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Prospective Development of Arctic Coal Reserves on the Basis of Spatial Organization of Communications *

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Abstract. In the current conditions of economic instability, the problem of developing the regional space of the Arctic zone, where huge reserves of hydrocarbons and other minerals are concentrated, which are the main driver of the future development of the Arctic economy, is becoming increasingly important. The development of the Arctic region was strongly influenced by the international environment, which, on the one hand, poses a threat to the Arctic mineral projects, and on the other hand, opens up new opportunities for their successful implementation. Against this background, the task of the Arctic coal industry within the framework of spatial and regional development is the territorial and production optimization of production and transportation of coal products. The purpose of the study is to analyze current trends in the development of the coal mining market in the new geo-economic and political conditions, which results in the proposed approaches to the spatial organization of the transport communications system, allowing maximizing the economic and export potential of the prospective development of Arctic coal reserves. It has been established that the current situation greatly affects the energy market. Russian coal market is being transformed under the influence of geo-economic transformations, the formation of new coal mining centers is shifting eastwards closer to the Asia-Pacific region, which will become the main center of coal trade in the near future. The study concludes that the efficiency of the development of Arctic coal reserves directly depends on the spatial organization of a complex system of integrated production and transport corridors (IPTC) that combine the production and logistics chain of mining and transportation of coal products into a single holistically integrated space of sea, coastal and land communications. On the basis of the analysis of the Taimyr coal basin, a priority level for the prospective development of mineral resources has been determined, based on a combination of factors that condition the economic and export potential of coal deposits.

Keywords: *Arctic zone, mineral resource center, complex integrated production and transport corridor (CIPT), multiplier effect*

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Introduction

The global economic agenda, including anti-Russian sanctions, creates new challenges for the Russian economy and the development of Arctic investment projects, which actualizes the task of searching for effective approaches to the spatial organization of economic development of Arctic spaces and resources that do not copy other models, but create own solutions taking into account features of the development of the national economy and the socio-economic context of the Arctic territories.

Currently, coal continues to be at the center of discussions about the prospects for global energy, including from the perspective of climatic factors, since it is not only the largest source of energy for industrial production (electricity, steel, etc.), but also one of the largest sources carbon dioxide (CO2) emissions. This shapes the global agenda for the global energy transition within the framework of the Paris Climate Agreement adopted in 2015 [1], that was joined by 184 countries, which began to develop their own national low-carbon development strategies (“carbon neutral” or “net zero” strategies), providing for the achievement of a zero balance of greenhouse gas emissions and their absorption by natural ecosystems by 2050 [1, Porfiryev B.N., p. 49]. At the same time, the most economically developed countries (mainly the countries of the European Union) set the goal of achieving “net zero”, which means complete decarbonization of the economy, implying an absolute refusal to burn fossil fuels in industrial production. These aspects are reflected in forecast estimates of the development of world coal markets [2], which should be taken into account when forming long-term strategies for the development of the Russian coal industry, including Arctic coal projects.

The current situation is that under the transformation of the global energy market influenced by anti-Russian sanctions, serious changes are taking place in international coal trade. Russia is the world’s third-largest coal exporter, and sanctions have disrupted trade flows as buyers aligned with the EU coal embargo seek alternative sources of supply. This has led to a reduction in Russian exports and increased competition in the global coal market, which is now characterized by high turbulence and price volatility. Under these conditions, the main factor determining the export potential of Russian coal will be its price competitiveness among exporting countries and accessibility to world economic centers. This largely depends on the development and efficiency of transport communications, allowing for barrier-free access to consumer markets and the possibility of diversifying export cargo flows depending on the price environment for energy resources and the geopolitical situation in the world.

[1] Paris Agreement (accepted by the UN FCCC 21st session on December 12, 2015). URL: https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf (accessed 22 March 2023).
[2] Coal 2022 Analysis and forecast to 2025. IEA. International Energy Agency. URL: www.iea.org (accessed 19 March 2023).

In the case of Arctic coal projects, this means the need to create spatially extended technological chains linking the production and sale of coal products with a reliable diversified system of transport communications (corridors). Such chains should begin in the Arctic, in places where fossil resources are developed, and extend to the regional economic centers of the country and the world.

In this context, the task of the export-oriented development of the Arctic coal industry is the territorial and manufacturing optimization of coal production and transportation, which determined the purpose of this work in relation to the research topic, where the issues of effective spatial organization of Arctic coal mining in the context of modern challenges are considered in a discussion context.

Literature review, materials and methods

The issues of spatial organization of the economy are the subject of many studies in foreign and domestic literature. A.G. Granberg made a special contribution to the development of this direction [2, p. 58], as well as S.S. Artobolevskiy [3, p. 102], P.A. Minakir [4, pp. 7–10], A.I. Tatarkin [5, pp. 10–15]. Among foreign authors, we should note the founder of new economic geography, Nobel laureate P. Krugman [6, pp. 227–235], the creators of modern regionalism B. Hettne and F. Söderbaum [7, pp. 6–21], J. Harrison [8, pp. 21–46] and many others.

The topic of spatial organization of the Arctic economy is reflected in a number of government documents, where the development of the resource potential of the Arctic territories (and water areas) is supposed to be carried out through the formation of mineral resource centers, which means the territory of one or more municipalities and (or) water area, within which there is a set of developed and planned for development deposits and promising areas, connected by a common existing and planned infrastructure and having a single point of shipment of extracted raw materials or products of their enrichment into the federal or regional transport system [3].

It is obvious that the realization of the significant resource potential (including coal) of the Arctic is inextricably linked with the development of the transport infrastructure of the Northern Sea Route, the icebreaker fleet and port infrastructure, as well as the system of land communications (transport corridors) connecting the Arctic territories (mineral resource centers) with regional economic centers of the country, as well as far and near abroad.

This approach is reflected in the Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035, where the creation of a unified backbone transport network (“Unified Backbone Network”) is declared as a strategic priority, which means the balanced and connected development of a transport network that combines the most important objects of transport infrastructure for all types of transport and ensures the functional unity of the transport

[3] Rasporyazhenie Pravitel'stva RF №-207-r ot 31 avgusta 2019 g. «Ob utverzhdenii Strategii prostranstvennogo razvitiya Rossiyskoy Federatsii na period do 2025 goda» [Order of the Government of the Russian Federation No. 207-r dated August 31, 2019 “On approval of the Spatial Development Strategy of the Russian Federation for the period until 2025”]. URL: https://www.garant.ru/products/ipo/prime/doc/72074066/ (accessed 15 March 2023).

system, sustainable interconnection and spatial development of the largest settlements, economic centers, main mineral resource and production zones, geostrategic territories [4].

The principles of forming a Unified Backbone Network also imply connections between mineral resource and production zones with Russian consumers and foreign markets. In this document, mineral resource centers are considered as types of macro-regional production clusters, which include "points of origin of freight flows", that is, current and future centers for generating demand for freight transportation services. It is noted that the creation of a Unified Backbone Network should be carried out on the principles of advanced planning and construction of main transport infrastructure [5], which is especially important for the sustainable development of the Arctic territories and the economic development of mineral and raw materials (including coal) resources.

In addition, Decree of the Government of the Russian Federation dated September 30, 2018 No. 2101-r, provides for a comprehensive plan for the modernization and expansion of the main infrastructure for the period until 2024, within the framework of which JSC Russian Railways developed its own program (Decree of the Government of the Russian Federation dated March 19.2019 N 466-r) [6], aimed at providing railway infrastructure for the spatial development of the country, which includes a set of measures to eliminate infrastructure restrictions and increase the traffic and carrying capacity of railway lines (the length of such sections on the railway network was 8.2 thousand km as of as of 01.01.2018) [7].

Literature review [9, pp. 105–112], [10, pp. 369–372], [11, pp. 62–75, 76–86], [12, pp. 5–23], [13, pp. 92–104], [14, pp. 1, 9, 13–15], [15, pp. 570–584], dedicated to the issues of sustainable development of the Arctic territories of the circumpolar regions and the analysis of state documents of strategic planning for the development of the national economy, led to a reasonable conclusion that the huge resource potential for the development of natural minerals in the Arctic directly depends on the comprehensive development of an integrated system of Arctic communications of all types of sea and land transport. It is the developed transport infrastructure based on an integrated communications system that makes it possible to create a supporting framework for the economic connectivity of the territories.

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[4] Rasporyazhenie Pravitel'stva RF ot 27 noyabrya 2021 N 3363-r «O Transportnoy strategii Rossiyskoy Federatsii do 2030 goda s prognozom na period do 2035 goda» [Order of the Government of the Russian Federation of November 27, 2021 N 3363-r "On the Transport Strategy of the Russian Federation until 2030 with a forecast for the period until 2035"]. URL: http://static.government.ru/media/files/7enYF2uL5kFZlOOpQhLl0nUT91RjCbeR.pdf (accessed 07 March 2023).

[5] Ibid.

[6] Rasporyazhenie Pravitel'stva RF ot 19.03.2019 N 466-r (red. ot 13.10.2022) «Ob utverzhdenii programmy razvitiya OAO "RZhD" do 2025 goda» (vmeste s "Dolgosrochnoy programmoy razvitiya otkrytogo aktsionernogo obshchestva "Rossiyskie zheleznye dorogi" do 2025 goda") [Order of the Government of the Russian Federation dated March 19, 2019 N 466-r (as amended on October 13, 2022) "On approval of the development program of JSC Russian Railways until 2025" (together with the Long-term development program of the open joint-stock company Russian Railways until 2025)]. URL: http://government.ru/docs/36094/ (accessed 25 February 2023).

[7] Ibid.

At the same time, the functional dominance of communication systems is the creation of conditions (and opportunities) for barrier-free interaction of business entities along the entire value chain from the extraction of mineral resources (production of processed products) to end-use markets. This is a prerequisite for ensuring sustainable socio-economic development of the Arctic territories and rational development of the natural resources of the Arctic.

In our opinion, the development of natural resources in the Arctic, including the task of active expansion of the presence of Russian producers in competitive markets, requires a dynamic approach based on the principle of "complementary expediency", which defines the target priorities of the spatial organization of economic development of mineral resources in the integration unity of the rapid development of the Arctic communication systems, which will ensure a multiplier effect in the development of Arctic territories of strategic importance and the national economy as a whole.

The development of integrated production and transport corridors (IPTC) will make it possible to vary and combine (diversify) possible options for transportation routes for extracted natural resources, depending on regional economic conditions, energy price conditions and the geopolitical situation in the world.

The relevance of this approach for the Russian Arctic as a unique region with extreme economic conditions, in our opinion, is obvious, since one of the main factors hindering the development of Arctic territories and the active economic development of mineral resources (including coal) is insufficiently effective spatial organization of Arctic transport communications.

Arctic agenda

Global demand for hydrocarbons is the main driver of the development of the Arctic economy, rich in natural resources, estimated by experts at more than 85.1 trillion m^3 of combustible natural gas, 17.3 billion tons of oil (including gas condensate), 7162.7 million tons of coal (3.6% of proven coal reserves in Russia as a whole) and other types of minerals (ferrous, non-ferrous, rare, rare earth, noble metals (gold, silver, platinoids), non-metallic: apatite ores, diamonds), which are a strategic development reserve mineral resource base of the Russian Federation.

Already today, the Arctic zone provides the production of more than 80% of combustible natural gas and 17% of oil (including gas condensate) in the Russian Federation [8]. Table 1 presents data on the main types of hydrocarbon (liquid, solid) minerals in the Arctic zone of Russia in the specific ratio of reserves and production in the volumes of reserves and production of the Russian Federation.

Table 1

[8] Ukaz Prezidenta Rossiyskoy Federatsii ot 26.10.2020 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 dated October 26, 2020 No. 645 "On the Strategy for developing the Russian Arctic zone and ensuring national security until 2035"]. URL: http://www.kremlin.ru/acts/bank/45972 (accessed 26 February 2023).

Main types of mineral hydrocarbon reserves in the Russian Arctic zone [9]

Group and type of mineral	Number of mineral deposits	Unit	Reserves (A+B+C1)	% of mineral reserves in the RF	Off-balance reserves	Production in 2021	% of production in the RF
Oil	282	mln t	3 879.5	20.8		69.3	13.2
Combustible gases (free gas)	204	billion m^3	37 417.5	76.3		607.5	87.4
Combustible gases (soluble gas)	264	billion m^3	390.7	25.2		9.2	1.3
Condensate	157	mln t	1 352.2	58		20.6	71.4
Coal	45	mln t	7 162.7	3.6	5 735.7	8.1	2.0

As for Arctic coal, the situation is not as simple as with liquid hydrocarbons: both from the point of view of the current contribution to the overall Russian coal production (2% of Russian production), and from the perspective of the strategic prospects of Arctic projects due to a number of external reasons and internal character.

Coal industry in Russia: state and trends

The coal industry is part of the country's fuel and energy complex, which is one of the basic in the structure of the national economy in terms of filling the budget, creating jobs, and ensuring economic growth [10].

According to the literature devoted to the analysis of the Russian coal industry [17, pp. 9-23], [18, pp. 70-76], [19, pp. 9–14], as well as the reports of coal mining companies published by the Central Dispatching Department of the Fuel and Energy Complex (CDDFEC) [11], as of the end of 2021, the total production capacity of Russian coal mining enterprises amounted to 497.7 million tons of coal per year, including by open pit method (in open pits) — 365.2 million tons of coal per year (73.4%), by underground method (in mines) — 132.5 million tons of coal per year (26.6%). According to Rosstat, in 2021, 438.4 million tons of coal were produced in Russia (according to coal mining companies — 438.4 million tons). Figure 1 shows the dynamics of coal production in the Russian Federation for the period from 1995 to 2021.

[9] Compiled by the authors based on the information on the state and prospects for the use of the mineral resource base of the Arctic zone of the Russian Federation as of March 15, 2021. URL: file:///C:/Users/Win/Downloads/45bb8bcc7b844220954744c0149a86f4.pdf (accessed 16 March 2023).

[10] As of January 1, 2022, the stock of operating coal mining enterprises in Russia includes 155 enterprises (mines – 53, open pits – 102). Coal processing in the industry is carried out at 76 processing plants and installations, as well as at the sorting facilities available at most coal companies.

[11] CDDFEC is a branch of the Federal State Budgetary Institution "REA" of the Ministry of Energy of Russia. URL: https://www.cdu.ru (accessed 19 March 2023).

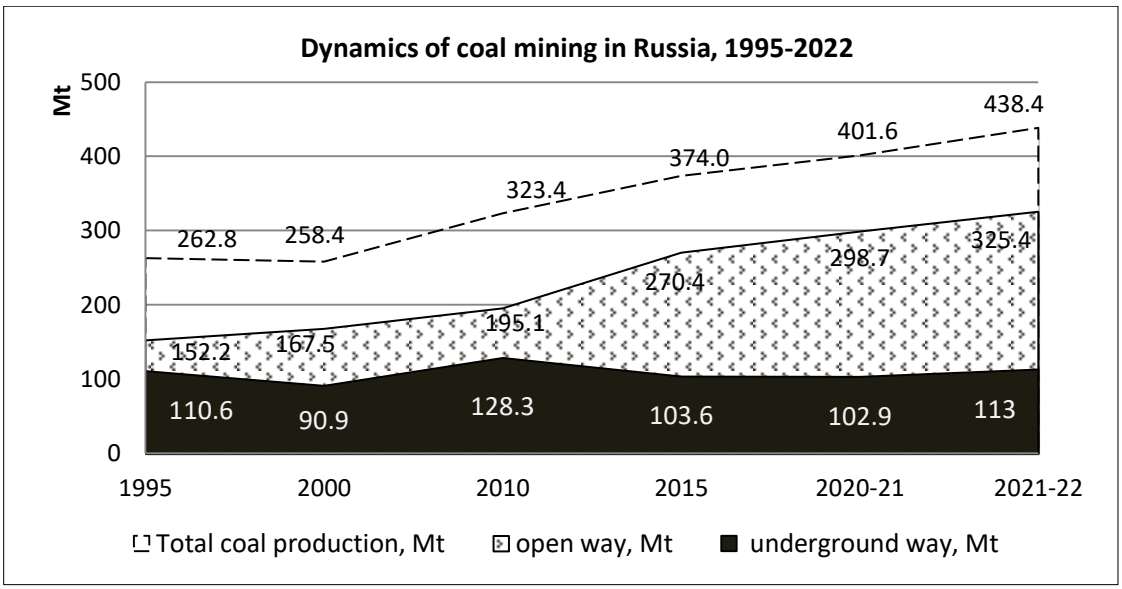


Fig. 1. Dynamics of coal mining in Russia, 1995–2022 [12]

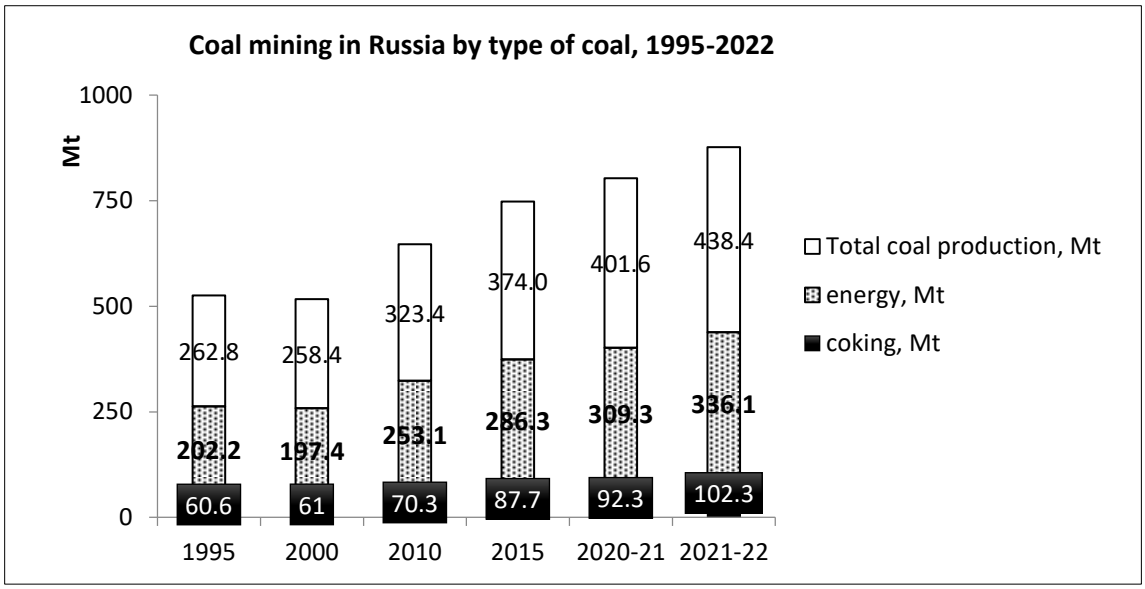


Fig. 2. Coal mining in Russia by type of coal, 1995–2022 [13]

Export. The volume of Russian coal exports in 2021 amounted to 215.1 million tons (Fig. 3), including 201.3 million tons (93.6%) to non-CIS countries and 13.8 million tons to neighboring countries (6.4%).

[12] Compiled by the authors based on reporting data from coal mining companies of CDDFEC. URL: https://www.cdu.ru (accessed 02 February 2023).
[13] Compiled by the authors.

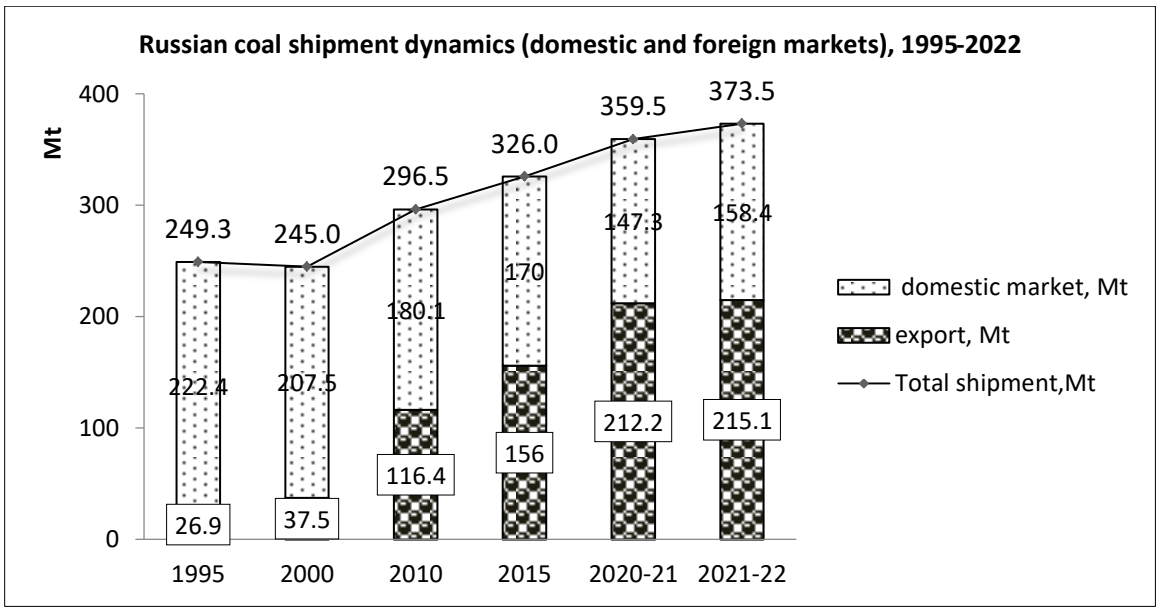


Fig. 3. Russian coal shipment dynamics (domestic and foreign markets), 1995–2022 [14].

Exports account for 57.6% of the total volumes of production and shipment of Russian coal (Fig. 4). The main share of exports falls on thermal coals — 192.5 million tons (89.5%), coking coals account for 10.5% (22.6 million tons) of exports.

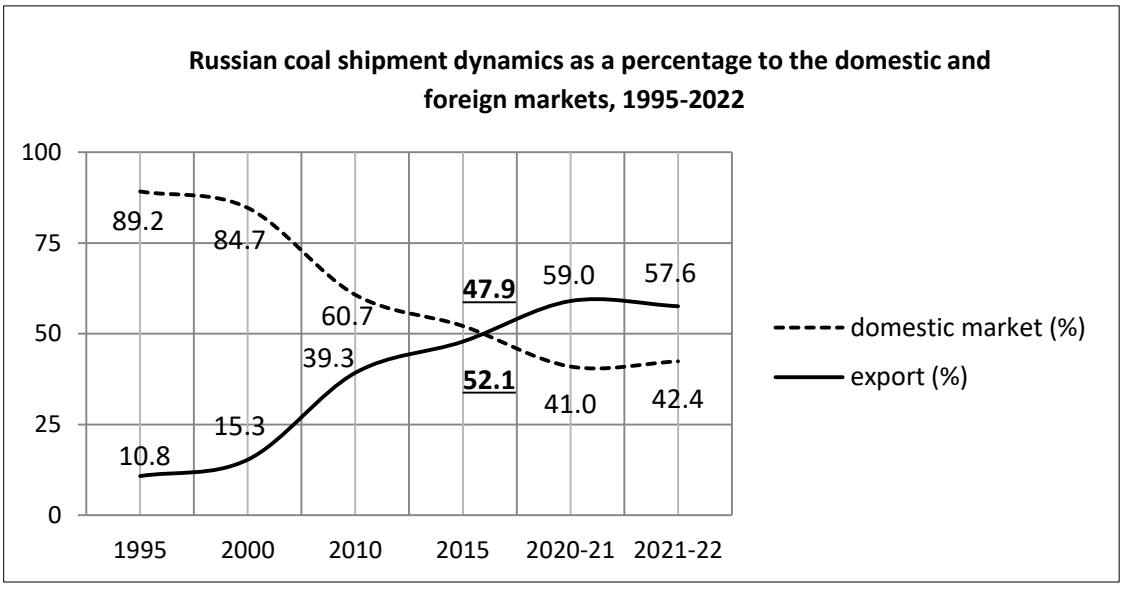


Fig. 4. Dynamics of Russian coal shipments to the domestic and foreign markets, 1995–2022 [15]

The total export volume in 2021 amounted to 215.3 million tons. Of the total export volume, the main volume of coal was shipped to non-CIS countries — 201.4 million tons (93.6%), 13.9 million tons were delivered to neighboring countries (6.4%). Fig. 5 presents the top 10 countries — the main importers of Russian coal (before the introduction of the coal embargo [16]), which accounted for more than 77% (165.9 million tons) of all Russian exports.

[14] Compiled by the authors.
[15] Compiled by the authors.
[16] The European Union has imposed an embargo on the import of Russian coal as part of the fifth package of sanctions against Russia, which entered into force on August 10, 2022.

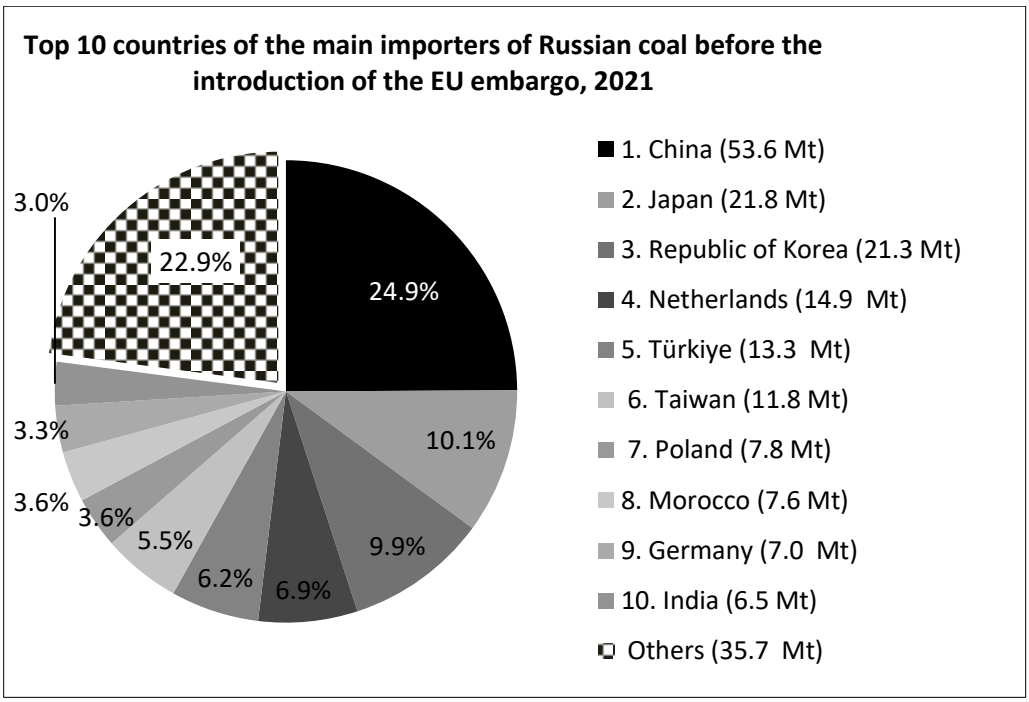


Fig. 5. Top 10 countries — the main importers of Russian coal before the introduction of the EU embargo, 2021 [17].

According to the Ministry of Energy, coal exports from Russia to the EU countries in 2021 amounted to 48.8 million tons (22.6% of total exports). The majority was thermal coal — 45.3 million tons (92.8%), coking coal for steel production — 3.5 million tons (7.2%). According to BCS Global Markets, before the coal embargo, Russia provided 70% of the EU's thermal coal needs.

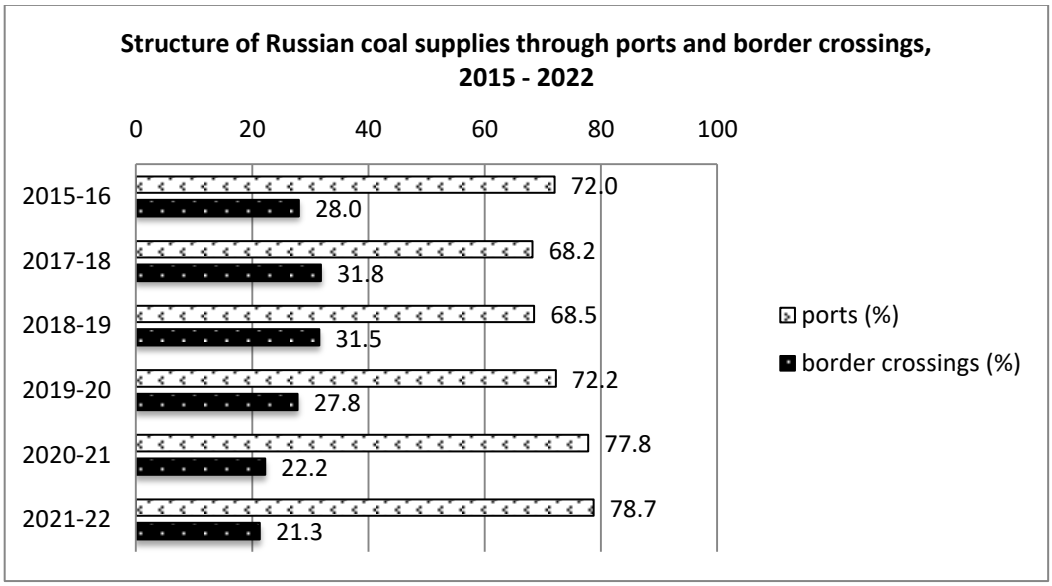
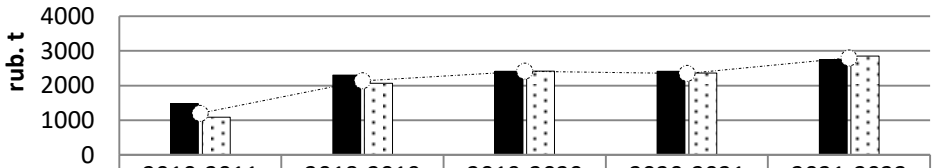


Fig. 6. Structure of Russian coal supplies through ports and border crossings, 2015–2022 [18].

Economic indicators of the coal industry development. The total average cost of production of 1 ton of coal (without costs for delivery to consumer markets) at the end of 2022 amounted to 2797.4 rubles, which is 19% (+446.74 rubles) higher compared to 2020.

[17] Compiled by the authors.
[18] Compiled by the authors.

Dynamics of changes in the total cost of production of 1 ton of coal in Russia, (rub./т), 2010-2022



	2010-2011	2018-2019	2019-2020	2020-2021	2021-2022
by underground method, rub./t	1479	2298	2411	2415	2750
open method, rub./t	1088	2068	2420	2362	2858
cost price averaged over the coal industry, rub./t	1197	2137	2415.5	2351	2797

Fig. 7. Dynamics of changes in the total cost of mining 1 ton of coal in Russia, (rub./t), 2010–2022 [19].

According to the results of 2021, the average price of 1 ton of shipped coal products amounted to 5576.1 rubles per ton (the increase was 245% or 3301.6 rubles/t). Export prices of Russian coal in 2021 also showed a significant increase — thermal coal exports: + 119%, metallurgical coal: + 228% compared to the 2020 level, respectively (Fig. 8, 9).

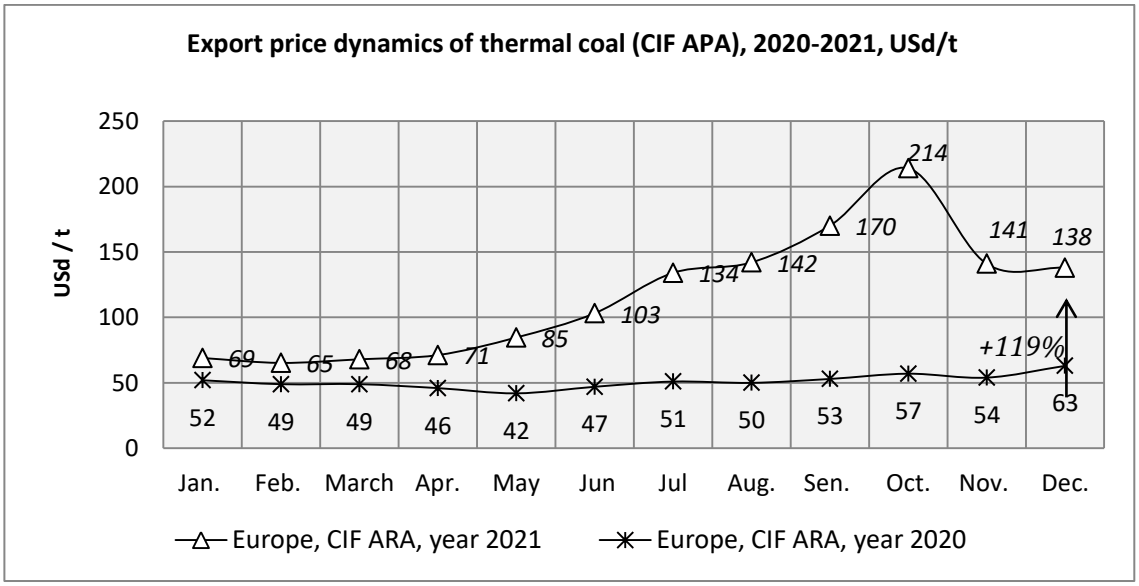


Fig. 8. Dynamics of thermal coal export prices (CIF APA), (USD/t), 2020–2021 [20].

[19] Compiled by the authors.
[20] Compiled by the authors.

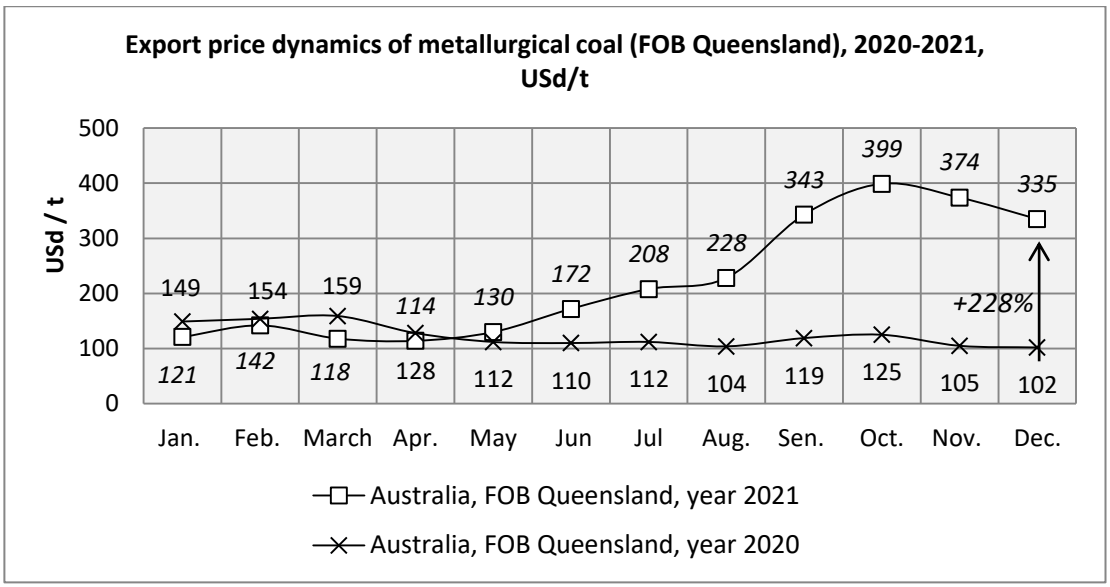


Fig. 9. Dynamics of metallurgical coal export prices (FOB Queensland), (USD/t), 2020–2021 [21].

Supply costs for metallurgical coal are generally higher than for thermal coal. This is because hard coal is more often mined underground and, on average, comes from smaller coal mines than thermal coal. In addition, the cost of preparing methyl coal is higher than for thermal coal. Therefore, as world prices and demand increase, deposits where coking coal is mined by open-pit mining increase their liquidity and, accordingly, their export potential. In this logic, investors prefer to invest in projects for the extraction of metallurgical coal, despite the fact that global consumption of thermal coal is 6.5 times higher than the volume of consumption of metallurgical grades (in 2022 — 6945 million tons and 1080 million tons, respectively), and imports — 3.4 times (in 2022 — 1035 million tons and 307 million tons, respectively), and in the forecast for the period until 2025, a decrease in imports of thermal coal is expected (-9.6% compared to 2022) , while imports of metallurgical grades of coal are expected to grow by +6.2% compared to the level of 2022 (Table 3). These trends reflect the global agenda for decarbonization of the world economy under the Paris Climate Agreement adopted in 2015 [22], joined by 184 countries.

The main supplier of coal for export is the Siberian Federal District — 76.6% (164.7 million tons) of the total export volume, including the share of Kuzbass — 62.8% (135.1 million tons) of the total export volume. Table 2 presents data from the largest exporters of Russian coal.

Table 2

Largest coal exporters (according to reporting data of coal mining companies) [23]

	2021	2020	in % to 2020
JSC SUEK	40 010.4	36 689.5	91.7
JSC MC Kuzbassrazrezugol	30 941.8	38 120.3	123.2
Sibanthracite Group:	16 942.6	17 162.9	101.3
— JSC Siberian Anthracite	7 132.6	7 146.9	100.2
— LLC Razrez Vostochnyy	3 893.4	2 733.2	70.2

[21] Compiled by the authors.
[22] Paris Agreement (accepted by the UN FCCC 21st session on December 12, 2015). URL: https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf (accessed 22 March 2023).
[23] Compiled by the authors.

LLC MC Elga Ugol	14 011.4	43 827.7	312.8
JSC HC SDS-Ugol	13 806.4	13 060.9	94.6
LLC VGK	9 893.8	9 141.9	92.4
JSC Stroyservis	7 914	11 301.2	142.8
LLC Raspadskaya MC	7 550.3	6 659.4	88.2
PJSC Kuzbasskaya FC	6 426.5	6 593.6	102.6
GC TALTEK	6 041.4	12 777.6	211.5
PJSC Mechel	5 602.1	4 207.2	75.1
other	42 556.6	49 711.6	85.6

The largest coal-mining region is the Kuznetsk basin, where more than half (55.0%) of all coal in the country and 71.6% of coking coal are mined (Fig. 10).

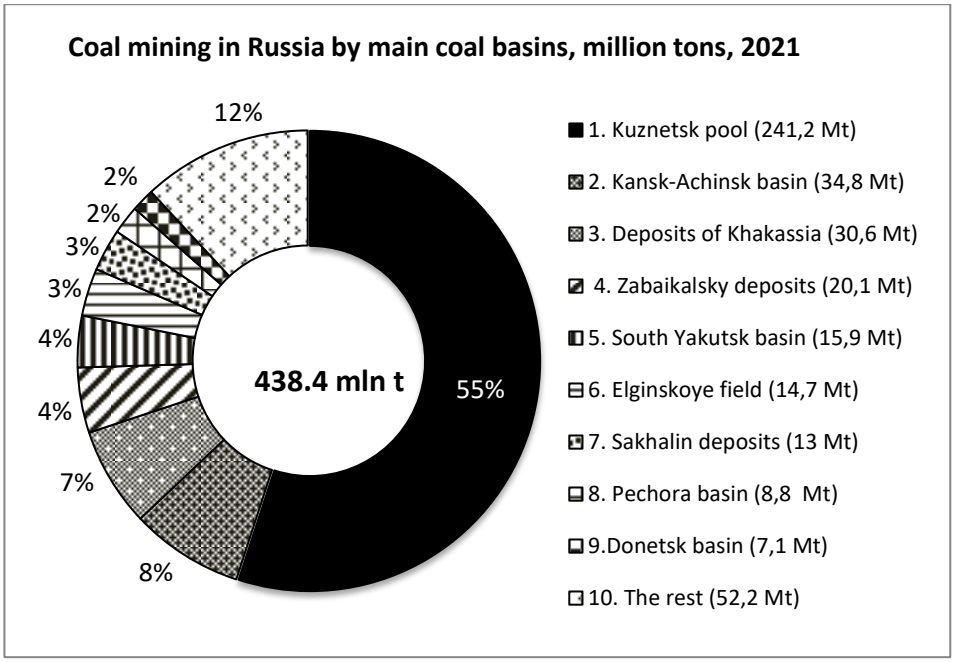


Fig. 10. Coal production in Russia by major coal basins (million tons), 2021 [24].

The role of Arctic coal mining: current status and development potential

The share of Arctic coal mining in the total balance of the Russian coal industry is about 2.7% (in 2021, the Russian Arctic — 10.2 million tons, Russia — 438.4 million tons), the share in Russian exports is 0.5% (in 2021, the Russian Arctic — 1.1 million tons, Russia — 215.1 million tons) [25].

Coal production in the Arctic as a whole is about 10–12 million tons, while there is a general trend towards a decrease in Arctic coal production. Thus, according to the results of 2021, 10.2 million tons were produced, which is 10.5% lower compared to 2020 (11.3 million tons) and 26.6% lower compared to 2015, when 13.9 million tons were produced, which is a historical maximum (Fig. 11).

[24] Compiled by the authors.
[25] According to CDDFEC. URL: https://minenergo.gov.ru/node/435 (accessed 19 March 2023).

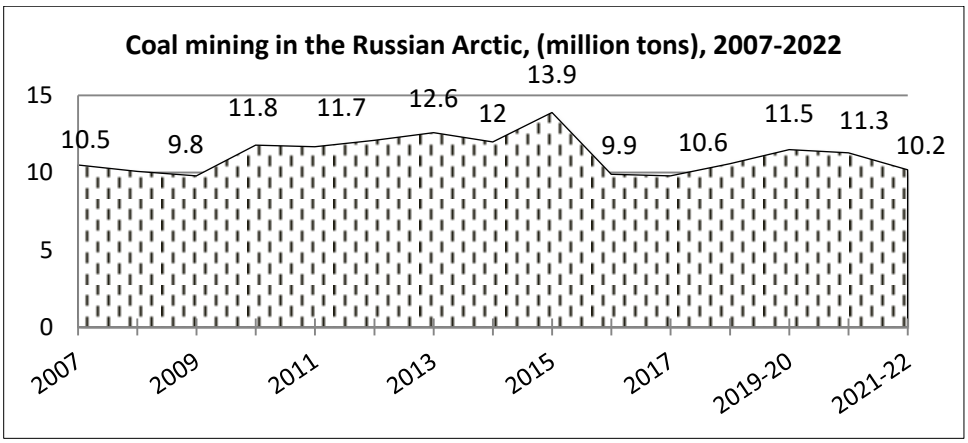


Fig. 11. Coal production in the Russian Arctic (million tons), 2007–2022 [26].

The main share in Arctic coal production is made up by Vorkuta deposits — about 86.3%, Chukotka — 10.8%, Yakutia — 2.9%, production on Spitsbergen (FSUE Arktikugol, Murmansk) is about 0.1%. The main supplies of coal mined in the Arctic, approximately 89% (9.1 million tons), go to the domestic market to satisfy municipal needs, the remaining 11% (1.1 million tons) are exported.

The development potential of Arctic coal mining is determined by a number of factors, both internal and external.

The favorable factors include:

- significant reserves of coal, including valuable coal grades (anthracite, coking coals), which are in greatest demand on international markets, making it possible to plan their development for the long term;
- acceptable level of complexity of mining and geological conditions for field development (open-pit mining of coal deposits);
- concentration of reserves in a relatively small area;
- relative proximity of seaports (Dikson, Dudinka, Igarka) and river communications (Yenisei River), which allows for diversified transportation both to international markets (mainly the Asia-Pacific region) and to industrially developed areas of the Krasnoyarsk Krai and other territories of Russia.

The factors hindering the development of Arctic coal projects are:

- insufficient level of development of transport communications, primarily the Northern Sea Route, including the lack of icebreakers and ice-class merchant ships to ensure year-round navigation and guaranteed supply of goods, primarily to the markets of the Asia-Pacific region [27];

[26] Compiled by the authors based on data from [18, p. 72].

[27] Thus, the analytical center of the Russian Energy Agency (REA) of the Ministry of Energy estimates the need for new bulk carriers for transporting coal for export in the amount of 82 vessels (79 Panamax and 13 Capesize) until 2030. Today, the total deadweight of the Russian bulk carrier fleet is about 6.2 million tons, of which about 4 million tons (65%) are used for coal. These capacities are enough to export a maximum of 140–150 million tons (in 2021, 240 million tons were exported by sea transport). According to experts, the cost of building coal bulk carriers (79 Panamax and 13 Capesize) will be 180–200 billion rubles.

- difficulties in field development due to extreme natural and climatic conditions;
- high costs associated with meeting environmental requirements for the development of natural reserves in the Arctic.

Balance reserves of Arctic coal (category A+B+C1) are estimated at 7162.7 million tons, category C2 — 2062.9 million tons (off-balance reserves — 5735.6 million tons), which is 3.6% of proven Russian coal reserves. Coking coals (categories A+B+C1) — 3163.59 million tons, make up 44.9% of the explored Arctic reserves, including especially valuable grades of coal (K, KO, KZh) — 2622.3 million tons. Coal reserves in the Arctic are distributed by 45 deposits. Most of it is located in the Komi Republic (Pechora coal basin) — 5.1 billion tons, which is 70.2% of coal reserves in the Arctic.

The second place in explored coal reserves is occupied by the Krasnoyarsk Krai with 1.4 billion tons (19.6%). The most significant reserves include the Vorkutskoe, Vorgashorskoe, Usinskoe coal deposits with the largest reserves of coking coal, which is a particularly valuable grade that is in great demand on world markets.

Table 3 and in Fig. 12 show coal basins that are partially or completely included in the Arctic zone of Russia.

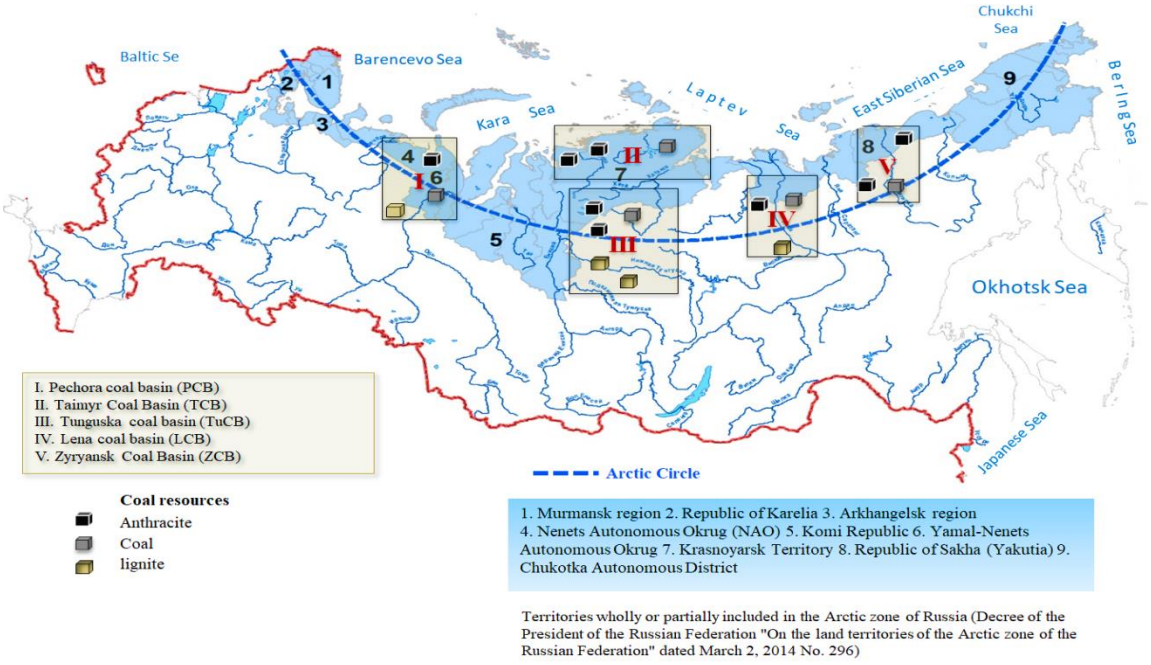


Fig. 12. Prospective coal basins of the Arctic zone of the Russian Federation [28].

The largest coal basins in the Arctic zone include Pechora, located in the Komi Republic (coal resources of 265 billion tons), Taimyr, which occupies a significant part of the Taimyr Peninsula (Krasnoyarsk Krai) with an area of more than 80 thousand km^2 (coal resources of 217 billion tons), stretches in the form of a narrow stripes in a northeast direction from the Yenisei Bay in the west to the coast of the Laptev Sea in the east. The Tunguska coal basin is the largest in Russia and the world in terms of coal resources (2299 billion tons) — stretches from north to south for 1800

[28] Compiled by the authors.

km and from west to east — for 1200 km (about 90% of the territory belongs to the Krasnoyarsk Krai, the remaining area included in the Irkutsk Oblast and Yakutia).

