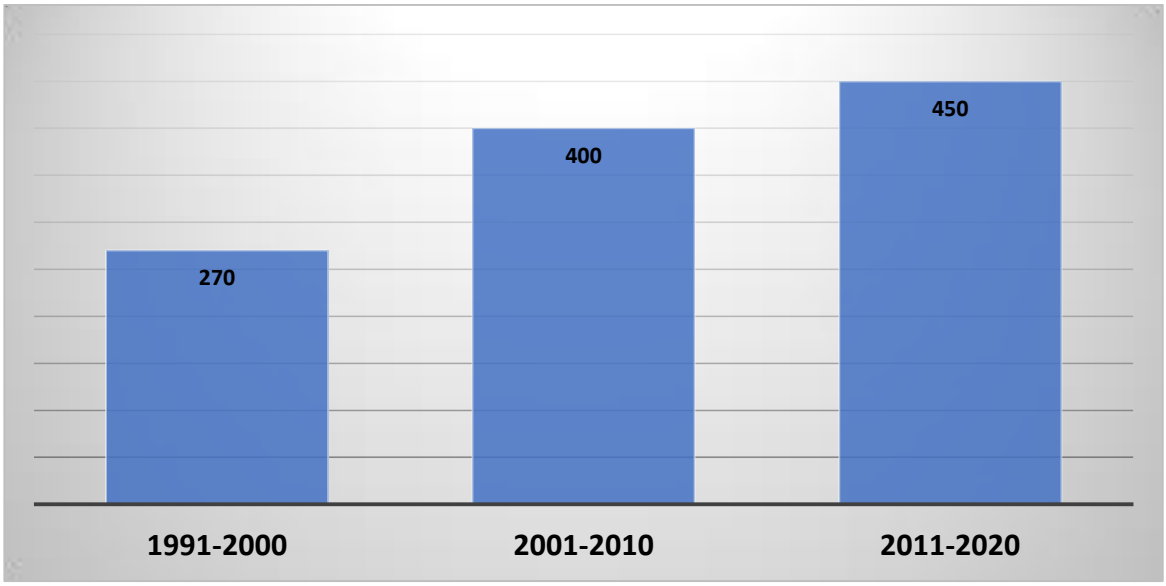

Fig. 1. Dynamics of the document corpus.

The language structure of the CD (Fig. 2) of the database is homogeneous, almost 86% (1042 documents) are Russian-language works, the rest of the materials are published mainly in English (151 records), there are works in German, but they are few in number (16 papers). Such a structure is explained by the sources of the database formation: the bulk of publications are included in the CD according to the results of national literature legal deposit survey, the receiver of which is the State Public Scientific and Technological Library of the Siberian Branch of the Russian Academy of Sciences. Works in foreign languages were either selected from remote databases, or entered the library collection through international book exchange or were published in Russian editions in a foreign language.

Fig. 2. Language structure of the document corpus.

The type-species structure of the CD from the "Scientific Sibirica" database is shown in Fig. 3, where articles from periodicals and continuing publications predominate, accounting for more than 48% of the records. Scientific journals, being the most efficient source of information, bring the latest results of scientific research to the audience. The most productive periodicals on the topic are the following: *Arctic and North; Arctic: Ecology and Economy; The Arctic Herald; Maritime fleet; Problems of the Arctic and Antarctic; Sever i rynok: formirovanie ekonomicheskogo poryadka; Transport of the Russian Federation; Transport Business of Russia*.

A significant share of information is published in conference proceedings (29%), where scientists and specialists directly exchange opinions and discuss issues of interest. Even during the pandemic, the activity of scientific events does not decrease: many of them are held virtually. It should be noted that the results of research on the study of the NSR can be found in all conferences, the topics of which are related to the study of the Arctic and the North. There are several events of various levels dedicated exclusively to the study of the NSR: The Arctic and the Northern Sea Route: *a regional scientific-practical conference "Influence of the Northern Sea Route on the socio-economic development of the Russian North" (Tiksi, 2000); 75 years since the beginning of the systematic study and development of the Northern Sea Route: International scientific and practical conference within the framework of IPY 2007/08 events (St. Petersburg, 2008); The strategy of Russian maritime activities and the economics of environmental management in the Arctic: Arctic-2012: All-Russian marine scientific and practical conference (Murmansk, 2012); Scientific and technical support for research and development of the shelf of the Arctic Ocean: All-Russian scientific and technical conference (Novosibirsk, 2010, 2012); Northern Sea Route: development of Arctic communications in the global economy "Arctic–2015": All-Russian maritime scientific and practical conference (Murmansk, 2015)* and others.