The Lenskiy coal basin with an area of 600 thousand km^2 is located in Yakutia (partially in the Krasnoyarsk Krai), along the banks of the Lena River and its tributaries and along the coast of the Laptev Sea from the mouth of the Lena River to Khatanga Bay. In terms of confirmed resources (1.647 billion tons), it is second after the Tunguska basin (contains 10% of the world's estimated coal resources and 25% of the coal resources of the Russian Federation). The Zyryanskiy coal basin (Sakha Republic) is located in the interfluve of the middle reaches of the Kolyma and Indigirka with an area of about 7500 km^2 (coal resources are about 40 billion tons).

Table 3 presents data characterizing the resource potential of coal deposits, fully or partially included in the Arctic zone of Russia.

Table 3

Coal basins fully or partially included in the Arctic zone of Russia [29]

Coal Basin	Resources	Reserves (A + B + C1)	Total field area	Characteristic
I. Pechorskiy	265 billion tons, incl. conditioned – 61 billion tons	8.2 billion tons	> 90.1 thousand km²	Located on the western slope of the Polar Urals and Pai-Khoi, in the Komi Republic, in the city of Vorkuta, the Nenets Autonomous Okrug and the Arkhangelsk Oblast. According to the degree of metamorphism, they range from brown to anthracite.
II. Taimyr	217 billion tons, incl. conditioned – 185 billion tons	89 million tons	> 80 thousand km^2	The basin is located in the north of the Krasnoyarsk Krai, occupying a significant part of the Taimyr Peninsula.
III. Tunguska	2299 billion tons	1.88 billion tons	> 1 million km^2	The largest in the Russian Federation and the world both in terms of coal resources and area. From north to south it stretches for 1800 km, and from west to east – for 1200 km.
VI. Lenskiy	1647 billion tons	2.1 billion tons	600 thousand km^2	The second largest coal resource basin in the Russian Federation, contains 10% of the estimated global coal resources and 25% of Russia's coal resources.

[29] Compiled by the authors.

The Taimyr coal basin is of the greatest interest from the point of view of export potential, as it contains significant reserves of valuable coking coal grades, which are in high demand on world markets.

The Taimyr coal basin has been known since 1843 and ranks 5th in the country in terms of coal resources (234 billion tons). The total coal resources are 217 billion tons, of which 185 billion tons are conditioned coal resources, with A+B+C1 category reserves of 89 million tons. The number of coal seams with a depth of 1 to 12 meters reaches several dozen. Fig. 13 shows the main deposits of the Taimyr coal basin.

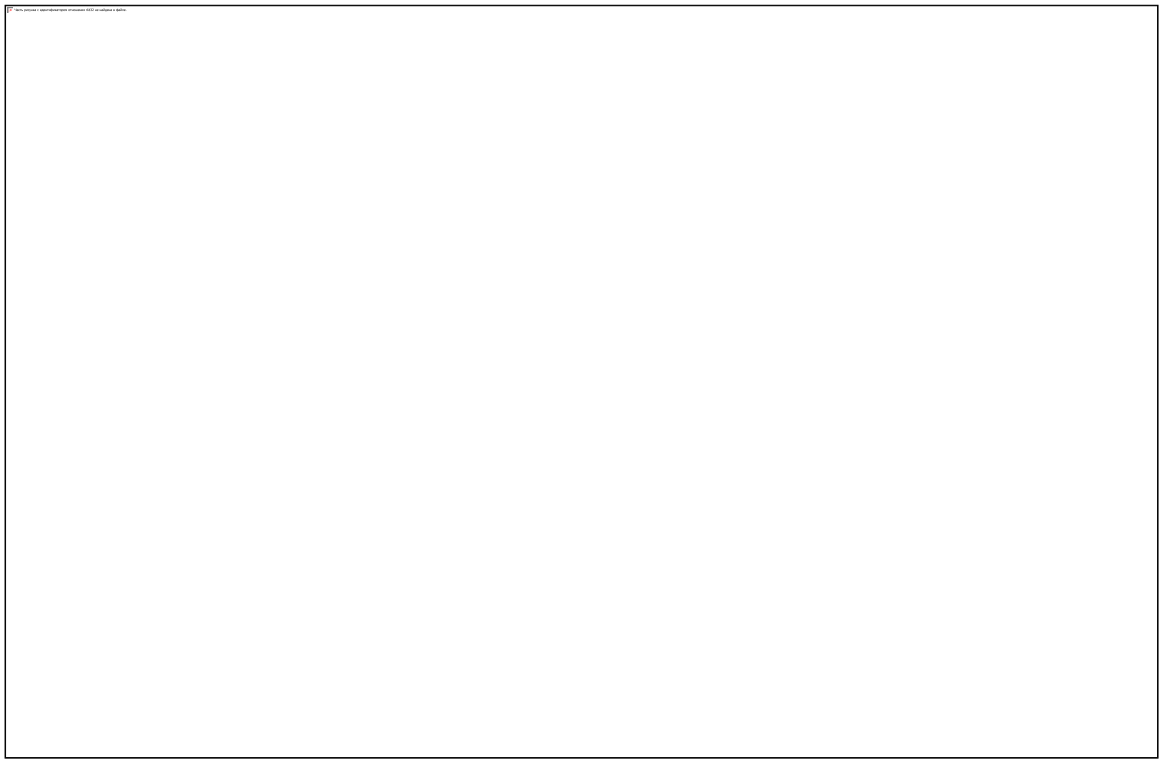


Fig. 13. Main deposits of the Taimyr coal basin [30].

The greatest prospects for the industrial development of coal resources are associated with the western part of the basin. A significant part of the reserves here is anthracite, which determines the high export potential of these deposits.

Currently, an investment project is already being implemented for the development of the Syradasayskoe coking coal deposit (located 105–120 km southeast of the village of Dikson, the resources of which are estimated at more than 5 billion tons of coal of G (gas), R (rich), C (coke) and LS (lean-sintering) grades) [31]. It is planned to create a coal cluster on the basis of this project [32]. The project to create a coal cluster in Taimyr will receive state support. As part of the project,

[30] Compiled by the authors.
[31] Na Taymyre postroyat fabriku po proizvodstvu ugol'nogo kontsentrata [A factory for the production of coal concentrate will be built in Taimyr]. URL: https://pulse.mail.ru/article/na-tajmyre-postroyat-fabriku-po-proizvodstvu-ugolnogo-koncentrata-6665585833829864916-5800849740666477922/ (accessed 19 March 2023).
[32] The project for the construction of a coal complex at the Syradasayskoe deposit, one of the largest coal deposits in the world, was included in the number of investment projects in the Arctic zone supported by the Government of the Russian Federation. The project is also included in the comprehensive investment project “Yenisei Siberia” and has the status of a regional investment project.

which is being implemented by the Severnaya Zvezda company (part of the AEON corporation), it is planned to build a coal preparation plant for deep processing of coal (production of coal concentrates from coking coal), a marine terminal, an airport, a rotational camp, a power plant, and a highway. As part of the development of the Taimyr coal cluster, the construction of a 60-kilometer highway is underway; this will connect all the objects of the project for the development of the Syradasayskoe coal deposit. The project is planned to produce 20 million tons of high-quality coal per year.

As a result of the analysis, we can conclude that the potential for coal production in the Arctic is determined by significant proven reserves, which are of strategic importance for the national economy in the long term. At the same time, it is important to emphasize that the economic development of Arctic coal reserves is impossible without the development of transport communications, which is determined by the Arctic specifics of extreme economic conditions, the length of the borders, including sea borders (from the Kara Gate to Providence Bay 5600 km), and the distance from domestic and global consumer markets. Therefore, the most promising and economically feasible form of development of Arctic coal reserves is the creation of spatial-economic formations in the form of mineral resource centers (MRCs), integrated into national and international transport corridors, i.e. connected by a common integrated transport and logistics infrastructure with the economic centers of the country and the world, which will make it possible to make the most efficient use of the economic potential of Arctic coal deposits.

Results and discussion

Taking into account all the factors listed above, we conclude that in modern conditions, the prospects for the development of Arctic coal mining largely depend on the possibility of delivering the extracted raw materials to global and domestic consumer markets. This means that when developing Arctic coal reserves, it is necessary to create spatially extended technological chains connecting production and sales of products with a reliable diversified system of transport communications. Such chains should begin in the Arctic, in places where fossil resources are developed, and extend to the regional economic centers of the country and the world. The solution to this problem will require the advanced development of the Arctic communications system, which implies a comprehensive approach, including the creation of integrated production and transport corridors (IPTC), allowing to maximize the competitive opportunities of Arctic mineral resources, including coal deposits.

It is also inextricably linked with the development of the port infrastructure of the Northern Sea Route as an effective route for the transportation of Russian goods, including the construction of modern icebreakers and ice-class transport vessels to ensure year-round navigation, which is very important for guaranteed and efficient satisfaction of demand and strengthening the position of Russian exporters in the global coal market, mainly in the Asia-Pacific region.

With regard to the research topic, in our opinion, the maximum effect of the economic development of the Arctic territories, allowing to use the opportunities of coal deposits in a comprehensive manner, will be manifested in the creation of not separate highly specialized development centers, but mineral resource centers (MRCs) integrated into the global (national and world) economic space, which implies the comprehensive development of production and transport corridors (IPTC) in the integrity of sea, river and land communications. This will allow optimizing transport logistics and diversifying routes for the delivery of coal (and its enrichment products) to consumer markets, depending on regional business conditions, energy price conditions and the geopolitical situation in the world.

Fig. 14 presents a conceptualization of the spatial organization of economic development of Arctic coal reserves (using the example of the Taimyr coal basin), characterizing the integrity of production and transport corridors (PTC) of sea and land communications to ensure the possibility of diversifying the supply of coal (and its enrichment products) to domestic and international markets in depending on regional economic conditions, energy price conditions and the geopolitical situation in the world.

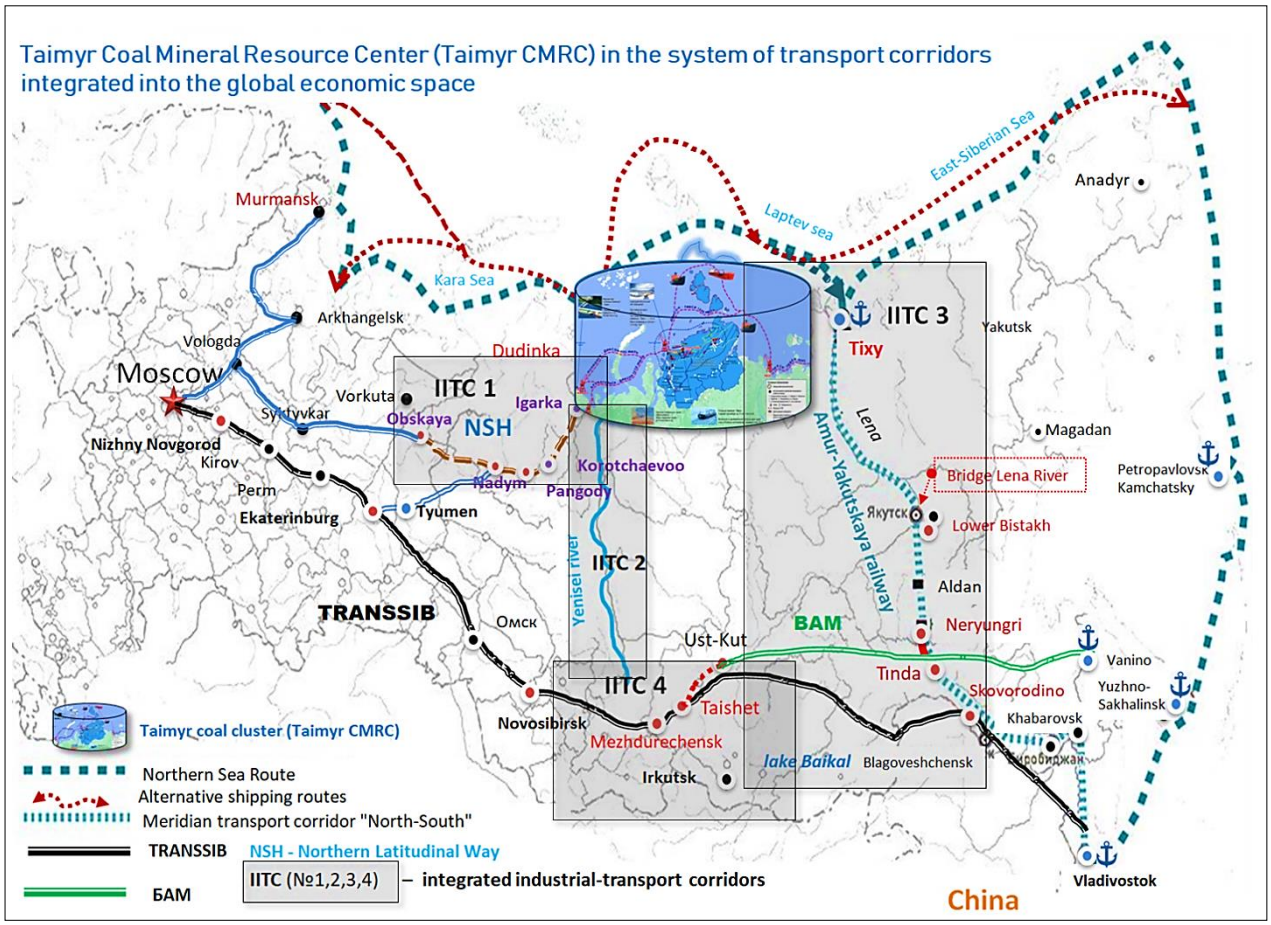


Fig. 14. Concept of spatial organization of prospective transport logistics for the development of Arctic coal resources in the integrity of sea and land transport corridors (Taimyr CMRC) [33].

[33] Compiled by the authors based on an analysis of strategic documents, development programs and complex investment projects implemented by the state and large companies with strategic interests in the Arctic region.

IPTC 1 (Northern Latitudinal Passage) is a production and transport corridor connecting the Northern Sea Route through the northern ports (Dudinka and Dikson) with key railway lines (the Tyumen–Nadym line and the northern latitudinal line starting from Arkhangelsk). IPTC 2 ("Yenisei of Siberia") is a production and transport corridor connecting the Northern Sea Route through the northern ports (Dudinka, Dikson) with the Southern latitudinal economic belt of Russia (Transsib, BAM). IPTC 3 and IPTC 4 ("Eastern Polygon" [34]) are production and transport corridors connecting the Northern Sea Route through the port of Tiksi with the BAM and the Trans-Siberian Railway, forming a subarctic bridge with the Southern latitudinal economic belt of Russia.

Thus, by providing a complete system of integrated production and transport corridors (IPTC 1, 2, 3, 4), Russia will have access to the shores of its eastern seas not only along the southern border, through the Trans-Siberian Railway and BAM in the area of Vladivostok and Khabarovsk, but much further to the north, up to the Arctic territories. Importantly, in addition to the transit and export function of delivering Arctic natural resources to the country's consumer markets and abroad, IPTCs will also significantly increase the economic development potential of the territories they cross.

Conclusion

An analysis of the current situation on the global coal market allows us to conclude that the main challenges for the Russian coal industry lie not in economic, but in geopolitical factors associated with anti-Russian sanctions (including the EU coal embargo), which block Russian exporters' access to European consumer markets, as well as "maritime blockade" (voluntary refusal of foreign shipping companies to work with Russian cargo) on the part of Western countries that joined anti-Russian sanctions, which sharply reduced the potential for maritime transport of domestic goods (including coal).

As a result of the introduction of the EU coal embargo, Russia lost a significant share of the global coal market (more than 51% or 109.6 million tons), which is estimated at $8 to 11 billion per year in lost export revenues.

Under these conditions, the liquidity of the Arctic coal reserves is significantly increasing, the development of which is proposed to be carried out on the principle of "complementary expediency", which defines the target priorities of the spatial organization of economic development of mineral resources in the integrity of the rapid development of the Arctic communications system, the creation of a system of integrated production and transport corridors (IPTC).

It seems that the implementation of this approach will provide unhindered access to the natural resources of remote areas of the Arctic. Relying on raw materials and transport and logistics capabilities, which open up additional opportunities for international transport corridors, strengthen the country's single economic space and increase the transit potential of the Arctic territories.

[34] Eastern Polygon — Far Eastern, Transbaikal, Krasnoyarsk and East Siberian railways.

Based on the presented arguments, the development of mineral resource centers (including coal MRCs) in the integrity of the system of production and transport corridors should be perceived as an absolute priority of the state Arctic policy and a key factor in ensuring the spatial organization of the economic development of natural resources in the Arctic, contributing to the sustainable socio-economic development of the Arctic territories and the national economy as a whole.

Thus, by starting a phased geostrategic reorientation of the country's economy to the north and east, Russia will be able not only to compensate for the consequences of changes in the European agenda that are negative for the country, but also to consolidate the prospects for a new rise in the national economy. In essence, this is a unique historical opportunity for stable development that can ensure the future of Russia as a great power.

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The Nuclear Icebreaker Fleet and Its Role in the Economic Development of the Northern Sea Route *

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Abstract. This scientific article studies the development of nuclear icebreakers, the history of their commissioning and service; the growth of nuclear icebreaker capacity is investigated. The Soviet and Russian stages of their history have been compared. A diagram of this development was constructed. Key tactical and technical data of nuclear icebreakers are compared; their proportionality and similarity are proved. The prospects of the nuclear icebreaker fleet development are investigated. The growth of cargo turnover along the Northern Sea Route in 1933–2022 is analyzed and systematized. The development of nuclear icebreakers is compared with the growth of cargo turnover along the Northern Sea Route, their interdependence is proved; the diagram of this interdependence is constructed. The reasons for the influence of both the development of the human economy and political events in and around Russia on the changes in the grouping of nuclear icebreakers are revealed. It is identified that the volumes of transportations along the Northern Sea Route in the 21st century are many times higher than in the Soviet era, largely due to the growth of the quality and quantity of the nuclear icebreaker fleet. The reasons for the reduction of the nuclear icebreaker fleet at the beginning of the 21st century under the influence of the general temporary reduction of cargo flows along the Northern Sea Route are shown. Maximum small and optimal sizes of nuclear icebreakers grouping for effective operation of the Northern Sea Route are specified.
Keywords: *nuclear, icebreaker, Arctic, Russia, economy, fleet, Northern Sea Route*

Introduction

The Russian economy has long been aware of the serious benefits of developing the Northern Sea Route (hereinafter referred to as the NSR) and its adjacent locations, and with their help — from building new logistics business models for states and large companies interested in delivering their cargoes via the NSR — to Russia itself. Without a high-quality and reliable nuclear icebreaker fleet, this is ineffective. Modern Russia demonstrates unique and large-scale achievements in this direction, both in shipbuilding and in the operation of nuclear icebreakers.

Actual history of nuclear icebreakers

During 32 years (1959–1991), 7 nuclear icebreakers of three different projects were built in the USSR: 1 of the project 92M “Lenin” (3.12.1959) [1], 4 of the project 1052.0: “Arktika” (25.04.1975) , “Sibir” (28.12.1977), “Rossiya” (21.12.1985), “Sovetskiy Soyuz” (30.12.1989) and 2 of the project 1058.0: shallow-draft “Taimyr” (30.06.1989) and “Vaygach” (25.07.1990) [2, Ushakov A.].

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These and further icebreakers are presented in the diagram in figure 1, taking into account the duration of their service (the separator in the figure shows 1991 as the border between the Soviet and Russian periods):

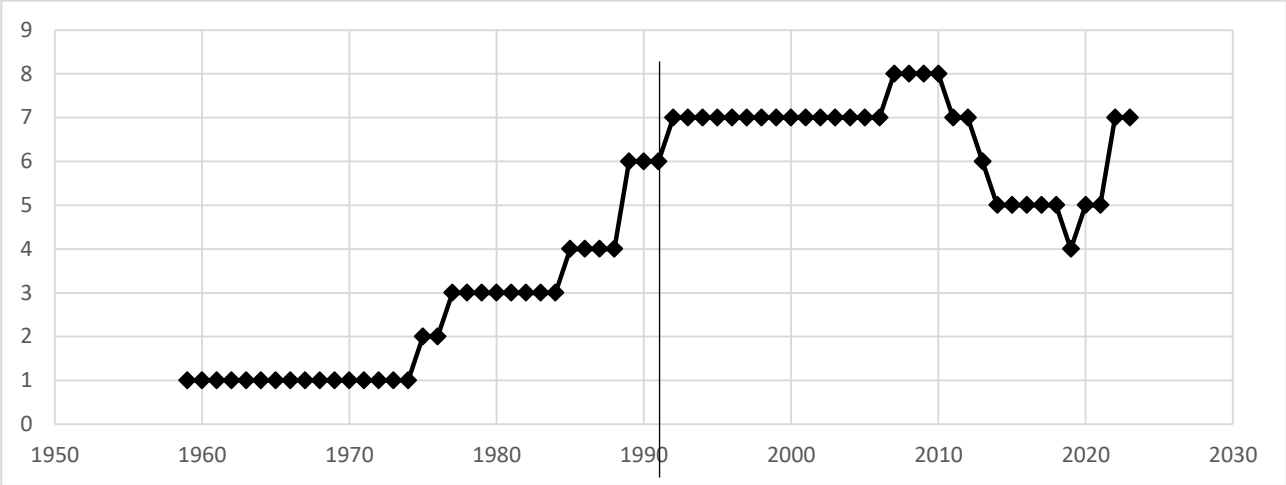


Fig. 1. Number of nuclear icebreakers in different years [1].

The dynamics of their commissioning intervals is quite interesting: 16 years — 2 years — 8 years — 4 years — 0.5 years — 1 year.

In the Russian Federation, during the same time — 32 years (1991–2023) — 5 nuclear icebreakers of two projects were built: 2 of the project 1052.0: "Yamal" (27.10.1992) and "50 Let Pobedy" (23.03.2007) and 3 of the project 2222.0 LK-60Ya: "Arktika" (21.10.2020), "Sibir" (25.01.2022) and "Ural" (22.11.2022).

Their dynamics of commissioning intervals is also very indicative: 14 years — 13 years — 2 years — 0.5 years. There is a lot in common between the dynamics of the Soviet (16–2–8–4–0.5–1) and post-Soviet (14–13–2–0.5) periods, showing a rather long acceleration point in icebreaker construction at 13–16 years, seriality during 2–4 years and even simultaneous commissioning of several ships in one year.

Fig. 1 shows that the dynamics of nuclear icebreakers development is visually obvious: their peak of 8 units occurred in 2007–2010, after which the number began to decline, and the lowest number was in 2019 — 4 vessels. Then the number of nuclear icebreakers started to grow, and in 2022 there were 7 units, almost back to the maximum achieved.

At the moment, 3 more nuclear icebreakers of 2 projects are being built: 2 of the project 2222.0 LK-60Ya: the already launched "Yakutia" (12.2024?) and "Chukotka" (12.2026?); "Rossiya" (12.2027?) of the project 1051.0 LK-120Ya. Two more icebreakers of project 2222.0 LK-60Ya is planned in the near future: "Kamchatka" (5.2024–2028?) and "Sakhalin" (10.2025–2030?). Thus, the current grouping of 7 icebreakers is planned to be at least maintained at the current level, and at a maximum — to be increased to 8. It is possible to build 2 more icebreakers of Project 1051.0 LK-120Ya until 2034 [3, Aleksushin G.V.]. Moreover, a new shipbuilding plant — SBC Zvezda in the

[1] Compiled by the author.

Far East — is involved in this new series, and the Soviet principle of building nuclear-powered icebreakers at a single enterprise is passing into the past.

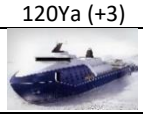
However, despite the obvious slight superiority of the USSR in the number of icebreakers built (7 versus 5+3), the combined displacement of Soviet icebreakers is actually the same (16.000 tons (Lenin), 4 by 23.460 tons and 2 by 19.600 tons = 149.040 tons) as that of the Russian ones (2 by 23.460 tons and 3 by 32.747 tons = 145.161 tons). It should be taken into account that now part of the shipbuilding capacity is occupied by 3 icebreakers under construction, and part of their total displacement has already been built.

Growth of domestic nuclear icebreaker capacity

It is obvious that designers are striving to constantly increase the capacity of nuclear icebreakers while maintaining their overall size, which can be seen in Table 1:

Table 1

Comparison of nuclear icebreakers' technical characteristics (power indicators are in bold) [2]

	project 92M "Lenin" (1)	project 1052.0: "Arktika" (6)	project 1058.0: "Taimyr" (2)	project 2222.0 LK-60Ya (3+5)	project 1051.0 LK-120Ya (+3)
					
Water displacement in tons (full/standard)	16000	23460	19600	32747/26771	71380/50398
Width, m	27.6	30.0 / 28.0	29.2 / 28.0	34.0 / 33.0	47.7 / 46.0
Power on shafts, kW	*32400*	*49000*	*32500*	*60000*	*120000*
Speed in clear water, knots	18	20.8	20.2	22	23
Ice capacity, m	*1.7*	*2.25*	*1.95*	*2.8-2.9*	*4.3*
Crew, people	243	130	89	54	127

There is a constant growth of displacement: icebreakers are gaining weight. However, the increase between the main projects 1052.0 and 2222.0 is already small — only 1.14 times, but the increase in power on the shafts is more significant — 1.22 times. Moreover, this power increase is not used to increase speed — it increased by only 1.06 times, which is significantly lower than the calculated coefficient — the increase in power was used to significantly increase icebreaking capability — by 1.24–1.29 times. This indicates not only quantitative, but also qualitative growth in the development of nuclear icebreakers, which suggests an increase in the efficiency of the technologies used. The same growth of efficiency is evidenced by a noticeable increase in the degree of mechanization and automation in management: 54 crew members on the icebreaker 2222.0, which is more than 2 times less than on the project 1052.0 with an increase in dimensions and displacement.

[2] Compiled by the author.

Judging by the known and publicly available performance characteristics, in the case of the nuclear icebreaker of the new project 1051.0, the matter is not just a new series of icebreakers (2222.0), which will be built at least until 2230, but a fundamentally new class of nuclear icebreakers — almost twice the size of the previous ones, and capable of passing through ice 4.3 m thick. The issue is the separation of two subclasses of nuclear icebreakers — conventional and heavy. It is obvious that heavy icebreakers are going to be used in cases and on routes with thick ice, significantly expanding the logistics capabilities on the NSR, and their width has been increased to guide larger-tonnage vessels. Their use will increase the range of wide-hull vessels sailing along the NSR. By the way, the unification of the internal structures of icebreakers is increasing, which reduces construction and operation costs. The new nuclear reactor "Rhythm-200" is particularly indicative in this respect.

Relationship between the dynamics of the nuclear icebreaker fleet and cargo turnover of the Northern Sea Route

Nuclear icebreakers are not a goal in themselves; their task is to ensure ice navigation of ships along the NSR, the profit from the operation of which is one of the important factors in the development of the Arctic [4, Liu M.].

The NSR began to be used in 1933[3]. An independent task in this study was to create the most complete picture of the dynamics of cargo traffic along the NSR, presented in Table 2:

Table 2

Dynamics of cargo traffic along the Northern Sea Route in 1933–2022. [4]

Year	Cargo, mln t	Year	Cargo, mln t	Year	Cargo, mln t	Year	Cargo, mln t	Year	Cargo, mln t
1933	*0.13*	1934	No data	1935	No data	1936	No data	1937	No data
1938	No data	1939	No data	1940	*0.35*	1941	*0.165*	1942	No data
1943	*0.289*	1944	No data	1945	*0.444*	1946	*0.412*	1947	No data
1948	No data	1949	No data	1950	No data	1951	No data	1952	No data
1953	*0.506*	1954	No data	1955	No data	1956	No data	1957	No data
1958	No data	1959	No data	1960	No data	1961	No data	1962	No data
1963	*1.264*	1964	*1.399*	1965	*1.455*	1966	No data	1967	No data
1968	No data	1969	No data	1970	*2.98*	1971	*3.032*	1972	No data
1973	No data	1974	No data	1975	No data	1976	No data	1977	No data
1978	No data	1979	No data	1980	No data	1981	*5.005*	1982	No data
1983	No data	1984	No data	1985	No data	1986	*6.455*	1987	*6.7*
1988	No data	1989	No data	1990	*5.5*	1991	*4.804*	1992	*3.9*
1993	No data	1994	No data	1995	*2.2*	1996	*1.8*	1997	No data
1998	*1.458*	1999	No data	2000	*1.6*	2001	*1.7*	2002	*1.5*
2003	*1.6*	2004	*1.65*	2005	*1.9*	2006	*1.956*	2007	*2.15*
2008	*2.1*	2009	*1.7*	2010	*2*	2011	*3.111*	2012	*3.6*
2013	*3.93*	2014	*3.982*	2015	*5.392*	2016	*7.47*	2017	*10.691*
2018	*19.6*	2019	*31.5*	2020	*32.97*	2021	*34.85*	2022	*34.034*

[3] Starodubtsev V. Shiroty vysokoy vazhnosti [Latitudes of high importance]. Kommersant, no. 53 (6047). March 29, 2017.

[4] Compiled by the author. Source: Severnyy morskoy put' [Northern Sea Route]. Rosatomflot. URL: http://www.rosatomflot.ru/o-predpriyatii/severnyy-morskoy-put/ (accessed 14 February 2023); Rosatom; Kalashnikov M. Sevmorput': ot deklaratsiy — k deystviyu! [Northern Sea Route: from declarations to action!]. URL: https://m-kalashnikov.livejournal.com/3443.html (accessed 14 February 2023).

Cargo traffic, which had gained momentum in the pre-war years, decreased during the Great Patriotic War. After the war, cargo traffic first slightly decreased due to economic recovery and then began to grow. But only the commissioning of the first nuclear icebreaker in 1959 significantly and rapidly increased this figure. The growing number of nuclear-powered icebreakers made it possible to significantly increase cargo turnover. The peak of transportations with a fleet of 4 nuclear icebreakers (they were assisted by 18 diesel sea icebreakers - also the peak number of diesel icebreakers, and only now this value has been restored again [5, Aleksushin G.V.]) was in 1987. Then, before the collapse of the USSR, the growth dynamics of cargo transportation along the NSR decreased, and by 1991, the traffic with 6 nuclear-powered icebreakers was already less than with 4 ones. The USSR leadership headed by M.S. Gorbachev failed to use the NSR effectively. After the collapse of the USSR in 1991, this process accelerated (although the NSR was opened to foreign ships in 1991, and a powerful increase in cargo traffic should have been observed), and it reached a record minimum by 1998, despite the fact that the fleet of nuclear icebreakers became even larger in 1992 — 7 units. This created an illusion that there was no need for a nuclear icebreaker fleet, and its replenishment was not taken care of for a long time.

In 2000–2009, there was a stabilization of the volume of cargo flows on the NSR; a slight increase in traffic occurred in 2003–2008 — from 1.6 to 2.1 million tons. But then the global economic crisis began, reducing cargo traffic to 1.7 million tons.

Most likely, the creation of FSUE Atomflot in August 2008 played an important role in the further growth of the nuclear icebreaker fleet and its provision of transportation.

Since 2009, a gradual growth began, rapidly gaining momentum. By 2011, the Russian Federation reached indicators comparable with 1971, and in 2015 — with 1981. The need to restore the nuclear icebreaker fleet to its previous volumes was realized, and in 2013 the lead nuclear icebreaker of the new series was laid down [6, Lasserre F.].

In 2016, the Russian NSR traffic exceeded the Soviet figures, but the number of nuclear icebreakers decreased to 5 vessels. In 2020 and 2021, due to the pandemic, the growth in flows decreased, but remained. Sanctions pressure on Russia in 2022 slightly reduced cargo traffic. The prospects seem much more profitable — there are plans to increase cargo flows to 80 million tons [7, Zelenkov M.Yu.].

A comparison of the dynamics of the nuclear icebreaker fleet development and the volume of cargo traffic along the NSR is presented in the diagram in Fig. 2:

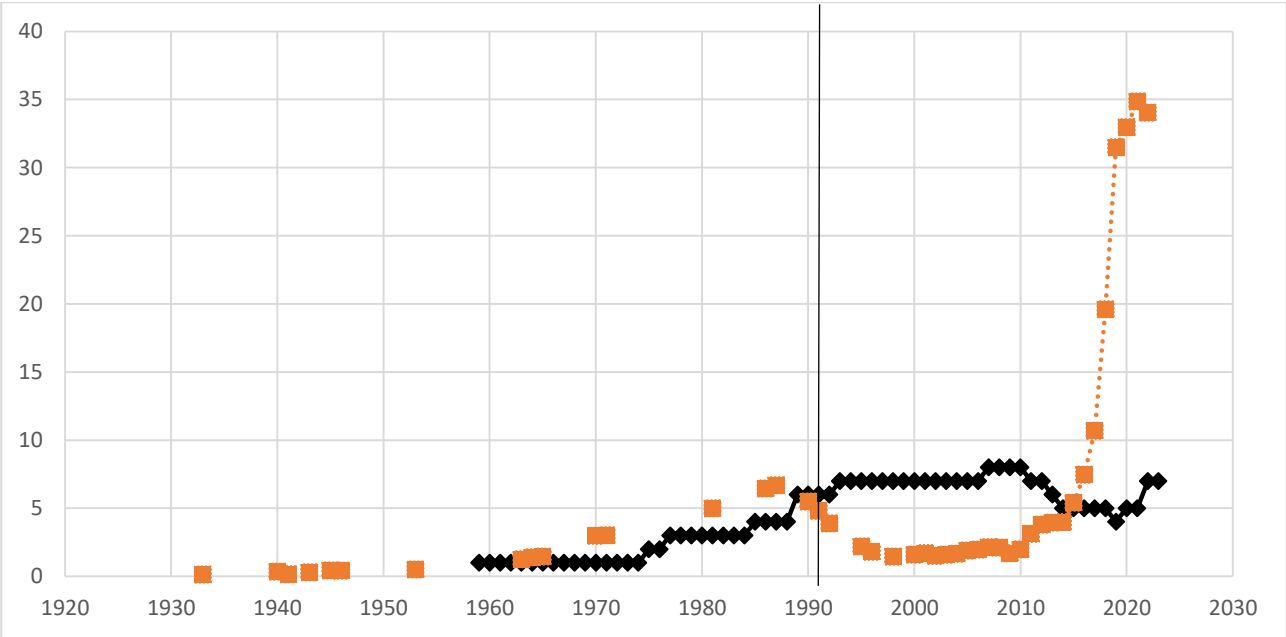


Fig. 2. Comparison of cargo traffic on the Northern Sea Route and the nuclear icebreaker fleet [5].

The diagram compiled by the author clearly shows how many opportunities were missed from the late 1980s to the early 2000s due to problems with the Russian economy. It is also obvious from the chart how poorly the NSR was exploited during the Soviet era.

Conclusion

In summary, it should be noted that due to the collapse of the USSR in 1991, the Russian Federation, in the process of building nuclear icebreakers, was forced to almost repeat the path already taken. Now it is at the point of furcation, after which, at the proper pace, we can significantly and qualitatively surpass the achievements of the USSR in the development of the Arctic and operation of the Northern Sea Route with the help of a nuclear icebreaker fleet. Unique positive trends have emerged: the development of a second shipyard for nuclear icebreakers (SBC Zvezda), the division of nuclear icebreakers into 2 different subclasses — conventional and heavy. The degree of mechanization and automation in the management of icebreakers is significantly increasing, as a result of which two icebreakers are controlled by fewer sailors than previously. The thickness of the ice to be overcome (which expands the navigation area and duration) and the power plants' capacity, their compactness and replaceability are increasing. The class of cargo ships under construction for high latitudes is growing: Arc7 ice-class ships are being built. As their number increases, it is also necessary to develop the Arc8 and Arc9 ice classes, which have not been developed by Russia. In total, 12 nuclear icebreakers have been built in the USSR and the Russian Federation from 1959 to the present day, 4 ones are under construction and 2 ones are being prepared for laying down. Domestic nuclear icebreakers indicate a very high level of technical thought and production capabilities of Russia, since only Russia builds nuclear-powered icebreakers — no other country in the world has built such vessels. Of course, it can be said that no

[5] Compiled by the author.

other country in the world has ever had the economically justified task of providing year-round navigation, but this is not true: in addition to Norway, Finland, Iceland and Great Britain, Canada, which needs these capabilities the most, has been striving for this level for a long time. The United States also has a small icebreaker fleet, which they plan to strengthen. But so far these states have not gone further than heavy diesel icebreakers. In addition, it is necessary to take into account the decrease of ice cover area around the North Pole, which strengthens the tendency to transport use of the Arctic Ocean and surrounding seas. And the rapidly growing indicators of cargo turnover of the Northern Sea Route, in which the icebreaker fleet is directly involved, are obvious. The only pity is that tourism opportunities on nuclear icebreakers are being reduced [8, Aleksushin G.V.] — "50 Let Pobedy" will be decommissioned sooner or later, and the rest of the Russian icebreakers for tourists are diesel ones.

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Assessment of Readiness of the Regional Economic System for the Implementation of the Concept of Integrated Processing of Mineral Resources (On the Example of the Murmansk Oblast)

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Abstract. For the Arctic regions, which have significant reserves of minerals, but the most environmentally fragile, the transition to the implementation of the concept of integrated processing of mineral resources becomes critically necessary due to the development of economic activity in this territory and the prospective plans for the development of new deposits, defined by the Strategy for the Development of the Arctic Zone of the Russian Federation up to 2035. The possibility of such a transition is ensured by the readiness of economic entities in the region to such changes. The purpose of this study is to assess the readiness of the regional economic system to the transition to the implementation of the concept of integrated processing of mineral resources on the example of the Murmansk Oblast and to determine the directions of implementation of such changes. As a result, it was revealed that the regional economic system of the Murmansk Oblast has a fairly high level of resistance and an average value of readiness for changes associated with the transition to the implementation of the concept of integrated processing of mineral resources, which characterizes the level of its readiness as the level of "unstable success". The key factors of resistance were identified and measures for their levelling were proposed, which allow concretizing the implementation of the Strategy for the Development of the Mineral Resource Base of the Russian Federation at the regional level and contributing to its further more effective execution.
Keywords: *Arctic, environmental management, sustainable development, mineral resource base*

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Introduction

One of the conditions for sustainable socio-economic development of territories and the most pressing issue of our time is the ecologization of the economy, which is aimed at reducing the environmental intensity of production [1, Saifidinov B.S., p. 110]. Therefore, the need for resource conservation is one of the important environmental requirements that determine the process of greening the economy.

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Resource conservation involves the development of the following areas of activity:

- saving material and energy resources, reducing the resource intensity of products;
- recycling of raw materials, waste disposal;
- complex processing of raw materials [2, Tutarishev B.Z., p. 14].

At the same time, the concept of integrated processing of raw materials involves activities to reduce the resource intensity of products through the development of waste management areas. For Russia, which has significant mineral resource potential, this issue becomes the most pressing and requires great attention in the context of sustainable development.

A wide range of works has been accumulated on the issue of implementing the concept of integrated processing of mineral resources.

The ideas for the integrated development of the subsoil and waste-free technologies for processing mineral raw materials are reflected in the works of M.I. Agoshkov, A.E. Fersman, N.V. Melnikov, K.N. Trubetskoy, V.A. Chanturia, N.N. Semyonov, I.V. Petryanov-Sokolov, B.N. Laskorin, D.R. Kaplunov, V.Z. Persitsa, N.N. Chaplygin; classification, scientific and methodological approach to geological and technological study and assessment of technogenic deposits were developed by M.I. Agoshkov, N.V. Melnikov, K.N. Trubetskoy, V.N. Umanets, M.B. Nikitin, prof. G.V. Sekisov, A.A. Taskaev and others; the study of the conditions of formation and placement, technologies and methods for studying technogenic deposits are considered in the works of V.A. Naumov, V.A. Makarov, A.B. Makarov, A.G. Talalay, B.B. Zobnin, S.I. Mormil, I.I. Kovlekov. The works of A.P. Vinogradov, V.I. Vernadskiy, A.I. Perelman, E.F. Emlin, A.V. Khokhryakov, M.A. Saprykin, V.S. Samarin, A.Ya. Gaev, Yu.M. Nesterenko, V.Ya. Zakharov, A.P. Butolin are devoted to the issues of assessing the impact of technogenic mineral formations on the environment; methodological approaches to the environmental and economic assessment of the use of technogenic mineral formations were developed by F.D. Larichkin, D.R. Kaplunov, A.I. Semyachkov, V.V. Bolshenko and others. An integrated approach to connecting the criteria of technological mineralogy with the technological properties of minerals and ores is developed in the works of V.V. Shchiptsov, B.I. Pirogov, A.A. Rogozhin, E.G. Ozhogin, O.B. Kotovaya, E.N. Levchenko. The works of famous domestic scientists I.N. Plaksin, O.S. Bogdanov, V.A. Chanturia, S.B. Leonov, V.P. Nebery, L.A. Barskiy, V.A. Bocharov, V.V. Karmazin, G.V. Sedelnikova, P.M. Solozhenkin, A.N. Zelikman, S.I. Polkin, E.V. Adamov, V.Ya. Mostovich, I.V. Shadrunova, E.V. Zelinskaya, V.P. Myazin, Yu.P. Morozov, L.V. Shumilova, N.L. Medyanik, N.N. Orekhova, M.I. Fazlullin, B.D. Khalezova, A.I. Edilbaev and many others are devoted to the creation of new resource-saving technologies for processing technogenic mineral raw materials [3, Gorlova O.E., p. 6].

The ideas and achievements of scientists are reflected in the Strategy for the Development of the Mineral Resources Complex of the Russian Federation up to 2035. The goal of the Strategy is to create conditions for the sustainable supply of mineral raw materials for socio-economic development and maintaining a sufficient level of economic and energy security of the Russian Federation. The directions for its implementation include both increasing the volume of geological ex-

ploration work and developing integrated processing of mineral raw materials, including through the involvement of accumulated technogenic deposits in processing. At the same time, the second direction has not yet received proper practical application, and it is necessary to strengthen measures to eliminate disproportionality in the implementation of the adopted Strategy.

The studies of assessing the readiness of Russia's resource regions for the integrated development of subsoil resources have recently become the most relevant. The works of such scientists as E.V. Goosen, O.N. Kavkaeva, V.I. Klishin, S.M. Nikitenko, S.V. Kovrigina, A.E. Kontorovich, K.S. Sablin, E.O. Pakhomova, L.V. Edler, E. Kagan, M.N. Ignatyeva, V.V. Yurak, A.V. Dushin, I.G. Polyanskaya and others can be highlighted among them. Famous foreign researchers such as J.D. Sacha, A.M. Warner, A. Gelb, R.M. Auty, D.C. North, J.J. Wallis, B.R. Weingast considered the problems of interaction between business and the state, as well as the influence of the resource component on the development of countries and regions; as a research problem, they emphasized the need for a broad interregional comparison of the current state of subsoil development in the resource-producing regions of Russia for the purpose of theoretical justification and practical development of new promising project forms interaction between public authorities and business structures on the principles of public-private partnership in the field of integrated subsoil exploitation and the development of an active regional policy focused on solving the problems of innovative development, import substitution and sustainable socio-economic development of the regions [4, Kontorovich A.E.].

Within the analytical review of existing works, it is noted that there is a significant emphasis on studying the issue of integrated subsoil development at the macroeconomic level, when such general indicators as GRP per capita, the share of extractive industries in added value are taken as the basis for the analysis [5, Sablin K., Kagan E.], state balance of mineral reserves [6, Ignatieva M.N., Yurak V.V., Dushin A.V.] and other statistical data on the state of regions to assess the impact of extractive industries on the environment, economic potential and social economic development of the region as a whole. At the same time, the microeconomic context of resolving the issue of integrated subsoil development, associated with assessing the readiness of the direct actors of this process — economic entities, including scientific institutions, remains insufficiently studied. In this regard, the authors consider it advisable to focus attention on this aspect and explore the problem of practical implementation of the concept of integrated processing of mineral resources, including the involvement of technogenic deposits in the processing in the context of increasing the economic activity of business entities as key actors engaged in direct activities for the extraction and processing of minerals. Their attitude, intensity of participation in these processes, interest will determine the possibility of implementing the concept of integrated processing of mineral resources. At the same time, different initial conditions of economic activity in the regions, based on historical, natural, socio-economic characteristics, impose their imprint on the implementation of economic activity by business entities in a particular regional economic sys-

tem [7, Bazhutova E.A., p. 61]. This necessitates clarification of ways to implement the Strategy at the regional level.

The most specific, and at the same time strategically important for the Russian economy, are the regions of the Arctic zone of the Russian Federation. These regions are given strategic importance by their rich resource potential. The specifics are determined not only by difficult climatic conditions, but also by the fragility of the Arctic ecological system, where the consequences of human activity can be critical and become irreversible [8, Zaikov K.S., Kondratov N.A., Kudryashova E.V., Lipina S.A. et al., pp. 10–12]. It is worth noting the negative trend emerging in the regions of the Russian Arctic in recent years. The share of generated waste in all-Russian indicators attributable to the Arctic regions of the Russian Federation is increasing, while the share of recycled waste is decreasing (Table 1). The largest share of waste among the Arctic regions is observed in the Republic of Sakha (Yakutia) (up to 48.8%) and the Murmansk Oblast (28%). However, the Murmansk Oblast has a higher growth rate of this indicator, which is a cause for concern.

The Murmansk Oblast is an industrially developed region, fully included in the Arctic zone. Most of its production potential is made up of enterprises of the mining and processing complex. The region's share in the all-Russian production of apatite and nepheline concentrates is 100%, nickel — 95%, iron ore concentrate — 10% [1]. At the same time, the existing waste management situation in the Murmansk Region is far from sustainable development standards. More than 98% (and in some years up to 99.8%) of all production and consumption waste in the region is generated by mining and mineral processing enterprises. Meanwhile, from 5 to 31% of the generated waste is used as a raw material for the manufacturing of products, for filling in the excavations of exhausted quarries and mines in different years. The remaining waste from the mining industry is buried in dumps and tailings [9, Klyuchnikova E.M., Masloboev V.A., p. 234]. As of 2020, the Murmansk Oblast has accumulated 3.5 billion tons of waste. At the same time, according to some estimates, only the processing waste from mining enterprises in the Murmansk Oblast contains reserves of non-ferrous metals (Ni, Cu, Co) in the amount of 1248 thousand tons, rare metals (loparite) of 100.8 thousand tons; iron — 31 million tons, zirconium — 0.7 thousand tons, apatite (P2O5) — 38.5 and nepheline (Al2O3) — 189.8 million tons [10, Larichkin F.D., Knysha V.A.]. These elements belong to strategic types of mineral raw materials, including those subject to the risks of import dependence [11, Bazhutova E.A., Skufina T.P.]. Leveling out this risk and solving the problem of self-sufficiency of the Russian national economy in such elements can be achieved by involving in the processing of accumulated technogenic deposits or organizing production in such a way as to extract them before they get into dumps.

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Table 1

Dynamics of generation, recycling, neutralization and disposal of production and consumption waste in the Russian Federation and the Russian Arctic, thousand tons

Regions of the Russian Federation	2018			2019			2020		
	Generation of production and consumption waste	Recycling and neutralization of production and consumption waste as a percentage of the total volume of generated waste	Of these buried, as a percentage of the total volume located at facilities owned by the enterprise	Generation of production and consumption waste	Recycling and neutralization of production and consumption waste as a percentage of the total volume of generated waste	Of these buried, as a percentage of the total volume located at facilities owned by the enterprise	Generation of production and consumption waste	Recycling and neutralization of production and consumption waste as a percentage of the total volume of generated waste	Of these buried, as a percentage of the total volume located at facilities owned by the enterprise
Russian Federation	7 266 054	52.6	28.8	*7828457*	*52.3*	*31.3*	6 955 717	49.3	22.5
Partially Arctic regions									
Arkhangelsk Oblast and Nenets AO	77 035	6.5	40	77579	4.1	44.4	34 221	4.6	26.9
Republic of Karelia	141 847	18.4	99.3	151058	12.1	99.8	150 128	7.7	99.6
Komi Republic	5 239	11.7	5.1	36025	12.4	87.1	40 225	1.0	89.5
Republic of Sakha (Yakutia)	427 128	59.9	48.4	528990	53.7	50.6	528 999	50.1	49.5
Largest entirely Arctic regions (by population)									
Murmansk Oblast	229 586	23.6	80	260049	15.6	75.1	305 637	12.2	32.1
Yamalo-Nenets AO	939	91.7	99.7	1730	80.7	96.8	488	105.2	97.1
Small entirely Arctic regions (by population)									
Chukotka AO	20 634	31.8	99.3	29246	44.7	79.9	23 715	69.3	92.2
Total for AZRF, people	902 408	35.3	62.1	1084677	29.7	75.6	1 083 413	30.1	65.8
Share in the all-Russian indicator, %	12.4%			13.9%			15.6%		

The adverse impacts of mining waste disposal from the social aspect reduce the quality of life of the population of the Murmansk Oblast, 42% of which lives in towns and villages located in close proximity to mining enterprises. From the economic point of view, degradation of the natural environment reduces the investment attractiveness of the territory [12, Fomenko M.A.] with the active development of the tourism industry in the region.

The new ambitious strategy for the development of the Arctic zone of the Russian Federation, approved in October 2020, Strategy for the development of the Arctic zone of the Russian

Federation and ensuring national security for the period up to 2035, sets one of the goals of transforming the Murmansk Oblast into a strategic center, where it is planned to create progressive infrastructure and conditions for development mineral resource base. A step towards this goal in 2022 was the signing of a cooperation agreement by Rosgeologiya and the Government of the Murmansk Oblast during the St. Petersburg International Economic Forum. The new agreement defines the basis for cooperation and interaction between the parties in the field of comprehensive geological study of subsoil and geological exploration in the Murmansk Oblast as part of the implementation of the Strategy for the development of the mineral resource base of the Russian Federation up to 2035. In accordance with the document, the Government of the Murmansk Oblast will contribute to the creation of optimal conditions to attract investments necessary for the comprehensive study and reproduction of the region's mineral resource base. Rosgeologiya will carry out work on comprehensive geological study, development and monitoring of the state of subsoil in the Murmansk Oblast using advanced methods and technologies of geological exploration, new high-tech methods for forecasting, identifying and integrated use of mineral raw materials [2]. However, the implementation of these intentions without the involvement of economic entities of the region is impossible.

According to the system principle, one system is a subsystem of another of a higher order. Thus, economic entities are subsystems of the regional economic system, and the state economic system, in which the decision is made to change the existing structure for the implementation of a particular type of activity, will be of the upper level for the regional system. Thus, the transition to the implementation of the concept of integrated processing of mineral raw materials is a change for which the economic systems of the regions and their constituent economic entities in particular should be ready. Moreover, the success of change implementation depends on the involvement of its executors, direct participants. Making changes is more difficult the larger the organization and the higher the level of resistance of subsystems to introduced innovations. Partly the size of an organization is related to its stability, and partly to the duration of its existence. Both factors are to some extent associated with the reluctance of subsystems to improve due to satisfaction, to a greater or lesser extent, with the existing state of affairs. Considering this situation in relation to the adopted approach to conducting business in the mining and mineral processing industry in the Russian Federation, it can be stated that considerable preliminary work is required prior to the implementation of such a change in order for it to be successful. The historically established practice of one- and two-component mining in Russia, given the significant wealth of mineral deposits, is the traditional way of working of mining companies. Changing their attitude to this issue, involving them in the process of multicomponent extraction and processing requires an in-depth study

[2] Press-reliz Ministerstva informatsionnoy politiki Murmanskoy oblasti «PMEF — 2022: Rosgeologiya i Murmanskaya oblast' dogovorilis' o sotrudnichestve v kompleksnom geologicheskom izuchenii i osvoenii nedr regiona» [Press release from the Ministry of Information Policy of the Murmansk Oblast "SPIEF - 2022: Rosgeology and the Murmansk Oblast agreed on cooperation in the comprehensive geological study and development of the region's subsoil"]. URL: gov-murman.ru (accessed 10 March 2023).

of the factors influencing this change in order to ensure the readiness of economic entities and the regional economic system as a whole for such changes.

Thus, the purpose of this study is to assess the readiness of the regional economic system for the transition to the implementation of the concept of integrated processing of mineral resources in terms of assessing the readiness of its economic entities for such a change using the example of the Murmansk Oblast, as one of the regions of the Arctic zone of the Russian Federation, and to determine the directions for implementation such changes.

In order to achieve this goal, it is proposed to solve the following tasks:

- to review methods for assessing readiness for changes at the level of economic entities and the regional economic system as a whole;
- to identify factors that create opportunities and factors that hinder the implementation of integrated processing of mineral resources in relation to economic entities;
- to carry out an expert survey of key economic entities in the region's industry using the example of the Murmansk Oblast;
- to assess the level of readiness of economic entities and the regional economic system as a whole, to propose measures to stimulate the transition to the implementation of the concept of integrated processing of mineral resources at the regional level.

Materials and methods

Review of methodologies for assessing readiness for change at the level of economic entities and the regional economic system as a whole

An integral aspect of the functioning of any system is its development. Development is a complex process of qualitative change in the system. In this case, the system can be understood as either a separate enterprise or a regional economic system as a whole. When initiating any changes at the upper-level system, it is necessary to understand the readiness of the lower-level subsystems to implement them. The understanding that change begins with determining the degree of readiness appeared in the world in the last decade of the last century thanks to the introduction of the term "organizational readiness for change" [13, Ansoff I.]. Its key idea is that it is possible to increase the probability of successful changes if one starts acting "before" the changes themselves. In Russia, interest in this development arose in the last 3–4 years [14, Khalitova I.V., p. 152–153]. The study of theoretical and methodological approaches to assessing the level of readiness was considered in management theory in the context of the situational approach (M. Fullan, M. Miles, G. Morgan, etc.), the human factor (Scott S., Jaf D., Kruger F., Price K., etc.), rationality: planning and control (Lepore D., Cohen O., Levin K., Bridges W., etc.), soft methods: organizational culture, power, conflicts, communications, etc. (Beriz L., Kruger F., Schwartz G., Davis S., etc.), system and factor approaches (Hannan M., Freeman J., Ulrich D., etc.), learning organizations (Kolb J., Rabin I., Osland J., Senge P., etc.), self-organization (Prigozhin I., Strengers I., Weick K., Quinn R., Sminia G.), "time theories" (Adesis I., Mintzberg G.). The practical aspect of assessing the readi-

ness of these approaches is to conduct a survey (questionnaire). In this case, the questionnaire itself can use different factors and criteria of readiness depending on the adopted approach, as well as different methods of calculating the level of readiness. Among them are:

- Method for determining the probability of success in implementing changes [15, Pavlova A.V.]. The essence of the method is to consider a set of indicators that have an impact on the subject of change under study, and their assessment by collecting expert opinions. At the same time, the identified groups of indicators are considered both from the view of their positive impact, which contributes to changes and generally determines the level of readiness, and from view of their negative impact, which determines the level of resistance to change [15, Pavlova A.V.]
- Readiness matrix by O. Vikhanskiy and A. Naumov. The method is based on assessing readiness for change through assessing the psychological readiness of personnel. If the employee is satisfied with the existing situation, and the risk of change is high, changes become impossible. In conditions where employees are dissatisfied with the current state of affairs, and the risk does not frighten them, the organization has a great chance of making successful changes.
- Model of changes or the Beckhard-Harris Change Formula [16]. The essence of the method is expressed by formula (1):

$$C > R, \text{ or } (Ds + V + Fs) > R \quad (1),$$

where

R — resistance to change;

C — readiness to change;

Ds — dissatisfaction with the current state of affairs;

V — vision of the desired future;

Fs — “first step” of the action program.

According to this formula, any change is possible only if the sum in brackets is greater than the elements of resistance to organizational change (R).

- Jody Spiro Questionnaire; according to this method, readiness consists of three factors:
  - Experience of participation in change implementation processes;
  - Existence of skills necessary for change implementation;
  - Positive attitude towards change: enthusiasm and readiness for responsibility.

The indicator is determined for each criterion, taking into account each result obtained, rather than an average overall indicator. If at least one criterion is low, the readiness for change is low. If all three factors are high, the strategy can be less structured and less detailed. If all factors are high, autonomous teamwork can lead the company to change without even requiring the assistance of management.

- The methodology for a balanced approach to assessing the readiness of projects as a whole is the TPRL (Technology Project Readiness Level) methodology. The unified method for assessing the level of technology readiness TRL (Technology Readiness Level) [17, Mankins J.C.] and the Stage-Gate® method [18, Robert G.C., Scott J.E.] were taken as a starting point for the development of such a methodology. The TPRL methodology, TRL and Stage-Gate® methods use a systematic approach, which allows describing project readiness levels for a wide range of disciplines in unified terms. Methodology TPRL provides a preliminary assessment of projects based on documents, showing in digital and graphical form the level and index of project readiness for each parameter. The application of the TPRL methodology provides experts with the opportunity to work more efficiently using such preliminary assessments. The TPRL methodology is based on 6 parameters for assessing the degree of project readiness, which are the minimum necessary set for a comprehensive assessment of the main axes of project development and the readiness of the project as a whole. Taken together, these parameters can be used to judge not only the development of technology and production, but also other aspects important for the successful commercialization of projects.
- DICE method: according to this method, 4 hard factors are the litmus test for assessing the likelihood of success of a change project: duration, integrity, commitment, effort [19, Sirkin H.L., Keenan P., Jackson A.]. The readiness level is calculated using formula (2):

$$DICE = D + 2*I + 2*C1 + C2 + E \quad (2),$$

where

D — Duration — time between project milestones

I — Integrity — the quality of changes will depend on the skills of the performers

C — Commitment - support for change (influential employees, managers — C1; employees affected by changes — C2)

E — Effort — new responsibilities of employees regarding changes in addition to operational work

Each factor is assigned a number from 1 (favorable) to 4 (unlikely). Projects with DICE between 7 and 14 are the best (in the success zone), between 14 and 17 are risky (in the worry zone), and over 17 are very risky (in the disaster zone).

Taking into account the problem considered in this study, it is worth noting that the method of expert assessments was also justified by researchers of regions' readiness for integrated subsoil development as necessary to take into account the significant differentiation of Russian regions and develop a methodology for searching for new implicit opportunities of regions [20, Sablin K.S., Kagan E. S., Sharov A.A., pp. 84–85]. The purpose of this approach was to assess the readiness of economic entities in the mining sector to form an integrated national economy through a comprehensive assessment of their readiness to develop domestic markets.

This study proposes to assess the readiness of business entities to transition to the implementation of the concept of integrated processing of mineral resources in terms of their perception of the factors that influence their adoption of such a decision, and to process the results obtained using the method of determining the likelihood of success in implementing the changes. The choice of this method was due to the fact that this methodology is applicable to any project, regardless of its scale, and can consider both a specific project or enterprise, and changes at the level of the economy as a whole, based on a wide range of indicators, which allows for a comprehensive assessment of upcoming changes.

Main research methods

The algorithm for applying the method for determining the likelihood of success in implementing changes includes the following steps:

- a set of indicators by which readiness for change will be assessed is established;
- each indicator is assigned a weight of its relative importance. Those indicators that are most important are given higher weights, and vice versa. For the convenience of calculations, the weights are distributed in such a way that their sum is equal to one;
- a significance coefficient is established for each of the indicators. The indicators are scored according to the extent to which the readiness characteristic contained in the indicator carries with it the capacity to change in principle. The assessment is carried out on a five-point scale: 5 — the most capable, 1 — the least capable indicator. The relative importance score of each indicator is multiplied by the corresponding importance coefficient of that indicator, and then the products are summed up. The sum results in an integral assessment of readiness to make changes. The maximum assessment of readiness of the enterprise can be 5, and the minimum — 1 [15, Pavlova A.V.].

A similar algorithm is used to assess the resistance level, where the selected indicators are considered from a risk perspective. An assessment is given of the probability of a risk occurring as a weight value and an assessment of its significance as the degree of influence on the result of the planned changes. Each resistance indicator is assigned its own significance coefficient (from 1 to 5) and its own weight, so that the sum of all weights equals 1.

After the value of the enterprise's readiness for change and the value of the level of resistance to change have been obtained, a matrix of the enterprise's positioning regarding the success of the changes undertaken is constructed. It is proposed to display the level of readiness for change horizontally, and the level of resistance — vertically. Each of the axes is divided into three zones that characterize the degree of readiness for change (high, medium, low) and three zones that demonstrate the level of resistance to change (strong, medium, weak). Accordingly, nine quadrants are formed within the matrix, indicating the possibility of making changes. The form of the proposed matrix is shown in Fig. 1.

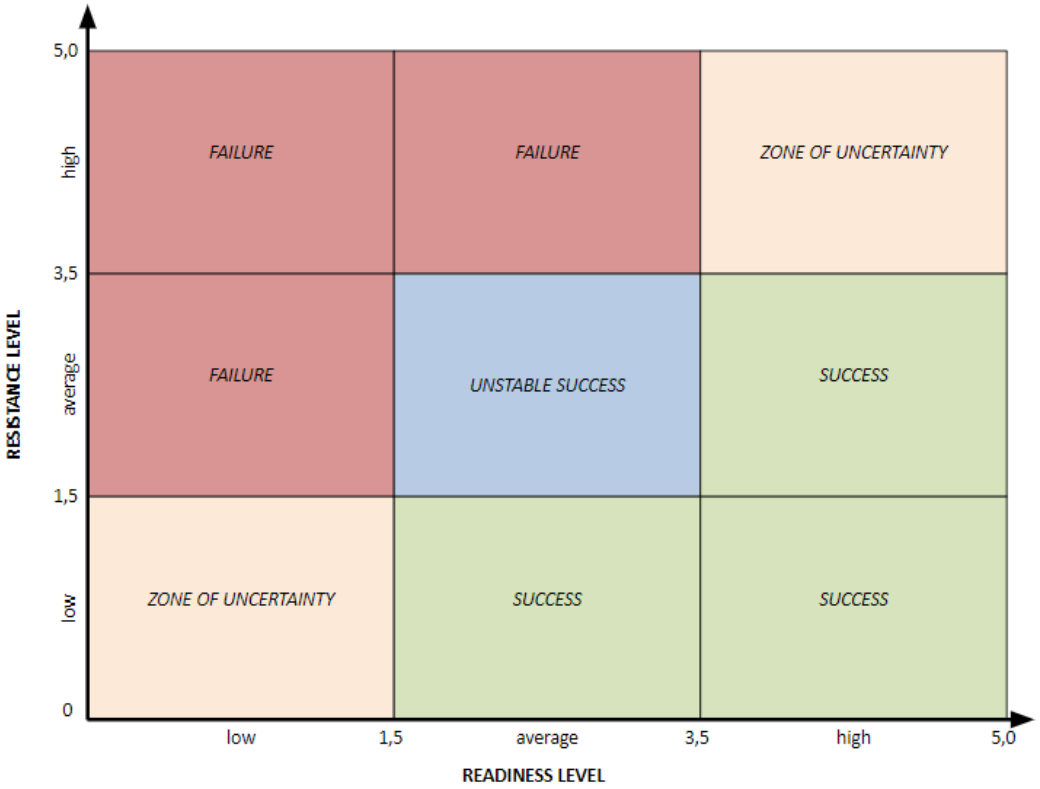


Fig. 1. Matrix of positioning of the enterprise regarding the success of implementing changes in its activities [3].

If the intersection of two values falls into the "success" quadrant, the company has the opportunity to make changes with minimal risks. If it is the "zone of uncertainty" quadrant, changes can have good results, but it is necessary to make great efforts to reduce the degree of resistance or increase the enterprise's readiness to accept and implement changes. If, as a result of the assessment, the enterprise falls into the "unstable success" quadrant, it is difficult to clearly judge the possibility of making changes and their success. A decision regarding this situation can be made only after a more in-depth analysis of the situation [15, Pavlova A.V., p. 7].

Such a positioning matrix allows determining specific measures to reduce the level of resistance to changes, which will ensure their successful implementation.

The study is therefore based on a mixed methodological approach. The qualitative method is used in the case of systematizing the factors of readiness and resistance of business entities in the Murmansk Oblast to the transition to the implementation of the concept of integrated processing of mineral resources, identified on the basis of content analysis of publications on this topic. The quantitative method is used to analyze data obtained by issuing expert assessments by representatives of business entities in the mining and processing industry of minerals in the Murmansk Oblast on factors of readiness and resistance in terms of their significance and implementation. Based on the interpretation of quantitative results, a qualitative analysis was carried out, including an explanation of the obtained estimates.

[3] Source: [15, Pavlova A.V., p. 7].

Information basis of the study

The study is based on a review of publications devoted to the problems and prospects for implementing the concept of integrated processing of minerals in the Russian Federation. The content analysis allowed identifying 20 indicators, systematized by their general characteristics into 5 group factors [11, Bazhutova E.A., Skufina T.P.].

The first group, "Resource Component", includes such indicators as: availability of mineral reserves, availability of production facilities, number of personnel and their qualifications, investment opportunities, sufficiency of components for production (additional substances, reagents, materials, components, etc.) and energy security.

The second group of factors, "Technological component", includes the developed potential technology for processing mineral raw materials, as well as patents and licenses for activities.

The third group, "Institutional environment", is represented by indicators that determine the legalization of an activity, namely the availability of permits to carry out an activity, the level of administrative barriers and state regulation of this activity in general.

Market factors are included in the fourth group "Market component" and include the level of prices, demand and competition in the market, entrepreneurial activity in the market in the form of the presence of the necessary suppliers and contractors who could be attracted to organize activities for the integrated processing of mineral resources.

And the fifth group of factors is designated as "Supporting environment" and is represented both by measures to support the type of activity on the part of the state, and by the development of partnership relationships, the readiness for cooperation of business entities to implement the integrated processing of mineral resources.

The presented classification of factors became the basis for the formation of an expert survey sheet, on the basis of which a study was conducted to assess the readiness and resistance of business entities in the Murmansk Oblast to the implementation of the concept of integrated processing of mineral resources.

Expert assessments were obtained from two major mining enterprises in the Murmansk Oblast, as well as from representatives of the scientific community. The key condition for conducting the survey was anonymity, so the results of the assessments obtained are presented in a generalized form. The assessment of the readiness of the regional economic system as a whole and the level of its resistance to upcoming changes was calculated as the average value of the assessments obtained for each economic entity in the region.

Discussion of results

As a result of the expert survey and the information obtained on the level of readiness and resistance, the following summary estimates of the level of readiness and resistance of the regional economic system of the Murmansk Oblast to the transition to the implementation of the con-

cept of integrated processing of mineral resources were obtained, presented in tables 2 and 3, respectively.

Table 2

Summarized results of the readiness assessment [4]

Name of indicator	Summary assessment of readiness by economic entities of the region			Summary assessment of readiness by business entities and scientific community		
	Relative weight	Significance factor	Result	Relative weight	Significance factor	Result
1. Resource component	0.20	3.00	0.60	0.17	2.67	0.44
1.1. Mineral reserves	0.10	4.50	0.45	0.13	4.67	0.62
1.2. Availability of production capacity	0.15	3.00	0.45	0.15	2.33	0.36
1.3. Personnel	0.20	1.00	0.20	0.19	1.00	0.19
1.4. Investments	0.23	2.00	0.45	0.20	1.33	0.27
1.5. Components for production (additives, reagents, materials, components, etc.)	0.15	3.50	0.53	0.15	2.67	0.41
1.6. Energy	0.18	5.00	0.88	0.17	3.33	0.57
Other:						
2. Technological component	0.25	2.10	0.53	0.27	1.73	0.46
2.1 Developed potential processing technology	0.35	3.00	1.05	0.40	2.33	0.93
2.2 Patents, licenses to carry out activities	0.35	1.50	0.53	0.40	1.33	0.53
Other:						
Availability and accessibility of equipment in the current geopolitical environment	0.30	1.00	0.30	0.20	0.67	0.13
3. Regulatory component						
3.1 Permission to carry out an activity	0.15	2.00	0.30	0.18	2.67	0.49
3.2 Administrative barriers	0.55	2.50	1.38	0.53	3.33	1.78
3.3 Government regulation (state of legal framework)	0.23	1.00	0.23	0.22	2.33	0.51
Other:	0.23	2.50	0.56	0.25	2.33	0.58
4. Market component						
4.1 Market price	0.23	1.25	0.28	0.22	1.83	0.40
4.2 Demand	0.25	1.00	0.25	0.28	1.67	0.47
4.3 Competition	0.25	1.50	0.38	0.28	2.00	0.57
4.4 Suppliers/ contractors	0.25	1.00	0.25	0.23	1.67	0.39
Other:	0.25	1.50	0.38	0.20	2.00	0.40
5. Supporting environment						

[4] Source: compiled by the authors based on the results of an expert survey.

5.1 Partners (their availability and willingness to co-operate)	0.18	1.10	0.19	0.17	1.40	0.23
5.2 Tax preferences from the state	0.35	1.50	0.53	0.32	1.67	0.53
5.3 Preferences from the state in terms of subsidizing costs	0.15	1.00	0.15	0.20	1.33	0.27
5.4 State preferences in terms of market regulation (prices)	0.15	1.00	0.15	0.15	1.33	0.20
5.5 State preferences in terms of stimulating demand for a new product	0.15	1.00	0.15	0.15	1.00	0.15
Other:						
Readiness assessment	1.81			2.01		

Table 3

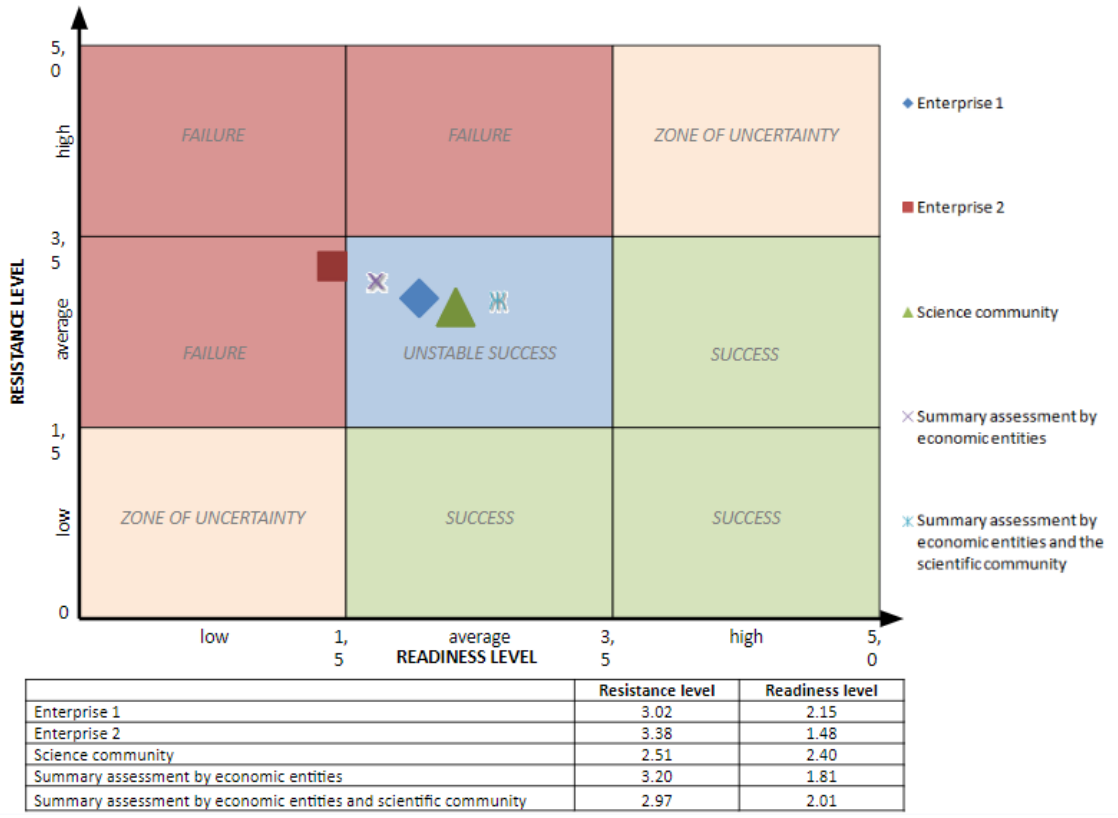
Summarized results of the resistance assessment[5]

Name of indicator	Summary assessment of resistance by economic entities of the region			Summary assessment of resistance by business entities and scientific community		
	Relative weight	Expert assessment	Result	Relative weight	Expert assessment	Result
1. Resource component	0.12	2.90	0.33	0.11	2.60	0.29
1.1 Insufficient reserves (content of valuable component)	0.10	2.50	0.25	0.07	2.00	0.13
1.2 Insufficiency (absence) of available production capacities	0.30	4.50	1.35	0.30	4.67	1.40
1.3 Insufficient number of personnel	0.13	3.50	0.44	0.08	2.67	0.22
1.4 Insufficient qualifications of personnel	0.13	4.00	0.50	0.13	3.33	0.44
1.5 High cost of components	0.08	2.00	0.15	0.10	2.00	0.20
1.6 Insufficient number of components	0.08	2.00	0.15	0.10	2.00	0.20
1.7 High energy costs	0.10	2.00	0.20	0.13	2.00	0.27
1.8 Insufficient energy capacity	0.10	3.00	0.30	0.08	2.33	0.19
1.9 Other:						
2. Technological component	0.43	3.00	1.28	0.37	3.17	1.16
2.1 Economic inexpediency of the existing technology	0.85	4.00	3.40	0.73	4.00	2.93
2.2 High cost of a patent and license to operate	0.15	2.00	0.30	0.27	2.33	0.62
Other:						

[5] Source: compiled by the authors based on the results of an expert survey.

3. Regulatory component	0.13	2.00	0.25	0.18	1.67	0.31
3.1 Impossibility of obtaining permission to carry out an activity	0.45	3.00	1.35	0.57	2.33	1.32
3.2 High administrative barriers to carrying out this type of activity	0.03	2.00	0.05	0.05	1.67	0.08
3.3 Insufficient regulation by the state (absence or incompleteness of the legal framework)	0.03	1.50	0.04	0.05	1.33	0.07
Other:						
4. Market component	0.20	4.30	0.86	0.20	4.00	0.80
4.1 Low price for the finished product on the market	0.15	4.00	0.60	0.17	3.33	0.56
4.2 Low demand for the finished product on the market	0.15	4.50	0.68	0.17	4.00	0.67
4.3 High competition for the finished product produced	0.15	4.50	0.68	0.18	4.33	0.79
4.4 Low competitive advantages of the new finished product	0.40	4.50	1.80	0.35	4.33	1.52
4.5 Absence (inadequacy) of suppliers/contractors	0.15	4.00	0.60	0.13	4.00	0.53
Other:						
5. Supporting environment	0.14	3.00	0.41	0.14	3.00	0.42
5.2 Lack of partners for organizing joint production for complex processing of minerals	0.23	3.50	0.79	0.22	3.00	0.65
5.3 Unwillingness of potential partners to co-operate	0.18	3.50	0.61	0.18	3.00	0.55
5.4 Inadequacy (absence) of preferences from the state on taxes	0.15	2.50	0.38	0.17	3.00	0.50
5.5 Inadequacy (absence) of preferences from the state to subsidize costs	0.15	3.00	0.45	0.17	3.33	0.56
5.6 Inadequacy (absence) of preferences from the state for price regulation	0.15	3.00	0.45	0.13	3.00	0.40
5.7 Insufficiency (absence) of preferences from the state to stimulate demand	0.15	3.00	0.45	0.13	3.00	0.40
Other:						
Resistance assessment	1.81			2.97		

After the readiness of the regional economic system of the Murmansk Oblast for changes and the level of expected resistance to these changes were assessed, we positioned the economic entities of the region and the regional economic system as a whole, with and without taking into account the opinion of the scientific community regarding the success of the changes transition to the implementation of the concept of integrated processing of mineral resources. The obtained matrix of positioning regarding the success of changes is shown in Fig. 2.



	Resistance level	Readiness level
Enterprise 1	3.02	2.15
Enterprise 2	3.38	1.48
Science community	2.51	2.40
Summary assessment by economic entities	3.20	1.81
Summary assessment by economic entities and scientific community	2.97	2.01

Fig. 2. Matrix of positioning of the regional economic system of the Murmansk Oblast regarding the success of the transition to the implementation of the concept of integrated processing of mineral resources [6].

In the process of managing the implementation of changes, it is important to assess the level of resistance in relation to each specific change. In this regard, the level of readiness and resistance was also assessed for each selected group of factors as the sum of its indicators.

Table 4

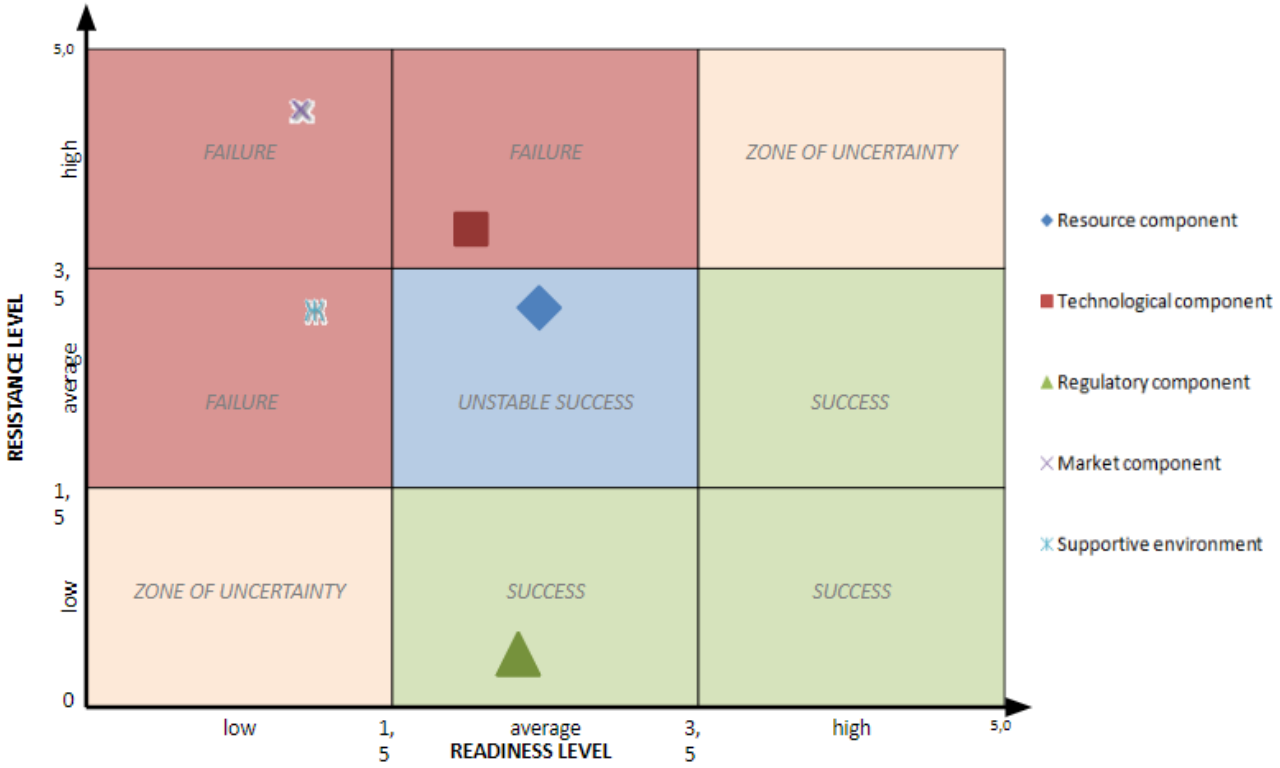
Assessment of groups of factors influencing the implementation of changes in the transition to the concept of integrated processing of mineral resources, according to the level of their readiness and resistance [7]

Group of factors	Summary assessment by economic entities in the region		Summary assessment for business entities and scientific community	
	Level of resistance	Level of readiness	Level of resistance	Level of readiness
Resource component	3.34	2.95	3.06	2.41
Technological component	3.70	1.88	3.56	1.60
Regulatory component	1.44	2.16	1.47	2.87

[6] Source: compiled by the authors based on the results of an expert survey.
[7] Source: compiled by the authors based on the results of an expert survey.

Market component	4.35	1.25	4.07	1.83
Supporting environment	3.13	1.18	3.06	1.39

Positioning of the group of factors relative to the change implementation success matrix is presented in Fig. 3.



	Resistance level	Readiness level
Resource component	3.34	2.95
Technological component	3.70	1.88
Regulatory component	1.44	2.16
Market component	4.35	1.25
Supporting environment	3.13	1.18

Fig. 3. Matrix of positioning of groups of factors for the transition to the implementation of the concept of integrated processing of mineral resources according to estimates of business entities [8].

Thus, as a result of collection and processing of the received expert opinions, the assessment of the readiness of the regional economic system of the Murmansk Oblast was 1.81 points (out of 5 possible) with a resistance level of 3.20 points (out of 5, where 5 is the highest level of resistance), which may be characterized as a level of "unstable success" when positioning a regional economic system. This means that the regional economic system of the Murmansk Oblast has a fairly high level of resistance and an average level of readiness for changes associated with the transition to the implementation of the concept of integrated processing of mineral resources. A separate collection of expert opinions from the scientific community was conducted on the issue of transition to the implementation of the concept of integrated processing of mineral resources. The scores obtained are also positioned in the zone of "unstable success" with a readiness level of 2.40 points (out of 5 possible) and a resistance score of 2.51 (out of 5, where 5 is the highest level of resistance). It is necessary to reduce the level of resistance to change and, if possible, increase

[8] Source: compiled by the authors based on the results of an expert survey.

the readiness of economic entities in the region to accept such changes. It was noted that the spread in the assessments of economic entities regarding their readiness has a differentiated value and ranges from 1.48 points (out of 5 possible) to 2.15 points (out of 5 possible), and the level of resistance is estimated almost equally from 3.02 up to 3.38 points (out of 5, where 5 is the highest level of resistance). In view of this, some enterprises are in the "failure" zone when making a decision on implementing the concept of integrated processing of mineral resources, i.e., the business entity is not ready to make changes and there are significant risks in their implementation. Others are in the zone of "unstable success", it is difficult to clearly judge the possibility of making changes and their success. The difference in assessments of business entities is determined by the different experience of the surveyed business entities in this area and the presence of proven processing schemes for them. Thus, a decision can be made only after a deeper analysis of the situation.

An in-depth analysis of the situation to determine the conditions under which a decision can be made for the implementation of the concept of integrated processing of mineral resources by business entities was carried out regarding a selected set of 5 groups of indicators, on which an expert survey was conducted. These groups of indicators were also positioned using the positioning matrix method relative to the success of the changes being undertaken. As a result, the group of factors "Regulatory component" fell into the "Success" zone, having a readiness rating of 2.16 points (out of 5 possible) and 1.44 points for the level of resistance (out of 5, where 5 is the highest level of resistance). Experts' comments indicated the relative transparency and clarity of the legal field, and the absence of administrative barriers to the implementation of this activity. The group of factors "Resource component" is in the zone of "Unstable success" with estimates of the readiness level of 2.95 points and the resistance level of 3.34 points. The lowest ratings included in the risk factors from this set of indicators, according to experts, were the insufficiency (absence) of existing production capacities and insufficient personnel: both their number and qualifications. The 3 remaining groups of factors were included in the "Failure" zone: "Supporting environment" (readiness level — 1.18 points; resistance level — 3.13 points), "Market component" (readiness level — 1.25 points; resistance level — 4.35 points), "Technological component" (readiness level — 1.88 points; resistance level — 3.70 points). The key risk indicators were the absence of regular consumers with a significant order volume; lack of interested partner companies ready to integrate into the existing technological process to implement additional extraction processes and more in-depth integrated processing of mineral resources; low competitive advantages of the additionally extracted valuable component compared to analogues on the market; lack of subsidizing costs from the state, especially in terms of conducting a feasibility study for the integrated processing of mineral resources; economic inexpediency of the existing technology for industrial development due to the above risks.

Conclusion

Thus, this study of assessing the readiness of the regional economic system to implement changes associated with the implementation of the concept of integrated processing of mineral resources allows us to formulate the following conclusions:

- The regional economic system of the Murmansk Oblast has a fairly high level of resistance and an average level of readiness for changes associated with the implementation of the concept of integrated processing of mineral resources.
- For the Murmansk Oblast, the factors of resistance are the groups of factors “Market component”, “Supporting environment”, “Technological component”, while readiness for the transition is ensured by the factors of the group “Resource component” and “Regulatory component”.
- The solution to the issue of transition to the implementation of the concept of integrated processing of mineral resources at the preparatory stage should be the fulfillment of a number of general conditions that can be of practical value for all resource regions of Russia. Firstly, this is a condition for ensuring the required level of demand. It is assumed that for the first periods it should be in the form of a state order, which would stimulate the economic activity of business entities for in-depth processing independently or within the framework of partner/outsourcing processes. The second condition is the need to develop marketing in the mining industry, not only from the point of view of the use of possible raw materials as a component for the production of any product, but also from a geological point of view, allowing at the time of developing feasibility studies for new deposits to assess the current possibilities of extracting the same useful component by deploying the concept of integrated processing at existing production facilities and comparing the resulting economic, environmental and social effects to make a final decision. The third condition, from a logistics point of view, is the creation of a logistics-distribution system through the establishment of a state management company that issues government orders, collects consumer orders on the market and redistributes completed government orders for the integrated processing of mineral resources in both small and large quantities, and also performing the function of searching for possible partners who could integrate into existing technological processes on outsourcing terms. In addition, an important condition of the first stage will be support from the state to subsidize the costs associated with conducting a feasibility study as a high-risk and costly activity for business entities. The mechanism for its implementation is possible through a grant system for the scientific community with corporate orders from business entities.

The results obtained allow us to highlight areas for studying the issue of ensuring integrated processing of mineral resources in relation to a specific regional economic system. Thus, this study can strengthen the practical orientation and develop the theoretical aspects of the concept

of integrated processing of mineral resources in the context of the regional economy, namely the management of the economic activity of economic entities in the region engaged in the extraction and processing of minerals, to stimulate their involvement in the implementation of integrated processing of mineral resources.

The originality of the research results lies in the identification of regional features that determine the readiness of the regional economic system, namely its economic entities, to implement the concept of integrated processing of mineral resources from the perspective of sustainable development, determining the directions for the formation of an organizational and economic mechanism for the implementation of this concept, which was previously insufficiently studied in independent scientific articles.

The results can be taken into account when developing specific measures for the implementation of the Strategy for the development of the Arctic zone of the Russian Federation and ensuring national security for the period up to 2035, contributing to the transformation of the Murmansk Oblast into a strategic center, where it is planned to create conditions for the development of the mineral resource base, as well as increase the efficiency of implementation Strategy for the development of the mineral resource complex of the Russian Federation up to 2035 by strengthening its adaptation to a specific region and using it as the basis for the development of a new Action Plan for the implementation of this strategy for the period of 2024–2030. According to the authors, for representatives of the state, business and science, the results of this study will contribute not only to the qualitative development of the Arctic territories of Russia, but also to the resolution of the accumulated environmental problems of the region.

Further research will be aimed at an in-depth study of the identified factors and the formation of a set of possible substantive solutions that can reduce resistance and increase the readiness of the regional economic system to implement the concept of integrated processing of mineral resources for the sustainable development of the Russian economy in general and its Arctic region in particular.

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Possibilities of Arctic Oil Transportation to the Refineries of the Republic of Bashkortostan

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Annotation. Communications play an important role in the economic development of states and regions, in the development of new markets by connecting distributed areas of economic activity. The modern sanction economy is characterised by the change of economic partners and, accordingly, communication directions. Thus, the vector of Arctic oil exports is shifting to the Asia-Pacific region, which increases the role of maritime communications for its transport. At the same time, from a practical point of view, it can be assumed that Arctic oil can become one of the resources of domestic refineries. The aim of the study was to consider the possibilities of providing the oldest oil refining complex of the Republic of Bashkortostan with Arctic oil and to build a basic scheme of spatial organisation of communications linking the economic space of Russia. Achievement of the set goal required the solution of the following tasks: to determine the role of Russia in the world oil exports on the basis of "bp Statistical Review of World Energy"; to conduct a comprehensive analysis of studies of domestic scientists on the issues of oil production, sales and refining, as well as promising Arctic offshore projects; and to consider the features of the oil refining industry of Russia and, in particular, the Republic of Bashkortostan. As a result of the research, the conclusions about the prospectivity of Arctic oil production and about the possibilities of its delivery to the refineries of the Republic of Bashkortostan have been obtained; for these purposes, a principal scheme of spatial organisation of communications linking oil deliveries from Arctic offshore fields to refineries in Ufa of the Republic of Bashkortostan has been developed.
Keywords: *Arctic zone, oil, communications, Republic of Bashkortostan, oil refinery*

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Introduction

Economic development of the Arctic is a conditional interaction of resource and infrastructure projects. According to the Ministry of nature and ecology of the Russian Federation, Arctic

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hydrocarbon reserves amount to 7.3 billion tons of oil and 55 trillion m^3 of gas [1]. In the context of the development of the Northern Sea Route and the Arctic shelf, the state actively supports investment projects already underway and expands opportunities to attract new investors (or economic agents). The issues of coordinating interests with the main subsoil users of the Arctic and developing the infrastructure of the Northern Sea Route (NSR) are discussed in more detail in [1, Ivanova M.V., Danilin K.P., Koshkarev M.V., pp. 538–550].

The most important task of the spatial organization of Arctic communications connecting the Arctic region with the intraregional economic space of Russia, along with increasing the efficiency of sea routes, is to expand connectivity with routes of other modes of transport. That is why in the legislative documents forming the long-term transformation of the NSR infrastructure, adopted for the period 2014–2022, much attention is paid to the development of ports: Order of the Government of the Russian Federation dated September 30, 2018 N 2101-r (as amended on April 13, 2022) "On approval of a comprehensive plan for the modernization and expansion of the main infrastructure for the period up to 2024" [2]; Order of the Government of the Russian Federation dated November 27, 2021 N 3363-r "On the transport strategy of the Russian Federation until 2030 with a forecast for the period up to 2035" [3]; Order of the Government of the Russian Federation dated 01.08.2022 N 2115-r "On approval of the Development Plan of the Northern Sea Route for the period up to 2035" [4]; Decree of the President of the Russian Federation dated July 31, 2022 N 512 "On approval of the Maritime Doctrine of the Russian Federation" [5]. Due to the fact that the main ports were formed in the process of natural development on the coast of all Arctic seas and along the flow of large rivers, they are in fact a link between sea and land transport.

Since the development and production of oil and gas reserves is strictly tied to the areas where they are found, the NSR is the most important communication and link between the production and the potential consumer. In 2013, Russia began implementing a unique project for oil production on the Arctic shelf, Prirazlomnoe, and already in 2014, a new type of oil entered the

[1] Soveshchanie po voprosam razvitiya Arktiki [Meeting on Arctic development]. URL: http://government.ru/news/35056/ (accessed 15 March 2023).

[2] Rasporyazhenie Pravitel'stva RF ot 30.09.2018 N 2101-r (red. ot 13.04.2022) «Ob utverzhdenii kompleksnogo plana modernizatsii i rasshireniya magistral'noy infrastruktury na period do 2024 goda» [Order of the Government of the Russian Federation dated September 30, 2018 N 2101-r (as amended on April 13, 2022) "On approval of a comprehensive plan for the modernization and expansion of the main infrastructure for the period until 2024"]. URL: http://www.consultant.ru/document/cons_doc_LAW_308743/e2924c25bca18b9070f6b8fc17747bd6f02eb32a/ (accessed 15 March 2023).

[3] Rasporyazhenie Pravitel'stva RF ot 27.11.2021 N 3363-r «O Transportnoy strategii Rossiyskoy Federatsii do 2030 goda s prognozom na period do 2035 goda» [Order of the Government of the Russian Federation dated November 27, 2021 N 3363-r "On the Transport Strategy of the Russian Federation until 2030 with a forecast for the period until 2035"]. URL: http://www.consultant.ru/document/cons_doc_LAW_402052/ (accessed 15 March 2023).

[4] Rasporyazhenie Pravitel'stva RF ot 01.08.2022 N 2115-r «Ob utverzhdenii Plana razvitiya Severnogo morskogo puti na period do 2035 goda» [Order of the Government of the Russian Federation dated 01.08.2022 N 2115-r "On approval of the Development Plan of the Northern Sea Route for the period until 2035"]. URL: http://www.consultant.ru/law/hotdocs/76610.html/ (accessed 15 March 2023).

[5] Ukaz Prezidenta RF ot 31.07.2022 N 512 «Ob utverzhdenii Morskoy doktriny Rossiyskoy Federatsii» [Decree of the President of the Russian Federation dated July 31, 2022 N 512 "On approval of the Maritime Doctrine of the Russian Federation"]. URL: http://www.kremlin.ru/acts/bank/48215/ (accessed 15 March 2023).

world market — arctic oil (ARCO). In fact, this was a new stage in the development of the Russian oil industry. Most of the oil production in the Arctic is concentrated in the continental part and on the shelf of the Barents and Kara seas. The main consumers of Russian crude oil are Europe (until 2022) and China. Thus, according to the "bp Statistical Review of World Energy–2022", in 2021, Russian oil imports in Europe amounted to 25% of all EU oil imports. Also in 2019–2021 Russia was among the top three leaders in global crude oil exports (Fig. 1). One of the features of the distribution of oil in the world is the heterogeneity of the relationship between reserves and production volumes [2, Filimonova I.V., Nemov V.Yu., Provornaya I.V. et al., pp. 69–77]; this is due to both the qualitative characteristics of reserves and political and economic factors, which largely determine the nature of the global oil market.

Fig. 1. The main countries of world oil exports as of 2021. [6]

The new "sanctions" era is creating new economic development horizons, including for Arctic projects. Will Russia remain the leader in oil exports, which countries will replace lost consumers, is it possible to use Arctic oil by domestic oil refineries (ORs)?

Literature review, materials and methods

The results of studying various scientific and information sources, as well as expert assessments, generally indicate positive dynamics in the implementation of Arctic oil and gas projects. The expert community foresaw a reversal of long-term priorities of export policy in the oil sector towards the countries of the Asia-Pacific region, mainly to India and China.

The main patterns of development of the world oil market, features of the distribution of oil reserves, analysis of the dynamics of reserve growth and the reproduction rate of the Russian oil resource base are presented in [2, pp. 69–77]. According to experts, the share of export volumes of oil and petroleum products over the past 20 years has consistently exceeded domestic consumption by 3 times. Scientists rightly note the strengthening of the Pacific direction of sup-

[6] Statistical Review of World Energy 2022. The 71st edition. URL: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf?ysclid=lggqmwykfm655085926 (accessed 02 April 2023).

plies, which is updated not only by the "sanctions" policy, but also by the intensive development of subsoil use in the east of Russia, the construction of the main pipeline infrastructure [3, Filimonova I.V., Nemov V.Yu., Provornaya I.V. et al., pp. 65–74]. In 2023, specialists from the industry analytical company Vortexa noted that in March of this year, 91% of oil and petroleum products exports went to India and China [7]. A number of authors justify the need to maintain the economic turnover of the development of oil resources in the Arctic, since this particular resource is the most important financial source of replenishment of the federal budget and the strategic objectives of the state [4, Kozmenko S.Yu., Kozmenko A.S., pp. 38–54].

The works of scientists from the Kola Science Center analyze in detail the state of the oil and gas complex of the Arctic zone of the Russian Federation (AZRF), the prospects of Russian producers in the global liquefied natural gas market from the perspective of diversification and modernization of oil and gas transport infrastructure, the organization of transport support for large energy projects in the aspect of maritime transportation of oil, coal and natural gas; directions for the development of domestic shipbuilding for the modernization of Arctic communications have been identified [5, Organization of infrastructure support...], [6, Global development trends...].

Modern forms of organizing the production and transportation of Arctic hydrocarbons are considered in works devoted to the organization of mineral resource centers in the Russian Arctic. Issues of arranging the production and transportation of Arctic hydrocarbons and other minerals are acquiring great significance within the framework of the implementation of the Strategy for the spatial development of the Russian Federation for the period up to 2025 [8] and the Strategy for the development of the Arctic Zone of the Russian Federation and ensuring national security for the period up to 2035 [9], which define new "economic localities": "geostrategic territories", such as the AZRF, and priority "mineral resource centers" (MRC). The research [7, Ivanova M.V., Kozmenko A.S., p. 92–104] notes that the definition of new localities is associated with new trends in the spatial organization of the country's economy and the shift of production of hydrocarbon raw materials to the underdeveloped territories of Eastern Siberia, the Far East and the shelf waters of the Far Eastern and Arctic basins. Features of the formation and prospects for the development of

[7] Analitiki soobshchili ob eksporte do 91% nefti iz Rossii v Kitay i Indiyu [Analysts reported that up to 91% of Russia's oil was exported to China and India]. URL: https://www.rbc.ru/politics/05/04/2023/642d48f49a7947c21d211fb5 (accessed 02 April 2023).