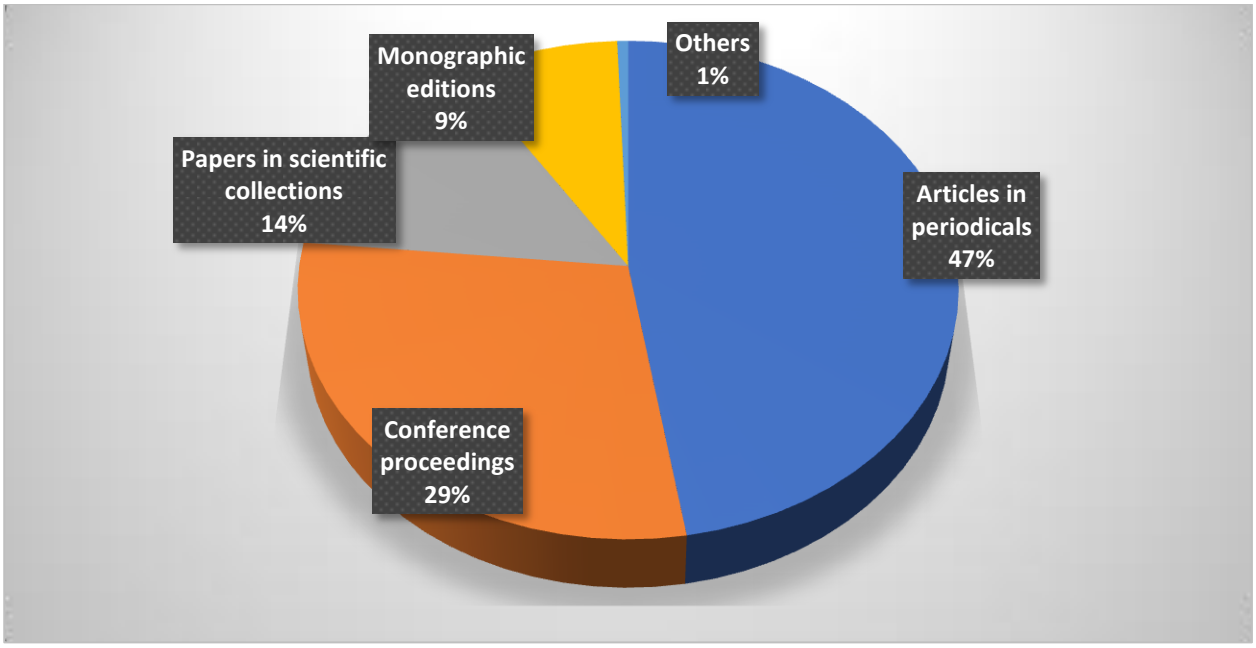

Fig. 3. Type-species structure of the document corpus on the topic.

Works published in collections of scientific papers account for 14%, thematic issues covering the study of the Northern Sea Route are among them: *the Northern Sea Route: State, Problems, Prospects (St. Petersburg, 2007); Transport and Logistics in the Arctic. Northern Sea Route: Course — Far East (Moscow, 2016); Problems of the Development of the Marine Fleet (St. Petersburg, 1999–2011)*.

The share of monographic publications is significant (9%). This type of documents deserves special attention, since it summarizes years of authors' research. This group includes various types of publications, such as scientific monographs, abstracts of dissertations, popular science publications, textbooks, bibliographic indexes, memoirs, albums, brochures.

Table 1

Types of monographic editions of the studied corpus of documents

No.	Publication type	Example
1	Scientific monographs	Bogdanov A.I. et al. *Problemy Severnogo morskogo puti* [Problems of the Northern Sea Route]. Moscow, Nauka Publ., 2006, 581 p. Doiban V.A., Batskikh Yu.M., Luzin G.P. *Severnyy morskoy put' i rynochnaya ekonomika: novye vozmozhnosti dlya razvitiya* [The Northern Sea Route and the Market Economy: New Opportunities for Development]. Apatity, 1995, 139 p. Johannessen O.M. et al. *Distantsionnoe zondirovanie morskikh l'dov na Severnom morskom puti: izuchenie i primenenie* [Remote Sensing of Sea Ice on the Northern Sea Route: Study and Application]. Saint Petersburg, Nauka Publ., 2007, 437 p.
2	Abstracts of dissertations	Bunik I.V. *Mezhdunarodno-pravovye osnovaniya regulirovaniya Rossiey sudokhodstva po Severnomu morskomu puti: avtoref. diss. kand. yurid. nauk* [International Legal Grounds for Russian Regulation of Shipping along the Northern Sea Route: Dr. Jur. Sci. Diss. Abs.]. Moscow, 2007, 25 p. Olkhovik E.O. *Teoreticheskie osnovy i metodologiya issledovaniya vodnykh putey dlya organizatsii morskikh transportnykh potokov Severnogo morskogo puti: avtoref. dis. dokt. tekhn. nauk* [Theoretical Foundations and Methodology for the Study of Waterways for the Organization of Maritime Transport Flows of the Northern Sea Route: Dr. Tech. Sci. Diss. Abs.]. Saint Petersburg, 2020, 42 p. Kiselev V.S. *Organizatsiya raboty lineynykh ledokolov na trassakh Severnogo morskogo puti na osnove imitatsionnogo modelirovaniya: avtoref. diss. kand. tekh. nauk*