[8] Rasporyazhenie Pravitel'stva RF ot 13.02.2019 N 207-r (red. ot 25.06.2022) «Ob utverzhdenii «Strategii prostranstvennogo razvitiya Rossiyskoy Federatsii na period do 2025 goda» [Order of the Government of the Russian Federation dated February 13, 2019 N 207-r (as amended on June 25, 2022) "On approval of the "Spatial Development Strategy of the Russian Federation for the period until 2025"]. URL: http://www.consultant.ru/document/cons_doc_LAW_318094/006fb940f95ef67a1a3fa7973b5a39f78dac5681/ (accessed 30 March 2023).

[9] 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 "Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035"]. URL: https://www.garant.ru/products/ipo/prime/doc/74710556/ (accessed 30 March 2023).

MRC are considered in the following works: [10], [8, Lipina S.A., Cherepovitsyn A.E., Bocharova L.K., pp. 29–39], [9, Filimonova I.V., Ivanova M.V., Kuznetsova E.A. et al., pp. 66–88; 10, Rozhdestvenskaya I.A., Rostanets V.G., pp. 83–87]. As a result, the study [9, pp. 66–88] indicates that the effectiveness of the MRC is determined by the development of the communications system and the interaction of national and corporate interests, generating a multiplier effect from the organization of mineral resource centers on the economy of the region and the country as a whole.

The works of Novosibirsk scientists are devoted to the issues of the characteristics of the raw material base of hydrocarbons, their influence on regional innovative development, as well as the peculiarities of the functioning of modern oil refineries in Russia [11, Filimonova I.V., Komarova A.V., Nemov V.Yu. et al., pp. 13–20; 12, Nemov V.Yu., Filimonova I.V., Provornaya I.V., Kartashevich A.A., pp. 149–161]. A large corpus of works by domestic scientists is devoted to the study of the prospects and features of the development of refineries in Russia in general and in the context of regions. The territorial distribution of production forces in individual regions of Russia and their features are discussed in the works of A.A. Biev [13, pp. 82–95], who suggests that expanding the network of small and modular refineries will become the most possible direction for further modernization of the fuel and energy sector.

Assessment of the long-term prospects for the development of the global and Russian oil refining industry is covered in the works of A.P. Solomonov [14, pp. 53–56], N.A. Budarina [15, pp. 110–114]. The authors forecast an increase in diesel fuel demand relative to other petroleum products in global consumption by 2025 (the share of diesel fuel consumption will increase from 32 to 37%). Such changes, in turn, will require modification of the structure of energy consumption for refining.

In addition to the above-mentioned authors, other scientists have studied the problems of the oil refining industry in Russia and the world: [16, Bashkirtseva N.Yu., pp. 63–68], [17, Braginskiy O.B.; 18, Braginsky O.B., pp. 232–237].

Scientific research is based on a general scientific approach. The theoretical constructions are based on the results of the analysis of expert assessments, strategies and other regulatory government documents addressing the development of the oil production and oil refining complex. Information sources were systematic research in the field of economic development of the Arctic, the oil industry and the Northern Sea Route; materials from specialized news agencies and legal reference systems; information and analytical materials from foreign analytical centers and government bodies of the Russian Federation.

Arctic oil resource base

The raw material base of liquid hydrocarbons in Russia, due to its significant volume and quality characteristics, provides domestic consumers with oil and petroleum products, and, de-

[10] Razvitie portovoy infrastruktury proektov v akvatorii Karskogo morya [Development of port infrastructure projects in the Kara Sea]. URL: https://www.sozvezdye-forum.ru/images/prez_2020/Grigoriev_MN_1.pdf (accessed 07 May 2023).

spite the sanctions policy, allows the country to maintain a leading position in the world ranking of exporters (Fig. 1). The main subsoil users of the Russian Arctic are the country's leading companies [19, Ivanova M.V., Danilin K.P., Koshkarev M.V., pp. 538–550]: PJSC Gazprom, PJSC Gazprom Neft, PJSC NK Rosneft, PJSC NOVATEK, PJSC Lukoil. In Russia, the most famous types of oil are: Urals, Siberian Light, ESPO, Sokolov, Vityaz, ARCO, Sakhalin Blend. According to news agencies, in 2023 China began purchasing "Arctic" brands of oil, such as ARCO, Varandey, Novy Port.

The top three Russian oil companies in terms of volumes and oil refining operating in the Arctic include Gazprom Neft (GPN). This company was the first to start oil production on the Russian Arctic shelf (Fig. 2).

Fig. 2. Gazpromneft's Arctic program [11].

Since 2008, LUKOIL has been operating a stationary ice-resistant loading berth with a capacity of 12 million tons of oil per year, 21 km from the coastline in the area of Varandey Island (Nenets Autonomous Okrug) in the Barents Sea [12].

The share of Arctic oil in the total gas production volume in 2020 exceeded 30%. Oil from the Prirazlomnoe and Novoportovskoe fields is supplied via the Northern Sea Route throughout the year. Since 2016, Novoportovskoe oil has been shipped through the Gates of the Arctic terminal with a capacity of 8.5 million tons per year (built in the Gulf of Ob, 3.5 km from the coastline) (Table 1).

[11] Vremya Arktiki. Arkticheskaya programma «Gazprom nefti» [Arctic time. Arctic program of Gazprom Neft]. URL: https://www.gazprom-neft.ru/upload/medialibrary/d81/arctic_prog.jpg (accessed 15 April 2023).
[12] Arkticheskiy vektor «LUKOYLa» [Arctic vector of LUKOIL]. URL: https://pro-arctic.ru/19/06/2013/technology/3908?ysclid=lhdl8rsgcr37716484 (accessed 15 April 2023).

Table 1

Basic characteristics of the projects [13]

No.	Field	Location	Characteristics	Oil	Transport infrastructure
1.	Prirazlomnoye	Pechora Sea, 60 km from the coast (depth up to 20 m)	The only operating offshore ice-resistant stationary platform in the Russian Arctic	ARCO (Arctic Oil)	Loading to tankers from the oil storage facility at the bottom of the platform, then along the NSR
2.	Novoportovskoye	Yamal Peninsula in the Yamal-Nenets AO, 250 km north of Nadym	The Gate of Arctic terminal, 3.5 km from the coast for safe loading of large-tonnage tankers	Novy Port	Pipeline to the Gate of Arctic terminal, loading into tankers, then along the NSR
3.	Vostochno-Messoyakhskoe	Gydan Peninsula of the Yamal-Nenets AO, 340 km north of the city of Novy Urengoy	The northernmost continental region of Russia. Horizontal and fishbone wells	no data	Pipeline to the Zapolyarye-Purpe main oil pipeline, then along the ESPO

The company has its own Arctic fleet, which includes two reinforced ice-class icebreakers of the Aker ARC 130A (IBSV01) project “Alexander Sannikov” and “Andrey Vilkitskiy” to support the operation of the Arctic Gate terminal and 6 Arc7 ice-class tankers. Passage along the NSR is ensured by the nuclear-powered icebreaker “50 Let Pobedy”.

Another largest oil and gas company in Russia is PJSC NK Rosneft. The company’s main activities are exploration and development of hydrocarbon deposits, including offshore ones, oil and gas production, processing of raw materials, sales of oil and gas, as well as their processed products in the Russian Federation and abroad. Rosneft owns 28 license areas on the Arctic shelf with total resources of 34.6 billion tons of oil equivalent, where the company continues to conduct geological exploration (Table 2) [14].

[13] Compiled by the authors. Source: URL: https://www.gazprom.ru/projects/prirazlomnoye/ (accessed 15 April 2023).
[14] Deyatel'nost' krupnykh neftegazovykh kompaniy v Arkticheskoy zone Rossii [Activities of large oil and gas companies in the Arctic zone of Russia]. URL: https://roscongress.org/materials/deyatelnost-krupnykh-neftegazovykh-kompaniy-v-arkticheskoy-zone-rossii/?ysclid=lhdlf16jwq283932385 (accessed 15 April 2023).

Table 2

Geography of licensed areas

Region	Number of projects	Shelves of the seas	Licensed areas	Total reserves
Western Arctic	19	Barents sea	Fedynskiy, Central Barents, Perseevskiy, Albanovskiy, Varnekskiy, West-Prinovozemelskiy, Gusinozemelskiy	16.3 bln TOE
		Pechora Sea	Russkiy, South-Russkiy, South-Prinovozemelskiy, West-Matveevskiy, North-Pomorskiy-1,2, Pomorskiy and Medynsko-Varandeyskiy, Dolginskoe	
		Kara Sea	East-Prinovozemelskiy-1, 2, 3, Severo-Karskiy	
Eastern Arctic	9	Laptev sea	Ust-Olginskiy, Ust-Lenskiy, Anisinsko-Novosibirskiy, Khatangskiy, Pritaymyrskiy	18.3 bln TOE
		East-Siberian Sea	East-Sibirskiy-1	
		Chukchi Sea	North-Vrangelevskiy-1,2, South-Chukotskiy	

Features of the oil refining industry in Russia

The oil refining industry is an important element of the energy supply system of the country's economy and the main direction of oil use on the domestic market in the motor and petrochemical sectors. Currently, there are more than 30 oil refineries located on the territory of the Russian Federation with an oil processing volume of more than 1 million tons per year [12, Nemov V.Yu., Filimonova I.V., Provornaya I.V. et al., pp. 149–161]. The largest refineries are mainly concentrated in the European part of Russia (Fig. 3).

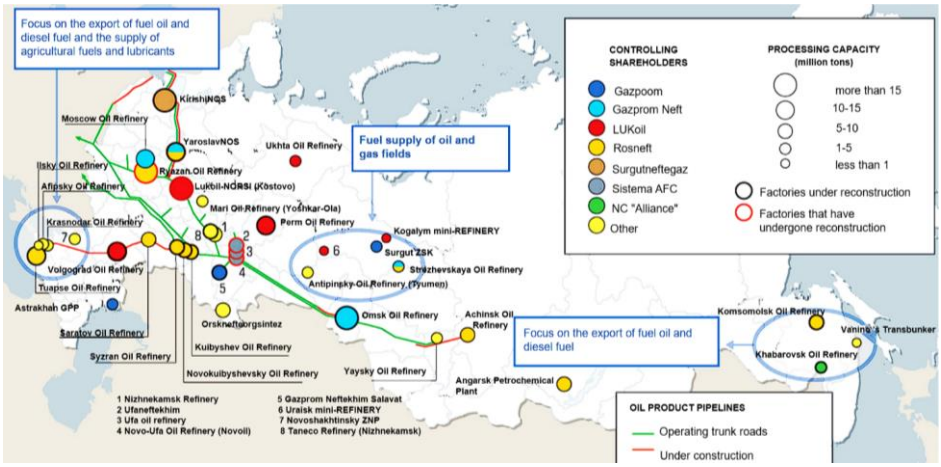

Fig. 3. Geographical distribution of the largest oil refineries in Russia [15].

[15] S 2016 g. AFK «Sistema» ne yavlyaetsya kontroliruyushchem organom, zavody prinadlezhat «Rosneft'» [Since 2016, AFK Sistema is not a controlling body; the plants belong to Rosneft]. URL: http://expert.ru/data/public/425663/425688/029_expert_20.jpg (accessed 10 April 2023).

The uneven distribution of refineries is explained by the USSR policy of locating refineries in the places of highest consumption [16] and in the areas of oil deposits [17]. This unevenness led to the fact that the Samara region and Bashkiria, for example, have three oil refineries each, while most regions have none.

Another feature of Russian refineries is the depth of oil refining, which is currently 82.5% (in Europe —85%, and in the USA — 96%). The high share of output of dark petroleum products is due to both domestic and foreign market demand and technological equipment.

According to experts, there is an urgent need to modernize oil refineries in Russia to increase the output of products with high added value and meeting environmental standards. The paper [11, Filimonova I.V., Komarova A.V., Nemov V.Yu. et al., pp. 13–20] considers trends towards deterioration in the structure and quality of the raw material base of the oil-producing regions of Russia. According to the results of the analysis, a quarter of the regions (out of 26 studied) fell into the group with a high degree of exploration (73%), with a high proportion of sulfurous (83.7%) and dense (59.4%) oil. One of these regions is the Republic of Bashkortostan, and its oil fields are among the oldest in Russia.

Why does the Republic of Bashkortostan need Arctic oil?

The Republic of Bashkortostan has a fairly diversified economy, with a 3% share of mineral production. The dominant activities, which determine the economic specialization of the region, are: oil refining, chemistry and petro-chemistry, which accounts for more than 30% of GRP (Fig. 4).

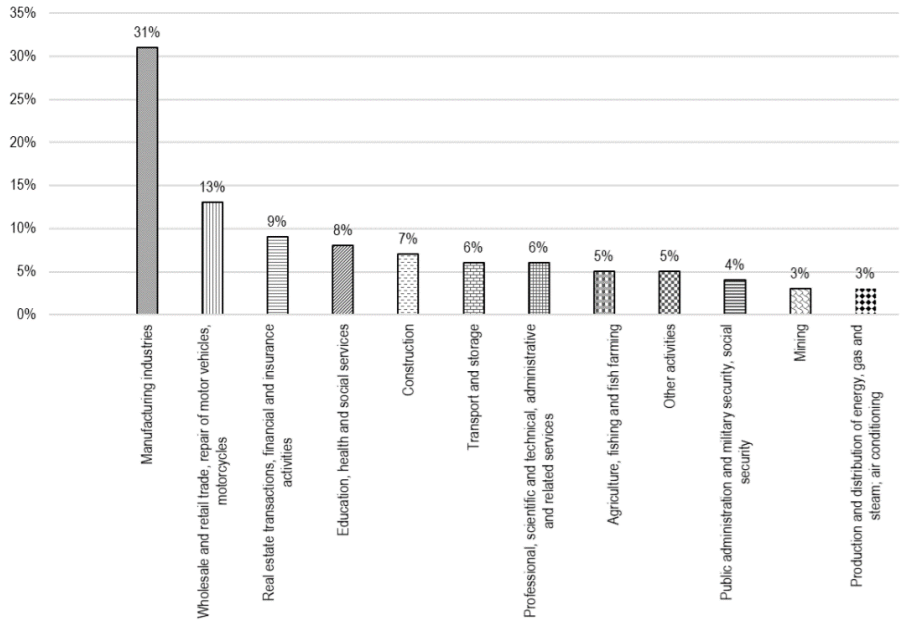

Fig. 4. GRP structure of the Republic of Bashkortostan for 2019 [18]

[16] Refineries in the Ryazan, Yaroslavl and Nizhniy Novgorod regions were oriented towards the Central Economic Region; a plant in Kirishi – to the Leningrad industrial center; a plant in the Krasnodar Krai – to the densely populated North Caucasus; factories in the Omsk Oblast and Angarsk – for Siberian consumption.
[17] Bashkir, Samara and Surgut oil refineries.
[18] Federal State Statistics Service. URL: https://rosstat.gov.ru/ (accessed 10 April 2023).

The Republic is a leader in the total design capacity of oil refineries among other constituent entities of the Russian Federation of similar profiles (Fig. 5). Considering the depletion of its own resource base, it is possible to assume the probability of insufficient supply of the republic's oil refining complex in the long term.

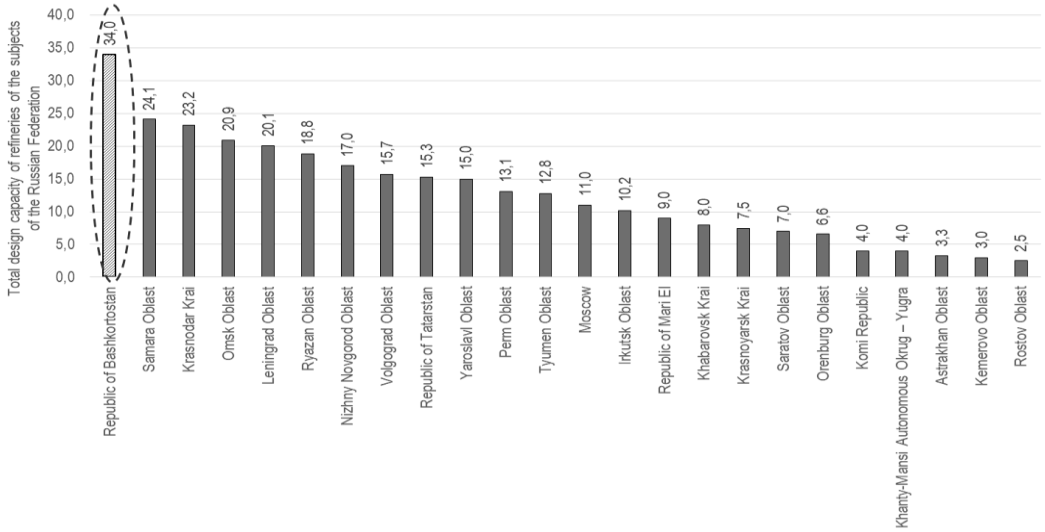

Fig. 5. Distribution of the total design capacity of oil refineries by regions of the Russian Federation [19].

As of 2020, the volume of crude oil refining exceeds the volume produced in the region by 55.76%, which means that oil is imported from other subjects of the Russian Federation to maintain the functioning of production specialization. Oil refineries in Bashkortostan process not only local oil, but also part of the Tyumen, Udmurt and Perm oil.

Identification of the characteristic phases of the "life cycle": origin, development, aging and new development (due to oil production in Western Siberia of the Russian Federation) confirms the probability of insufficient supply of the oil refining complex of the Republic (Fig. 6).

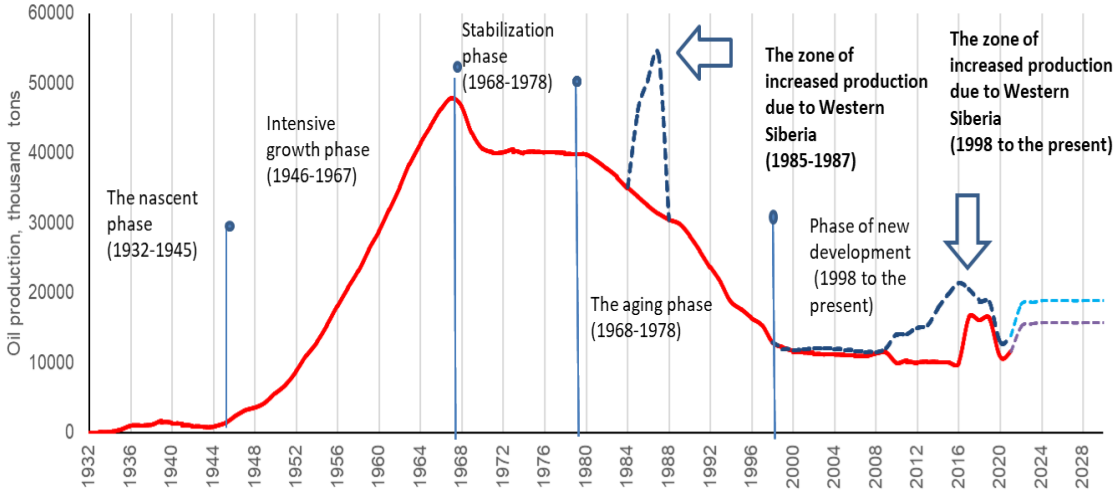

Fig. 6. Schedule of oil production in the Republic of Bashkortostan and adjacent territories [20].

[19] Source: Compiled by authors by URL: https://energybase.ru/processing-plant?ysclid=lhdm0pc5je367599669 (accessed 15 March 2023).

At the same time, according to the estimates of the Federal Agency, the volume of oil produced in the Republic in 2021 was 7.7% higher than in 2020, due to an increase of 39.8% in the number of wells drilled and by 33.3% of wells put into operation [21]. Thus, the low quality of the raw material base stimulates the use of new technological processes in the development of new fields; for example, the development of wells using hydraulic fracturing allows the use of new and poorly draining areas of the formation. Indeed, this confirms the opinion of experts that this region is distinguished by a high level of innovation and a high degree of hard-to-recover reserves [11, Filimonova I.V., Komarova A.V., Nemov V.Yu. et al., pp. 13–20]. At the same time, new mining methods are unsafe for the environment. Thus, the search for new sources of raw materials for the refineries of the Republic of Bashkortostan is a promising and urgent problem.

Spatial organization of communications to supply ORs of the Republic of Bashkortostan

Most of the major oil production projects in the Russian Federation are being commissioned in the Arctic, primarily in the Yamalo-Nenets Autonomous Okrug, Nenets Autonomous Okrug, on the left bank of the Yenisey River in the Krasnoyarsk Krai and within the Vankor-Suzun zone, as well as on the shelf of the Arctic seas [20, Oil and gas complex of Russia]. Figure 7 presents a schematic diagram of the spatial organization of communications connecting oil supplies from Arctic fields on the shelf to oil refineries in the city of Ufa of the Republic of Bashkortostan.

Fig. 7. Scheme of spatial organization of communications for oil supplies from Arctic offshore fields to oil refineries in Ufa, Republic of Bashkortostan [22].

[20] Ishalin R.I., ed. Letopis' bashkirskoy nefti (1932–2007) [Chronicle of Bashkir oil (1932–2007)]. Ufa, Bashgeoproekt, 2007, 400 p.; according to Bashneft Annual Reports. URL: Annual Reports (bashneft.ru) (accessed 23 March 2023).

[21] Spravka o sostoyanii i perspektivakh ispol'zovaniya mineral'no-syr'evoy bazy Respubliki Bashkortostan na 15.03.2021 g. Federal'nogo agentstva po nedropol'zovaniyu ot 14.01.2021 № 049-00016-21-00 [Certificate on the state and prospects for the use of the mineral resource base of the Republic of Bashkortostan as of March 15, 2021, Federal Agency for Subsoil Use dated January 14, 2021 No. 049-00016-21-00].

[22] Source: compiled by the authors by URL: Map of Arctic deposits. Arctic shelf (russiancouncil.ru) (accessed 20.03.2023).

It can be concluded that the main oil fields are located in the North-West of the Arctic zone. Possible options for delivering Arctic oil to the Republic of Bashkortostan may be combined routes: sea, river, rail and road.

The cost of river transportation is significantly lower than overland transportation. So, according to Fig. 7, the closest river artery to the deposits is the Ob River. Research [21, Khorokhina Ya.V., pp. 422–424] showed: firstly, the transport fleet of Siberia is outdated, its wear and tear is 70%; secondly, the industry does not have vehicles capable of operating in extremely shallow river conditions (0.5–0.8 m). In addition, it is well known that ice cover near the Ob River is approximately 150 days at the source and about 220 days at the mouth, and this is from 40 to 60% per year. However, the interaction of river transport with land transport (road and rail) is carried out through transport hubs operating on the basis of river ports. On the banks of the Ob, these are: Barnaulskiy, Novosibirskiy, Surgutskiy, Sergino, Salekhardskiy and Tomskiy, the service boundaries of which reach the coast of the Ob. Their role in transport provision of the West Siberian region is great. On the basis of these conclusions it is possible to propose a model of advanced hydrocarbon importation for local consumers while renewing the transport river fleet. In addition, a promising topology for the development of the railway network has been developed in the Russian Federation, which indicates plans for the construction of strategic, cargo-generating, technological and socially significant railway lines oriented towards the Arctic coast. It is possible that in the future the supply of raw materials for the functioning of the production specialization of petrochemical and oil refining will be carried out by rail, although this will significantly increase the cost of final products compared to river transport.

Conclusion

For both the state and resource-extracting companies, the Arctic, despite the harsh climate, underdeveloped infrastructure, and remoteness from domestic and foreign markets, remains a region of promising development. Under the new sanctions policy, the rich resource base of Arctic oil opens up new opportunities in new foreign markets, and can also be in demand in the domestic market, supplying Russian refineries. Obviously, there are certain difficulties in dealing with the domestic market: complex transport logistics and the need to modernize refineries. However, the directions stated in the country's development strategies allow making long-term plans in this direction.

As already noted, despite the sanctions [23], oil production in the Russian Federation in 2021 amounted to 524 million tons, while exports amounted to 230 million tons (43.8%), 56.2% of oil was sent to the domestic market. According to the research [22, Fedorova O.A., p. 49], oil produc-

[23] Aleks Budris. Itogi goda: rossiyskaya neftyanka vystoyala, no padeniya ne izbezhat' [Results of the year: the Russian oil industry has survived, but a fall cannot be avoided]. URL: https://www.forbes.ru/biznes/483005-itogi-goda-rossijskaa-neftanka-vystoala-no-padenia-ne-izbezat?ysclid=lffcdq6tb253609273 (accessed 18 March 2023).

tion in 2015 amounted to 533.5 million tons, exports — 241.3 million tons (45.2%). The production reduction in 2021 relative to 2015 was 1.8%.

The focus on export of finished products contributes to the development of production specialization of the region's petrochemical and refining profile, but currently finished products are mainly sent to the domestic market and Asia-Pacific countries.

In the long term, interregional communications with the lowest costs are necessary to ensure the specialization of the petrochemical and oil refining profile of the Republic of Bashkortostan with mineral raw materials — oil. On the one hand, the question of whether the refineries of the Republic of Bashkortostan will be supplied with Arctic hydrocarbon raw materials remains open and requires further research; on the other hand, the development of pipeline transport by PJSC Transneft may involve the supply of oil to the region in the future. Currently, the growth pole is the Arctic zone, where oil and gas companies are involved [23, Yakusheva U.E.]. Focusing on the long-term development of these companies and the development of the territories of Eastern Siberia and the Far East will contribute to the development of various water and land communications, which will certainly have a positive effect in the future.

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Interaction between Enterprises of the Real Economy Sector of the Russian Arctic Zone and Educational Organizations (Using the Example of the Arkhangelsk Oblast): Content, Trends and Assessments

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Abstract. The team of authors of the article conducted a sociological study aimed at analyzing and assessing the interaction of enterprises in the real sector of the economy and organizations of higher and secondary education in the field of personnel training for the Arctic Zone of the Russian Federation using the example of the Arkhangelsk region. The results of the study allowed us to conclude that the growing shortage of specialists with higher and secondary vocational education in the shipbuilding, forestry and fishing industries of the Arkhangelsk region in recent years has stimulated the interest of enterprises in cooperation with educational organizations. The study revealed significant differences in the level of interaction by enterprise size. The most intensive cooperation between educational organizations is carried out with large enterprises planning staffing for the medium term, having the greatest personnel needs, as well as human and financial resources to build interaction in their interests. The study also showed a trend towards establishing long-term connections between educational organizations and large enterprises using a variety of cooperation tools and involving students in work activities during their studies with a view to subsequent employment. At the same time, quantitative and qualitative data indicate the vulnerable position of small and medium-sized enterprises in terms of cooperation with educational organizations and, as a consequence, the provision of personnel. This is due both to the limited human resource for planning personnel policy, and to the fact that the few educational organizations in the region, as a rule, give priority to cooperation with major players, due to their status and ability to provide material support to the educational institution.

Keywords: *staffing, labor market, shipbuilding industry, forestry industry, fishing industry, Arctic zone of the Russian Federation, Arctic, employers, educational organizations, practical training*

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Introduction

Intensifying cooperation between enterprises and educational organizations of higher and secondary vocational education is one of the main trends in the development of both the education system and the socio-economic development of the region or a subject of the Russian Federation [1, Kudryashova E.V., Sorokin S.E., Bugaenko O.D.]. The educational, scientific and technological policy of Russia is being formed from the standpoint of the need for close interaction between the personnel training system, real economy and the social sphere [1]. The key challenges in the field of personnel training, which determine the relevance of this problem, are, firstly, the shortage of graduates of engineering, pedagogical and medical specialties; secondly, the insufficient skills quality of graduates and their adaptability to the employer's requirements. In this regard, in recent years the range of various forms and mechanisms of interaction between employers and educational organizations has expanded significantly [2, Balatskiy E.V., pp. 58–75].

The relevance of this problem for the Arctic zone of the Russian Federation (the Russian Arctic) is due to the fact that the above challenges, as well as transformations in the labor market associated with the demographic situation, the development of the digital economy and the sanctions regime of Western countries, have a particularly strong impact on the Arctic regions with their traditionally high level of migration, population outflow and economic dependence on conditions in commodity markets. The "Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035" highlights the discrepancy between the system of secondary vocational and higher education in the Arctic zone and the requirements of the economy and social sphere of qualified and highly qualified personnel as a risk for the development of the Russian Arctic [2].

Researchers note that the regions of the Russian Arctic are characterized by an increase in personnel shortages and insufficient training of specialists in the Arctic territories [3, Efimov I.P., pp. 118–132]. Scientific research also substantiates the fact that the higher education system is insufficiently focused on priority areas of the Russian Arctic development, which require specific human resources [4, Sigova S.V., Stepus I.S.].

[1] Ukaz Prezidenta Rossiyskoy Federatsii ot 01.12.2016 № 642 «O Strategii nauchno-tekhnologicheskogo razvitiya Rossiyskoy Federatsii» [Decree of the President of the Russian Federation dated December 1, 2016 No. 642 "On the Strategy for Scientific and Technological Development of the Russian Federation"]. URL: http://kremlin.ru/acts/bank/41449 (accessed 09 August 2023).

[2] Ukaz Prezidenta Rossiyskoy Federatsii ot 26.10.2020 № 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 dated October 26, 2020 No. 645 "Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035"]. URL: http://www.kremlin.ru/acts/bank/45972 (accessed 09 August 2023).

Research review

The interaction of professional educational organizations with enterprises in various sectors of economy is a topic in demand for study. Monitoring studies [5, Shugal N.B., Kuznetsova L.B., p. 72] are carried out, interdisciplinary comprehensive scientific projects are implemented, trends and models of interaction are conceptualized through the lens of interdisciplinary positions [6, Fleck M.B., pp. 154–171].

Part of the long-term project "Monitoring the Economics of Education", carried out since 2002 by HSE University, is the collection of data and analysis of the interaction between the education system and employers, mainly using the example of secondary vocational education (SVE) [7, Shuklina E.A., pp. 86–99]. One of the latest statistical reviews takes into account such important forms of interaction as professional and public accreditation, practical training at enterprises, participation in professional skills championships according to WorldSkills standards, and the presence of experienced teachers in the manufacturing sector [5, Shugal N.B., Kuznetsova L.B., p. 72].

In 2021, the authors Blinov V.I., Satdykov A.I. and Siliverstova I.V., based on the research, described the current state of interaction between professional educational organizations and enterprises in 29 constituent entities of the Russian Federation, including those related to the Russian Arctic. The authors come to the conclusion that traditional forms of interaction (practical training) are most widespread and there are no tools for partnership institutionalization [8, pp. 41–70].

A team of scientists from the Ural Federal University conducted a study to evaluate the practices of interaction between leading universities and enterprises that were drivers of the regional economy [7, Shuklina E.A., pp. 86–99]. The researchers considered a wide range of issues of interaction, including efficiency in such aspects as replenishment of staff, creating an innovative environment, the social development of territories, and enterprise management. The authors come to the conclusion that simplified forms of interaction between universities and enterprises prevail, which is to a certain extent explained by the lack of desire of employers for long-term and innovative forms of cooperation, which, in turn, is due to the "features of the labor market, the "overproduction" of personnel by universities, excessively replenishing the professional region structure" [7, Shuklina E.A.].

In 2022, a team of scientists from the Plekhanov Russian University of Economics, as part of monitoring studies, prepared a report on trends in the development of education in the world and in Russia, including the interaction of universities with industrial partners. The authors named strengthening cooperation with industry as one of the main trends in the development of higher education. The report provides a classification of models, levels and areas of interaction [3]. The re-

[3] Vzaimodeystvie vuzov s industrial'nymi partnerami. Rezul'taty monitoringa informatsii o tendentsiyakh razvitiya vysshego obrazovaniya v mire i v Rossii [Interaction of universities with industrial partners. Results of monitoring in-

port discusses scientific, technological and innovation partnerships in conjunction with personnel training. The authors provide a detailed overview of rating measurements of interaction processes, the methodology of which contains criteria for the participation of employers in personnel training [4].

The works of T.A. Grosheva [9, pp. 165–172], E.V. Kudryashova [1], E.Ya. Kogan [10], M.B. Fleck [6] are devoted to the issues of conceptualization of this topic. A team of scientists under the authority of E.V. Kudryashova considers the process of interaction between universities and the production sector in the context of the implementation of the "third mission". The authors highlight key areas of cooperation, which include various forms of enterprise participation in educational activities [1]. It is noted that the most important aspect of interaction is the process of building joint long-term strategies with universities, planning personnel needs and determining the set of competencies of future young specialists [1].

The works of F.F. Dudyrev [11], A.Yu. Petrov [12], T.V. Fedosova [13], G.S. Siraya [14] and others are devoted to certain aspects of interaction between educational organizations and enterprises.

Issues of interaction between educational organizations and enterprises in the Arctic zone of the Russian Federation are also the focus of attention of the scientific community. Researchers raise questions about the system of interaction between Arctic universities and individual enterprises in the region as part of the implementation of educational projects [5]. A methodology for assessing the consistency of regional vocational education systems with the demands of the labor market and, as a result, forecasting the personnel needs of enterprises in the Russian Arctic are being developed and tested [15, Stepus I.S., pp. 594–612].

Today, despite the great attention to the issues of interaction between employers and educational organizations, there is no relevant quantitative and qualitative empirical data on the identified issues in relation to the Arctic region. In addition, previous studies poorly take into account the specifics of staffing and regional labor markets in the context of individual industries.

Research methodology

The collection of empirical data for the study was carried out using sociological tools. In 2022, the Institute for Strategic Development of the Arctic (Northern (Arctic) Federal University named after M.V. Lomonosov – NArFU) undertook a sociological study on the topic "Staffing of the shipbuilding, forestry and fishing industries of the Arkhangelsk region in the context of digitalization" [16, Saburov A.A., Minchuk O.V., Nikiforov A.S., pp. 211–233]

Primary data collection was carried out using questionnaires and in-depth interviews.

formation on trends in the development of higher education in the world and in Russia]. Moscow, Federal State Budgetary Educational Institution of Higher Education "Plekhanov RUE", 2022, 132 p.

[4] Ibid.

[5] Arktika — natsional'nyy megaproekt: kadrovoe obespechenie i nauchnoe soprovozhdenie [The Arctic is a national megaproject: staffing and scientific support], Arkhangelsk, NARFU Publ., 2016, 264 p.

The survey was conducted between August 3 and September 6, 2022 using the LimeSurvey Internet platform. The general population of the study included enterprises of the shipbuilding, forestry and fishing industries of the Arkhangelsk region, taking into account the main and additional types of economic activities in accordance with the All-Russian Classifier of Types of Economic Activities (Table 1) [16, Saburov A.A., Minchuk O.V., Nikiforov A.S., pp. 211–233].

Table 1

Types of economic activity by economic sector

Economic sector	Types of economic activities
Forestry industry	02 Forestry and logging 16 Manufacture of wood and products of wood and cork, except furniture, manufacture of articles of straw and plaiting materials
Fishing industry	03 Fisheries and fish farming 10.2 Processing and preserving of fish, crustaceans and molluscs
Shipbuilding industry	25.99.26 Production of ship propellers and paddle wheels 30.1 Construction of ships, vessels and boats 33.15 Repair and maintenance of ships and boats

The total population of the study consisted of 90 legal entities of various organizational and legal forms. The sampling population consisted of 50 legal entities.

All industries were represented in the sampling population: fishing, shipbuilding, forestry. The survey covered large (46%), as well as medium and small (54%) industrial enterprises [16, pp. 211–233].

40% of fishing enterprises, 64% of forestry enterprises, and 44% of shipbuilding enterprises completed a survey from the total population of legal entities in each of the industries under consideration. In the forestry industry, 36 enterprises were surveyed, having more than 54% of the employees of the entire industry in the region; in the fishing industry – 10 enterprises, employing more than 54%; in the shipbuilding industry – 4 enterprises, having 93% of employees [16, pp. 211–233].

The questionnaire included 36 questions, divided into three main blocks:

- forecasting personnel needs;
- demanded competencies and satisfaction with the level of training of graduates;
- interaction with educational organizations.

Questions related to the discussed topic in the article were included in the third block [16, p. 211–233].

As part of the study, the following indicators were determined and analyzed:

- the presence of interaction;
- forms of interaction;
- interaction factors;
- consequences of interaction;
- general assessment of interaction;
- assessing the effectiveness of implemented forms of interaction;

- assessment of the effectiveness of communication channels.

From November 2022 to July 2023, a survey of enterprises from the selected sample was conducted using semi-structured interviews. 23 employer representatives were interviewed. The informants were mainly managers, deputy HR & administration directors, HR executives and other structural divisions of enterprises, as well as experts from the field of education.

The interview guide included three sets of questions. The first block of questions concerned the problems of staffing of enterprises. The second block was aimed at identifying the attitude of informants to the level of training of graduates of educational organizations. The third block of questions was devoted to the processes of interaction between employers and educational organizations.

Research results

Empirical evidence shows high interest among enterprises in collaborating with universities and colleges. 61.9% of employers who took part in the study would like to begin or resume various types of interaction with educational institutions of higher and secondary vocational education.

Many informants drew attention to the fact that more and more employers understood the impossibility of getting a ready-made graduate "here and now" and were increasingly turning to educational institutions with the initiative of comprehensive long-term cooperation.

"Enterprises understand that they need to take care of their staff. Repurchasing is expensive, that is, people have to pay more, so in this case it is not always effective. It's better to do it differently, it's better to attach people in the finest sense of this word, to connect their lives with the life of the enterprise. Therefore, the first thing that enterprises do is to place an order. This trend already started a year or two ago" (informant No. 22, expert, shipbuilding industry).

"When a general director of the large enterprise decided on the main development milestones, he came to the conclusion to play the long game. We established a special scholarship program for students... ... plus, we were integrated not only into scholarships, but into the competitive process, when the enterprise is integrated into the formulating of topics of students' projects and the research development stage, and the defense stage. ...This vocational-oriented approach of early meeting with the university is tailored to the request of the enterprise" (informant No. 5, representative of an educational organization, graduate employability manager).

During the interview, cases of recent initiation of complex cooperation with the university by the enterprise were also recorded: *"... our employer (a large enterprise in the fishing industry) has better finances, they are now (at the university) designing premises with their own symbols, placing stands. We will have fish in one of the rooms on the 5th floor, and they will donate fish for our pools. …. They are ready to involve personnel, conduct classes in a number of disciplines, or involve their partners in these classes... They have already trained for free a number of employees of the university under the professional retraining aquaculture program"* (informant No. 3, representative of an educational organization, fishing industry).

Moreover, competition for future qualified workers encourages large enterprises to work with schools to conduct career guidance counseling and prepare for the Unified State Exam in principal subjects.

"For four years now we have been conducting one of the career guidance projects at our enterprise. We are looking for teachers in mathematics, physics and computer science and we are "educating" tenth graders at our base... We pay teachers for their work; the pupils go there for free ... so that they ... come to us for technical training" (informant No. 10, a large enterprise, ship-building industry).

"We hold general meetings in schools in the districts. …. We gather the children and explain who we are, what we are, and we do this in conjunction with the Higher Engineering School (university), that is, we travel together… And there are some different activities for children: quests, games, and other events" (informant No. 12, large enterprise, forestry industry).

According to employers in the Arkhangelsk region, interaction with educational organizations brings the greatest benefit to providing their enterprise with personnel (the average rating is 4.1 on a 5-point scale, where 1 is the least benefit, 5 is the greatest benefit). Significant, but secondary goals that are achieved during cooperation are: creating a positive image and increasing reputation (average score – 3.8), solving production problems (average score – 3.6), implementing the social responsibility of the enterprise, overall contribution to the region development and education system (average score – 3.3), fulfillment of external obligations to the state or founders (average score – 3.1). The significance of such cooperation, primarily for solving the personnel problems of enterprises, is confirmed by the fact that 90.5% of surveyed employers have hired graduates with whom interaction was carried out over the past three years (Fig. 1).

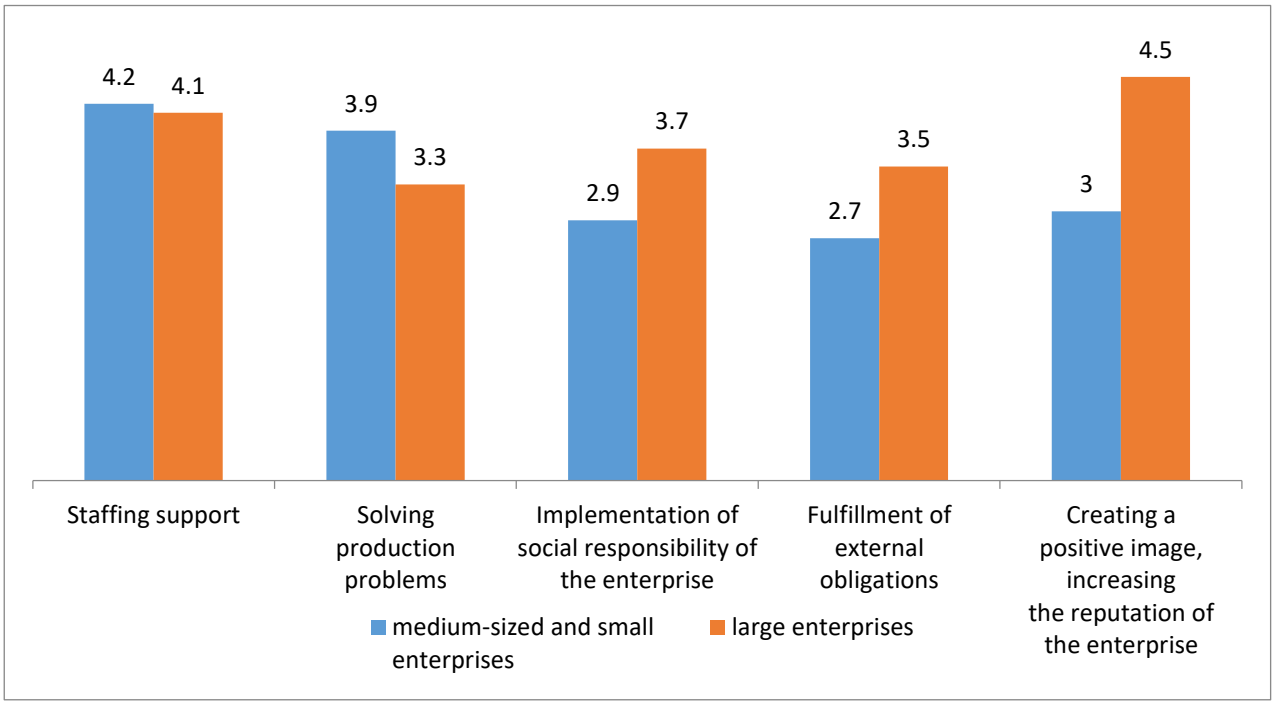

Fig. 1. Average score of enterprises' assessment of the benefits of interaction with educational organizations, from 1 – least benefit to 5 – greatest benefit (%).

The number of partners from educational organizations varies significantly for enterprises depending on their size. Informants - representatives of small and medium-sized enterprises more often mentioned 1–2 educational institutions as regular partners. In turn, the region's largest employers interact with dozens of universities and colleges.

"The spectrum is quite wide. If we take universities that are not located in the Arkhangelsk region, it is somewhere around 29 today or 30, I don't remember. That is a fairly wide range, starting from Sevastopol, Novocherkassk and Rostov-on-Don. Plus all urban institutions of secondary vocational education, plus half of them in Arkhangelsk, probably" (informant No. 9, large enterprise, shipbuilding industry).

"We have expanded the geography of interaction with educational institutions; that is, now about 35 cooperation agreements have been concluded with 35 institutions across the country in the required areas of training for our enterprise" (informant No. 10, large enterprise, shipbuilding industry).

Analysis of quantitative data showed that enterprises use all the proposed methods of interaction with educational organizations of higher education and secondary vocational education. However, the level of interaction between enterprises and secondary vocational education organizations is somewhat lower than with higher education organizations. On average, for each form of interaction, 4.8% of employers cooperate with educational institutions. The only significant exception is the conclusion of an agreement on targeted training: this form of interaction is much more often practiced by enterprises with SVE than with HE (57.1% versus 33.3%).

Table 2

Prevalence and assessment of forms of interaction between employers and HE and SVE organizations

Form of interaction between employers and educational organizations	Employers' assessment of the effectiveness of the form of interaction, average score on a scale from 1 to 5		Share of employers using this form of interaction with educational organizations, %	
	HE	SVE	HE	SVE
Advanced training courses for employees of the enterprise, implementation of professional retraining in these educational organizations	3.90	3.38	95.2	61.9
Organization of practical training / internships for students	3.65	3.89	81	85.7
Participation of an enterprise representative in the management of an educational organization (membership in the supervisory or trustee board of an educational organization)	3.57	2.67	33.3	28.6
Participation of enterprise representatives in the educational process (teaching, conducting practical classes, scientific guidance on writing final qualification papers) of these educational organizations	3.44	3.20	42.9	47.6

Participation of an enterprise representative in the development / examination of educational standards / educational programs / modules / practice programs of these educational organizations	3.44	3.00	42.9	42.9
Partnership and (or) sponsorship of specialized competitions, Olympiads, etc.	3.38	3.00	38.1	42.9
Participation in other events (scientific conferences, round tables, public hearings, projects, etc.) organized jointly with (or) these educational organizations	3.36	3.18	66.7	52.4
Participation in career guidance events (career fairs, admissions events, etc.) organized jointly with (or) these educational organizations	3.33	3.75	71.4	57.1
Implementation of a network educational program, including a mentoring institute at the enterprise	3.20	3.43	47.6	33.3
Participation of an enterprise representative in the state final certification (as a member or chairman of the commission)	3.18	3.30	52.4	47.6
Enterprise scholarship programs (cash payments to students who excelled in their studying in specialized areas)	3.13	3.13	38.1	38.1
Functioning of the basic department of an educational organization	3.13	2.40	38.1	23.8
Interaction with educational organizations through the participation of an enterprise representative in councils and other advisory structures under government bodies (regional and local) involved in the implementation of educational policy	3.11	3.14	42.9	33.3
Concluding an agreement on targeted training	3.08	3.60	57.1	47.6
Organization of training and internships for teaching staff / teachers of educational organizations at an enterprise	2.90	2.80	47.6	47.6
Financial and resource support for the educational activities of these organizations (sponsorship, arrangement of educational laboratories, purchase of educational equipment, etc.)	2.43	3.25	33.3	57.1
Participation in public accreditation of these educational organizations	2.00	2.40	23.8	23.8

In cooperation with HE organizations, employers most often come to such forms of interaction as the completion of advanced training courses for employees of the enterprise and professional retraining in educational organizations (95.2%); organizing practical training / internships for students (81%); participation in career guidance events (career fairs, admissions events, etc.) organized jointly with (or) educational organizations (71.4%). These forms of cooperation are used by more than 70% of all surveyed organizations.

In cooperation with vocational education organizations, employers most often use such forms of interaction as organizing practical training / internships for students (85.7%), taking advanced training courses for employees of the enterprise, carrying out professional retraining in educational organizations (61.9%), and participating in career guidance events organized jointly with (or) these educational organizations (57.1%).

The average score for assessing the effectiveness of all forms of interaction with HE and SVE organizations by employers is almost identical – 3.19 and 3.15 points, respectively. The presented data is visualized in Figure 2.

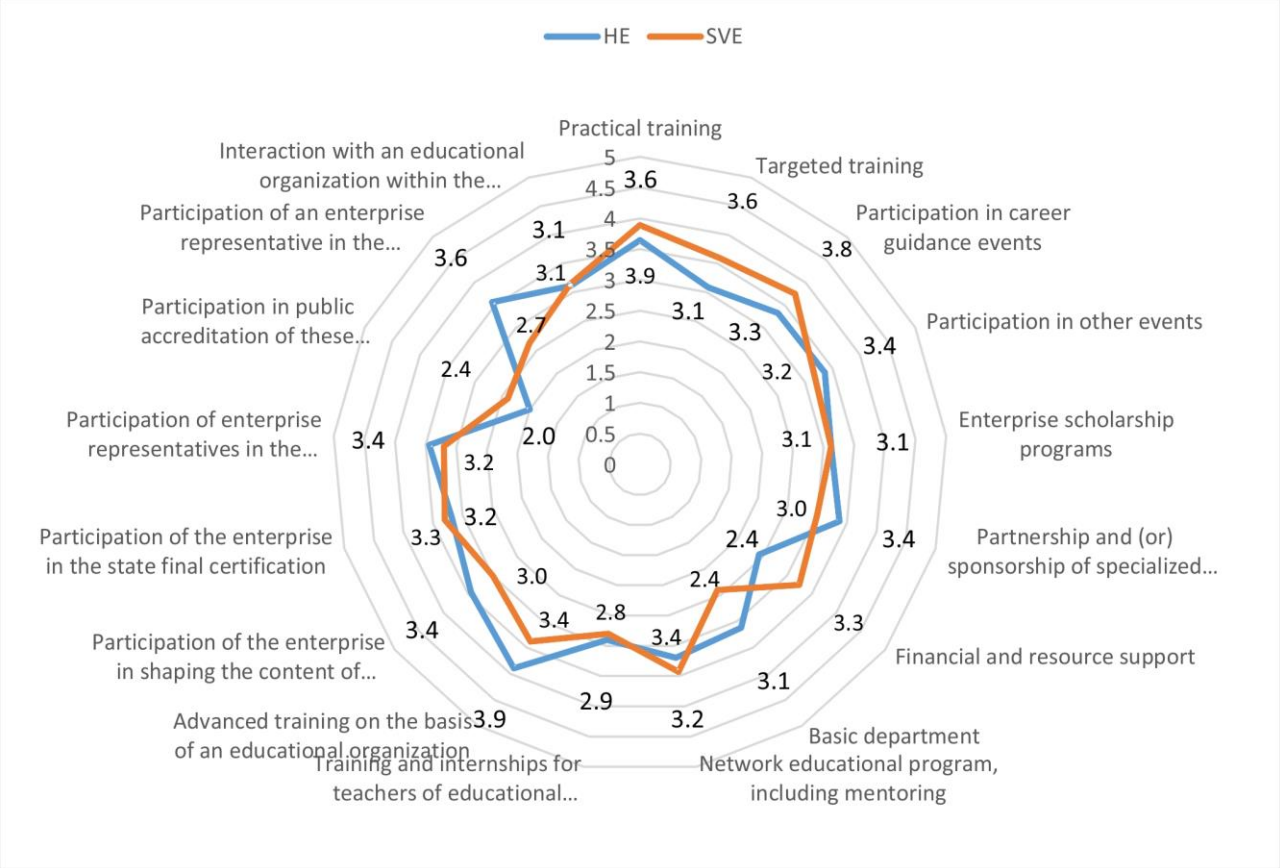

Fig. 2. Assessment of the effectiveness of forms of interaction with educational organizations (HE and SVE) of enterprise representatives.

Common forms of cooperation with HE organizations – the completion of advanced training courses for employees of the enterprise and the organization of practical training / internships for students – are recognized by employers as the most effective (average rating – 3.90 and 3.65 points, respectively). With regard to interaction with vocational education organizations, employers highly rate the effectiveness of the organization of internships / internships for students (3.89 average score) and career guidance activities (3.75 average score).

At the same time, the frequency of use of interaction forms does not always correspond to the assessment of their effectiveness. In particular, forms of cooperation that are highly rated as effective are participation in the management of an educational organization (average score 3.56 points), participation of an enterprise representative in the development / examination of educa-

tional standards / educational programs / modules / practice programs of these educational organizations (3.44 points), participation of enterprise representatives in the educational process of these educational organizations (3.44 points) is practiced by less than half of the surveyed enterprises. The effectiveness of the employer's direct participation in the educational process is repeatedly emphasized by informants.

"This year we actively began working with our 28th technical school in this direction. For example, we made our own adjustments and comments to the curriculum for certain professions. For example, for the training of welders we developed a program of additional practical internships for teachers of craftsmen and educational institutions, so that they would teach children exactly the equipment and skills that they will see at the enterprise" (informant No. 10, a large enterprise in the shipbuilding industry).

"This year we have project activities with forest engineers, that is, we gave them a direct project, a task, they carried it out, went to our plots, watched the technological process, and interacted with our employees. And in principle, they have already prepared a project, they will present it to us, and we will select the best students and somehow try to keep them close to us" (informant No. 12, large enterprise, forestry industry).

The study revealed an uncharacteristic case of the initiation and implementation of educational products for teachers of educational organizations by an enterprise. Moreover, this practice was highly appreciated both by the enterprises and by universities and colleges. *"Two years ago, we did such a project with educational institutions: for teachers of "Aquatic Bioresources and Aquaculture" we created a course of online lectures, where specialists from our company spoke, plus we invited quite professional foreign and domestic experts. It was an intensive course of online lectures for a month. After that, we brought them to our sites in Murmansk, showed how it looked in reality, and with this message they went to their universities. ... After this, firstly, our recognition in specialized institutes increased greatly, and secondly, a queue for internships was immediately organized..."* (informant No. 16, large enterprise, fishing industry).

One of the major obstacles to the flow of teachers from industry into education is the uncompetitive salaries.

"... it is clear that those who go to sea... earn not the same money as what people earn on the shore... Therefore, it is difficult with personnel, I mean with personnel from the industry, and here personnel are needed from the industry" (informant no. 3, representative of an educational organization, fishing industry).

Survey data show that the most common and effective format of interaction is the organization of student internships, which consists of performing certain types of work related to future professional activities [6], by students, as a rule, in real production conditions. For employers, this is

[6] Prikaz ot 5 avgusta 2020 goda N 885/390 «O prakticheskoy podgotovke obuchayushchikhsya» (s izmeneniyami na 18 noyabrya 2020 goda) [Order of August 5, 2020 N 885/390 "On practical training of students" (as amended on November 18, 2020)]. URL: https://docs.cntd.ru/document/565697405 (accessed 30 October 2023).

one way to conduct early professional selection. Thus, one of the representatives of the fishing industry enterprise noted: *"We expect that after the internship a certain number of people will stay or return after training, depending on the course. Someone is already expressing a desire to work in the company, to continue graduate work for our own benefit"* (informant No. 16, large enterprise, fishing industry).

The effectiveness and relevance of this form is indirectly confirmed by data on the willingness to organize salaried placement. Thus, 47.6% of employers noted that such experience was being implemented at their enterprises; another 28.5% indicated that there was a readiness for this, but the presence of financial or administrative barriers did not allow it. And only 23.8% of employers are generally not interested in salaried placement.

The "Plant – technical college" system is recognized by both employers and educational organizations as one of the most successful practice-oriented training. Existing since 1965, it provides continuous multi-level engineering and technical education for specialists from shipbuilding and ship repair enterprises in Severodvinsk. Students studying under the "Plant – technical college" system are full-time students, but during their studies they work at these enterprises from the Freshman semester. *"If it's "Plant – technical college", it's a 100% ready-made specialist in all characteristics. Why? Because we do the internship ourselves... they've been working at our plant for about three semesters"* (informant No. 10, large enterprise, shipbuilding industry).

The general assessment of satisfaction of enterprises with interaction with educational organizations of the Arkhangelsk region can be characterized as average and conservative. 52.4% of employers are satisfied with the interaction, including 19% who are completely satisfied. A third of respondents found it difficult to give a general assessment. The average satisfaction score was 3.62 out of 5. Noteworthy is the fact that 60% of medium and small enterprises, mainly representatives of the forestry industry, found it difficult to answer the question about satisfaction with interaction, which is probably an indirect indicator of the limited cooperation with educational organizations (Fig. 3).

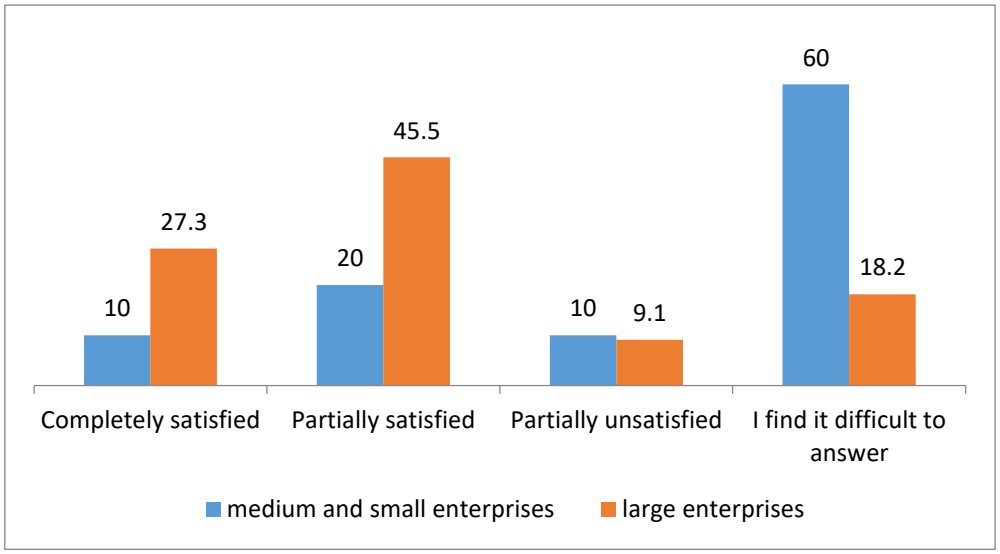

Fig. 3. Satisfaction of the enterprise with the level of interaction with educational organizations.

Among the obstacles to the development of cooperation, the greatest weight, according to employers, is the disinterest of educational organizations (38.1%); the costs and efforts of the enterprise to organize cooperation do not justify the obtained results (33.3%); lack of understanding of educational organizations of the subject of cooperation (33.3%).

On the part of large enterprises, the most significant problem was the disinterest of educational organizations and the unjustifiability of the efforts invested in cooperation. This point of view is expressed to a greater extent by representatives of the shipbuilding and forestry industries. Informants also mentioned difficulties of an organizational nature: *"We quite often encounter not a problem, but a condition that is not very comfortable for us, when an educational organization sends us ... a schedule of practices almost the day before, I say exaggeratedly. And in order to organize an internship, we need to go through some certain formal things, including organizing access control"* (informant No. 9, large enterprise, shipbuilding industry).

Informants-employers also mentioned the fact that an obstacle to cooperation between educational organizations is their outdated material and technical base.

"We have been cooperating with the technical school ... for three years in the framework of training of forestry machine operators ... But the technical equipment there leaves much to be desired. After all, they are machinists, they have expensive equipment, and expensive simulators; in general, this issue is being resolved for now" (informant No. 12, large enterprise, forestry industry). Further, the informant expressed the hope that modern equipment for this technical school could be purchased within the framework of the "Professionality" program.

"Now we have new fishing vessels; two of them are already in the fishery. They have the most modern equipment. The university simply does not have the training facilities to match these vessels. Therefore, we still have to train on the job" (informant No. 13, large enterprise, fishing industry)

There is uncertainty about the interest of educational organizations in interaction with medium and small enterprises. In interviews, many representatives of SMEs spoke about difficulties in dialogue with educational organizations.

"The problem is that educational organizations are not particularly looking for connections with us. We interact with the college; they give us students for practice. We have an agreement, for example, with the school in Kotlas. We interact and work with them. But we suffer a shortage of painters. I couldn't find any college to conclude an agreement. What amazes me more is that the educational institutions are not interested in concluding any agreements with the enterprise for the same practice" (informant No. 2, representative of SMEs in the shipbuilding industry).

SME employers are also not always informed about the possibilities of reaching out to students potentially interested in working. *"It's just that in reality I'm not even given the opportunity to talk and make suggestions to students... There's not even a notice board or an admissions events where a potential employer can introduce himself"* (informant No. 2, representative of SMEs in the shipbuilding industry).

Another challenge for small and medium-sized enterprises, especially in the shipbuilding industry, is the high competition of the largest employers for personnel and, accordingly, for cooperation with educational organizations: *"I tried to hire specialists who could make small-scale ship drawings, I needed a young specialist. I called the university manager, and I said to the director, "Can I hire some student to work?" The first thing he said was that all of them intended to work at large enterprises. And secondly, he gave me the phone number of the teacher who was responsible for their practice, and their placement. I dialed a number and had the design office on the phone. This teacher managed a design drawing bureau at the same time, and all those students worked there"* (informant No. 2, representative of SMEs in the shipbuilding industry).

An important advantage of large employers in building profitable cooperation with educational organizations is the opportunity to sponsor and improve the material and technical base of educational organizations and develop educational products.

"If you have been to Severodvinsk, there is a building that is well equipped for all our professional directions. And we should say a big thank to the plants, because much equipment was purchased as their sponsorship" (informant No. 6, representative of the management of an educational organization).

At the same time, representatives of educational institutions noted that there is an unpreparedness of some employers to work together on the content of education: *"Everyone says that educational institutions do not teach what employers need. That is, a person comes to the plant and learns again how to work... But there are no initiatives to do something... even to get involved in the plans..."* (informant No. 3, representative of an educational organization, fishing industry).

In addition, some employers still expect to receive instantly a ready-made specialist in accordance with rapidly changing personnel needs.

"Now they have a colossal demand for import substitution. "That is, give us those who will be innovators. Give us those who will improvise." But this is creative thinking. Initially, do you need a functionary to ensure the operation of the equipment, or do you need Kulibin, who will create something from this? But they are not born out of the blue; this is a different type of thinking" (informant No. 5, representative of an educational organization, graduate employability manager).

"A representative of an employer in the timber industry came not long ago... "We are ready to hire your graduates". And I say: "But they don't exist. I have eight graduating cellulose workers this year; they are all already employed... In order for you to get a technologist now, you need to find him at school, send him to us to get employer-sponsored education, we will teach him, and you will get him" (Informant No. 6, representative of the management of an educational organization).

"Not so long ago at one forest industry enterprise I was invited to a working meeting regarding the training of specialists, and one of the managers said: "I now need a driver, a site foreman and someone else". "Do you need it now? And tomorrow, and in 5 years? Do you have any vision?" (Informant No. 11, employee of the university department).

Representatives of enterprises noted factors that could expand opportunities for cooperation with educational organizations:

- availability of state support measures for effective interaction with educational institutions (benefits, compensation, etc.), 61.9%;
- high level of student training, allowing to be involved in the production process without lengthy adaptation and retraining, 52.4%;
- manifestation of interested activity on the part of educational institutions, 38.1%.

Large and medium and small enterprises generally did not show significant differences in determining the factors mentioned above. A higher level of student training could greatly contribute to the expansion of cooperation with educational organizations specifically for the fishing and shipbuilding industries.

Analysis of the interviews shows that one of the key factors for successful cooperation between an employer and an educational organization is a regular dialogue, when a mutual understanding of needs, opportunities and limitations is achieved. *"This was actually a very difficult process for the simple reason that we even had a misunderstanding. That is, what we say, how we verbalize competencies and how the employer understands them are very different stories... Shipbuilding enterprises have become accustomed to our approach over many years. And we are. And there we have fewer contradictions. … There's been quite a long history with the timber industry, and it's even gotten to the point where I'm a member of the council for the development of qualifications in the timber industry now. They deliberately introduced me into so that industrialists could understand a little how personnel were trained"* (informant No. 6, representative of the management of an educational organization).

During the dialogue, many informants emphasized the importance of established personal relationships for maintaining quality interaction.

"We have a practical training specialist. ... He has been working for a long time, he has a lot of acquaintances in personnel services, which are shipowners, fishermen or crewing companies... The time comes and he approximately knows who and where to get a job based on the level of grades, knowledge, according to reviews of teachers, by behavior..." (informant No. 3, representative of an educational organization, fishing industry).

"In the case of informal connections, these relationships are maintained due to favorable relationships between teachers and students during training, which subsequently influences the further maintenance of these acquaintances, assistance and cooperation. In addition, students and teachers often work in the forestry industry, and children of forestry workers study" (Informant No. 15, SME, forestry industry).

Conclusion

The results of the study showed that in recent years the growing shortage of specialists with higher and secondary vocational education in the shipbuilding, forestry and fishing industries

of the Arkhangelsk region has stimulated the interest of enterprises in cooperation with educational organizations. The processes of interaction between enterprises and educational organizations in the Arkhangelsk region are currently undergoing a period of active development, which is confirmed both by the variety of forms of interaction and the intensification of their use, and by the subjective assessment identified from the results of the survey and interviews.

The study revealed significant differences in the level of interaction by enterprise size. The most intensive cooperation between educational organizations is carried out with large enterprises planning staffing for the medium term, having the greatest personnel needs, as well as human and financial resources to build interaction in their interests. The study also showed a tendency to establish long-term connections between educational organizations and large enterprises using a variety of cooperation tools (practical training, participation in the planning and implementation of the educational process, competitions, scholarships, purchase of educational equipment, etc.) and involving students in work activities during their studies for the purpose of subsequent employment. In addition, for the purpose of long-term staffing, large companies work with schools in the region, thus providing vocational guidance at an early stage.

Quantitative and qualitative data indicate the vulnerable position of small and medium-sized enterprises in terms of cooperation with educational organizations and, as a consequence, the provision of personnel. This is probably due both to the limited human resource for planning personnel policy, and to the fact that the few educational organizations in the region, as a rule, give priority to cooperation with major players, due to their status and ability to provide material support to the educational institution. This explains the relatively low participation of SMEs in the development of educational products and direct teaching and, in general, a lower level of awareness about the possibilities of cooperation with educational organizations.

For the sustainability of staffing in key industries in the region, taking into account the challenges identified as a result of the study for the interaction of enterprises with educational organizations, the following measures seem appropriate:

1. Development by government authorities of sectoral institutional mechanisms (for example, in the form of advisory bodies) to ensure regular dialogue between representatives of employers and educational organizations on issues of personnel training, information about cooperation opportunities, and replication of best cooperation practices.

2. Development of public-private partnership mechanisms, including the federal project “Professionalism” to provide a modern material and technical base for educational organizations, including training equipment.

3. Financing by government bodies of educational programs of additional education (including professional retraining and vocational training programs) with the participation of employers and educational organizations in in-demand specialties.

4. Ensuring remuneration for the teaching staff of educational organizations at a competitive level for the wider involvement of practicing specialists in the educational process and ensuring a high level of teaching.

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Algorithm for Overcoming the Monoprofile of the Arctic City: The Case of Norilsk

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Abstract. The research question of the article — identifying ways to overcome the single-industry nature of the city of Norilsk — have been concretized by solving the following tasks: to substantiate the "specificness" of Norilsk among the largest Arctic cities of Russia; to determine the role of the agglomeration effect in strengthening the support of Norilsk for the projects of Taimyr and the entire Eastern Arctic; to determine the potential of Norilsk Nickel's service structures and urban entrepreneurship for new mining and infrastructure projects in the Eastern Arctic; propose mechanisms for implementing the Norilsk Support Strategy. The methodological base of the study was formed by the concepts of technological modes, development blocking of old-industrial / mono-industrial territories and supportive settlements. Main results: Norilsk is the most specific among the largest Arctic cities of Russia according to the composite index, made up of nine key demographic, economic, socio-cultural indicators. Non-standard approaches are needed to diversify its economy. The agglomeration effect can constructively contribute to Norilsk's transformation from a single-industry city into a base city for the development of the Eastern Arctic. The most important areas of structural transformation of Norilsk's economy include strengthening the practice-orientation and geographical expansion of consumers of services of the local scientific and educational complex; establishment of an entrepreneurial layer in new industries and types of production activities; and entry of the city's entrepreneurship together with the plant's service structures into the market of projects and settlements in the Eastern Arctic. The main mechanisms for the implementation of the Norilsk Strategy are: "mirror" actions in the eastern Arctic of the city and the Norilsk Nickel combine; transformation of Norilsk into a center for the provision of security services for the territories of the eastern Arctic; a center of formation of the Arctic cruise tourism from Dudinka to Anadyr; a center for accumulating best practices of renovation of the Arctic housing and communal services for their replication in the cities and towns of the Eastern Arctic. Recognition of Norilsk's success in becoming a base city in the Eastern Arctic will be an increase in its administrative status: transformation into a city of federal significance.

Keywords: *monoprofile city, core city, transformation, Arctic agglomeration effect, composite index of specificity, structural shifts in the urban economy, Norilsk, the center of development of the Eastern Arctic*

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Introduction

For almost a century, the dynamics of the economic development of the city of Norilsk, its attractiveness to migrants and the tone of its social development have been depended on the city-forming enterprise Norilsk Nickel. The new realities of large-scale development of Taimyr, the rise of the Asian Arctic, where the main new projects of the Arctic zone of the Russian Federation will be launched in the coming decades, put forward the strategic task of radical diversification of the city's economy, expansion and "extension" of its basic functions for the neighboring eastern Arctic territories. This should become a new driver for the development of Norilsk. The relevance of precisely this large-scale task is dictated by federal, Arctic (zonal), regional and local arguments.

Due to Western sanctions, Russia is turning to the Asia-Pacific countries. The country urgently needs cities that can become a state "anchor" for such a turn in the Arctic, along the NSR route — like container warehouses, logistics bases, reliable transit supply bases. The city of Norilsk, the port of Dudinka, and the Alykel airport are capable of fulfilling these tasks with a clear state policy in this matter and careful depressurization of their former corporate mono-profile.

In the context of the geopolitical rise in the significance of the Russian Arctic, it is important for the country to have an independent and economically strong outpost city not in the European, but in the eastern, Asian, part: the Western sanctions increase the need for internal consolidation of the few small elements of the settlement of the eastern Arctic. Norilsk could potentially act as such a "collector" of qualified personnel, a technological, production service center for the neighboring regions of the Republic of Sakha (Yakutia) and the Chukotka Autonomous Okrug [1].

The Taimyr Peninsula is already becoming a platform for the implementation of new projects by a dozen Russian resource corporations. It would be wasteful to miss the opportunity to provide their basic "equipment" to the nearest and largest city in the eastern Arctic. The country simply does not have another such large city in the eastern Arctic as Norilsk, or such a large port for supplying Asian Arctic projects as Dudinka. Dudinka could take over from Murmansk the functions of delivering social goods for the eastern Arctic according to the long-existing "Yenisei–NSR" scheme (this can be seen as a revival of the idea and practice of "Kara expeditions" of the early 20th century).

The focus on mono-industry in the context of deep technological changes in the city-forming enterprise itself seems to be used up for the city and threatens a further significant reduction in the population. Statistics confirm that in recent years there has been a reduction in the number of workers in manufacturing (that is, metallurgical) industries — the main ones for the company.

[1] Strategiya sotsial'no-ekonomicheskogo razvitiya munitsipal'nogo obrazovaniya gorod Noril'sk do 2035 goda kak opornogo goroda Arktiki (vostochnoy Arktiki). Utverzhdena resheniem Noril'skogo gorodskogo Soveta deputatov ot 20 iyunya 2023 goda № 8/6–193 [Strategy for the socio-economic development of the municipality of Norilsk until 2035 as a supporting city of the Arctic (Eastern Arctic). Approved by decision of the Norilsk City Council of Deputies dated June 20, 2023 No. 8/6–193]. URL: https://norilsk.ru/files/50741/83786/strategiya_2035.pdf (accessed 08 August 2023).

The introduction of artificial intelligence technologies at the Norilsk plant (the "Technical breakthrough 2.0" program, implemented in the "Industry 4.0" ideology, the creation of digital twins of real production processes, "Sulfur program 2.0", etc.) means, in the long term, a transition to unmanned, fully automated production. For example, by 2025, ore mining at the Glubokaya mine of the Skalistyy mine at a depth of 2–2.5 km will already be carried out in the most autonomous mode.

For the city, this means the need to look for new opportunities for economic self-realization. It is impossible to attract and retain talents without a new challenge project. Qualified personnel and talents clearly determine the type of dynamics of the future development of Norilsk [2].

This new urban development project for Norilsk should be aimed at turning it (together with Dudinka and Alykel) into a supporting city for the development of the eastern Arctic and transit routes to the countries of the Asia-Pacific region. In Soviet times, the city already partially fulfilled these functions: it was a natural laboratory for developing new methods of pile construction on permafrost, growing crops in the Arctic, testing equipment in extreme natural conditions, etc. [3] It is a question of returning to these tasks in an intensified mode, taking into account the shift of investors' attention to the Eastern Arctic and the new geopolitical situation (primarily the closing of traditional European markets for the natural resources of the Russian Arctic).

The object of the study was the single-industry city of Norilsk as the most specific one in the Russian and world Arctic, the largest center of Russia in the eastern Arctic. The subject of the study was the key, closely interconnected factors of overcoming mono-industry — the transformation of Norilsk into a base for the development of the Eastern Arctic and raising its status to a city of federal significance.

The purpose of the study was to determine the algorithm (specific actions) for overcoming the modern single-industry nature of Norilsk (through a new support and a new status). It determined the necessity of solving four research tasks:

- to justify the "specialness" of Norilsk among other major Arctic cities of Russia as a prerequisite for the subsequent proposal of extraordinary actions to dynamize the development of the city;
- to characterize the specifics of the agglomeration effect in the Arctic conditions and determine its specific role in strengthening the support of Norilsk in performing basic functions for new projects in neighboring Taimyr and the entire eastern Arctic;
- to determine the potential of the service structures of Norilsk Nickel and city universities as factors in the "supply" of production services for new mining and infrastructure projects in the eastern Arctic;

[2] Ibid.
[3] Pilyasov A.N. Noril'sk mozhet stat' stolitsey vsey aziatskoy Arktiki [Norilsk can become the capital of the entire Asian Arctic]. Interview. Newspaper "Oxygen.Life". February 24, 2021. URL: https://kislorod.life/opinions/norilsk_mozhet_stat_stolitsey_vsey_aziatskoy_arktiki/ (accessed 01 July 2023).

- to propose the main mechanisms for implementing the Norilsk as the Basic City Strategy through: a) radical expansion of the basicity area from Taimyr to the eastern Arctic; b) unified strategy for the actions of the city and the plant in the eastern Arctic; c) obtaining the status of a city of federal significance.

The author's background for this study includes several previously published works and interviews [4] on the problems of modern development of single-industry towns, including Norilsk [1–2]. The novelty of this work lies in the consideration of the particular problem of diversifying the economy of Norilsk in the global context of the formation of new geopolitical and geo-economic alliances in Asia and the expected changes in the Asian Arctic associated with the implementation of a significant number of new mining projects there. Another new aspect that deepens previous ideas is associated with the development of a specific algorithm of actions (events) for the transformation of Norilsk from a single-industry city to a base city, compatible with the existing Russian management practices and traditions. For the first time, a specificity index was developed, which made it possible to compare the largest cities in the Russian Arctic according to this criterion.

The information basis of the work was, firstly, the materials from municipal regulatory legal acts, primarily key strategic planning documents — the Plan for the modernization of the single-industry city of Norilsk (approved by Resolution of the Administration of the city of Norilsk, Krasnoyarsk Krai dated January 10, 2014 N 01 (as amended by the Resolution of the Administration of the city of Norilsk, Krasnoyarsk Krai dated November 7, 2017 N 501); Strategy for the socio-economic development of the municipal formation of the city of Norilsk until 2030 (approved by the decision of the Norilsk City Council of Deputies dated December 18, 2018 No. 10/5-229); 25 current municipal programs of the city of Norilsk ; secondly, municipal statistics data for the largest Arctic cities of Russia; thirdly, personal interviews with experts and leaders of the city of Norilsk, which the author has conducted over the past 30 years, first as Head of the Arctic Department of the State Committee for the North of Russia, then as Director of the Centre of the Economy of the North and Arctic, Council for the Study of Productive Forces, in recent years — as General Director of the ANO Institute of Regional Consulting.

Methodology and research methods

The theoretical and methodological basis for developing ways to diversify the economy of the single-industry city of Norilsk are three research trends that have been actively developing in recent decades in world social science. The first trend is work on technological structures in line with the integrated paradigm of Kondratiev–Perez–Glazyev [3–5], which give an idea of the general philosophy of the economy of the new technological era of the fifth and sixth Kondratiev (development of robotics and sensors, nanotechnology, artificial intelligence systems, Internet of things, virtual or augmented reality of digital twins, unmanned vehicles, additive technologies,

[4] Pilyasov A.N. Noril'sk mozhet stat' stolitsey vsey aziatskoy Arktiki [Norilsk can become the capital of the entire Asian Arctic]. Interview. Newspaper "Oxygen.Life". February 24, 2021. URL: https://kislorod.life/opinions/norilsk_mozhet_stat_stolitsey_vsey_aziatskoy_arktiki/ (accessed 01 July 2023).

wireless communication technologies, global information networks, integrated high-speed transport systems, etc.). On the one hand, these technological trends reduce the social, value and partly economic significance of the city-forming enterprise; on the other hand, they give the single-industry city of Norilsk a chance to effectively perform the functions of a "support" in Taimyr and in the eastern Arctic as a whole — as a "capital" city, a center of interregional influence.

The modern strength of the city is ensured by innovation, technology, and the quality of human capital, for which Norilsk has a higher potential than neighboring Arctic cities. Previously, it was accumulated in the interests of the city-forming enterprise, and now the task is to deploy it for the successful implementation of the city's basic functions.

The second research trend is associated with identifying the main barriers to the economic diversification of a single-industry city in the form of an idea of three blocks to new development: cognitive, functional, political lock-ins [6–8]. Norilsk is a textbook case of how the decades-old "track" shapes the cognitive (inertial ideas about development opportunities only within the framework of an already established economic specialization), functional (inviolability of the contracting of the city-forming corporate structure with the main economic partners) and political ("merger" of the management of the city-forming enterprises and of a single-industry city) lock-ins to development [2]. Norilsk Nickel still accounts for about 95% of industrial production and 80% of the city's gross municipal product as it was 30, 50 years ago. As the period of development uninterrupted by disasters increases, the shortage of ideas about alternatives to the once chosen path of development inevitably increases, and doubts about the advisability of an alternative search if the current situation is favorable and sufficiently stable grow [2].

The third research trend is related to the concept of support settlements. The concept reflects the extreme unevenness of spatial development, which is usually characteristic in the first phases of the deployment of a new technological structure (in our case, associated with artificial intelligence). Similarly, support settlements were spoken about at the dawn of the formation of an industrial structure in the Far North of the USSR a hundred years ago. Subsequently, when a new technological structure conquers the main economic spaces of the country and spatial development becomes more uniform, the concept of "support" dies out [5].

For the first time (or in one of the first federal regulatory legal documents) the concept of support [6] was used in the Spatial development strategy of the Russian Federation for the period

[5] Strategiya sotsial'no-ekonomicheskogo razvitiya munitsipal'nogo obrazovaniya gorod Noril'sk do 2035 goda kak opornogo goroda Arktiki (vostochnoy Arktiki). Utverzhdena resheniem Noril'skogo gorodskogo Soveta deputatov ot 20 iyunya 2023 goda № 8/6–193 [Strategy for the socio-economic development of the municipal formation of Norilsk until 2035 as a supporting city of the Arctic (Eastern Arctic). Approved by decision of the Norilsk City Council of Deputies dated June 20, 2023 No. 8/6–193]. URL: https://norilsk.ru/files/50741/83786/strategiya_2035.pdf (accessed 08 August 2023).

[6] "Support settlement" is a settlement on the basis of which accelerated development of social, transport and engineering infrastructure is provided to ensure the implementation of guarantees in the field of education, access to medical care, cultural services and the fulfilment of other needs of the population of the territories of one or more municipalities. It is envisaged that these anchor settlements will ensure "advanced development of territories with a

until 2025 (Order of the Government of the Russian Federation dated February 13, 2019 N 207-r; as amended by the orders of the Government of the Russian Federation dated 08/31/2019 N 1945-r, dated 03/23/2021 N 719-r, dated 12/16/2021 N 3633-r, dated 06/25/2022 N 1704-r, dated 09/30/2022 N 2877-r). In the last year, a special study on the supporting cities and towns of the Arctic was conducted [9]. In this study, Norilsk is defined as simultaneously possessing five support functions: a center for supporting the mining industry, a transport and logistics support settlement, a center for innovation and information support, a center for socio-cultural support of the population and an internal security support settlement.

Our difference in understanding the Norilsk support from the authors of this work consists of two aspects. Firstly, we do not consider the Norilsk support per se, but as a favorable condition, as a basis for further diversification of its economy through a set of new "core" types of economic activities that can be provided to surrounding territories (settlements and municipal areas) and detailed specialization cities in already existing support functions. Secondly, we put forward the task of significant geographical expansion of the Norilsk support base: the provision of production, transport and social services not only for the surrounding territory, but for the entire Taimyr region as a territory of pioneer development, to the eastern Arctic (Arctic uluses of Yakutia and the Chukotka Autonomous Okrug) — we see the process of gradual development of the local support of Norilsk into a zonal one for the entire eastern Arctic.

Main results

1. The most special city of the Russian Arctic

Norilsk is undoubtedly the most special city in the Russian, and perhaps, the global Arctic. The exaggerated specificity is a consequence of the unique wealth of the local mineral resource base, which made it possible to mine ore from the surrounding Norilsk deposits for almost a century, preserving the location of the city's core; extreme climatic conditions (here one can recall the famous Norilsk "black blizzards"), which for decades were aggravated by regular emissions of sulfur from mining and metallurgical enterprises; enclave geographical location (extreme transport isolation from the main network of roads and railways of the country). In the 20th century, a special industrial region was created in Taimyr — an Arctic economic island with a monopoly departmental structure of the Norilsk Nickel plant (now, after corporatization, it is the oldest Arctic corporation in Russia) and the unique accumulated competencies of sedentary life in these uncomfortable conditions of three generations of workers.

Let us evaluate the degree of specificity of Norilsk in comparison with other largest cities in the Russian Arctic. To obtain reliable results, it is necessary to "compare the comparable", that is, to take the largest from the initial sample of Arctic cities, with a population of more than one hundred thousand people (as many urbanists believe, one hundred thousand inhabitants for an Arctic

low level of socio-economic development, which have their own potential for economic growth, as well as territories with low population density and projected increase in economic potential".

and northern city is a kind of threshold that differentiates settlements into centers of local and interregional (zonal) influence: Norilsk, Murmansk, Arkhangelsk, Severodvinsk, Novyy Urengoy, Noyabrsk. In this list, Murmansk and Arkhangelsk are the administrative capitals of the regions, four cities are single-industry (Severodvinsk is single-industry in military-industrial complex mechanical engineering, Norilsk — in mining and metallurgical production, Novyy Urengoy and Noyabrsk — in hydrocarbon production).

To assess the degree of specificity, we use the method of creating a composite latent indicator, which is often used by researchers when comparing countries, regions and cities of the world (one of the most famous examples is Richard Florida's composite index of creativity of countries) [10–11]. In accordance with this method, all indicators are converted into dimensionless indices (normalized) using the formula: Ri= (Xi-Xmin)/(Xmax-Xmin) or Ri= 1-((Xi-Xmin)/(Xmax-Xmin)), so that all cities line up from 0 (worst value) to 1 (best value).

Partial indices for the blocks "demography" (D), "economy" (E), "social sphere" (S) are calculated as the arithmetic average of their constituent indicators. The composite specificity index (CSI) is calculated as the arithmetic mean of the partial indicators.

Of the variety of indicators that can characterize the specificity of an Arctic city, it was decided to take the most accessible to the researcher, obvious in terms of the features they characterize and easy to use (that is, not aggregate). These turned out to be demographic, economic and social ones.

The first ones characterize the peculiarities of the local community of the city, first of all, the degree of its "productivity". It is known that cities in the Arctic emerged as administrative centers of state presence, or as resource, mining (production and transport) settlements. From the perspective of differences from "mainland" ones, the resource cities of the Arctic are special first of all.

The second ones reflect the economic profile of the city, in our case, answering the crucial question of whether the city is mono-profile or multifunctional (in the Arctic this means metropolitan). A single-industry city is also economically more specific due to the special problems that arise in its relationship with the city-forming enterprise.

The third ones characterize the state of the social sphere, and in a broad interpretation — the socio-psychological, socio-cultural state of the city. In the specific realities of an Arctic city, this means assessing the degree of "islandness" of the entire urban social system. The more insular it is, the more specific it should be recognized. Thus, our approach to assessing the specificity of an Arctic city implicitly means determining the degree of its remoteness from the standards of large cities in the temperate zone, which, on the contrary, are multidisciplinary, transport-equipped, organizationally and culturally diverse.

The demographic index was formed as the arithmetic mean of normalized indicators of population density, gender structure (ratio of men and women) and the share of the working-age population in the total population of the city (Table 1). The first characterizes the degree of com-

pactness or, conversely, dispersion of urban spaces. Our expectations are based on the fact that the Arctic city is an administrative center or, as a mono-resource city, has a feature versus the "mainland" city in the relatively easy capture of surrounding undeveloped spaces. It should therefore be generally less "dense" than a typical large temperate zone city. This is often empirically confirmed by the fact that Arctic cities sometimes have separate areas that are tens of kilometers away from the historical center (for example, Norilsk or Noyabrsk). In this regard, an Arctic city is all the more specific, the less densely populated it is internally.

The classic industrial and fishing Arctic demanded male labor in the main "life-sustaining" types of economic activity. Therefore, our expectations to see traces of these traditions in the gender structure of the largest Arctic cities are justified. The further an Arctic city is from its mainland "twin", the more masculine it should be. Therefore, the gender structure, the ratio of men and women in the local human population, is an important characteristic of preserved (or, conversely, lost) Arctic specificity.

The share of the working-age population similarly characterizes the extent to which city residents are connected to work: after all, it is well known that the natural extremes of the Arctic shape the life plans of many people to temporarily reside here during the work cycle (and upon its completion, to leave the North). Therefore, the more pragmatic the population structure is in terms of unambiguously linking urban residence with work, the more (other things being equal) it can be recognized as being Arctic-specific, that is, removed from mainland city standards (when there are many pensioners, disabled people, people unable to work due to more comfortable living conditions).

In terms of all demographic indicators, Norilsk has clear differences in comparison with other major Arctic cities of Russia (which, in turn, differ from major mainland cities): it has minimal urban population density; clear and rare for the Russian Arctic male dominance in the urban population; maximum share of the working-age population. Therefore, we can say that Norilsk has specificity squared.

The economic index was formed as the arithmetic mean of the normalized indicators of per capita investment, per capita industrial production and the number of enterprises per 1000 people (Table 1). The first characterizes the tone of economic development, activity in creating new and updating old fixed assets: all of them — corporate and budgetary investments in the city. There is nothing particularly Arctic in this phenomenon itself: both capital cities (for example, Moscow) and single-industry cities in the temperate zone can have either exceptionally high or low rates of per capita investment.

However, when comparing cities within the Arctic zone, new knowledge arises: which of them has that high economic tone, for the sake of which, in fact, Arctic cities exist in the Arctic zone: in conditions of high production and living costs, their justification is largely ensured by the tone the entire dynamics of economic development (otherwise why are they needed?). Therefore, dynamism can be considered that essential specificity of an Arctic city, which should set it apart

from the more “calm” cities of the temperate zone (however, it should be said that after a phase of dynamic development, Arctic cities can also experience periods of such depression and failure, up to closure, which are difficult to imagine for cities of similar size in the temperate zone).

The per capita volume of industrial production, which was obtained as a result of summing up Economic activity indicators — the volume of shipped goods of own production, work and services performed in-house for the extraction of minerals; manufacturing industries; provision of electrical energy, gas and steam, air conditioning; water supply, sanitation, organization of waste collection and disposal, pollution elimination activities — characterizes the degree of monoindustry of the city. In itself, it is not a purely Arctic specificity, but taken within a sample of Arctic cities, it certainly characterizes the peculiarity of the city as a purely production, single-industry (or, conversely, more administrative and service-oriented).

The latter indicator of the number of enterprises per 1000 people is an indicator of the organizational diversity of the city’s economic structure. Thus, it is not explicitly Arctic specific, but if we see the Arctic city as more “thin” in terms of institutional environment than a “mainland” city, then it turns out that the more uniform the organizational environment, the more the city is removed from the mainland standard with its typically diverse organizational, economic, and cultural environment (single-industry cities on the mainland are the exception rather than the rule in their general pool; for the Arctic, on the contrary, the presence of single-industry, mining cities is absolutely typical). Within the sample of Arctic cities, this indicator clearly stratifies them into two groups — single-industry ones, in which there is no organizational diversity and the indicator is minimal, and more diversified, in which the indicator is maximum.

The question may arise: why are the common indicators of the unemployment rate, per capita income, and industry structure not used in the assessment? All these indicators can be the result of different forces and not necessarily derived from Arctic specifics. We tried to select for evaluation only those that, in our opinion, pursue the idea of differences between an Arctic city and its mainland counterpart, assessing it in terms of its distance from the universal standard of a temperate zone city.

We believed that by choosing the criterion of remoteness from the mainland analogue, we would be able to find the most remote and less remote cities within the sample of the largest Arctic cities and to choose the most specific one (the most Arctic).

Norilsk is extreme in each of selected economic indicators: it has the highest indicators of per capita investment, industrial production volume, but minimal indicators of organizational diversity — the number of enterprises and organizations per 1000 people. That is, it appears as a strongly single-industry city compared to other Arctic cities; it has a single-industry specificity squared even in comparison with the gas capital of Russia — Novyy Urengoy.

The social index was formed as the arithmetic average of the number of doctors per 10.000 people, the number of hospital beds per 10.000 people and the city’s inclusion in areas with limited delivery times for goods (yes/no).

Let us explain the "strange" set of indicators for assessing the urban social system. Many years of experience in working with the public sector of Arctic cities has led to the conclusion that urban healthcare is the most specific area in which the differences between an Arctic city and a mainland city are greatest. In the Arctic city, the polyclinic model of medicine is usually reduced, on the other hand, the hospital model of medicine is more developed. There is always an acute shortage of qualified personnel, so the supply of labor resources is shifted to nurses, and there are fewer doctors (especially with a narrow specialization) compared to similar conditions on the mainland. Perhaps such Arctic specificity also exists in the education system, but it is much more difficult to identify it with superficial statistical indicators; it is recorded at a deeper level.

Therefore, from the viewpoint of diagnosing differences and Arctic characteristics, urban medicine is "more grateful" for the researcher than education or an even more unified culture. Hence our attention to the indicators of the provision of doctors (which are traditionally scarce in the Arctic) and beds (which characterize the dominant hospital rather than outpatient model of medical care here — small air ambulances take patients from remote areas directly to hospitals, and not to polyclinics).

The inclusion of an indicator of the city's transport accessibility in the block of social indicators —whether it belongs to areas with limited delivery times or not — seems completely unexpected. However, transport isolation is so pervasive in all aspects of the city's social and cultural life that the same resulting values of social indicators of Arctic cities on a year-round network and in an area with limited transport accessibility may in fact indicate completely different quality, forms, costs provision and delivery of social services in both cases.

Norilsk, even in this space of social indicators, turned out to be the most specific among the already specific cities of the Arctic (Table 1): it has the smallest number of doctors, and it is the only one of all the large cities of the Arctic that does not have year-round land connection with the "mainland".

Table 1

Comparison of the largest Arctic cities in Russia, as of January 1, 2022 [7]

	Norilsk	Murmansk	Arkhangelsk	Severodvinsk	Novyy Urengoy	Noyabrsk
Total population	*184.1*	*279.1*	*342.2*	*179.7*	*118.7*	*109.5*
D1. Population density, people/km^2	41.0	1 659.5	1 185.7	151.4	1 046.4	90.2
D2. Share of women per 1000 men	984	1 169	1 242	1 134	1 015	1 062

[7] Sources for calculation: Regiony Rossii. Osnovnye sotsial'no-ekonomicheskie pokazateli gorodov. 2022. Noril'sk-2022. Slagaemye byudzheta [Regions of Russia. Basic socio-economic indicators of cities. 2022. Norilsk-2022. Components of the budget]. URL: https://xn--h1aecgfmj1g.xn--p1ai/files/40634/179803/1_osn_svedeniy.pdf (accessed 03 July 2023); Itogi sotsial'no-ekonomicheskogo razvitiya munitsipal'nogo obrazovaniya gorod Noril'sk za 2022 god [Results of the socio-economic development of the municipality of Norilsk for 2022]. URL: https://norilsk.ru/files/22661/33155/itogi_2022.pdf (accessed 03 July 2023).

D3. Share of working-age population, %	68.5	59.9	60.4	57.2	66.2	64.1
Private index of D-specificity	*1*	*0.174*	*0.192*	*0.450*	*0.685*	*0.760*
E1. Per capita investment in fixed capital (in actual prices), thous. rub.	832.2	328.2	90.0	59.0	457.5	118.7
E2. Per capita volume of industrial production, thous. rub.	4912	707.9	222.2	56.4	865.0	346.3
E3. Number of enterprises and organizations per 1000 people	10.9	31.2	27.3	13.2	21.1	11.3
Private index of E-specificity	*1*	*0.161*	*0.089*	*0.296*	*0.393*	*0.372*
C1. Number of doctors per 10.000 people	40.8	73.4	86.1	64.2	57.7	68.5
C2. Number of beds in 24-hour hospitals per 10.000 people	65.3	122.3	96.7	82.5	63.3	68.1
C3. Area with limited delivery times for cargo: yes / no	1	0	0	0	0	0
Private index of C-specificity	*0.989*	*0.093*	*0.145*	*0.386*	*0.542*	*0.436*
Composite specificity index (CSI)	0.996	0.143	0.142	0.377	0.540	0.523

It is not surprising that according to the composite specificity index (CSI), Norilsk turned out to be the most special among the largest cities in the Arctic, leaving the second city in this ranking, Novyy Urengoy, far behind. The entire city, as an economic island with a monopoly corporate structure, can be considered a “specific asset” [12]. Hence, it inevitably follows that the solutions to diversify its economy and depressurize its mono-industry should be sought for piecemeal, individual, special — non-routine ones.

2. Arctic agglomeration effect and how it can be used to overcome the single-industry nature of Norilsk

For Norilsk, a conceptual understanding of the Arctic features of the manifestation of the agglomeration effect is of practical importance, because it determines to what extent and how this effect can be used for transformation from a single-industry city to a supporting one, the basis for the development of Taimyr and the entire eastern Arctic.

Traditionally, the agglomeration effect is associated with the activities of cities, especially large ones [8], in which the environment of high population density and economic entities creates favorable preconditions for the maximum emancipation of its power. The first (classical) work on the agglomeration effect appeared in 1961 [13], but only since the 1990s there has been a revolution in research interest in the agglomeration effect and related issues of geographic concentration of economic activity [14–17], which revealed the sources of increasing returns for the economy (when a single increase in factors of production in an environment of dense communication and economic interaction of economic actors provides the snowball effect — a multiple greater increase in the results of output volumes, production, gross product).

However, numerous "classical" studies of agglomeration and agglomeration effect neglect geography and history: they do not take into account the factors of changing latitudinal zonality and evolution of technological structures in cities — agglomeration centers. It is reasonable to understand urban agglomeration not as a static state, but as a spatio-temporal process that is associated with the action of internal and external forces.

What does this mean for large Arctic cities — agglomeration centers? They should be considered, certainly recognizing their significant differences from the cities of the temperate zone on the one hand, on the other hand, in the context of their transition from the fourth to the fifth technological order, based on information technology, artificial intelligence and the Internet of things.

What are the Arctic specifics of the agglomeration effect?

- The ultra-low overall economic and settlement density of the Arctic zone of the Russian Federation determines the special role and significance of a few high-density enclaves, densely populated land plots housing large cities — new centers of intellectual wealth in the Arctic (along with long-known mining centers of resource wealth). It is quite possible that the comparative importance of such large urban centers with a population of one hundred thousand for the Arctic is higher than cities with a population of one million for their temperate zone. In the case of the Arctic, not only constant, year-round, but even temporary high density is important, for example, in a single-industry city during periods of intensive pioneering development of a "feeding" field, or during major events of an international, national or interregional/zonal nature.
- The inseparable unity of economic activity and transport infrastructure in the Arctic (especially strong at the stage of pioneer economic development) means for an urban agglomeration the presence of two fundamentally different situations: a) agglomeration on a year-round land network; b) agglomeration located in areas with limited delivery times. In the first one, agglomeration effects unfold close to the diagram of the

[8] The canonical definition is that the agglomeration effect is associated with the existence of cities of over 100 thousand people, which have satellite cities within an hour's accessibility (usually up to one hundred kilometers).

Christaller hierarchy of service centers; in the second — to the scheme of supporting base cities, first described by the famous Soviet northern expert S.V. Slavin.

- Strong corporate influence on large Arctic cities: resource corporations — on mining monotowns of the Arctic; state corporations Rosatom, the Ministry of Defense, the Ministry of Emergency Situations — on large administrative centers and regional capitals. In the Arctic conditions, not only classical large administrative or service centers can produce an agglomeration effect, but also resource centers — in this case it has a "corporate" genesis.

Thus, the Arctic agglomeration effect has a year-round and temporary, seasonal or event-based manifestation; in its strength of manifestation, it acutely depends on the specific forms of coupling of economic and transport and logistics functions (all functions are connected in one city, the functions of production activities and sea/river/air transport support are carried out in neighboring cities; whether the center of the urban agglomeration itself is located on a year-round ground network or in areas with limited delivery times); on the strength of the structure-forming corporate framework and the form of partnership of the city authorities with it.