		[Organization of the Work of Linear Icebreakers on the Routes of the Northern Sea Route based on Simulation Modeling: Cand. Tech. Sci. Diss. Abs.]. Saint Petersburg, 2020, 22 p.
3	Scientific and popular publications	Popov S. V. *Avtografy na kartakh* [Autographs on Maps]. Arkhangelsk, Severo-Zapadnoe Publ., 1990, 238 p. Burkov G.D. *My prishli k tebe, polyus! (K 35-letiyu pokhoda atomnogo ledokola "Arktika" na Severnyy polyus)* [We Came to You, Pole! (To the 35th Anniversary of the Voyage of the Nuclear Icebreaker "Arktika" to the North Pole)]. Saint Petersburg, AANII Publ., 2012, 220 p.
4	Memoirs	Lid J. Sibir' — *strannaya nostal'giya : avtobiografiya* [Siberia is a Strange Nostalgia: an Autobiography]. Moscow, Ves Mir Publ., 2009, 302 p. (Annotation: A Norwegian businessman about his participation in the development of Siberia and the Northern Sea Route). Miroshnichenko P.G. *Veteran Arktiki ledokol "Ermak"* [Veteran of the Arctic Icebreaker "Ermak"]. Norilsk, APEX Publ., 2013, 207 p.
5	Training manuals	Lepustin I.Yu., Lukin P.D., Martyshenkov V.E., Sabadash A.I. *Sovremennye tendentsii i perspektivy razvitiya avtomaticheskikh sistem upravleniya atomnykh ledokolov: ucheb. posobie* [Modern Trends and Prospects for the Development of Automatic Control Systems for Nuclear Icebreakers: Textbook]. Saint Petersburg, GUMRF Publ., 2019, 436 p. Romanovskiy V.V., Malyshev V.A., Sorokin Yu.V. *Grebnye elektricheskie ustanovki ledokolov i sudov ledovogo plavaniya: ucheb. posobie* [Rowing Electrical Installations of Icebreakers and Ice-Going Ships: Textbook]. Saint Petersburg, GUMRF Publ., 2019, 400 p.
6	Bibliographical index	Lieberman A. A. *Sovetskoe obshchestvo v vospominaniyakh i dnevnikakh. T. 6. Kul'tura. Nauka. Prosveshchenie* [Soviet Society in Memoirs and Diaries. Vol. 6. Culture. Science. Enlightenment]. Moscow, Indrik Publ., 2006, 603 p. (Annotation: Research in the Arctic and the development of the Northern Sea Route, p. 212–235).
7	Albums	Emelina M. A. *Ledokol "Krasin": istoriya v fotografiyakh* [Icebreaker "Krasin": History in Photographs]. Moscow, Paulsen Publ., 2016, 168 p.
8	Brochures	Kryukov V., Moe A., Shmat V. *West Siberian oil and the northern sea route: current situation and future potential*. Norway, 1996, 23 p. Selin V.S. *Organizatsiya deyatel'nosti i ekonomicheskaya otsenka gruzopotokov v zapadnom sektore Severnogo morskogo puti* [Organization of Activities and Economic Assessment of Cargo Flows in the Western Sector of the Northern Sea Route]. Apatity, KSC RAS Publ., 2000, 42 p.

"Other" (1%) includes deposited manuscripts, maps, photo albums, preprints, reviews.

Among the authors with the highest publication activity on the topic, we should mention V.S. Selin and A.V. Istomin, Doctors of Economics, — employees of the Luzin Institute for Economic Studies of the Kola Science Centre, Russian Academy of Sciences, engaged in the study of the economy of the NSR [2, 3]; Doctor of Historical Sciences Yu.F. Lukin, a professor of the Northern (Arctic) Federal University, covering the geopolitical problems of the development of the Arctic in general and the NSR in particular [4, 5]; Doctor of Historical Sciences S.I. Boyakov (Yakutsk Scientific Center of the Siberian Branch of the Russian Academy of Sciences) and Candidate of Historical Sciences A.E. Goncharov (Reshetnev Siberian State University of Science and Technology), whose works are devoted to the history of the NSR development [6, 7].