What is the specificity of the agglomeration effect at the stage of transition from the third or fourth Kondratiev to the fifth or sixth? In the industrial era, the pioneering development of the Arctic and the North took place areally, spatially, with the simultaneous formation of large mineral resource centers, regional energy and transport infrastructure. The unity of technologically linked mining and infrastructure production is called territorial-production (district inter-industry) complexes. The regional effect obtained from the "fresh" large West Siberian oil and gas fields, when their large-scale development involved the simultaneous deployment of production, energy and transport facilities linked into systemic unity in a large areal (district) complex, ensured the profitability of the entire West Siberian oil and gas project. As for the agglomeration, large-city effect, it was in the third or fourth technological order in the North and the Arctic, in the shadow of the regional one.

But everything changed during the transition to the fifth Kondratiev, when large cities, including in the Arctic, began to be understood as "innovation machines" [18], that is, places where talent is concentrated, new knowledge is developed, experience and best practices are exchanged through ultra-dense communication [9].

Unlike the regional one, the agglomeration effect operates at an "arm's length" distance, that is, 100, up to 150 km (the regional one can involve economic entities at a distance of up to several hundred km into its orbit). It is not surprising that, simultaneously with the agglomeration effect, the topic of economic clusters was developed in research as a network of collaborating companies localized in the "near-circuit" (city, single labor market, district), linked to the local sci-

[9] Therefore, the strength of the agglomeration effect can be measured not only by the volume of the consumer market of the central city and its nearby satellites, but also by the products of innovative activity, for example, the number of patents per thousand inhabitants.

entific and educational complex and the structural divisions of the local government that supports them. It was at the fifth stage of Kondratiev that the “close” and seemingly complementary and reinforcing each other agglomeration and cluster effects moved into the main research agenda of spatial effects, and the regional effect was pushed into the “shadow” of scientific discussion in the economy of the Russian and Arctic regions. This is also due to the fact that the innovative activity, on which the technologies of the fifth Kondratiev are based, is over-concentrated in space by its nature (compared to the industrial activity of the third and fourth Kondratiev).

The author received confirmation that the agglomeration effect in the Arctic is not a speculative construct, but a reality, when leading the development of the strategy of three neighboring Yamal cities — Noyabrsk as the center of an urban agglomeration with a population of one hundred thousand, Muravlenko as a satellite city of Noyabrsk, and Gubkinskiy as a city too geographically remote from Noyabrsk to fall under its agglomeration effect. The result of the comparison of the “satellite” Muravlenko and the “non-satellite” Gubkinskiy was the statement of major differences in the economic behavior of the city authorities (you have a “big brother” or you are the “real owner of your small ranch”), the structure of the types of economic activities of small businesses in both cities and different quality and workload of the cultural sphere, in particular, local history museums [19].

As previously noted, Arctic urban agglomerations are internally heterogeneous and can be divided into several types:

- a) Christaller (overland), when a city-administrative or resource center provides a range of services for nearby smaller urban settlements, with which it is connected by intensive production, transport, logistics and socio-cultural ties. In this case, the city-agglomeration center concentrates the functions of an economic and multimodal (airport, railway station, river port, bus station) center. Such an agglomeration center of the quasichristaller “continental” type is, for example, Noyabrsk.
- b) The overland situation is also much more specific, when either the agglomeration center, or its satellites, or all of them together are located in areas without a year-round land transport network: b1 — Novyy Urengoy as a city-centre is itself located on a year-round transport network, but the numerous settlements of shift workers around it are located in areas with limited delivery time. There is an “air agglomeration”: the Novyy Urengoy airport serves as a base for all mono-resource satellite villages around; b2 — Norilsk and its satellite cities are all located outside the year-round ground transport network, but inside the Norilsk industrial area they are united by an “island” road network. The presence of large cities such as Yakutsk, Norilsk, located outside the year-round transport network, but at the same time serving as the center of an agglomeration of cities “off-road”, is the strongest Russian specificity [20]. Indeed, all over the world, including in the Arctic countries, the existence of the agglomeration effect is strictly linked to the presence of a permanent transport network between the center of

the agglomeration and satellite cities. However, in the Russian Arctic, the agglomeration effect works both in the case when the center itself is on a year-round network, but its satellites are not (Novyy Urengoy), and when both the center and satellite cities are not on a year-round surface national road network, but are connected by an "island" highway (Norilsk–Dudinka–Alykel).

- c) The maritime Arctic factor introduces the most important feature in the form of the abolition of the Christaller hierarchy — all Arctic centers of urban agglomerations located at sea, like global cities, are included in the pan-Arctic network, and size does not matter here and does not determine their place in the hierarchy — they are like sea outposts countries, of equal value. These are Murmansk and Arkhangelsk, which are located on the sea coast, have seaports and at the same time serve as city centers for the agglomeration network (Murmansk — Kola, Severomorsk, Gadzhievo, Murmashi; Arkhangelsk — Severodvinsk, Novodvinsk, etc.).

In this classification of Arctic agglomerations, Norilsk occupies a very special place, because it combines features of all types at the same time: it has features of a "land" hierarchical agglomeration, as well as features of a sea agglomeration (due to its inclusion in the agglomeration network of a river/sea port Dudinka); features of a large administrative center of a vast territory: Norilsk — the territory of the Norilsk industrial district, Dudinka — the Taimyr municipal district; features of an "air agglomeration" (due to the patronage of Snezhnogorsk, which is part of the city, but is connected with it only by air); common features of "roadless" agglomeration centers located in areas with limited delivery time.

Instead of the usual multifunctional city-center of an agglomeration, as in areas with year-round land communications and dense settlement of the temperate zone, in the case of the Norilsk industrial district, a "distributed" agglomeration of a polycentric structure arises from one production (Norilsk) and two transport and logistics centers (Dudinka, Alykel). Norilsk is the main production center, Dudinka is the main sea/river port gate of Norilsk to the Yenisei and the Northern Sea Route, the village of Alykel is the air gate of Norilsk.

Why does this separation occur? The first reason is the location of the mining center — a single-industry city in an area with limited delivery time, which means impossibility to rely on a network of land roads and dependence of such a single-industry city on water and/or air transport. As a comparison of Norilsk, an isolated island, with other largest cities in the Arctic, which are located on the all-Russian network of roads and railways, shows, it is in the first case that there is a clear spatial separation of production and transport functions across several cities (in the second case, the functions are consolidated in one city).

But why couldn't an airport be built in Norilsk and seasonal water delivery of goods be organized? This is where the geographical factor comes into play. As a rule, Arctic mining operations created in the industrial model were based in single-industry towns in areas with mountainous terrain (which is absolutely natural), near natural resource deposits. Water ports associated with

large rivers or sea deltas will require a different landscape and relief. Likewise, airports require vast valleys for modern large transport and passenger aircraft to take off and land. Different requirements for the relief of mining production and transport hubs in the conditions of tightly integrated "industrial and transport" development of the North inevitably cause spatial dispersion of the mining center in the mountains, the airport on the plain and the sea/river port in the valley or on the coast.

Therefore, in areas with limited terms of cargo delivery, single-industry mining cities inevitably had to exist in the vicinity of river port cities and towns (villages) with airports (for small aviation, which serves small single-industry villages, this pattern does not apply — the airport can be located in the very village).

Our fellow researchers of the supporting settlements of the Russian Arctic note that the Arctic zone is often characterized by the phenomenon of "spreading" the most important functions of the city (primarily production, transport and logistics) over several neighboring settlements [9]. In this case, there is a rejection of the Christaller hierarchical lattice of multifunctional central places and a transition to a local network of centers specialized in a particular function. However, this is true only in the specific circumstances of mining development in the era of the third Kondratiev.

For the "plain" oil and gas economic development, which followed the mining industry in the next wave in the 1960–1970s, already in the fourth Kondratiev, these patterns do not work (the landscapes of mining production and transport logistics coincide here — one city is able to perform all functions at once): significant volumes of export demanded the creation of an initially year-round transport network — all large single-industry towns created in that period, as a rule, had a year-round operating supporting railway and highway.

Only Norilsk can be called a canonical Arctic agglomeration out of all the listed ones (Table 2):

- the city is located in an area with limited delivery time,
- resource (production) profile,
- production and transport functions are dispersed across three cities: Norilsk, Dudinka, Alykel (Fig. 1).

Table 2

Comparative analysis of the largest Arctic cities

	Norilsk	Murmansk	Arkhangelsk	Severodvinsk	Novyy Urengoy	Noyabrsk
It is an agglomeration center	Yes	Yes	Yes	No, it is part of the Arkhangelsk agglomeration	Yes	Yes
Located in an area with limited delivery	Yes	No	No	No	No	No

time/no year-round road net-work that connects to the mainland						
Year-round railway inte-grated into the national network	No	Yes	Yes	Yes	Yes	Yes
Specializatio n	Single-industry (mining)	Administrative center	Administrative center	Single-industry (processing)	Single-industry (mining)	Single-industry (mining)
City-airport distance	39 km	33 km	14 km	38 km	7 km	19 km
City-sea/river port distance	91 km	In the city	In the city	In the city	No port	No port

Fig. 1. Spatial structure of the Norilsk agglomeration [10].

The Norilsk agglomeration in its current form emerged, one could say, by accident: in the current rotational model of mining development, the center cannot grow to the size of an administrative center. This was the result, on the one hand, of the Soviet industrial model of development of the North, which in the third Kondratiev was aimed at populating uninhabited spaces with stationary cities and towns; on the other hand, the super-richness of the Norilsk deposits, which made it possible to shift mining sites over the course of a hundred years, but not radically change the location of the city itself, preserving it without radical compression and turning it into a rotational city. There were deposits of energy and life-sustaining resources next to the unique Norilsk multicomponent ores — first, Taimyr coal was used, then, from the 1960s, the resources of the gas fields of Western Taimyr. This made it possible to relatively easily solve the most important issue of heat and power supply for a large Arctic city. The Norilsk agglomeration took shape from the very first decades of development of the Norilsk industrial area, however, the nature and intensity of connections between the structural elements of this agglomeration certainly changed over time.

[10] Source: Google Earth.

The agglomeration effect can work on the modern transformation of Norilsk from a single-industry city to a base city for the development of the Eastern Arctic. This requires systemic efforts from all structural elements of the Norilsk agglomeration — Norilsk itself (see section 3), the seaport of Dudinka and Alykel airport, transforming them from purely corporate into basic ones for Russia's development of its eastern Arctic.

The turn of Norilsk from a single-industry into the central city of the eastern Arctic is impossible without a simultaneous turn of the port of Dudinka to a broader specialization in servicing the cargo of "new Kara expeditions", and more broadly speaking, commercial and social cargo flowing from the trans-Siberian depths of Siberia along the Yenisei in the direction of the eastern Arctic. Today, the Murmansk–Anadyr–Vanino route, which dominates in terms of cargo traffic in the maritime Arctic, should be diversified by the Yenisei–NSR route.

In Dudinka, it is advisable to create an eastern transport and logistics hub for warehousing and transshipment of transit container cargo, internal cabotage, including budgetary cargo, formation of maritime service complex companies that carry out repairs, supplies and bunkering of ships, and in the future — construction of a new shipyard in Dudinka, using the competencies of Norilsk engineers.

Another event is the inclusion of Alykel airport in the core aviation transport network of Siberia and the Far East with a radical expansion of the geography of flights through the airport inside Taimyr, to neighboring Yakutia and the Chukotka Autonomous Okrug, the establishment of a charter flight Norilsk–Tiksi–Pevek (Keperveem)–Anadyr, which will be co-financed by all participating regions. After all, in the entire space up to Anadyr, there is simply no airport of similar scale capable of performing the functions of air communication integration. NK Rosneft and MMC Norilsk Nickel have already agreed on the joint use of airport infrastructure, on the creation of a new service center to service rotational personnel and aviation equipment for the Rosneft Vostok Oil project (the air route of the Norilsk–Dikson–Bay North project is already operating). In the near future, a change in the airport's operating hours and a transition to a 24-hour format is being considered, which will expand the reception time for aircraft [11]. But we should talk about an even greater expansion of the service functions of the Alykel airport and the Dudinka seaport in the interests of liberating the forces of the agglomeration effect to transform Norilsk into the base city for the development of the Eastern Arctic.

3. Structural shifts within the city's economy to consolidate the role of Norilsk as a supporting (base) city of the Eastern Arctic

Effective performance of the functions of a support base for the development of the Eastern Arctic, which is associated with overcoming the modern single-industry status of Norilsk, will require deep structural changes in the city's economy that are in line with the fifth technological

[11] Rabotu aeroporta Noril'ska planiruyut sdelat' kruglosutochnoy [It is planned to operate the Norilsk airport around the clock]. URL: https://tass.ru/ekonomika/18230315 (accessed 08 August 2023).

order: increasing the role of knowledge-intensive production services, areas of application of artificial intelligence and the Internet of things, digitalization of municipal management processes and etc. The unity of transformations of external, agglomeration connections (see section 2) and internal connections in the city economy itself ensures the success of the strategy of gaining "centrality" for Norilsk.

The first direction is strengthening and increasing practice orientation in the work of the city scientific and educational complex (city innovation system), the core of which is the N.M. Fedorovsky Polar University. Norilsk is the only city in the eastern Arctic that has its own university, not a branch. Therefore, the concentration of Arctic engineering competences, design and construction in the conditions of "melting" permafrost, and monitoring of the condition of buildings and structures in the warming Arctic [12] is non-alternative.

However, it would be wrong to reduce its entire long-term development only to the development and implementation of engineering and technical solutions that ensure the sustainable functioning of social and engineering infrastructure facilities in the context of climate change. The development strategy of the Polar State University until 2035 should be extremely ambitious and firmly aligned with the priorities of turning Norilsk into a supporting city of the Eastern Arctic, that is, with solving the problems of modern life support for Arctic settlements, organizing production services for resource companies operating in this territory (in Taimyr, Evenkia, Yakutia and Chukotka), Arctic cruise tourism projects, etc. The following scheme is considered: the accumulation of Arctic competencies at the university, the selection of the most advanced and effective, their replication in the settlements of the Eastern Arctic.

The second direction of the structural transformation of the city economy, which strengthens the basic functions of Norilsk, is the formation of an entrepreneurial layer in new industries and types of economic activity. According to formal indicators of entrepreneurship development, the city occupies the last position among large and medium-sized cities in the Russian Arctic. However, the point is not even a lag in the level of development of entrepreneurship, but the fact that trade entrepreneurship dominates among small and medium-sized businesses, and for the purposes of supporting Norilsk, more production entrepreneurship and firms in the industrial segment are needed. For example, the creation in Norilsk, with the participation of Rosgeologia, of a private junior mining business for prospecting and exploration of new mineral deposits in Taimyr, Evenkia, and the eastern Arctic.

Such a large industrial center as Norilsk, with engineering competencies accumulated over decades, will not be able to establish its stronghold without the formation of a layer of small and medium-sized manufacturing industries in new areas, for example, the environmental industry:

[12] The task of creating a research center for construction technologies and monitoring the condition of buildings and structures in the northern and Arctic territories in Norilsk is set in the Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035 (as amended by the Decree of the President of the Russian Federation dated December 11, 2021 No. 651). We believe that it is advisable to create it under the auspices of the Polar State University.

enterprises for processing scrap metal, old tires, production of building materials with adding sulfur (for example, sulfur concrete), building blocks, production of energy-saving equipment, etc.

The third direction of the structural transformation of the city economy is the entrance of the production service structures, which are located inside the Norilsk Nickel plant, together with Norilsk entrepreneurs, to the wider market of Taimyr and its new projects, the entire eastern Arctic.

For example, several large projects for new economic development will be implemented in Taimyr until 2035 (Fig. 2): the project for the development of the Chernogorskoe platinoid deposit of Russian Platinum, the northern part of the Vankor oil cluster of Rosneft (the Ust-Yenisei oil production center of the Independent Oil and Gas Company), a project for the development of the Syradasay coal deposit AEON, exploration work with the potential for transition to the economic activity of NovaTEK, Gazpromneft, Surgutneftegaz and Lukoil [13]. At least a dozen new projects will be launched in the forecast period in Yakutia and the Chukotka Autonomous Okrug (Table 3).

In terms of turning Norilsk into a supporting, base city for the development of the Eastern Arctic, it is proposed to see all these projects as a potential market for production service companies of the city and the plant. Many of the works that are currently performed by the service departments of Norilsk Nickel (Table 3) can be performed not only for the plant, but also for a wide range of resource companies operating in the eastern Arctic. After all, there are simply no specialists in the Eastern Arctic who are more familiar with the Arctic specifics than those in these structures.

There should be a strengthening not only in matters of geographic expansion, but also in the range of services offered (as technologically advanced as possible) for settlements and projects in the eastern Arctic: for example, the dissemination of best practices in the use of lidar scanners on drones for laser scanning of the earth's surface [14], transition for LNG fuel when using heavy mining equipment [15], developing the institution of free prior informed consent (FPIC) when interacting with local residents during the implementation of new mining projects [16]. Federal policy in the Eastern Arctic should encourage the rapid replication of this experience by the structures of the plant and Norilsk small businesses in mining companies and settlements in Taimyr, Evenkia, Yakutia and Chukotka.

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[13] Strategiya sotsial'no-ekonomicheskogo razvitiya munitsipal'nogo obrazovaniya gorod Noril'sk do 2035 goda kak opornogo goroda Arktiki (vostochnoy Arktiki). Utverzhdena resheniem Noril'skogo gorodskogo Soveta deputatov ot 20 iyunya 2023 goda № 8/6–193 [Strategy for the socio-economic development of the municipality of Norilsk until 2035 as a supporting city of the Arctic (Eastern Arctic). Approved by decision of the Norilsk City Council of Deputies dated June 20, 2023 No. 8/6–193]. URL: https://norilsk.ru/files/50741/83786/strategiya_2035.pdf (accessed 08 August 2023).

[14] «Nornikel'» vnedril mobil'nye lidarnye skanery na rudnikakh v Noril'skom divizione [Norilsk Nickel has introduced mobile lidar scanners at mines in the Norilsk division]. URL: https://www.comnews.ru/digital-economy/content/222286/2022-09-22/2022-w38/nornikel-vnedril-mobilnye-lidarnye-skanery-rudnikakh-norilskom-divizione (accessed 08 August 2023).

[15] «Nornikel'» v 2022–2023 godakh postroit zavod po proizvodstvu SPG v Noril'ske [Norilsk Nickel will build an LNG production plant in Norilsk in 2022–2023]. URL: https://tass.ru/ekonomika/10656647 (accessed 08 August 2023).

[16] «Nornikel'» zavershit stroitel'stvo poselka na severe Krasnoyarskogo kraya v 2026 godu [Norilsk Nickel will complete the construction of a village in the north of the Krasnoyarsk Krai in 2026]. URL: https://tass.ru/ekonomika/15648581 (accessed 08 August 2023).

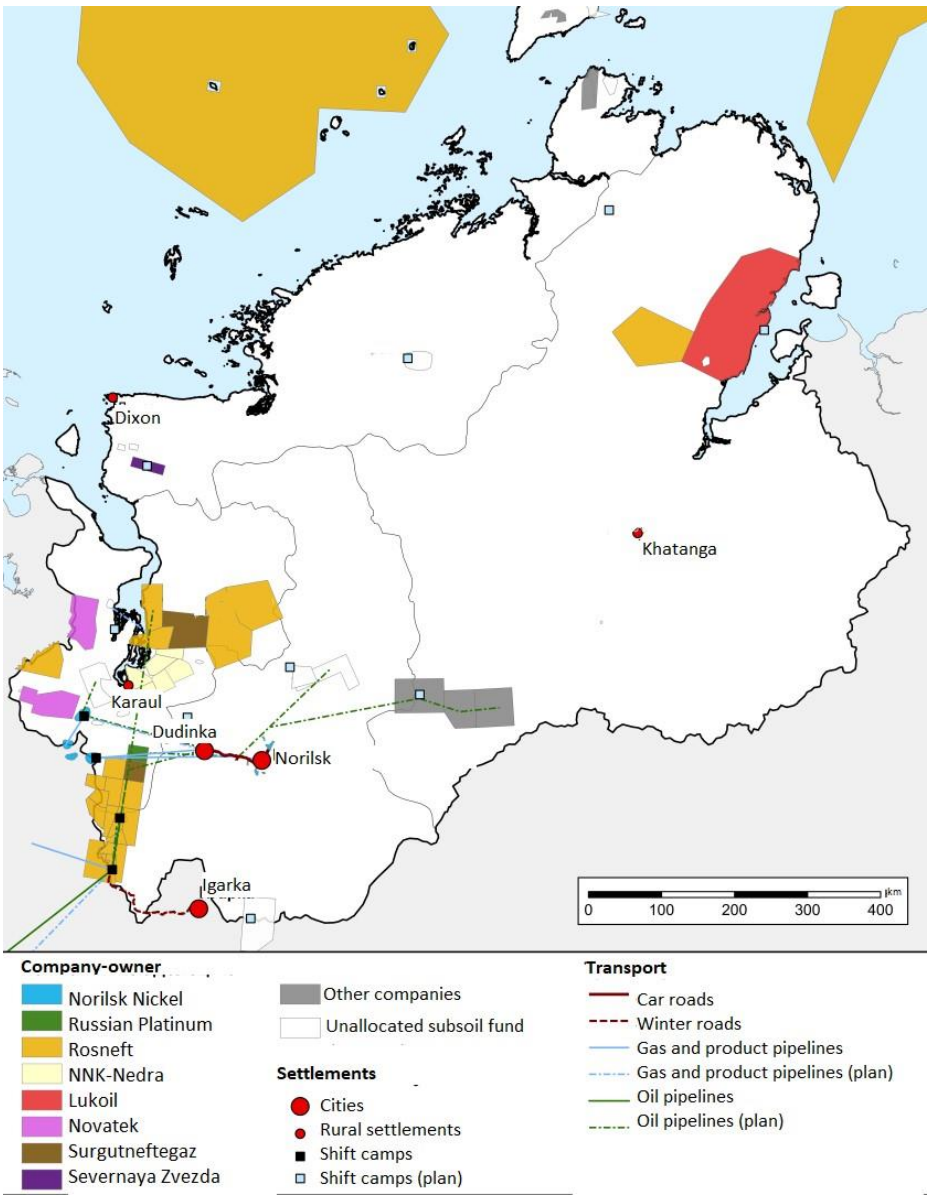

Fig. 2. Distribution of licensed areas of key companies in the Taimyr Dolgano-Nenets district [17].

Table 3

Norilsk supply and demand for production service structures of Eastern Arctic projects [18]

Production service structures — divisions of Norilsk Nickel	Types of work performed	Eastern Arctic projects — potential markets for Norilsk production services
Polar Construction Company LLC	Complex of general construction works: geodetic, mining preparation, tunneling, excavation, drilling and blasting, installation, electrical installation, commissioning, repair and construction, sanitary and finishing work of a wide, universal profile (over 3 thousand people).	Chukotka: Baimskiy copper ore project Beringovskiy coal project Pyrkakaysko-Mayskiy ore project Projects of gold and silver deposits Valunistoe, Kekura, Karalveem and others. Yakutia: Tomtorskiy rare earth project, Taymylyrskiy coal project, Zyryanskiy coal project, etc.
Norilsknickelremont LLC	Maintenance and repair of fixed assets of metallurgical plants and processing plants, power plants, electric motors and transformers, shut-off valves, self-	

[17] Cartography by B.V. Nikitin, graduate student of Lomonosov Moscow State University.
[18] In characterizing the profile of activities of the production service structures of Norilsk Nickel, data from the company's annual reports are used.

	propelled diesel equipment, automotive equipment; lifting machines and road construction mechanisms; rolling stock, mechanical and technological equipment, railway and crane tracks, electrical equipment and communication lines, as well as instrumentation, computer equipment. Production of metal structures, rubber products from polyurethane, polypropylene, production of building materials – polystyrene concrete, polymer concrete, rust converter, carpentry, etc. (over 10.1 thousand people).	
Norilsk Supply Complex LLC	Production of finished metal products, non-metallic products, woodworking.	
Scrap Metal Processing Plant LLC	Activities for the collection, processing and sale of scrap ferrous and non-ferrous metals generated after dismantling	
Norilsk Nickel Technical Services LLC	Geological exploration, geophysical and geochemical work in the field of subsoil study and reproduction of the mineral resource base.	
Norilskgeologia LLC	Search and exploration of deposits of nickel, copper, platinum group metals and non-metallic technological raw materials on the territory of the Taimyr Peninsula and in adjacent areas	
Vostokgeologia LLC	Search and exploration of deposits of copper, gold and molybdenum in southeastern Siberia and the Far East	
Geocomp LLC	Search and exploration of nickel and copper deposits in the southern part of central Siberia and the Taimyr Peninsula	

4. Key mechanisms for implementing the Norilsk support strategy

There is long-standing competition in the Russian European Arctic for the role of a key development base between Murmansk and Arkhangelsk, but in the Asian Arctic no one has yet even nominated a candidate city for this role [19]. In terms of size, Norilsk is the undisputed (monopoly) leader. The limiting factor to become a supporting base city is the distance from water (river and sea) routes, which is overcome when the port of Dudinka is depressurized; its cut-off from the national network of land roads, which is partially neutralized when Alykel airport turns to resource projects and settlements in the eastern Arctic (Taimyr, Evenkia, Yakutia and Chukotka) — which is already starting to happen, for example, as a result of agreements between Rosneft and Norilsk Nickel. For Norilsk, these processes mean that it can only become a base for the Eastern Arctic by fully utilizing the effect of the Norilsk–Dudinka–Alykel agglomeration.

The most important political and economic condition for the transformation of Norilsk into a supporting city of the Eastern Arctic for Russia is the “mirror strategy” of the actions of the city and the plant in the Eastern Arctic. The paradox is that overcoming the single-industry nature of

[19] Pilyasov A.N. Noril'sk mozhet stat' stolitsey vsey aziatskoy Arktiki [Norilsk can become the capital of the entire Asian Arctic]. Interview. Newspaper "Oxygen.Life". February 24, 2021. URL: https://kislorod.life/opinions/norilsk_mozhet_stat_stolitsey_vsey_aziatskoy_arktiki/ (accessed 01 July 2023).

the city and acquiring the functions of a capital city is only possible through joint actions with the city-forming enterprise, which created the single-industry nature of Norilsk over a hundred years of economic history. But it is simply impossible to do otherwise in a situation where more than a quarter of the city's population —employees of the plant's divisions.

It is proposed to develop such a "mirror strategy" for the long-term actions of the city and the plant in the eastern Arctic and coordinate it with the relevant ministries of the Government of the Russian Federation (primarily the Ministry of Natural Resources, the Ministry of Economic Development and the Ministry of Eastern Development of Russia). According to this strategy, on the one hand, the city "follows" the company to the places of its new location and its divisions: for example, the Trans-Baikal Territory (Bystrinskiy project), Magadan Oblast (the Polyus-Gold project for the development of the Natalka gold deposit). It is logical to conclude cooperation agreements and even twinning between Norilsk and Chita, Norilsk and Magadan.

On the other hand, the potential expansion of Norilsk in the eastern Arctic should necessarily take into account the interests of Norilsk Nickel. Therefore, it is advisable for the city and the company to jointly approach the federal government of the Russian Federation with an initiative to give Norilsk Nickel the opportunity to participate in the acquisition of licenses for subsoil areas along the Arctic front of Russia east of Taimyr, thereby updating the corporate regional effect [21]. Then the city's ambitions for a stronghold in the eastern Arctic will be supported by the power of the company, which will also carry out its own expansion into promising mining projects east of Taimyr. In this case, there will be a constructive synergy between the city and the company for the interests of the country, but outside the single-industry city — in the entire Eastern Arctic.

In the news of recent months, one can see how some elements of this strategy are already beginning to be implemented by the plant. The head of Norilsk Nickel, V. Potanin, announced a restructuring of the company's investment policy — from expansion into foreign markets to an emphasis on Russia [20]. Our proposed strategy for the plant's expanded presence in the eastern Arctic is fully consistent with this new priority. New close interaction between the city and the plant is ensured in the recently adopted Comprehensive plan for the social and economic development of Norilsk until 2035 [21].

Thus, the novelty of our approach in approving the "mirror strategy" of the city and the plant is that it goes beyond the city's contours, the entire eastern Arctic becomes its scope of action (more precisely, we argue that 1) the joint efforts of the city and the plant on the outer contour the eastern Arctic will bring both partners more benefits than scattered actions in this direc-

[20] Potanin zayavil, chto «Nornikel'» perestroit investitsionnuyu politiku s aktsentom na Rossiyu [Potanin said that Norilsk Nickel will rebuild its investment policy with an emphasis on Russia]. URL: https://tass.ru/ekonomika/16858345 (accessed 08 August 2023).
[21] Rasporyazhenie Pravitel'stva RF ot 10 dekabrya 2021 goda № 3528-r [Order of the Government of the Russian Federation of December 10, 2021 No. 3528-r]. URL: http://publication.pravo.gov.ru/Document/View/0001202112140024 (accessed 08 August 2023).

tion; 2) the focus on Russia "in all azimuths", which is already starting to happen [22], is less constructive for the plant than a targeted joint strategy with the city for actions in the eastern Arctic). Such a coordinated strategy of action turns out to be in the interests of the country, the city and the plant itself.

The realities of the modern development of the Russian Arctic are such that Rosatom has already de facto received the status of a superorganization in this process, which officially, according to the Decree of the President of the Russian Federation, became the infrastructure operator of the Northern Sea Route. Rosatom has created a powerful Arctic division and accepted responsibility for the delivery of budgetary cargo via the NSR; for the integrated transport and energy development of a number of new Arctic projects (escorting cargo ships with nuclear icebreakers and power supply to floating nuclear power plants and other low-power nuclear power plants); it has also started to develop the new Pavlovskoe ore deposit on Novaya Zemlya.

Therefore, the expansion of Norilsk Nickel's activity in the eastern Arctic inevitably presupposes the conclusion of a partnership agreement with Rosatom. This is already happening in a narrow format: Norilsk Nickel plans to conclude an agreement on the nuclear icebreaker Sibir of project 22220 until 2041 "for icebreaking support of ships providing cargo transportation for the implementation of the Southern Cluster projects, increasing the capacity of the Talnakh enrichment plant, implementing "Sulfur program" and the main activities of the enterprise in the Norilsk industrial region" [23]. In a narrow format, there is cooperation on the development of the Kolmozerskoe lithium deposit in the Murmansk Oblast — it is planned to create a joint venture between Rosatom State Corporation and MMC Norilsk Nickel [24]. Norilsk Nickel and Rosneft agreed on a fuel supply system in the north of the Krasnoyarsk Krai, which guarantees the sustainability of gas supply to the Norilsk industrial region in conditions when Rosneft received at auctions the new Deryabinskiy and Turkovskiy sections of the Taimyr oil and gas field (which Norilsk Nickel had previously claimed) [25].

However, as in many other cases of interaction between the plant and the city, the plant and Rosatom, the plant and Rosneft, in the interests of the country and the dynamic development of Norilsk, a significantly wider format of interaction between the main actors is needed than is currently accepted — for the purpose of constructive guardianship of the exploration and devel-

[22] For example, the expansion of Norilsk Nickel's subsidiary in the Yamal-Nenets Autonomous Okrug. URL: https://tass.ru/ekonomika/15951241 (accessed 08 August 2023).
[23] «Nornikel'» planiruet zaklyuchit' dogovor na atomnyy ledokol «Sibir'» do 2041 goda [Norilsk Nickel plans to conclude a contract for the nuclear icebreaker Sibir until 2041]. URL: https://tass.ru/ekonomika/16455795 (accessed 08 August 2023).
[24] «Nornikel'» v 2022–2023 godakh postroit zavod po proizvodstvu SPG v Noril'ske [Norilsk Nickel will build an LNG production plant in Norilsk in 2022–2023]. URL: https://tass.ru/ekonomika/10656647 (accessed 08 August 2023).
[25] Vostok Oyl vyigrala auktsiony na Turkovskiy i Deryabinskiy uchastki nedr na p-ve Taymyr [Vostok Oil won the auctions for the Turkovskiy and Deryabinskiy subsoil blocks on the Taimyr Peninsula]. URL: https://neftegaz.ru/news/gosreg/675810-vostok-oyl-vyigrala-auktsiony-na-turkovskiy-i-deryabinskiy-uchastki-nedr-na-p-ve-taymyr/ (accessed 08 August 2023).

opment of the territories of the Eastern Arctic by the largest corporate player here, represented by Nornickel, and the largest city of Norilsk.

The large-scale agreement between Norilsk Nickel and Rosatom is all the more important because the state corporation is gradually moving to a project-oriented model of using icebreakers, when each of them will be assigned not to a water area, but to a specific project (localized group of projects) [26]. It will be impossible to carry out effective supervision of projects and settlements in the Eastern Arctic without coordination of these plans not only with the relevant federal ministries, but also with Rosatom. In the context of this strategic line, it is advisable to propose Norilsk as a location for the headquarters of private and public companies operating in the eastern Arctic: Rosatom, Rosneft, Roscosmos, NovaTEK, etc.

Another promising way for the Russian Federation to strengthen Norilsk's centrality in the eastern Arctic is to provide security services, civilian and military. Norilsk can become a consolidating force in the efforts of the Ministry of Emergency Situations to create crisis management centers and emergency rescue units in Dudinka in Krasnoyarsk, Tiksi in Yakutia, and Pevek in Chukotka.

Separately, all these cities are already involved by the Ministry of Emergency Situations in the comprehensive security system to protect the territories and population of the eastern Arctic zone from emergencies of natural, human and military origin. But we are talking about the headquarters of the EMERCOM services for the Eastern Arctic (the center of the EMERCOM network of territorial Arctic units) being located in Norilsk as the largest and most technically equipped city in the Eastern Arctic. It is here that the training of professional rescuers with Arctic specifics capable of conducting long-term effective search and rescue operations in the Arctic seas and on land would be organized. In the future, part of the government functions should be transferred to Norilsk as a city of federal significance as a result of the creation of federal service units here — not only the Ministry of Emergency Situations, but also the Ministry of Defense, the State Duma, a number of federal ministries and Roshydromet.

Another direction for combining the efforts of all territories of the Eastern Arctic is the establishment of Arctic cruise tourism here from Dudinka to Anadyr, including through scaling the positive Norilsk experience of creating the "Arctic" tourist and recreational cluster [27] (Norilsk is the center of cultural, educational and industrial tourism, Dudinka is the center of event and ethnographic tourism, Putorana plateau — extreme and ecological one) to Chukotka Pevek, Provideniya and Anadyr (and such a task is set in the program documents of the Chukotka Autonomous Okrug).

[26] Rosatom zayavil o neobkhodimosti po-novomu ispol'zovat' ledokoly iz-za rosta nagruzki na SMP [Rosatom announced the need to use icebreakers in a new way due to the growing load on the Northern Sea Route]. URL: https://tass.ru/ekonomika/16622923 (accessed 08 August 2023).

[27] Turistsko-rekreatsionnyy klaster «Arkticheskiy» mozhet byt' rasshiren za schet Evenkii [The "Arctic" tourist and recreational cluster can be expanded to include Evenkia]. URL: https://tass.ru/ekonomika/12226537 (accessed 08 August 2023).

Due to an objective crisis situation in the city's housing and communal services, Norilsk was forced to begin a radical renovation of the housing stock and the entire city's public utilities earlier than other cities and towns in the Eastern Arctic. The positive element is that in order to strengthen the basic functions of the city in the eastern Arctic, it is necessary to accumulate positive experience in the reconstruction of the urban economy for its subsequent "relay race" transfer to the east further — to the villages of Yakutia, the cities and towns of the Chukotka Autonomous Okrug. For example, the transition from the plaster facade of residential buildings to curtain wall facade technologies as more energy efficient and durable [28].

Natural recognition of Norilsk's success in becoming a pivotal city of the Eastern Arctic will be an increase in its administrative status — transformation into a city of federal significance. In essence, this means a radical transformation of Norilsk from a closed island local single-industry city into an Arctic center of federal and global significance open to the world.

Technically, this means a systematic and multilateral positioning of the city on numerous international platforms, the intensification of freight transportation through the Yenisei–NSR system, including export "deep Siberian" cargo intended for the Asia-Pacific markets (for example, grain) [29]; liberation of the export potential of local small businesses and a multiple increase in the export products of Norilsk entrepreneurs and the number of export-oriented small and medium-sized businesses.

In the Arctic of Asia, which is entirely Russian (unlike the Arctic of Europe), it is advisable to organize a regular conference — an analogue of the "Arctic Frontiers", which is held every two years in Tromsø, Norway, for the Arctic territories of Europe and America. Norilsk could become a platform for regular holding of the "Arctic Frontiers of Asia", using its twinning ties with Asian cities both in its north, in Russia, and in its south, in China, India, and Iran.

The city will be the bridge that connects Russian Arctic Asia and south/southeast Asia at this regular forum. It would be advisable to locate visa centers in the city for leading Asian countries, which today act as markets for Norilsk Nickel products. They are also capable of becoming tourist markets for the main recreational destinations of Norilsk and its environs in the "Arctic" tourist and recreational cluster. The creation of visa centers for Asian countries in the city will simplify travel for the plant's employees and intensify contacts between city entrepreneurs, experts, and managers with partners from Asian countries. A container terminal for Asia-Europe transit

[28] Renovatsiyu zhil'ya v Noril'ske budut provodit' tekhnologiey navesnykh fasadov [Housing renovation in Norilsk will be carried out using curtain facade technology]. URL: https://tass.ru/nedvizhimost/11797355 (accessed 08 August 2023).

[29] Strategiya sotsial'no-ekonomicheskogo razvitiya munitsipal'nogo obrazovaniya gorod Noril'sk do 2035 goda kak opornogo goroda Arktiki (vostochnoy Arktiki). Utverzhdena resheniem Noril'skogo gorodskogo Soveta deputatov ot 20 iyunya 2023 goda № 8/6–193 [Strategy for the socio-economic development of the municipal formation of Norilsk until 2035 as a supporting city of the Arctic (Eastern Arctic). Approved by decision of the Norilsk City Council of Deputies dated June 20, 2023 No. 8/6–193]. URL: https://norilsk.ru/files/50741/83786/strategiya_2035.pdf (accessed 08 August 2023).

cargo will be created in Dudinka; Alykel will actually become an international airport connecting Norilsk with Asian countries.

Discussion and conclusions

It may seem strange that, given the urgent need for the country, its Arctic zone, Norilsk itself to become the central city of the eastern Arctic from a single-industry city, there is no clear discussion of this topic either on the platforms of federal executive bodies, or in the chambers of the federal parliament, or in strategic documents planning the development of the Arctic zone of the Russian Federation. It seems that part of the explanation lies in the "triple lock" phenomenon of this idea.

Firstly, the federal authorities do not see Norilsk as a supporting base for the development of the Eastern Arctic because such a base is traditionally sought in the Far Eastern Federal District (in Soviet times there were such bases for the development of the "Far North", but in the south — Khabarovsk, Vladivostok, Magadan). However, now we are talking about a large Arctic development base in the Arctic itself — similar to Murmansk and Arkhangelsk, but in the east. But in the Far Eastern Arctic, in the North-East of Russia, there is simply no such large base city. Therefore, there is no topic of searching for a base city for the Eastern Arctic, since it simply does not exist in the Far Eastern Arctic. And Norilsk is not part of the Far Eastern Federal District (together with the Krasnoyarsk Krai, it is in the Siberian Federal District), so it simply does not participate in this search for a base "from the outside" of the Far Eastern Federal District. Indeed, why look for a base city for the eastern Arctic (Taimyr, Yakutia, Chukotka), which is mainly included in the Far Eastern Federal District, outside the Far Eastern Federal District.

Secondly, the city-forming Norilsk Combine does not see Norilsk outside the role of its single-industry city. It agrees to participate in the improvement of the city and the comfort of the urban environment, but cannot even imagine that the city could have "external" administrative ambitions for guardianship and patronage over the eastern Arctic. In the current situation they are the saving grace for the city, because they give it a new impetus for development, which it can no longer receive from within: due to the technological modernization of the plant, the number of employees will be steadily declining.

Thirdly, both Dudinka and Alykel, without which the implementation of the centrality of Norilsk in the eastern Arctic is impossible, have traditionally been "hermetically" specialized to the needs of the plant, which were exclusively limited to economic ties with Europe, and not with the eastern Arctic (neither Dudinka nor Alykel fully worked with the eastern Arctic). The first year-round flight along the NSR was organized in the Soviet years precisely in a western direction — to export Norilsk concentrate to Murmansk. And in the eastern Arctic, the basic role of Murmansk was fixed, from which sea deliveries to the North and icebreaker support of convoys of ships to Anadyr were carried out.

This triple blocking closed the possibility of discussing new prospects for Norilsk for many years — outside the traditional role of the city at the plant.

A "methodological" question may arise about the priority of solving the problems of acquiring Norilsk functions of Taimyr, zonal (for the eastern Arctic) and national (for the countries of South Asia) support. In the ideology of the industrial era, with its accepted linear "conveyor" scheme for obtaining results, we could only talk about a consistent movement from task to task, about a kind of gradual ascent of Norilsk to the status of a city of federal significance, a global city.

But in the new times, when modern projects of NovaTEK and Gazprom Neft in the Arctic are being implemented in the logic of simultaneous parallel movement in construction at an accelerated rate, in several directions at once, and then final assembly on site from ready-made block modules, the requirements for gradual ascent are not mandatory. It is necessary to begin work in all three directions at the same time, find overlaps between them, prepare the city to overcome its previous single-industry status, turning into a supporting city-center that performs new functions of integral support.

This is a triune task that should be solved jointly: by acquiring the functions of a Taimyr support, Norilsk is preparing itself for a full-fledged role as a base for the development of the entire eastern Arctic; and this role, in turn, puts Norilsk on the pedestal of a city of federal significance/global city, performing the most important national functions in Asia [30].

It will be extremely difficult to implement the described plan for the ascent of Norilsk from a single-industry city to the only city of federal significance in the Arctic, the support base for the development of the eastern Arctic. After all, this completely contradicts the entire inherited trajectory of development of the city, the industrial one, to which several generations of Norilsk residents have become accustomed over a hundred years of development. Only new people who are not attached to the plant and are very brave, but who have powerful and long-term support from the federal center, which has "put their money" on Norilsk, will be able to implement this scenario. A more comfortable and routine alternative: the usual picture of the development of the city under the plant, slightly improved by the large-scale modernization of the city's utilities and social sphere.

In this article, the author wanted to outline the upper limit of possible and completely justified claims of Norilsk, without any illusions about the ease of implementing the Norilsk city superproject "a leap from the realm of single-industry to the realm of centrality in the Asian Arctic".

[30] Strategiya sotsial'no-ekonomicheskogo razvitiya munitsipal'nogo obrazovaniya gorod Noril'sk do 2035 goda kak opornogo goroda Arktiki (vostochnoy Arktiki). Utverzhdena resheniem Noril'skogo gorodskogo Soveta deputatov ot 20 iyunya 2023 goda № 8/6–193 [Strategy for the socio-economic development of the municipal formation of Norilsk until 2035 as a supporting city of the Arctic (Eastern Arctic). Approved by decision of the Norilsk City Council of Deputies dated June 20, 2023 No. 8/6–193]. URL: https://norilsk.ru/files/50741/83786/strategiya_2035.pdf (accessed 08 August 2023).

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Development of Aquaculture in the Northern and Arctic Territories: Problems and Solutions (On the Example of the Arkhangelsk Oblast)

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Abstract. The relevance of this study is due to the need to develop and implement in regional practice effective management decisions that promote the development of fish farms and increase aquaculture production. Since fish farming (aquaculture) is one of the structural components of the fishery complex, the authors pay attention to both the peculiarities of its development in the conditions of the North and the Arctic, and the specifics of economic activity in the field of aquaculture projects. The article presents the results of a survey of the population of the Arctic territories of the Arkhangelsk Oblast on the consumption of fish and fish products, which allowed establishing various consumer profiles of preferences depending on their age category, as well as to identify the main reasons constraining the consumption of fish and fish products (among which: high price, availability of low-quality products in retail outlets, the lack of ability and desire to cook among the younger generation). Based on the results of expert interviews with producers of fish and fish products, as well as with representatives of the scientific community and authorities of the Arkhangelsk Oblast, a problem matrix was compiled and the necessary activities were identified to address key issues of the development of aquaculture projects in the region.
Keywords: *North, Arctic region, socio-economic development, fisheries, fish industry, fish farming, aquaculture*

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Introduction

During the period of aggravation of the geopolitical situation, one of the priority directions of the current state policy is ensuring the food security of our country, import substitution and reorientation of Russian exporters to new markets [1], including a more complete satisfaction of the

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[1] Strategiya razvitiya agropromyshlennogo i rybokhozyaystvennogo kompleksov Rossiyskoy Federatsii na period do 2030 goda (utverzhdena rasporyazheniem Pravitel'stva Rossiyskoy Federatsii ot 8 sentyabrya 2022 g. № 2567-r) [Strategy for the development of the agro-industrial and fishery complexes of the Russian Federation for the period

needs of the domestic market. Traditionally, issues of food security in the northern and Arctic territories of Russia are associated with the work of enterprises in the fishery complex, including both fishing sector and fish farming (aquaculture projects). Fish and fish products are included in the mandatory diet of the population of the North and the Arctic, which is determined both by the eating habits of the local population and the undeniable benefits of fish products, and by the presence of a large number of water bodies with quite significant amounts of resources. However, despite this, the development of both freshwater and marine aquaculture in the Arctic regions of Russia remains at a rather low level. At the same time, in global practice over the past decades, aquaculture has been the fastest growing sector of food production. It should be noted that according to the results of a number of studies [1, Kozenko Z.N., Kozenko K.Yu., Vorobyov N.N.; 2, Ermakova N.A., Micheles T.V.], Russia has both an extensive domestic market and significant reserves for the development of aquaculture projects.

The northern and Arctic regions of the Russian Federation are an area of risky agriculture and, due to harsh climatic conditions, have a number of restrictions in food production. That is why today their territories are often dominated by imported products, which, unfortunately, are not always distinguished by high quality characteristics. The problems of providing the population with fresh and high-quality food, including fish and fish products, issues of food security are described in detail in a number of works by domestic and foreign scientists [3, Ivanov V.A.; 4, Sukhanov G.G., Sukhanov S.G.; 5, Moriarity R.J., Liberda E.N., Tsuji L.J.S.].

The most important stage preceding the sale of fish and fish products to the population is processing. For example, in Norway, only 44% of fish caught is processed and put on the market (mostly fillets); the remaining 56% could be used to produce animal feed [6, Hjellnes V., Rustad T., Falch E.]. However, since most foreign and domestic fishing vessels do not have special equipment, the extracted aquatic biological resources are not used effectively enough.

In our opinion, the practical aspects of the formation and transformation of the consumer market in the Arctic regions deserve special attention, because *"... the level of personal consumption and the level of development depend on the state of the consumer market, including the level of prices for the most important goods and services, their range and quality production relations, stability of money circulation, standard of living of the population..."* [7, Tutygin A.G., Chizhova L.A., Urykov V.A., p. 77].

Taking into account the above, we considered it relevant to conduct a sociological study of the preferences of consumers and producers of fish products using the example of the Arctic municipalities of the Arkhangelsk Oblast in order to identify problems and opportunities for the development of the corresponding sector of the consumer market. Therefore, within the framework of this article, using scientific research methods such as comparative analysis, systems approach, statistical data analysis, survey, expert assessments, we will further consider the following: the

until 2030 (approved by Decree of the Government of the Russian Federation dated September 8, 2022 No. 2567-r)]. URL: https://mcx.gov.ru/upload/iblock/fda/p8s312xvzbzgbnme51z16c4mmn5rnilp.pdf (accessed 07 April 2023).

features of the development of the fisheries complex of the northern and Arctic regions of Russia; the results of a survey conducted by the authors of the population of the Arctic territories of the Arkhangelsk Oblast on the consumption of fish and fish products; the final conclusions of expert interviews taken from representatives of the management of the fishing industry enterprises of the Arkhangelsk Oblast, government bodies and business support institutions, and the scientific community in order to identify key problems and opportunities for the development of aquaculture projects in the region.

Features of the development of the fishery complex of northern and Arctic regions of Russia

Northern fishing has a rich history; for example, back in the 10th–12th centuries, the first Russian navigators began to develop lands on the coasts of the White and Barents Seas, where they were engaged in fishing, fur and sea animals hunting [8, Lobanov K.V., Chicherov M.V., pp. 41–42]. Even before the reign of Ivan the Terrible, products of Pomor fisheries were sold to other regions of Rus', and under Ivan the Terrible, international fairs began to be held in Arkhangelsk, and Pomor goods were sold to other countries [2].

According to historical data, in 1905, there were about 29 thousand industrialists in Arkhangelsk, who annually harvested more than 8.6 thousand tons of fish [9, p. 23]. However, in 1918, the fishing industry of the Arkhangelsk Oblast faced the problem of dilapidated and technically backward vessels. But the Soviet government quickly found a solution to this issue, and at the end of June 1920, the first trawler started operating in Arkhangelsk. In 1937, Arkhangelsk fisheries enterprises already had 12 trawlers, 137 units of motor and more than 2 thousand units of sailing rowing fleet, the service infrastructure was also built. Only due to these efforts it was possible to increase the volume of fish production from 12.9 thousand tons in 1932 to 37.3 thousand tons in 1936 [9, p. 43].

The Soviet state has achieved significant success in the production of fish and other aquatic biological resources; for example, in the Arkhangelsk Oblast over the forty-year period from 1940 to 1980, this volume was increased 10 times, then a steady downward trend in volumes was observed (Fig. 1).

[2] Interview with Deputy Director of the Solovetskiy Maritime Museum, member of the public organization “Association of Northern Navigation” Svetlana Vladimirovna Rapenkova. URL: https://m.rusmir.media/2016/11/01/pomori (accessed 08 April 2023).

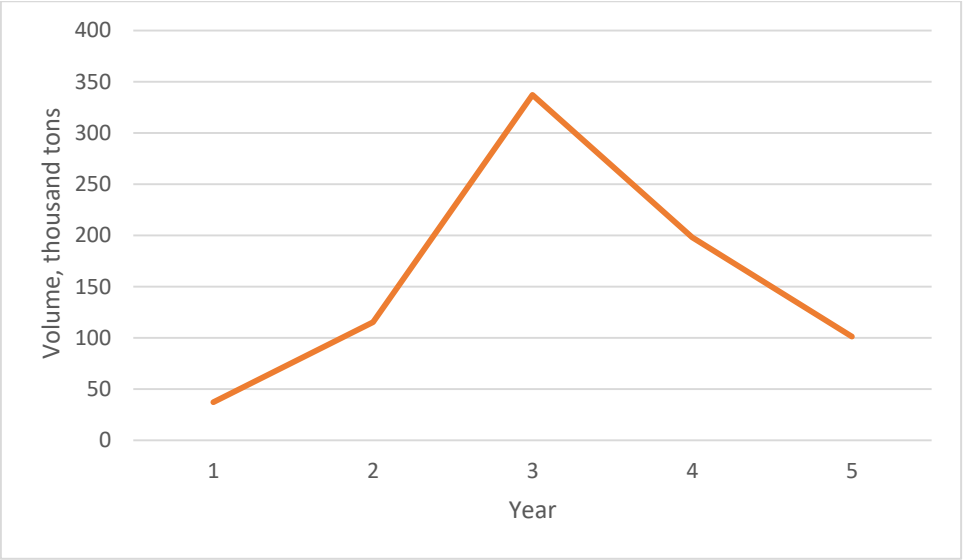


Fig. 1. Fishing and production of other aquatic bioresources in the Arkhangelsk Oblast, thousand tons [3, 4].

If we look at the current situation, the absolute leader in terms of production of fish and other aquatic biological resources among the Arctic regions of Russia is the Murmansk Oblast. The Arkhangelsk Oblast and the Republic of Karelia occupy second and third places in this list of regions, respectively. It should be noted that for the period 2017–2022, an increase in the production rate is typical only for the Republic of Karelia (Fig. 2).

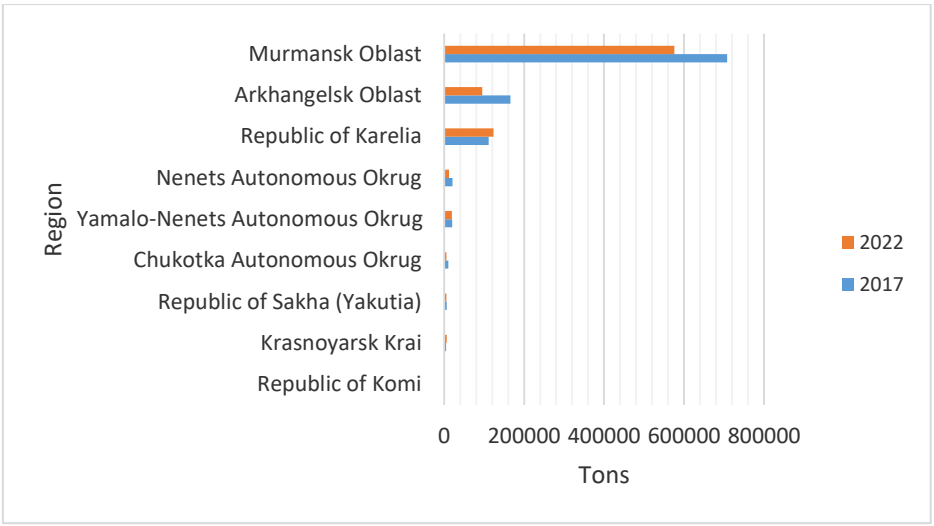


Fig. 2. Fishing and production of other aquatic bioresources in the Arctic zone of the Russian Federation (including fish farming), tons [5].

At the same time, the current state of fishing volumes in the Arkhangelsk Oblast is below the level of 1960 and more than three times lower than the peak level of 1980.

Recently (in the early 2000s), a relatively new type of activity for domestic enterprises of the fishing industry started to develop — fish farming. Undoubtedly, there are significantly fewer

[3] Source: compiled by the authors using data from the Pomor Encyclopedia and Rosstat.
[4] Regions of Russia. Socio-economic indicators. 2021. URL: https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2021.pdf (accessed 18 April 2023).
[5] EMISS. Fishing and extraction of other aquatic biological resources. URL: https://www.fedstat.ru/indicator/43941 (accessed 18 April 2023).

enterprises engaged in fish farming in the Arctic regions of Russia than enterprises specializing in fishing, and this is quite natural (Table 1).

Table 1

Number of enterprises engaged in fishing and fish farming in the Arctic regions of Russia [6]

	Fishing		Fish farming		Δ 2020–2005	
	2005	2020	2005	2020	Fishing	Fish farming
Republic of Karelia	69	41	64	104	-28	40
Republic of Komi	4	8	16	11	4	-5
Nenets Autonomous Okrug	16	21	0	0	5	0
Arkhangelsk Oblast	80	44	11	8	-36	-3
Murmansk Oblast	448	184	22	25	-264	3
Yamalo-Nenets Autonomous Okrug	38	61	0	3	23	3
Krasnoyarsk Krai	64	69	6	20	5	14
Republic of Sakha (Yakutia)	69	125	5	8	56	3
Chukotka Autonomous Okrug	15	61	6	1	46	-5
Total	803	614	130	180	-189	50

If the leader in the field of fishing (as noted above) among the Arctic regions of Russia is the Murmansk Oblast, then the first place in the field of fish farming belongs to the Republic of Karelia. In the Arkhangelsk Oblast, unlike other regions of the Russian Arctic, the number of both fishing and fish farming enterprises has decreased over the last 15 years. However, in recent years in the Arkhangelsk Oblast, there has been an increase in production volumes by fish farming enterprises with accompanying government support (Table 2).

Table 2

State support for fish farming companies in the Arkhangelsk Oblast [7]

Indicators	Year					
	2017	2018	2019	2020	2021	2022
Subsidy for feed (million rubles)	1.9	3.0	4.4	8.4	6.8	7.4
Subsidy for fish seeding material (million rubles)	0.2	0.4	0.6	0.7	2.8	1.9
Subsidy for aquaculture equipment* (million rubles)	-	-	-	-	-	3.5
Number of fish farms received state support (units)	3	4	4	4	6	8
Planned production volume (tons)	-	-	130	130	230	260
Actual production volume (tons)	111	130	173	221	260	332

* *Note: equipment subsidy was introduced in 2022.*

In 2022, all fish farming enterprises in the Arkhangelsk Oblast, without exception, took advantage of government subsidies for their activities.

Study of the consumer market for products of the regional fishing industry (results of a survey of the population of the Arctic territories of the Arkhangelsk Oblast)

In order to study the peculiarities of fish and fish products consumption by the residents of the Arctic territories of the region, we conducted a sociological study using Yandex.Forms in the period from January 24 to April 3, 2023. The survey used a quota sampling method, where the criteria for dividing respondents into groups were place of residence and statistical proportions of the population for working citizens and pensioners [10, p. 167]. The sample consisted of 400 peo-

[6] Regions of Russia. Socio-economic indicators. 2022. URL: https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf (accessed 18 April 2023).
[7] Data provided by the Ministry of Agriculture and Trade of the Arkhangelsk Oblast.

ple from the Arctic municipalities of the Arkhangelsk Oblast, of which 71% were workers and 29% were pensioners. Figure 3 shows the structure of respondents according to their place of residence in the Arkhangelsk Oblast.

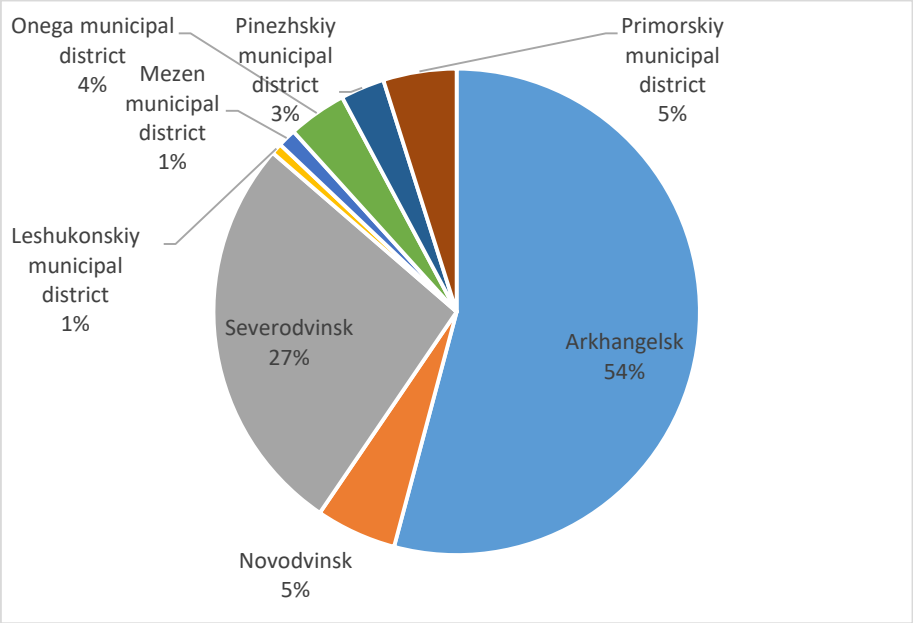


Fig. 3. Structure of respondents by geographical feature.

The survey showed that almost a third of respondents consume fish and fish products quite often (almost every day or 1–2 times a week). Rare consumption of such products was noted by 28% of respondents (Fig. 3).

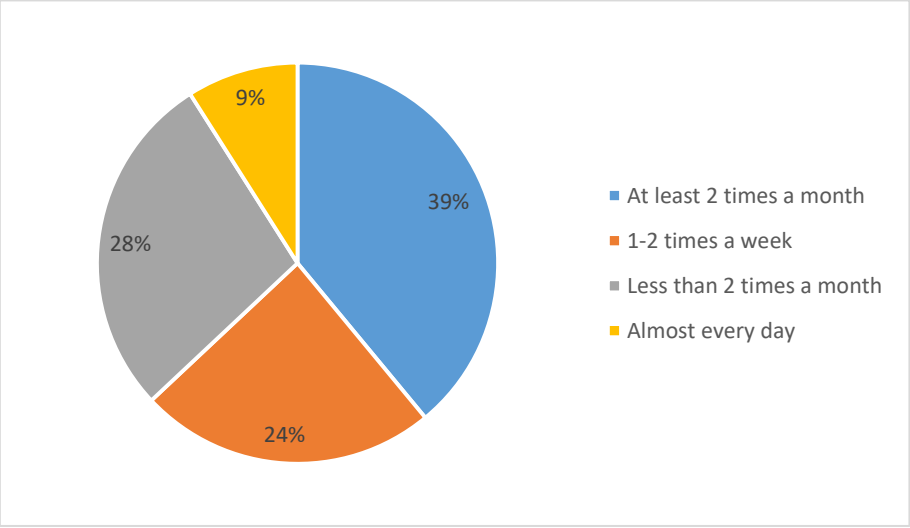
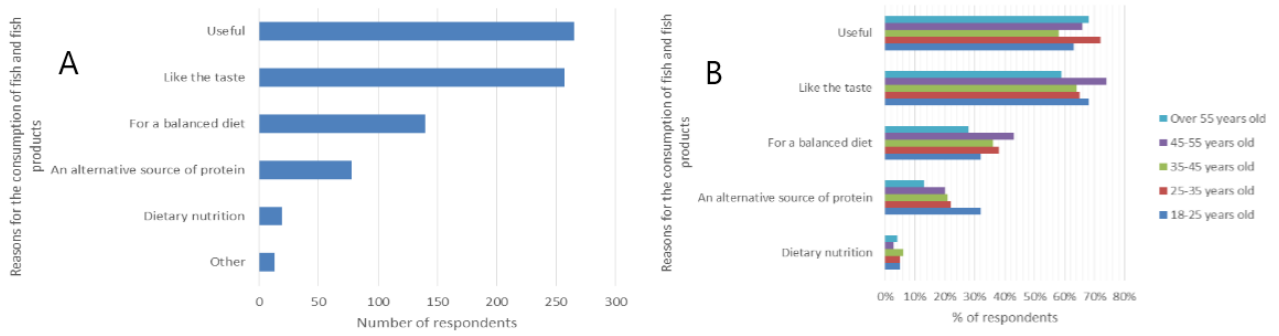


Fig. 4. Frequency of consumption of fish and fish products.

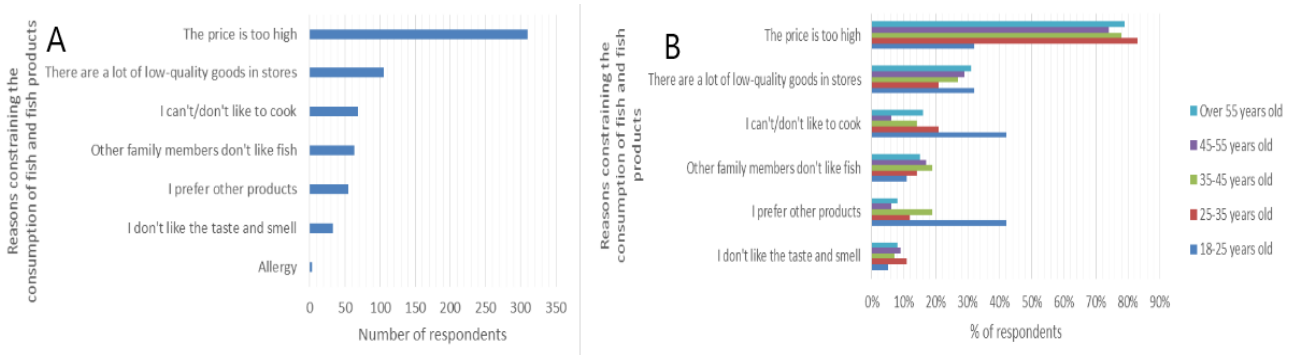
The most popular answer was “at least 2 times a month” — it received 39% of the respondents’ votes. Let us further consider the reasons for consumption of fish and fish products (Fig. 5).



**respondents could choose several answer options in this question*

Fig. 5. Reasons for consuming fish and fish products A) distribution of answers for all respondents; B) distribution of answers by age groups of respondents.

The majority of respondents, regardless of age, explained the main reasons for consuming fish and fish products by the benefits of this product and their taste preferences. The following answers were given as "other": "we eat fish for variety" and "other family members (wife, mum) make the choice of purchase and cooking". Fig. 6 visualizes the reasons for respondents' refusal to increase the volume of consumption of fish and fish products.

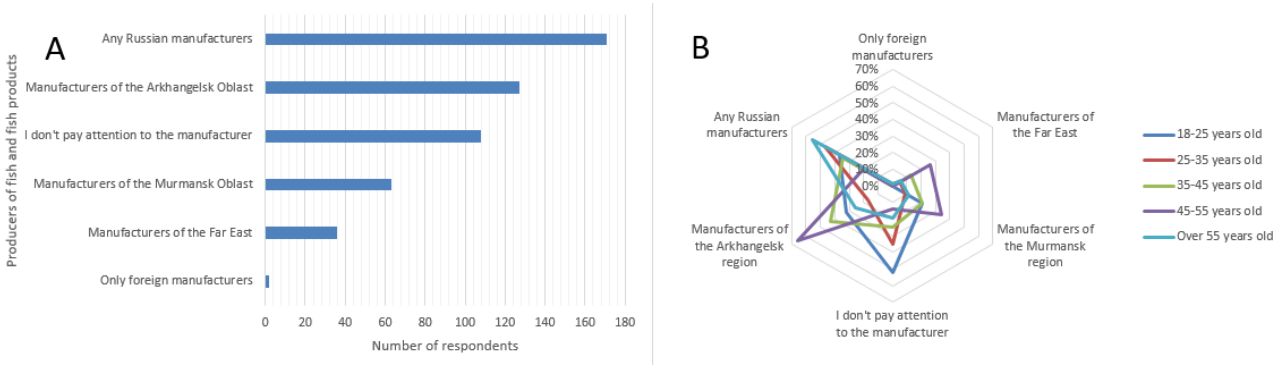


**respondents could choose several answer options in this question*

Fig. 6. Reasons limiting the consumption of fish and fish products A) distribution of answers for all respondents; B) distribution of answers by age groups of respondents.

The absolute majority of respondents are prevented from consuming fish and fish products in larger quantities than the current one by the high price. For almost a third of respondents, an important aspect is the presence of low or unacceptable quality products in retail trade. An interesting point is that for young people (from 18 to 25 years old), one of the main reasons limiting consumption is the lack of ability and desire to cook.

When purchasing fish and fish products, the majority of residents of the Arctic territories of the region under study give preference to domestic producers, mainly from the Arkhangelsk and Murmansk oblasts. At the same time, only a quarter of respondents practically do not pay attention to the geographical and other affiliation of the manufacturer (Fig. 7).

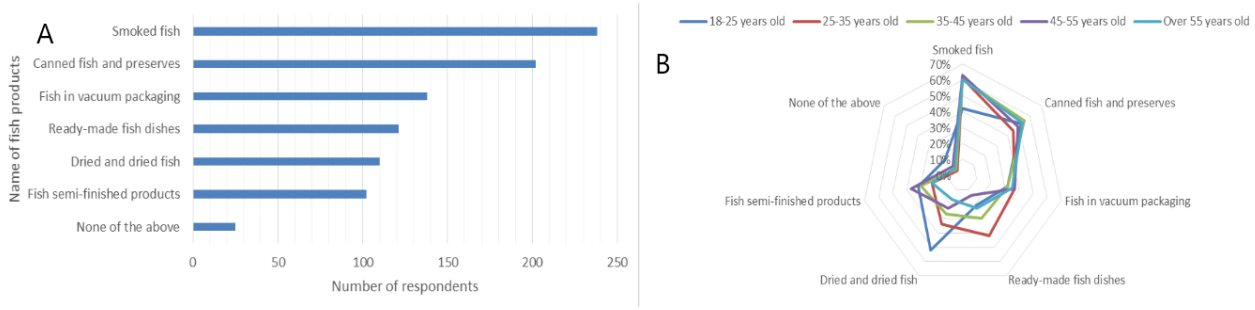


**respondents could choose several answer options in this question*

Fig. 7. Consumer preferences for producers of fish and fish products A) distribution of answers for all respondents; B) distribution of answers by age groups of respondents.

Preference for purchasing goods from local producers is given mainly by people aged 35–55 years. The profile of older people is sharply shifted towards any Russian manufacturers. Most likely, this is due to a decrease in income during retirement. Young people aged 18–35 often do not pay attention to the manufacturer when shopping, being guided by other purchasing criteria (Fig. 7 B). A number of respondents noted that it is very difficult to find a manufacturer from the Arkhangelsk Oblast in stores. Some people catch fish themselves; 68 people (or 17% of respondents) do it to some extent.

The leading position among fish products consumed by respondents is occupied by smoked fish, canned fish and preserves are in the second place, and vacuum-packed fish is in the third place (Fig. 8).



**respondents could choose several answer options in this question*

Fig. 8. Purchase of fish products A) distribution of answers among all respondents; B) distribution of answers by age groups of respondents.

It should be noted that respondents who chose the answer “none of the above” do not consume fish products as a matter of principle, but buy only fresh fish and cook it. Consumer profiles (Fig. 8 B) by age of respondents have some differences. For example, people aged 25–45 years prefer ready-made fish dishes, and young people aged 18–25 years have a preference for consuming dried fish. At the same time, almost 59% of respondents usually spend up to 1 thousand rubles per month of their household income on fish products, and 85% of respondents spend more than 1 thousand rubles per month on fresh fish (Fig. 9).

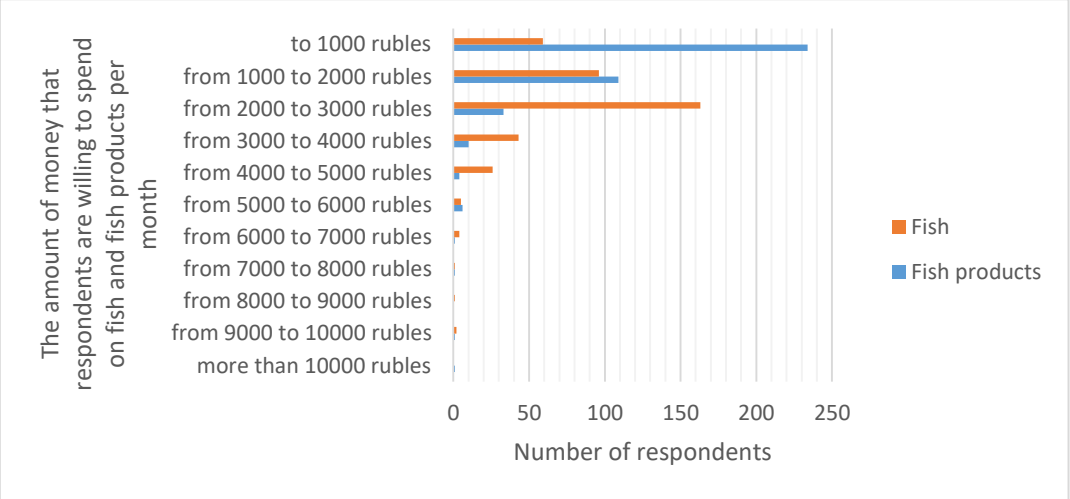


Fig. 9. Average household expenditure on fish and fish products per month, thousand rubles.

It should also be noted that the leading answer of the urban population on the issue of average expenditure on fish and fish products is the option “from 2 to 3 thousand rubles per month”, and among the rural population the prevailing answer is “from 1 to 2 thousand rubles”, which indicates a lower level of income and the possibility of independent fishing. At the same time, the majority of residents of both rural and urban areas are ready to spend no more than 1 thousand rubles per month on fish products.

Key challenges and opportunities for the development of aquaculture projects in the Arkhangelsk Oblast: expert community opinion

The development of the fishing industry, including aquaculture production, is one of the priority areas of economic development, which is reflected in a number of strategic planning documents at the federal [8] and regional levels [9]. For example, one of the objectives of subprogram No. 2 “Development of the fishery complex of the Arkhangelsk Oblast” of the state agricultural development program [10] is to create conditions for the sustainable development of aquaculture. Thus, aquaculture production (mainly trout farming) in the Arkhangelsk Oblast increased by more than 2.5 times in the period 2010–2022 (Fig. 10). However, as practice has shown, the development of

[8] Strategiya razvitiya agropromyshlennogo i rybokhozyaystvennogo kompleksov Rossiyskoy Federatsii na period do 2030 goda (utverzhdena rasporyazheniem Pravitel'stva Rossiyskoy Federatsii ot 8 sentyabrya 2022 g. № 2567-r) [Strategy for the development of the agro-industrial and fishery complexes of the Russian Federation for the period until 2030 (approved by Order of the Government of the Russian Federation dated September 8, 2022 No. 2567-r)]. URL: https://mcx.gov.ru/upload/iblock/fda/p8s312xvzbzgbnme51z16c4mmn5rnilp.pdf (accessed 07 April 2023).

[9] Oblastnoy zakon «Ob utverzhdenii strategii sotsial'no-ekonomicheskogo razvitiya Arkhangel'skoy oblasti do 2035 goda» ot 18 fevralya 2019 goda № 57-5-OZ [Regional Law “On approval of the strategy for the socio-economic development of the Arkhangelsk Oblast until 2035” dated February 18, 2019 No. 57-5-OZ]. URL: http://pravo.gov.ru/proxy/ips/?doc_itself=&backlink=1&nd=123138726&page=1&rdk=0&fulltext=1&scrolltop=33317#I0 (accessed 07 April 2023).

[10] Postanovlenie Pravitel'stva Arkhangel'skoy oblasti ot 9 oktyabrya 2012 g. № 436-pp «Ob utverzhdenii gosudarstvennoy programmy razvitiya sel'skogo khozyaystva i regulirovaniya rynkov sel'skokhozyaystvennoy produktsii, syr'ya i prodovol'stviya Arkhangel'skoy oblasti» (red. ot 06.10.2022) [Decree of the Government of the Arkhangelsk Oblast of October 9, 2012 No. 436-pp “On approval of the state program for the development of agriculture and regulation of markets for agricultural products, raw materials and food in the Arkhangelsk Oblast” (as amended on October 6, 2022)]. URL: https://office.dvinaland.ru/docs/pub/e2832479ccf2b08f8543e131a0f6c32b/default/?& (accessed 07 April 2023).

this type of activity is associated with a certain set of problems and difficulties, the views on which among various representatives of the expert community of the Arkhangelsk Oblast often not only do not coincide, but are sometimes in opposite planes (Table 3). The interview involved 9 experts whose activities are directly related to the development of fish farming (aquaculture projects) both from the production process and scientific component, and from the position of government authorities responsible for supporting this area in the region.

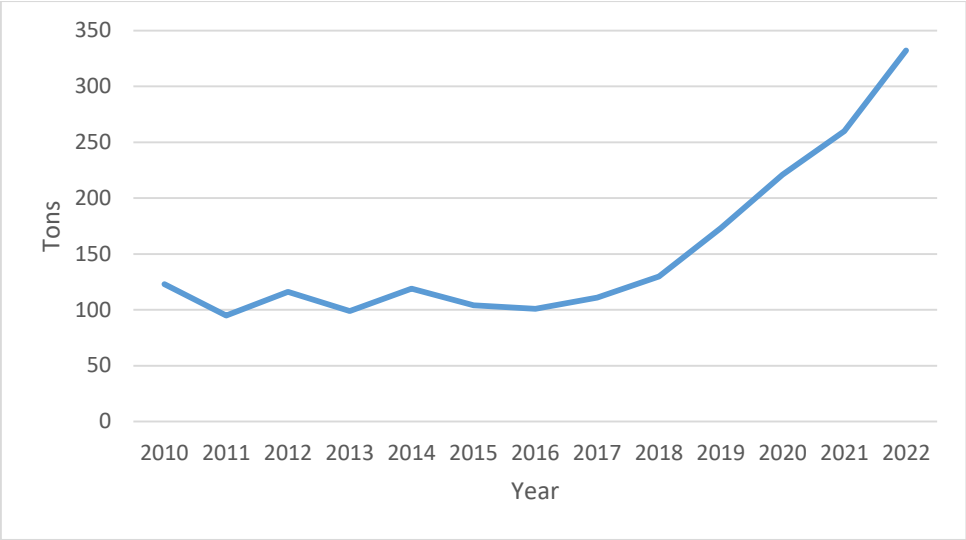


Fig. 10. Aquaculture production in the Arkhangelsk Oblast, tons [11].

Table 3

Matrix of expert community opinions on identifying problems of aquaculture project development in the Arkhangelsk Oblast [12]

Problem	Representatives of government authorities and business support institutions	Representatives of enterprises	Representatives of scientific community
Poor development (in some cases lack of) infrastructure	Lakes suitable for fish farming have difficult (or no) transport accessibility	Problems with logistics (high transport costs). Many potential consumers are located far from aquaculture production sites	Lack of transport and energy infrastructure is a factor constraining the development of fishery activities in the region
High costs of energy resources, including the use of recirculating water supply (RWS) installations in fish farming.	For the cage aquaculture method, high energy costs are less problematic than for RWS. However, in the near future, most districts of the region will be gasified, which will remove a number of difficulties caused by the high costs of electricity for RWS	High energy tariffs are one of the main problems, even though the cage method of cultivation is used	The problem exists, but its impact is overestimated, since most fish farms in the region do not use RWS, but the cage method of growing aquaculture, which, in comparison with RWS, is less energy-intensive
Technological problems	The problem with the purchase of foreign feed is solved by import substitution	Russian feed is significantly inferior in quality to foreign analogues	There are no serious technological problems

[11] Data provided by the Ministry of Agriculture and Trade of the Arkhangelsk Oblast.
[12] Compiled by the authors.

Need for innovations, including renewal of fixed assets	This area currently does not need innovation	Innovations are necessary both in technological, marketing and other aspects. An enterprise may lose its competitiveness without them	This area currently does not need innovation
Environmental restrictions and threats	There are no obvious problems in terms of ecology and environment		Cage fish farming causes significant harm to the environment, especially when located on lakes that are sources of drinking water for the local population
Inconsistency of opinions regarding the prospects for fish farming and aquaculture development projects in the region	Recirculating water supply (RWS) installations are promising for the development of aquaculture projects		The fishing industry of the Arkhangelsk Oblast should be primarily focused on catching and processing fish, and not on growing it
Lack of government support	There is no problem. State support is provided in sufficient volume	Current support measures are only sufficient to maintain current production volumes. State support is clearly not enough to expand the range of aquaculture species produced, increase volumes, and create new aquaculture enterprises.	Along with increasing subsidies, coordination and informing the economically active population about the possibilities of creating a business in the field of fish farming (aquaculture) is needed. Currently, new entrepreneurs in this field need professional competencies
Lack of professional competencies and interest from existing entrepreneurs and the younger generation in the implementation of projects	Lack of talented, professionally trained and motivated young people	The problem is the quality of education and the mismatch between the level of specialists' training and the requirements of employers	Not good enough conditions for the younger generation to create their own entrepreneurial projects

Basically, the interview questions touched upon the problems of developing aquaculture projects in the Arkhangelsk Oblast, which the experts identified as following: poor development (in some cases, absence) of infrastructure; high energy costs, including when using recirculating water supply (RWS) installations in fish farming; technological problems; need for innovation, including updating fixed assets; environmental restrictions and threats; inconsistency of opinions regarding the prospects of fish farming and aquaculture development projects in the region; insufficient government support; lack of professional competencies and interest among existing entrepreneurs and the younger generation in implementing projects.

Experts — representatives of fish farming enterprises — noted that one of the favorable factors for the development of trout farms is the constant demand of the region's population for the products of local producers due to existing consumption traditions. However, the development of fish farming is hampered by the high cost of production, especially taking into account the fact that 60–65% of these costs consist of expenditures of fish farming enterprises on imported feed. It is well known that Norway has been the leader in the production of aquaculture feed in

the Nordic countries, but the owners of local trout farms are faced with a similar problem [11, Aas T.S., Åsgård T., Ytrestøyl T.].

An analysis of interviews with production experts showed that aquaculture projects based on recirculating water supply (RWS) technology currently have one serious problem — the high cost of energy resources. At the same time, the advantage of RWS is the ability to artificially create favorable climatic conditions for the process of reproduction and population growth (the optimal room temperature should be 15–17°C). It should be noted that the opinion of production experts regarding the personnel problem is that the region should pay attention to the quality of training of specialists for the fishing industry.

Personnel issues related to the availability of specialists of a certain profile and the level of their training did not leave any of the experts indifferent. It is important to note here that, according to the latest data, not only the fishing industry, but also the economy of the Arkhangelsk Oblast as a whole is experiencing a personnel shortage [13]. The Higher School of Fisheries and Marine Technologies of NArFU named after M.V. Lomonosov takes an active part in training relevant personnel for fishing activities in the region.

Experts — representatives of the scientific community — noted that the future of the fishing industry of the Arkhangelsk Oblast should not be associated with the artificial cultivation of fish, but primarily with its catching and processing. This is confirmed by the opinion of our colleagues that the North and the Arctic are rich in aquatic biological resources that only need to be used correctly [12, Novoselov A.P., Lukina V.A., Matveev N.Yu., Matveeva A.D.; 13, Tortsev A.M., Studenov I.I.].

Separately, it is necessary to emphasize environmental limitations and threats, since experts —representatives of the scientific community — noted that: "... A trout cage farm of 100 tons produces the same amount of pollutants as a village of 7 thousand inhabitants...". The possible negative impact of fish farming (aquaculture) enterprises on the environment and the need to assess the corresponding environmental risks are discussed in detail in a number of studies by foreign scientists [14, D'Orbcastel E., Blancheton J.-P., Aubin J.; 15, Chen X., Samson E., Aurélien T., Aubin J.]. However, along with the above, the important role of the socio-economic component of aquaculture development projects cannot be neglected. Best practices in various legal and other economic conditions have been implemented in Northern Norway and Alaska [16, Raspotnik A., Rottem Vigeland S., Osthagen A.], as well as in the Republic of Karelia of the Russian Federation [17, Sterligova O.P., Kuchko Ya.A., Savosin E.S., Ilmast N.V.; 18, Kuritsyn A.E., Makarova T.A., Efremov S.A.].

In addition to the problems described above, representatives of the expert community note the presence of transformations in the culture of consumption and cooking of fish and fish

[13] Ekonomika Arkhangel'skoy oblasti stala ispytyvat' kadrovyy golod [The economy of the Arkhangelsk Oblast began to experience a personnel shortage]. URL: https://rusnord.ru/economic/59789-jekonomika-arhangelskoj-oblasti-stala-ispytyvat-kadrovyj-golod.html (accessed 07 June 2023).

products, which are observed not only in the Arkhangelsk Oblast and in the Arctic zone of the Russian Federation, but also in Russia as a whole. For example, young generations are changing their gastronomic preferences from traditional to simpler and more accessible, which in some cases is due to the significant role of the public catering system.

The interviews with experts also touched upon some problems of the fishery complex in general. One of the representatives of business support institutions in the region said: "... The problems of fishing need to be judged from different levels: in ocean fishing the problem is quotas, in coastal fishing — the dilapidation of villages, and in the inland (regional, local) we have almost no one catches...". The expert, a representative of government authorities, noted that currently at the regional level there are significant violations of the "catch – sale – consumption" chain, manifested, on the one hand, in the lack of interest of most trading companies, especially federal chains, to enter into contracts with local producers due to the impossibility of stable and significant supplies of fish and fish products (as well as the presence of financial interest in discounts from large suppliers), and on the other hand, due to the presence of certain difficulties for local producers in storing and selling their products, which means that the demand of the population for food products on the local market is not fully met.

The solution to the identified pool of problems of aquaculture projects in such a northern region as the Arkhangelsk Oblast (part of which belongs to the Arctic zone of the Russian Federation), in our opinion, should be comprehensive in nature, have an appropriate basis in terms of consolidating activities in regional programs, departmental documents, strategic documents planning, etc. In this case, the main attention should be paid to the development of transport, logistics and energy resource components aimed at achieving the socio-economic goals of territorial development [19, p. 240; 20, Tutygin A.G., Chizhova L.A., Lovdin E.N., p. 183].

Table 4 provides a brief overview of some possible areas of management decisions and examples of such decisions made in the current conditions of high volatility of environmental factors that contribute to the development of aquaculture projects and the fishery complex of the Arkhangelsk Oblast.

Table 4

Ways and examples of solving problems of aquaculture projects in the Arkhangelsk Oblast

Problem	Ways and methods of solution	Examples from modern practice of managerial decision-making
Poor development (in some cases lack of) infrastructure	Creation of an infrastructure (transport and logistics) framework for existing and potential fish farming (aquaculture) projects	There are no effective examples of solutions in the region *
High costs of energy resources, including the use of recirculating water supply (RWS) installations in fish farming.	Subsidizing energy costs	There are no effective examples of solutions in the region *
Purchase of feed	Creation of a regional food supply base	On 23 December 2022, a feed production facility was opened at the campus of the Higher School of Fisheries and Marine Technologies

		of the Northern (Arctic) Federal University [14]
Need for innovations, including renewal of fixed assets	Priority state support for enterprises investing in the renewal of fixed assets and the introduction of modern production technologies. Lobbying and promotion of local goods in the regional consumer market	Since 2022, subsidies for equipment for aquaculture projects are available [15]
Environmental restrictions and threats	Monitoring of compliance with environmental standards and requirements by fish farms	There are no effective examples of solutions in the region *
Lack of government support	Revision of principles and types of state support for the development of aquaculture projects	Increase subsidies for aquaculture projects by 25% in 2022 (compared to the previous period)
Lack of professional competencies and interest from existing entrepreneurs and the younger generation in aquaculture projects	Monitoring of staffing needs of employers and compliance of professional competencies of graduates of specialized institutions in the region. Introduction of modern teaching methods into the practice of training specialists	In 2023, a new higher education program "Aquatic Bioresources and Aquaculture" was introduced on the basis of the Higher School of Fisheries and Marine Technologies of Northern Federal University [16]

* *according to the authors*

According to Table 4, the Arkhangelsk Oblast practice lacks effective examples of solutions to such problems of aquaculture project development as: poor infrastructure development, high energy costs, environmental constraints and threats. Therefore, it is currently necessary to consolidate the efforts of authorities, entrepreneurs and the expert community to elaborate measures that will promote the development of activities in the field of aquaculture and increase the economic returns from existing fish farms in the region.

Conclusion

As the historical overview of the socio-economic development of the Arctic regions of Russia in general and the Arkhangelsk North in particular shows, fishing and industry play a very important role both in terms of food security of the population and in the formation of economic relations in the regional economic system. The heyday of the fishing industry of the Arkhangelsk Oblast was in the Soviet period of the 1980s, when the volume of fish catching and production of other aquatic biological resources was about 340 thousand tons per year. Over the past 15 years, in the Arkhangelsk Oblast, unlike other regions of the Russian Arctic, there has been a decrease in the number of fishing and fish farming enterprises. The volume of fish catches also decreased significantly (almost three times) compared to the peak period of the 1980s. Currently, one of the priority tasks of regional state policy is the development of the fishery complex, including ensuring the production of aquaculture.

Within the framework of the research to identify problems and opportunities for the development of the relevant sector of the consumer market of fish and fish products of local pro-

[14] Official website of NArFU. URL: https://narfu.ru/mrt/novosti/all/374792/ (accessed 07 July 2023).
[15] Data from the Ministry of Agriculture and Trade of the Arkhangelsk Oblast.
[16] VK Group of the Higher School of Fisheries and Marine Technologies of NArFU. URL: https://vk.com/vshrimt_narfu (accessed 07 July 2023).

ducers on the example of Arctic municipalities of the Arkhangelsk Oblast, the authors conducted a consumer survey and a number of expert interviews with producers of these products, as well as with representatives of the scientific community and authorities. The survey results made it possible to establish different consumer preference profiles of the population depending on their age category. The main reasons limiting the consumption of fish and fish products have been identified, including high prices, the presence of low-quality fish and fish products in retail outlets, as well as the lack of ability and desire to cook among the younger generation.

An analysis of expert opinions made it possible to identify such problems in the development of aquaculture projects in the Arkhangelsk Oblast as:

- poor development (sometimes absence) of infrastructure;
- high energy costs when using recirculating water supply (RWS) installations in fish farming;
- technological problems;
- necessity of innovation, including renewal of fixed assets;
- environmental restrictions and threats;
- insufficient government support;
- lack of professional competencies and interest among existing entrepreneurs and the younger generation in implementing projects.

Despite the existing positive examples from the practice of developing aquaculture in Russia and beyond, Arkhangelsk experts (representatives of government authorities, business and the scientific community) have a discrepancy in opinions regarding the prospects for fish farming and aquaculture development projects in the region. According to representatives of the scientific community, the fishing industry of the Arkhangelsk Oblast should focus on catching and processing fish, and not on its artificial cultivation, which is too costly and associated with a number of environmental risks. This issue is certainly debatable and requires further research, especially taking into account the factors of instability of the external environment and the need to increase the sustainability of regional food systems in the face of sanctions pressure [21, p. 353].

Solving a number of problems in aquaculture projects in the Arkhangelsk Oblast could be facilitated by consolidating the efforts of authorities, entrepreneurs and the expert community to develop effective management solutions aimed at developing the activities of fish farms.

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The Market of Traditional Food Products of Indigenous Minorities of the European North of Russia: Big Data Analysis

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Abstract. In recent years, the entrepreneurial activity of Small Indigenous Peoples of the North (SIPN) has increased significantly due to favorable economic climate through the development of programs of subsidizing traditional economic activities. Their representatives are involved in the production and promotion of traditional products on global and local markets, including through the Internet. This is the result of the transformation of the traditional lifestyle and adaptation to digital innovations. The study aimed to analyze the market of the SIPN' traditional food products in the European North of Russia in the Internet on the basis of big data. The materials of the study were text messages related to the traditional economy of indigenous minorities, uploaded using methods and tools of automated data collection from the "VKontakte" social network. Data processing was based on innovative methods for analyzing large-scale data, the assortment of products of the traditional economy of the indigenous peoples of the European North of Russia, the offers for the sale of which were posted on the social network for the period in 2019–2022, were studied. Recently, the activation of producers of SIPN' traditional food products in the Internet became the result, on the one hand, of restrictions due to the coronavirus pandemic, on the other hand, of increased interest to the SIPN' culture and the Arctic biological resources, which provide their high adaptability, health and well-being. As a result, these northern products have acquired the status of a delicacy. It has been revealed that the most popular product on the Internet market in the European North of Russia is fish and seafood. The practical significance of the study is connected with the possibility of applying the results in the drafting and adjustment of strategic and program documents aimed at the development of the Arctic territories, preservation of the traditional way of life and economic activities of the indigenous peoples of the European North of Russia.

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Introduction

The preservation of traditional forms of economy and life activities of the representatives of Small Indigenous Peoples of the North (SIPN) is extremely important for achieving sustainable development of society. This ensures the maintenance of the history and culture of the peoples, enriches current perceptions of the surrounding world, and allows material artefacts and spiritual traditions to be passed on to future generations.

In recent years, the entrepreneurial activity of indigenous minorities has increased significantly due to favorable economic climate through the development of programs of subsidizing traditional economic activities. Their representatives are involved in the production and promotion of products in global and local markets, including through Internet resources. This is the result of the transformation of traditional lifestyles and adaptation to digital innovations.

Trade relations (buying and selling goods and services) are the most popular area of manifestation of indigenous peoples' traditional forms of economic activity. However, in this study, communications with the participation of indigenous minorities, using the results of traditional economic practices, are not limited to trade and affect much more diverse areas of interaction between parties to market relations in other areas, such as exchange relations (exchange in kind, barter), labor relations, including formal and informal employment, subsidies and other financial support from the state and business, as well as material assistance from relatives and other motives and intentions of communication participants.

The purpose of the article is to analyze the market of traditional indigenous food products of the European North of Russia in the Internet space based on big data arrays. This will expand knowledge about the practices of these peoples in terms of economic relationships with various stakeholders (government authorities, business community, non-profit organizations, population, etc.). At the same time, this will help to obtain information about the extent to which indigenous peoples are ready to enter the market and offer the results of their traditional economic activities for sale, whether they are familiar with the functionality and capabilities of modern digital platforms (in particular, social networks) that help them conduct entrepreneurial activities, and which types of products from traditional forms of economic activity are the most popular. More specific questions are also of interest, for example, what types of products of the traditional economy are most often offered on the market on the Internet (fishing, reindeer herding, hunting, collecting

and processing forest products — berries and mushrooms, folk arts and crafts, including souvenirs and etc.).

Our research is limited by the general methodology, as we are analyzing data that is linked to individual northern regions and has signs indicating that the actor is a representative of the indigenous peoples of the North (through appropriate identification of the community in a social network, the use of linguistic markers). Nevertheless, this approach does not exclude the possibility that the range of observations includes cases where the real party offering goods resulting from the traditional economy of indigenous peoples is not ethnic representatives, but ordinary trade intermediaries.

Review of marketing practices for selling traditional food products of indigenous peoples of the North

The market of traditional food products of indigenous peoples includes products from reindeer husbandry, fishing, hunting, and gathering (berries, mushrooms, nuts, medicinal herbs, etc.). In modern conditions, the traditional economic activities of indigenous minorities are primarily aimed at both ensuring their livelihoods and at producing and selling traditional goods (with significant state support).

The geography of the study is marked by the borders of the European North of Russia. Not enough research has been devoted to the functioning of the market for traditional indigenous food products in this territory. In this regard, we will consider the existing marketing practices for the sale of traditional indigenous food products in the northern and Arctic regions of the country where SIPN live. Traditional products are sold through agro-industrial enterprises, national communities, slaughtering complexes, factories, peasant farms, individual and private reindeer farms, as well as private intermediaries who purchase products in bulk from indigenous people, etc. [1, Bogdanova E.N., Andronov S., Asztalos Morell I.].

Currently, the sale of reindeer herding and fishing products is officially possible by concluding contracts at a set price, which is usually below the market price, which often does not suit reindeer herders, fishermen and hunters. In this case, the Khanty, Mansi and Nenets have difficulties with the sale of fishery products associated with existing quota systems that limit sales volumes, and local residents express concern that they only accept fish from “insiders” [2, Martynova E.P.].

In order to stimulate reindeer herders, hunters, and wild plant gatherers to sell products at an affordable price in some northern regions, the state provides subsidies. The condition for receiving a subsidy is the acceptance of products of traditional crafts by legal entities at a price that is recommended by regulatory legal acts at the regional level and is the sum of the subsidy rate and the purchase price paid to individuals by the receivers at their own expense [3, Loginov V.G., Ignatieva M.N., Balashenko V.V.]. However, under the terms of state support, sellers should deliver their products only to “authorized enterprises” at a fixed (often reduced) price. Reindeer herd-

ers try to avoid such channels for selling their products, since they suffer significant losses when delivering meat associated with the "grading game" [4, Pilyasov A.N., Kibenko V.A.].

The next way to sell products of a traditional economy, in particular among the Dolgans, Evens and Evenks, is its sale through private entrepreneurs [5, Kaduk E.V.], acting as intermediaries between product manufacturers and consumers. Delivery of handicraft products through entrepreneurs has certain positive aspects:

- businessmen offer the most favorable prices than when delivering products to enterprises;
- sellers (representatives of indigenous peoples offering their products) receive immediate cash;
- saving money on transporting meat and fish to the consumer, as entrepreneurs come to buy the products themselves;
- barter of traditional food products for other goods necessary for indigenous people [2, Martynova E.P.].

This method is popular among residents of the North (for example, in 2018, the sale of antlers to illegal buyers exceeded the sale to the state through the Yamalskiy state farm by 5 times [1]). However, such a distribution channel carries its own risks, as it creates conditions for manipulating prices towards lower ones. Nevertheless, it is worth recognizing the value of this "barter", as it is a vital source of essential goods for indigenous peoples leading a nomadic way of life.

Another marketing channel for traditional indigenous food products is independent (spontaneously organized) trade in urban and rural areas. This can be implemented at city fairs (for example, in honor of Reindeer Herder's Day), at markets and trade "from a sleigh". This is in fact illegal trade (except for official city events). In this regard, some representatives of indigenous minorities register as individual entrepreneurs or choose other organizational and legal forms for conducting official business activities, which ensures their control over the harvesting of deer meat and the sale of products. A striking example is the entrepreneurial model of Yamal reindeer husbandry. Medium- and small-sized reindeer farms (for example, peasant farms or individual reindeer herding farms) are largely dependent on state support and have the opportunity to sell their products either to slaughter stations or to agricultural production cooperatives according to a predetermined (not always fair) price, or to the population (mainly ethnic villages) at a price, which they set themselves [6, Bogdanova E., Lobanov A., Andronov S.]. Large reindeer herding farms are self-sufficient and can influence pricing during negotiations on the sale of products with intermediaries or enterprises engaged in the subsequent processing of meat products [7, Andronov S.V., Bogdanova E.N., Lobanov A.A.].