The most frequently cited works were identified using the Russian Science Citation Index (eLibrary), among which the collective monograph by E.P. Bashmakova with co-authors on the forecast of NSR cargo flows [8], as well as the book by S.I. Boyakova on the development of the NSR [6], which were cited in the publications of other researchers 79 and 58 times, respectively.

Fig. 4 shows the thematic structuring of the corpus of documents. It can be seen from the diagram that most of the publications relate to the study of the technical aspects of the NSR development. In recent decades, economic issues have come to the fore; historians traditionally pay great attention to researchers in the Arctic, including the NSR. Fewer publications are devoted to the problems of navigation support and transport infrastructure of the NSR. Works about the climatic-geographical and ecological block along the NSR route are not numerous, but they are given considerable attention in the information sources covering the study of the Arctic and the Arctic Ocean.

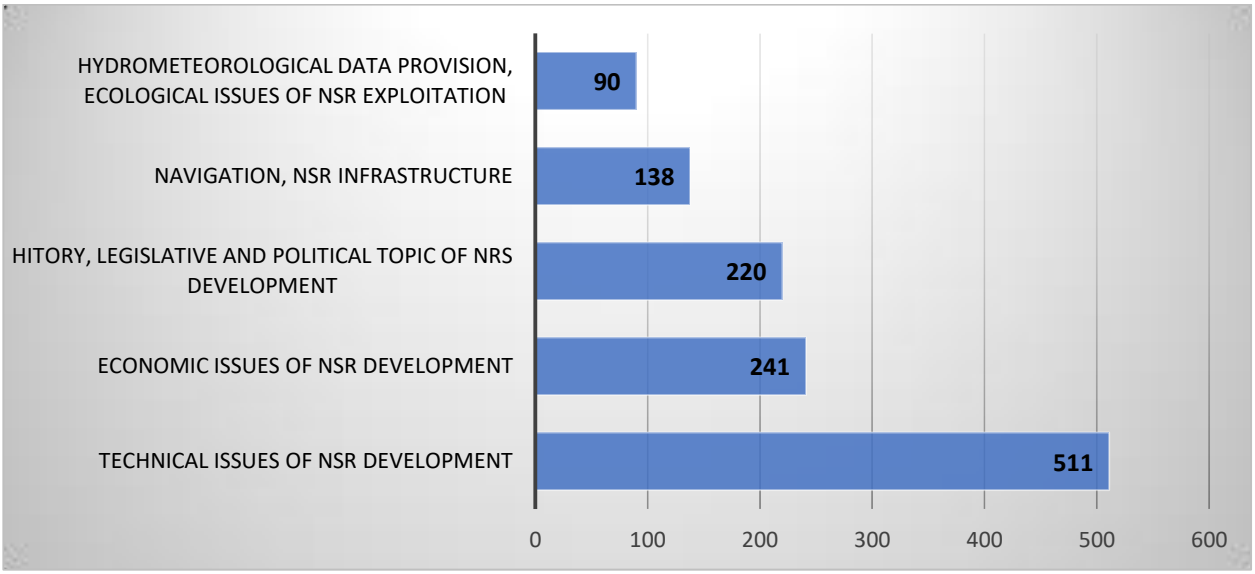

Fig. 4. Thematic structure of the corpus of documents on the topic.

Conclusion

The article has presented a scientometric analysis of the corpus of documents from the database “Scientific Sibirica”, devoted to the research of the NSR: temporal, linguistic, species-type and thematic structures of the corpus are presented; the most productive periodicals, thematic collections of scientific papers and conferences are named; special emphasis is placed on the analysis of monographic publications, authors with high publication activity on the topic and frequently cited works are identified. It should be noted that the bibliographic database “Scientific Sibirica” is free for Internet users on the library website (www.spsl.nsc.ru), in the options “Catalogs and databases” — “Bibliographic databases” — “Scientific Sibirica”. Recently, when generating a database, a digital identifier of the DOI object and (or) a hyperlink to the full text of an electronic publication are indicated, so users can get the information they are interested in from any computer.

The results of the scientometric analysis can be useful for specialists in the field of study and development of the Northern Sea Route to optimize and coordinate research with leading experts and research centers, as well as representatives of grant-giving organizations when making decisions on research funding.

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