[1] Olenevody Yamala nachali sezonnuyu kompaniyu po sboru pantov [Yamal reindeer herders have started a seasonal campaign to collect antlers]. URL: https://www.1tv.ru/news/2003-07-02/251310-olenevody_yamala_nachali_sezonnuyu_kampaniyu_po_sboru_pantov?start=auto (accessed 15 May 2023).

In the Khanty-Mansi Autonomous Okrug–Yugra, the creation of entrepreneurial structures is also proposed as the most effective tool for the functioning of traditional economic sectors among indigenous peoples [3, Loginov V.G., Ignatieva M.N., Balashenko V.V.].

The prerequisites for the development of the market for traditional indigenous food products are created by the expansion of digitalization of the traditional economy. Thus, in 2014, Russia started implementing a program to eliminate the digital inequality, especially in hard-to-reach areas where a high proportion of indigenous peoples live. As part of the implementation of the first stage of this program, more IT camps were created [2]. S.Yu. Belorussova notes that "users of ethnic communities demonstrate adaptability to the Internet space: on the one hand, they actively participate in virtual life, on the other, the real world remains the true support of their identity" [8, Belorussova S.Yu.]. The researcher also points out that indigenous peoples have different attitudes towards the processes of digitalization and informatization: some believe that this contributes to the "unity of the people", others think that this has a "negative" effect. However, despite large-scale digitalization, a high proportion of remote areas remain without or with limited access to the Internet. In this regard, "tundra radio remains the most reliable and fastest means of communication among the indigenous peoples, since cellular communications and the Internet work only near fuel and energy infrastructure facilities, trading posts and settlements" [3].

However, the processes of digitalization and informatization in the Arctic region are gradually changing the distribution of traditional indigenous food products. Networks of sellers and buyers began to be created among reindeer herders, fishermen, hunters and gatherers of wild plants via the Internet, mobile communications, instant messengers, etc.

In turn, L.V. Elmendeeva notes the great demand among indigenous minorities for the use of online platforms for the sale of wild plants and other national products (mushrooms, nuts, venison, etc.) in Yugra [9]. V.V. Simonov and I.V. Samsonova also confirm this fact, pointing out that the Evenks of Southern Yakutia began to actively use digital platforms, primarily WhatsApp, to accept orders for picking berries, herbs, mushrooms and their further implementation (exchange, sale) [10]. Digitalization conditions have accelerated the transition of the process of contracts and transactions with non-timber resources into the virtual space and thereby demonstrated the ability of this traditional practice to modernize, and therefore its sustainability. The Internet played the role of a trigger for reflection on the tradition and culture associated with ethnomedicine and historically rooted everyday practices of using herbs and berries. Traditional knowledge was thus "scaled" and became the property of the local "mass market" [10, Simonova V.V., Samsonova I.V.].

[2] V Rossii nachalsya vtoroy etap ustraneniya tsifrovogo neravenstva [The second stage of eliminating the digital divide has begun in Russia]. URL: https://digital.gov.ru/ru/events/40814/?utm_referrer=https%3a%2f%2fwww.google.com%2f (accessed 16 June 2023).
[3] The Economy of the North — ECONOR 2020. URL: https://oaarchive.arctic-council.org/handle/11374/2611 (accessed 16 June 2023).

Besides, many fishermen form “friendly” client networks through mobile communications and messengers and take orders for fish [2, Martynova E.P.].

Researchers often note that the exchange of traditional food products for other goods (petrol, sugar, etc.) is common [11, Arzyutov D.V.], and the lack of goods in stores in rural areas is compensated for through various forms of exchange, for example, among Dolgans and Nganasans in Taimyr [12, Davydov V.N.; 13, Vasilyeva V.V.]. In the western part of Taimyr, a multi-level structure of product exchanges has been developed, including traditional food, between the tundra and the village, between the village and the city, inter-village and intra-village exchange [12, Davydov V.N.].

The scientific literature identifies the following types of market exchange and practices of sharing traditional food products in the northern regions:

- tradition of “sharing” in market conditions: hunting and fishing products are traditionally shared among the peoples of the North [14, Ventsel A.]. However, it is worth noting that this type of product sharing, as a rule, is carried out only within traditional communities and extends more to the products of hunting, fishing and gathering, both among the Evenks and the Khants, Mansi, and Nenets [15, Kaduk E. V.; 2, Martynova E.P.];
- barter exchange is often repeated with one partner on the basis of trust and stable social ties [16, Humphrey C.]. This type of exchange is preserved in the absence of an acute shortage of funds as a convenient form of interaction, when each of the parties can immediately get the necessary things, sometimes used when repaying a commodity loan in a store;
- commodity loan and trust in relations between sellers and buyers: this phenomenon is still observed in remote northern settlements. It should be noted that goods are “provided on credit” only to those in whom the seller has confidence; the term of payment for the goods is not stipulated in advance;
- charity as a form of product sharing has been implemented by some entrepreneurs, for example, in the Anabar region of the Republic of Sakha (Yakutia) [15, Kaduk E.V.].

The sale of traditional food products is influenced by mining companies. Serving the working settlements of extractive companies creates a guaranteed market for the sale of products produced by indigenous peoples. Informal trade with “gas workers” and “oil workers” provides income for reindeer herding farms. But here an ambiguous situation arises. On the one hand, wealthy “shift workers” represent sales markets for indigenous minorities, but on the other hand, there is a non-equivalent exchange of goods [17, Kryukov V.A., Shishatsky N.G., Bryukhanova E.A. et al.].

All the above-mentioned fully corresponds to the realization of reindeer husbandry products. However, there are some distinctive features with regard to the marketing of fishing, hunting and wild plants. Fishing is often an activity that accompanies reindeer husbandry. Fishermen from the northern settlements and villages have mastered private outbound trading: they deliver fish to

regional centers and large towns, and sell it near markets and supermarkets [2, Martynova E.P.]. However, such trade forms part of the "shadow" market. Fish is often an exchange commodity for other food products, fuel, etc., because in order to sell it in monetary terms it is necessary to obtain a sales license under a quota, which is established annually [15, Kaduk E.V.].

It is more difficult for representatives of indigenous minorities to organize the sale of wild plant products, which are much less profitable compared to reindeer herding and fishing products and form their added value mainly at the stage of processing and production of biologically-active preparations. Gathering is perceived as a cultural practice and trade. The Evenks often sell wild plants in the form of "sharing" between relatives and friends [18, Simonova V.V.]. According to some researchers, their collection and sale is currently the only source of income for indigenous peoples of remote rural settlements [19, Malysheva M.S.; 20, Taskaev A.I., Pautov Yu.A.]. Predominantly, the population sells collected berries and mushrooms to pickers, from whom the products are later bought by enterprises. A.N. Pilyasov notes that in Soviet times, despite the Arctic natural nonstationarity, the idea of creating a stationary conveyor belt for large-volume processing of wild plants was discussed [4]. However, this idea was never realized, and currently the processing of these products is carried out mainly by small enterprises.

In the conditions of the European North of Russia, the market for hunting products as a traditional economic activity of indigenous peoples is practically leveled, since the importance of hunting as a commercial trade in this territory is lost, and hunting itself becomes a demanded commodity on the market of tourist services [21, Anufriev V.V., Mikhailova G.V., Davydov, et al.]. Currently, hunting in the European North is mostly an amateur activity [20, Taskaev A.I., Pautov Yu.A.]. However, for the autochthonous population living in the territories of the European North, hunting resources are most often obtained for intra-family consumption and occupy a leading place in the diet of rural residents [21, Anufriev V.V., Mikhailova G.V., Davydov et al.].

Thus, we can conclude that the marketing behavior of traditional food producers is influenced by a set of different factors: severity of natural and climatic conditions, settlement system, availability of a resource base, transport and settlement networks, volume and forms of government support, industrial activities in the territory, technological equipment, procurement infrastructure, income level and others. Researchers note that northern entrepreneurs currently have a high rate of adaptation to changing conditions.

A comparative analysis of the scientific literature devoted to the issues of the market for traditional food products of indigenous peoples shows that research on this topic was carried out mainly in different northern territories, often in one direction of the traditional economy and mainly using sociological research methods. At the same time, there are no comprehensive studies that examine the issues of marketing the products of traditional forms of management in the European North of Russia through various marketing channels, including the use of digital technologies. This confirms the relevance of this study. The introduction of the digitalization process into the economic activities of indigenous minorities, as well as the accelerated development of the

methodology for analyzing large data sets, makes it possible to apply new research methods to analyze the range of traditional food products offered on the market and identify the behavioral trajectories of indigenous peoples of the European North of Russia in the sale of these products in the Internet.

Theoretical approaches to the use of "big data" for the analysis of socio-economic phenomena and processes

The methodology of this research is based on the concept of big data, where the term "big data" means not only a set of large-dimensional data, but also a set of methods and tools with which this data can be processed.

The concept of big data has no generally accepted documented history. Its origins can be traced back to 1880, when the US government was faced with the need to process the results of the population census [22, Ohlhor F.]. In the 20th century, the concept was further developed in Western science, in parallel with the implementation of space programs and projects in the field of biotechnology. This concept represents a growing area of developing methods for studying the ever-increasing volume of information due to the development of the field of information and communication technologies in general and the giants of the technical industry in particular. The term "big data" was created by analogy with definitions that in the English-speaking tradition characterize various spheres of public life ("big science", "big business", "big pharma", etc.). Let us consider the key features of this concept.

Firstly, the key characteristics of big data are: volume; complexity and diversity of data types and structures (for example, digital traces left on the Internet and other digital repositories for subsequent analysis); high speed of creation (in "real" time) and analysis of new data [23]. These features "fit" into the "3V" formula, which is formed by combining the attributes of "big data": Volume, Variety and Velocity. However, it should be clarified that there are currently no generally accepted requirements for the volume of big data. Only a few works propose hypotheses about the permissible volume of databases of this type [for example: 24, Shal A.V.].

Secondly, the lack of a clear, proven algorithm for working with the primary data itself. It is about the approach to the information itself (how to collect, document and store it), and not about working with the data and the applicability of certain proven scientific methods (grouping, comparison, etc.). The publication of a special issue of Nature in September 2008 is considered to be a turning point in understanding big data as a source of new opportunities and challenges and, at the same time, a separate field of research [25]. The editorial column of this issue noted that the formation of the information society makes increasing demands both to scientists and scientific organizations, and to society as a whole, connected with scientific activity. The establishment of a separate field of knowledge (conditionally "data management") as a new discipline and at the same time a protocol for the actions of scientists and scientific personnel is becoming increasingly relevant. More and more data are being created and analyzed every day, and science as a cogni-

tive practice and a social institution has yet to adapt to this and create the necessary infrastructure.

Thirdly, focusing on current processes, actions, changes, etc. rather than on accomplished events in the past. For comparison, some areas of research within the framework of "big data" have recently become more and more developed: for example, approaches to big data analysis, which help commercial organisations to make business decisions to increase productivity and profitability [26, Balusamy B., Abirami R.N., Kadry S., Gandomi A.H.]. However, being focused on past events and creating reports and various "dashboards", this area of activity is only indirectly related to the scientific research of big data (Data Science). The latter are mainly aimed at analyzing the present or recent past and are aimed at drawing conclusions about the future [23].

Fourthly, pronounced interdisciplinarity. The concept of big data as the basis of the methodological approach finds application in a variety of scientific disciplines — natural, social and humanities. Here are examples of studying and using "big data" in various fields of scientific knowledge.

Economic research using big data examines how the use of big data in reverse logistics helps to track the movement of goods and reduce costs [27, Butt A.S., Ali I., Govindan K.]. Social science studies the use of big data on mobile positioning to identify changes in the dynamics of entertainment tourism in China [28, Zhao Z., Yuan Z., Zhao S., et al.]. In cultural science, the dilemma of balance between preserving the ecological health of popular cultural sites and the interests of visitors is considered [29, Whitney P., Rice W. L., Sage J., et al.]. In medicine, "big data" is used to generalize the processes of establishing reference intervals based on real data [30, Ma S., Yu J., Qin X., et al.]. In geography, the foundations for creating large-scale information panels for mobility data are being developed [31, Conrow L., Fu C., Huang H., et al.]. In behavioral sciences, big data is used to conduct timely analysis of diseases [32, Singh K., Li S., Jahnke I., et al.]. Local history studies research the risks of establishing digital control over the population in India [33, Paunksnis Š.]. In financial analysis, "big data" becomes a source of information for making decisions on mergers and acquisitions of companies [34, Fanning K., Drogt E.], in agriculture — to reduce waste in supply chains of agri-food products [35, Ouro-Salim O., Guarnieri P., Leitão F.O.]. In anthropology, one of the most interesting areas of application of big data is the analysis of social networks [36, Tindall D., McLevey J., Koop-Monteiro Y., et al.], and in chemistry — methods for modeling the chemical roasting process [37, Yan F. et al.]. Thus, it is not an exaggeration to say that the scope of the concept of big data is almost universal.

In domestic scientific works, the concept of "big data" is also very popular and is widely used in interdisciplinary research: healthcare, journalism and public relations, linguistics, rhetoric and communication strategies, statistics and cybernetics. There are also review studies and applied articles on the topic of directly working with a large amount of information [38, Vaseva G.S., Baldina M.Yu.].

Fifthly, the use of software both at the stage of data collection and processing, and the minimization of "manual" methods of analysis, with the participation of a "human" only when setting tasks and at the stage of interpreting the results obtained. From the view of scientific research methodology, the concept of "big data" is gradually becoming one of the most promising areas for expanding scientific knowledge and creating research programs with the potential to obtain new information that cannot be accumulated without the use of methods for automatically collecting and processing a large array of disordered data, which is one of the essential characteristics of the general concept of big data arrays. Many analysts also pay attention to this [4].

Thus, the main criteria of "big data" are the volume, variety and high speed of data creation; lack of a recognized algorithm for working with the data itself within a particular study; current relevance of the data (they continue to be generated in the present time); applicability in all scientific disciplines and mandatory use of software for work. Market research certainly lends itself to big data methodology and is a promising area of research. Of particular interest is the study of sales of traditional food products of the indigenous peoples of the North, which are sold not only on the wholesale market, but also through Internet resources.

Materials and methods

The material for the study was messages on the social network VKontakte (https://vk.com/), which are thematically related to the sale of products from the traditional economy of indigenous peoples in the regions of the European North of Russia (Murmansk Oblast, Komi Republic, Republic of Karelia, Nenets Autonomous Okrug, Arkhangelsk Oblast). Data upload period: from 01.01.2019 to 05.06.2022.

As part of the study, methods to analyze big data arrays were used, that is, structured or unstructured data of large volumes and significant variety, processed by horizontally scalable software tools in order to use them for generating statistics, analysis, and forecasts and decision making [39]. This study involved the collection, processing and intelligent content analysis of an array of unstructured text data.

According to the classification of big data analysis methods recommended by McKinsey Global Institute [5], the following methods were used:

- methods of the Data Mining class: learning association rules, regression analysis (calculation of significance indicator);
- artificial neural networks (automatic checking of grammar, spelling, work with dictionaries);
- spatial analysis through the use of topological and geographic information in the data;
- statistical analysis;

[4] Manyika J. Big Data: The Next Frontier for Innovation, Competition, and Productivity. McKinsey Global Institute Report, 2011. URL: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/big-data-the-next-frontier-for-innovation (accessed 13 May 2023).
[5] Ibid.

- visualization of analytical data (presentation of analysis results in the form of spatial tables and graphs).

For uploading social network posts, the upload source was determined: thematic communities or user profiles. Searching for communities and uploading content was carried out using a platform for working with social network data (https://www.elibrary.ru/item.asp?id=40880722, patent registration number 2019662001). The platform is developed in the Python3 programming language. The program uploads and analyzes data using the public API VKontakte (Application Programming Interface; https://dev.vk.com/api/overview). This method allows making requests directly to the social network database, which makes it possible to upload content in a convenient form. Linguistic markers were developed, on the basis of which search queries were compiled. After this, using the VK API groups.search method (https://dev.vk.com/method/groups.search), thematic communities were selected using search queries. Thus, a list of thematic communities was obtained. Next, posts were unloaded from community walls. The VK API method (wall.get) was used to upload content from the walls of communities and users.

For data processing, the Russian DSML (Data Science & Machine Learning) class platform PolyAnalyst was used, which includes "tools for collecting and aggregating data, analyzing them, generating reports and interactive visualization of results based on BI technologies" [6]. As part of our research, the methodology was adapted to specific scientific tasks [40, Petrov E.Yu., Sarkisova A.Yu.], which emphasizes the novelty of this research.

The processes of collecting, processing and subsequent analysis of data include the following stages: collecting an array of big data (using an open API), processing big data (on the PolyAnalyst platform) and interpreting the results of data mining.

The search query was formed on the basis of the research goals set at the initial stage of the work, and taking into account the given words, which are linguistic markers, combined into 3 groups: products of traditional farming (for example: "reindeer", "antlers", "horns", "fish", "mushrooms", "berries", "honey", "fur", etc.), an indication of the geographical region and indigenous peoples (for example: "Komi", "Sami", "Murmansk Oblast", "Karelia", etc.), as well as linguistic markers that represent a typical "purchase and sale" situation (for example: "sell", "selling", "sale", "price", etc.). Based on the results of the download, a large data base with a volume of 77 GB was formed. After tagging and filtering, 89.970 community messages were selected for further processing.

The sample of messages and subsequent analytics were prepared using the PolyAnalyst platform. Using natural language processing algorithms and statistical tools, text analytics made it possible to solve such analysis problems as preparing texts for analysis (in particular, indexing, removing duplicate records, correcting spelling errors in data tables, etc.), recognition and extraction of named entities (in relation to our research — "geographical locations") and keywords extraction.

[6] PolyAnalyst 6.5. Megaputer Intelligence. 2021. URL: www.megaputer.ru (accessed 01 June 2022).

After filtering keywords and entities representing the range of products of a traditional economy and corresponding to the situation under study, the results of the analysis were visualized in the form of graphs and then interpreted using PolyAnalyst software solutions.

Thus, the methodological features of this study meet all the criteria of the "big data" concept. First of all, this is a large volume of primary information (77 GB), which represents unstructured data of significant diversity that cannot be analyzed without special software tools — in this case, a platform for working with social network data, developed in the Python programming language, the VK API method (searching for thematic communities and downloading content from the walls of communities and users) and the Russian DSML class platform PolyAnalyst. There is still no critical point in the volume of data that separates the applicability of "big data" methods and qualifies the study as such, even when analyzing social networks [36, Tindall D., McLevey J., Koop-Monteiro Y., et al.]. However, we especially note that the result of uploading in our case, which in itself is very large and can be analyzed exclusively using software, is only the final result of the work carried out at one of the stages of this research.

Let us also note other important qualifying features of the work carried out, corresponding to the above-mentioned criteria of "big data": the lack of an established algorithm for working with the data itself, primarily due to the novelty of the approach to studying the market for indigenous people's products; we are analyzing current processes that continue to accumulate new units of observation and have not undergone any qualitative changes at the moment.

Internet market of Arctic traditional food products of the European North of Russia

The object of the study was the offers for the sale of products of traditional economy (reindeer breeding, fishing, hunting, collection of wild plants, etc.) in the subjects of the Russian Federation belonging to the European North of Russia (Fig. 1).

Fig. 1. European North of Russia as an object of research [7].

In the regions under study, big data analysis was used to collect data on the offerings of traditional food products of the indigenous peoples. The most active regions in which these products are offered on the Internet market through the social network VKontakte are the Komi Republic (41.2%), the Republic of Karelia (38.9%) and the Murmansk Oblast (16.2%). Producers of traditional food products in the Arkhangelsk Oblast (2.3%) and the Nenets Autonomous Okrug (1.4%) are less active.

Based on the results of analyzing a large array of data on offers of traditional food products using the PolyAnalyst platform, a cloud of keywords was built (Fig. 2), which shows that the most popular product on the Internet market of the European North of Russia is fish and other seafood.

[7] Source: Fig. 1–8 are prepared by the authors using the PolyAnalyst platform.

Fig. 2. Cloud of keywords characterizing traditional food products offered on the Internet market of the European North of Russia.

The most significant types of fish products are smoked, dried and salted fish, cod liver, various types of caviar (red and black caviar, for example, pike, nerka, pink salmon, trout, chum salmon, herring, etc.), shrimp, scallops, etc. In the social network “VKontakte”, offers of such types of fish as trout, cod, pink salmon, sea bass, chum, nerka, salmon, etc. predominate. Keyword relationships demonstrate that portioned fillets, steak and fish caviar are more in demand on the market (Fig. 3).

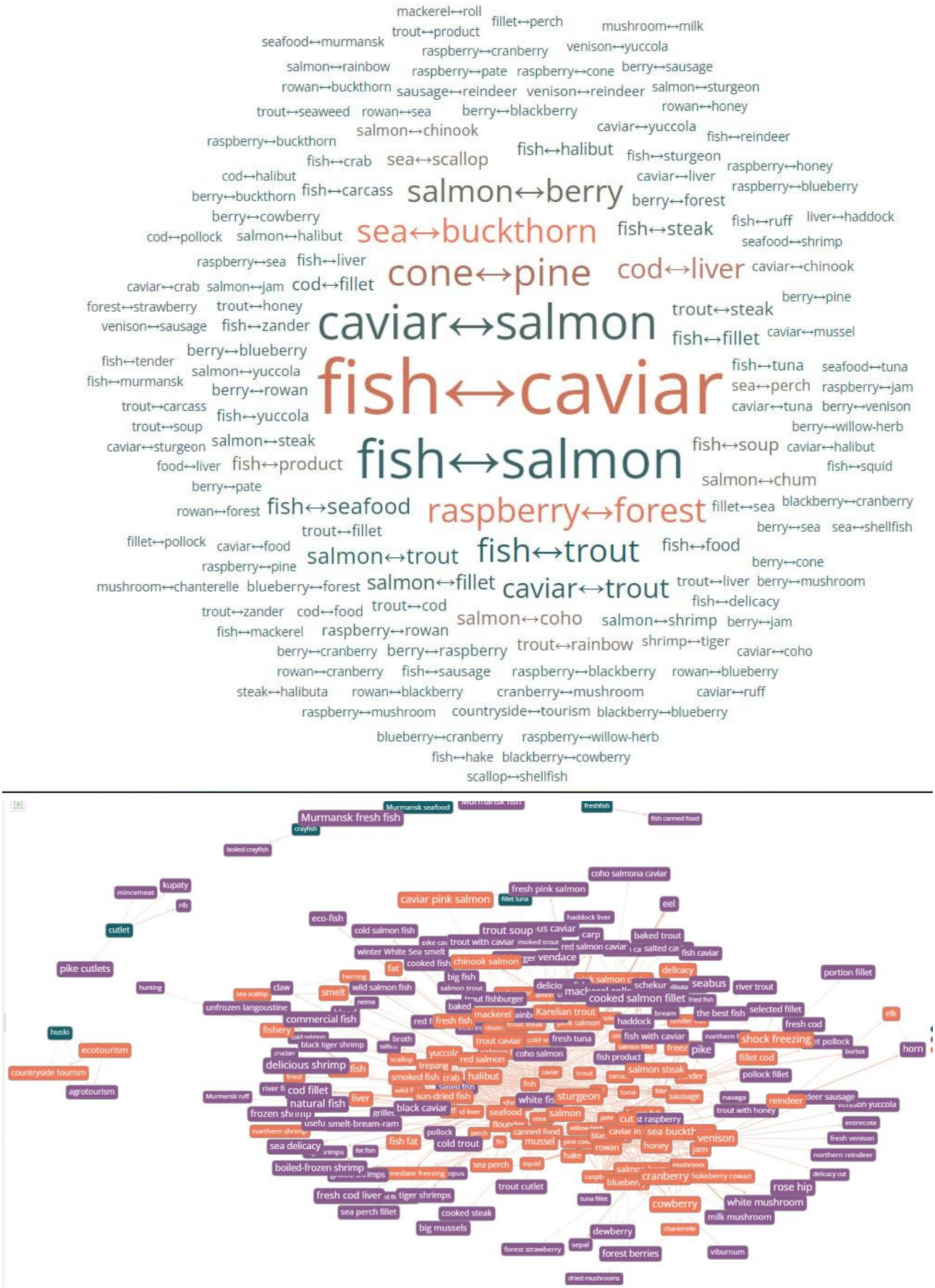

Fig. 3. Relationship of keywords characterizing traditional food products offered on the Internet market of the European North of Russia.

At the same time, products of reindeer husbandry and wild plant collection are the least represented on the market. All types of wild berries are on sale: lingonberries, cranberries, cloudberries, blueberries, sea buckthorn and raspberries. The connection of keywords characterizing traditional indigenous food products demonstrates that the main specialization of the Internet market of the European North of Russia is northern fish products — both ready-made and fresh (or fresh frozen), which are promoted as a delicacy. No comprehensive offer of traditional products of the North in the assortment based on big data analysis has been identified, as no connection between different types of products (venison, fish, wild plants) has been noted.

Using the PolyAnalyst platform, a graph (Fig. 4) was constructed characterizing the degree of support for a traditional product in the Internet market (that is, the number of posts on a social network in which this product is offered).

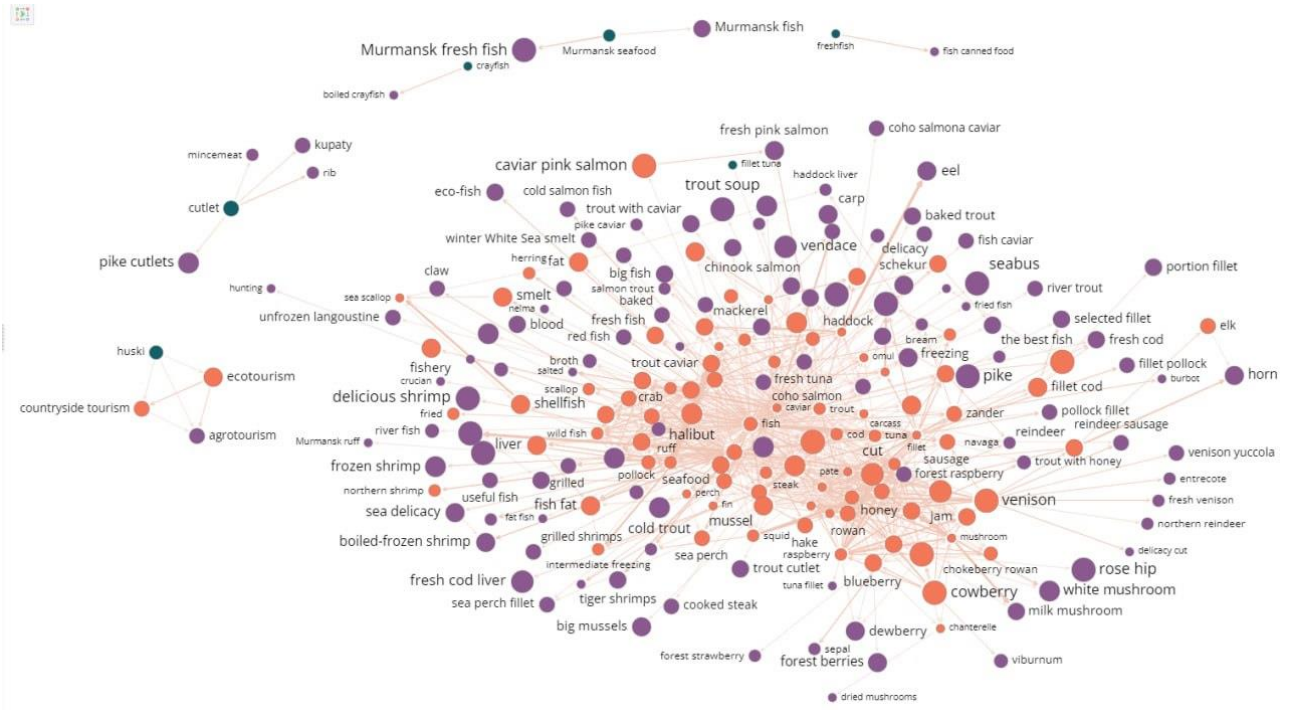

Fig. 4. Graph: traditional food products offered on the Internet market of the European North of Russia.

The graph reveals the geographical affiliation of traditional food products offered on the Internet market: for example, “Karelian trout”, “Murmansk fish”, “Murmansk ruff”, “Murmansk seafood”, etc. At the same time, services that are indirectly related to the traditional economic activities of indigenous peoples are visualized: “rural tourism”, “ecotourism”, “agro-tourism”. Certain nodes of the graph characterize the range of traditional food products offered on the Internet market of the European North of Russia (Fig. 5–8).

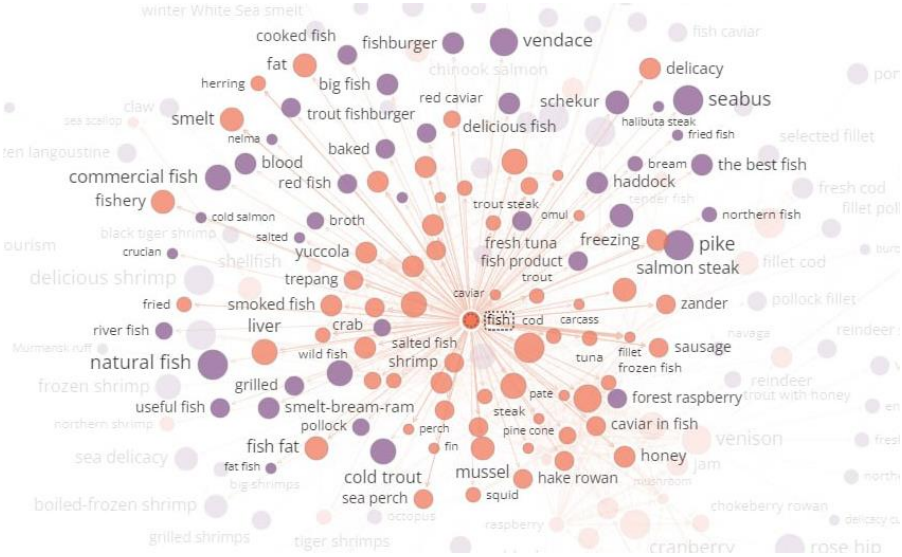

Fig. 5. Node of the “Fish” graph.

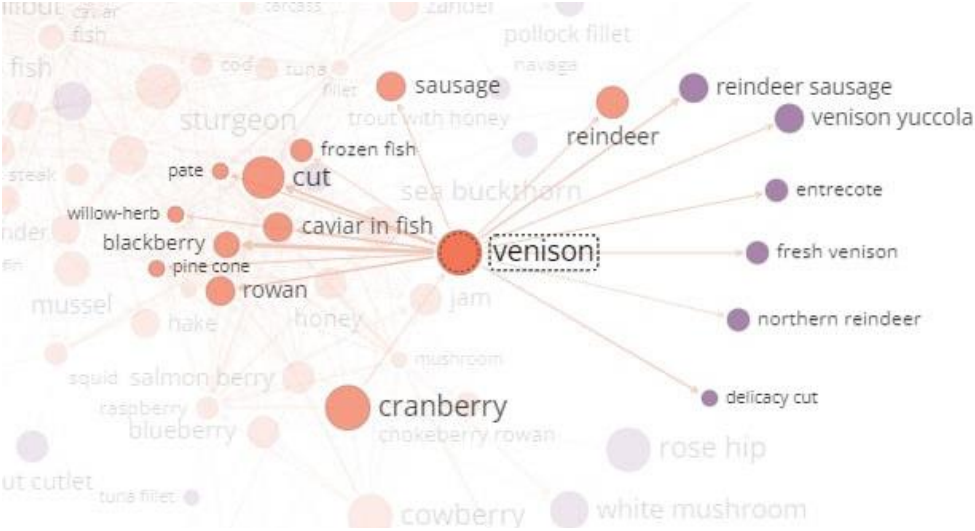

Fig. 6. Node of the “Venison” graph.

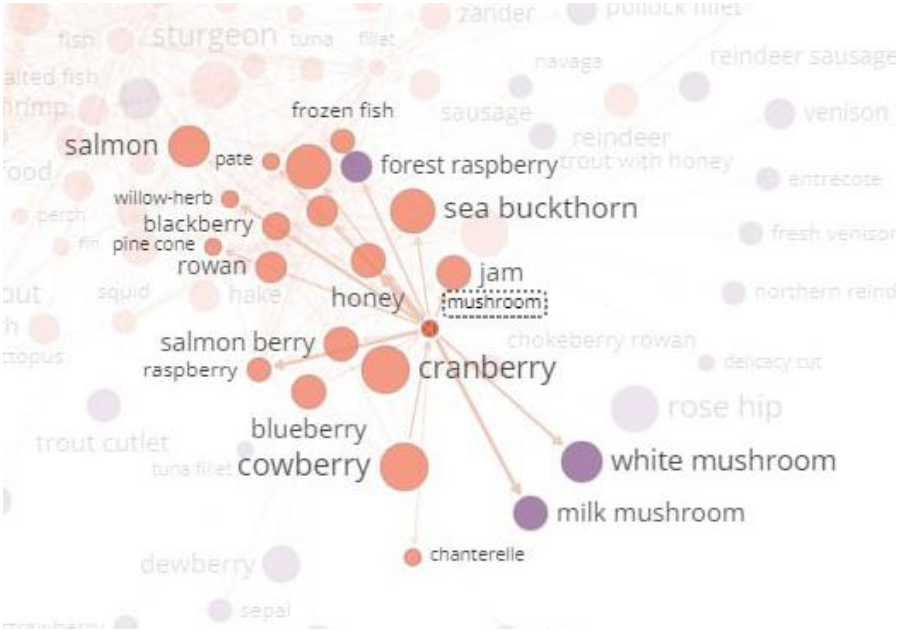

Fig. 7. Node of the “Mushroom” graph.

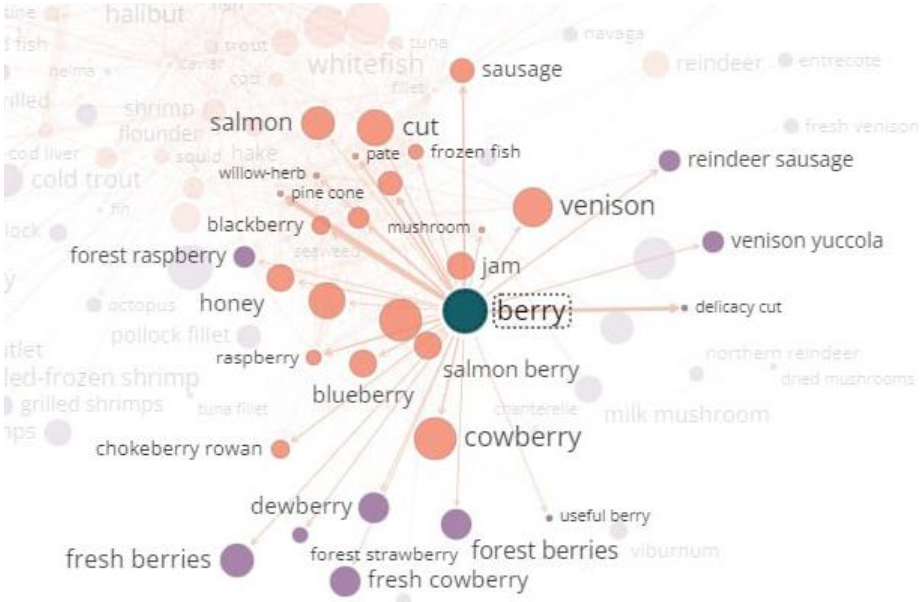

Fig. 8. Node of the “Berry” graph.

Analysis of the nodes of the graphs characterizing proposals for the sale of traditional food products of indigenous minorities of the European North of Russia through the social network “VKontakte” shows that the most popular products are fish (smoked and fried fish, fishburgers, yukola, fish soup, etc.) and venison (sliced meat, sausage, pate, entrecote, yukola). The assortment of mushrooms is small, and they are offered along with other “gifts of the forest” (berries, pine cones, etc.). At the same time, berries are a popular product, sold both separately and as an addition to fish and meat products.

Conclusion

Information and communication technologies have entered all spheres of public life. Northern entrepreneurs now have a high speed of adaptation to changing conditions and are generally very successful in adapting to the challenges of the new times. It is not surprising that the digitalization of economic activity has also affected the economic practices of indigenous minorities. In the modern world, retail sales of traditional products are increasingly carried out via the Internet. This was not only the motivation for the research presented here, but also provided an opportunity to apply innovative technology for collecting and analyzing big data to study this market segment. The range of traditional food products of indigenous peoples offered through the social network “VKontakte” was analyzed, and the marketing trajectories of indigenous peoples of the European North of Russia were partially identified in terms of the sale of traditional food products in the Internet.

It has been established that the most popular product on the Internet market of indigenous minorities in the European North of Russia is fish and seafood: smoked, dried and salted fish, cod liver, various types of caviar, shrimp and scallops. Northern fish products, both ready-made and fresh (or fresh frozen), are the main specialty of the Internet market of the European North of Russia with the participation of indigenous minorities.

The scientific novelty of the research is the identification of the structure of the traditional food products market of the indigenous peoples of the European North of Russia, represented in the Internet, using an innovative methodology of analysis. The practical significance lies in the prospects for applying the results in the development and adjustment of strategic and program documents for the development of Arctic territories and the preservation of the traditional way of life and economic activities of the indigenous peoples of the European North of Russia: in particular, the adaptation of programs for the introduction of digital technologies in places of traditional residence and economic activity of SIPN, taking into account the specifics of zoning to increase the accessibility of state and municipal services, including programs to support the traditional economy of the SIPN; expanding the use of big data analysis technologies (including data from Internet trading platforms and social networks) to monitor the state of the traditional food market in order to ensure the food security of the population; on the basis of the analysis of the assortment range and price formation for traditional food products, development of a set of measures to support the sale of traditional products in order to increase their economic and physical accessibility for the population.

The results of the scientific research were tested within the framework of the work “Development of risk models of the impact of climate change and traditional nutrition on the health and adaptation of the indigenous population of the Arctic region of the European North of Russia” of the world-class scientific and educational center “Russian Arctic”.

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Barriers and Factors of Tourism Business Development in Russia and the Arctic (Based on the Results of an Expert Survey)

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Abstract. The tourism sector is the most important for the socio-economic development of countries and regions, contributing to the preservation of historical and cultural values, the formation of humanism and tolerance in the world. However, there are many difficulties in the tourism business that have become seriously exacerbated during the COVID-19 pandemic and contribute to a rethinking of the problems and factors of tourism development. In Russia, since 2020, the focus has been on the development of domestic tourism, and this further contributed to the restoration and maintenance of a certain stability in this area, which is especially important during the period of aggravation of the geopolitical situation in Russia and the world, from 2022 to the present. Nevertheless, the issues of barriers to the development of tourism in our country remain relevant, taking into account the ideas, orientations and practices of both tour operators and consumers of tourism services, which actualizes sociological research in this aspect. In order to identify the existing barriers and factors for the successful development of tourism in Russia, the authors conducted a sociological study in 2021 among tourism specialists who acted as experts and represent authorities, tourism business and science in Russian and foreign regions. The study was conducted in a qualitative strategy using the in-depth interview method, during which 31 experts were interviewed. The results of the expert survey may be useful in the further development of the tourism industry in the Russian regions.
Keywords: *tourism, tourism business, tourism barrier, tourism development factor, tourism product, quality of life*

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Introduction

The tourism industry is the most important in improving the quality of life of the population, since it affects all significant areas of peoples' lives related to both their daily, work, cultural and leisure activities. Being a key element of the regional economy, tourism contributes not only to the development of the social infrastructure of settlements, but also to a deeper knowledge of the culture, history of the territories, and the formation of tolerance in relations between people.

The Strategy for the development of tourism in the Russian Federation for the period up to 2035, adopted in 2019, recognized the need to accelerate growth rates and strengthen the role of

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tourism in economic development, since in recent years the industry has formed about 4% of the country's gross domestic product [1].

Tourism plays a special role in the Arctic, contributing to the effective development of territories and improving the quality of life of the population living there. Considering the high resource intensity of economic activity, the lag in the quality of life from the Russian average, the low competitiveness in the business sector in the Arctic territories noted in the Development strategy of the Arctic zone of the Russian Federation, the development of tourism in the Arctic will, without a doubt, contribute to the improvement of these indicators, as well as the formation of a comfortable, well-equipped environment and socio-economic development of the Arctic territories as a whole, which is also indicated in this document as goals for the period until 2035 [2].

There are many challenges to tourism development in Russia and the Arctic. The measures taken by Russia in the pre-pandemic years to stimulate the development of inbound and domestic tourism led to an improvement in a range of indicators related to the growth of tourists' number in our country and an increase in Russia's place in the ranking of countries in terms of competitiveness in the travel industry. However, a significant problem remained the suboptimal price-quality ratio for a number of types of tourism, high transport costs, lack of hotel rooms, unrecognizability of Russian tourism brands and other difficulties that hampered its development.

During the COVID-19 pandemic, the need to develop domestic tourism has become especially acute and, under these conditions, has become global [1, Ulak N.]. In 2020–2021, prospects for the development of tourism in the Russian Federation, according to analysts [3], had a high level of uncertainty, especially in the global tourism market [2, Sahakyan M., Antamoshkina E.; 3, Ivanov I.A., Golomidova E.S., Terenina N.K]. However, now it can be argued that the pandemic has made it possible to focus on the domestic tourism, declared in the Tourism development strategy as one of the main courses for the development of the tourism sector in our country, which is especially important in the modern period in the current geopolitical situation.

It should be noted that in 2021 and 2022, there was a positive trend in domestic organized tourism compared to 2019 and 2020, according to the Association of tour operators of Russia [4]. The situation is different with inbound tourism, where there has been a significant decline in indi-

[1] Strategiya razvitiya turizma v Rossiyskoy Federatsii na period do 2035 goda, utverzhdena Rasporyazheniem Pravitel'stva RF ot 20 sentyabrya 2019 g. № 2129-r. S. 22 [The strategy for the development of tourism in the Russian Federation for the period until 2035 was approved by Order of the Government of the Russian Federation of September 20, 2019 No. 2129-r. P. 22]. URL: http://government.ru/docs/37906/ (accessed 30 January 2023).

[2] 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 "Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035"]. URL: https://www.garant.ru/products/ipo/prime/doc/74710556/ (accessed 30 January 2023).

[3] Misikhina S. Rossiyskiy turizm: dostizheniya, problemy, mery podderzhki pri pandemii koronavirusa [Russian tourism: achievements, problems, support measures during the coronavirus pandemic]. Moscow, National Research University Higher School of Economics, 2020. URL: https://goo.su/Cpkb (accessed 20 March 2023).

[4] V ATOR podveli turisticheskie itogi 2021 goda [ATOR summed up the tourism results for 2021]. URL: https://www.atorus.ru/news/press-centre/new/58171.html (accessed 28 January 2023); ATOR podvela predvaritel'nye itogi turisticheskogo 2022 goda [ATOR summed up the preliminary results of the tourism year 2022]. URL: https://www.atorus.ru/node/50839 (accessed 28 January 2023).

cators since 2020. Thus, according to Rostourism estimates, economic losses from the decline in tourism amounted to more than 1.5 trillion rubles in 2020 [5]. According to the results of three quarters of 2022, the inbound tourist flow to Russia of foreign citizens decreased by 99.5% compared to 2019 and by 16% compared to 2021 [6].

Experts believe that the tourism industry in Russia has long been in need of change, and the crisis situation that emerged as a result of the coronavirus pandemic and the tense geopolitical conditions in the world should generally contribute to the already emerging transformation [4, Loguntsova I.V.].

In modern conditions, the tourism sector in Russia continues to experience a difficult period, caused by a sharp decline in incoming tourism and an urgent need for the further comprehensive development of tourist destinations within the country. In this regard, research to identify barriers and factors for the further successful functioning of the tourism industry is of particular importance, which was undertaken in the framework of this study. The results obtained will be useful in carrying out targeted work to eliminate existing difficulties and develop this area in Russian regions, including the Arctic territories.

Literature review

The scientific literature has approved the interdisciplinary status of the tourism phenomenon, which, being a socio-economic phenomenon, is revealed through a variety of approaches: economic-managerial, regulatory, legal, recreational, geographical, cultural, systemic and others [5, Varlamova A.V., p. 136]. In the modern world, tourism has become a significant industry, but scientists note that its theory and methodology are still in the process of formation [6, Sharma R., p. 90].

Researchers in the field of sociology of tourism consider tourism as a journey for consumption and leisure [7, Cohen E., Cohen S.; 8, McCannell D.]. The phenomenon of mass tourism receives a critical assessment in early sociological theories, because it is associated with artificial, unreal authenticity, based on consumerism and hedonism of visitors and exploitation of the culture of local residents. In this regard, E. Cohen talks about the commodification of local culture, i.e. its transformation into a commodity for tourist consumption [9, p. 372]. This can lead to cultural forgeries created specifically for external consumers [10, Belkina S.V.], as a result of which the original meaning is lost and the authenticity of cultural artifacts is destroyed, and the culture, having become the object of display, is expropriated from local residents [11, Pine J., Gilmore J.].

[5] Glava Rosturizma rasskazala ob ubytkakh iz-za otsutstviya inostrannykh turistov [The head of the Federal Tourism Agency spoke about losses due to the lack of foreign tourists]. URL: https://tass.ru/ekonomika/9116567 (accessed 30 March 2023).
[6] ATOR podvela predvaritel'nye itogi turisticheskogo 2022 goda [ATOR summed up the preliminary results of the tourism year 2022]. URL: https://www.atorus.ru/node/50839 (accessed 28 January 2023).

At the present stage, discussions continue regarding the problem of authenticity and the need of tourists for the authenticity of cultural artifacts, which is especially important in the context of globalization and active development of the impression economy.

At the same time, in the context of postmodern society, ideas about authenticity are subject to transformation: if the experience gained by a tourist corresponds to his motives and expectations, then it can be called authentic [12, Moshnyaga E., p. 110]. As a result, truly new impressions replace and fade into the background the authenticity of the cultural objects themselves. Thus, cultural tourism as a special type of tourist practice is transformed into experience tourism [13, Karpova G.A., Khoreva L.V.; 14, Sushchinskaya M.D.], which involves the direct participation of the tourist in the life of the visited object, involvement in practices atypical for visitors.

The processes of transformation of the tourist himself and the motivation of his trips are conceptually comprehended through the use of the category of status liminality, which is understood as the uncertain status position of an individual or community during territorial movement, characterized by temporality, status-role mobility from the view of social identity, involvement in the value-normative dimension and reflexivity [15, Katernyy I.V., p. 228]. In the process of gaining a tourist experience, a person temporarily abandons his usual status, usual way of life and identity, but after the trip he returns to his usual state. The tourist experience is associated with an exit from the sphere of everyday life into an extra-structural reality, where connections between people are filled with vivid affects, and the experience gained penetrates to the depths of the personality [15, Katernyy I.V., p. 232].

In the conditions of a postmodern society, tourism is transformed into post-tourism [16, Moshnyaga E.V.], where the organization of travel turns into a game of making a profit from the provision of comfortable and safe services. The post-tourist is no longer looking for novelty and authenticity and most likely will not question them, but is more focused on receiving pleasure in a hyperreality specially created for him [15, Katernyy I.V., pp. 233–234].

J. Urry, in his mobile theory, takes tourism from the sphere of leisure to the sphere of consumption, and the latter represents the basis of contemporary postmodern society — the consumer society. Having identified two types of consumption — Fordist (mass) and post-Fordist (individualized), the scientist classifies modern tourism as the second type, where, in addition to the emphasis on separation from the “mass” of other consumers, the so-called image, visual consumption (consumption of ready-made images attractive to photography) is of great importance [17, Urry J.].

Thus, the conceptual distinction between the phenomena of tourism and travel is carried out in sociological discourse through the definition of tourism as a modern leisure and consumer practice, which is provided and supported by a whole range of tourism services designed to satisfy the diversified (individualized) needs of visitors for pleasure and experience.

One of the most important problems in the development of tourism in modern society, characterized by high dynamism, uncertainty and unpredictability, is the crisis of confidence. In addition to the risk of receiving a fake experience and encountering artificial authenticity, the entire range of tourism services is in question. Tourism, like any service, is characterized by intangibility and the absence of clear, calculable quality criteria. At the same time, a wide range of interactions at each stage of the journey, which includes a large number of subjects, each of which should guarantee the safety of the tourist, is specific to tourism [18, Barashok I.V., Rudenko L.L., p. 78]. The presence of a large number of intermediaries and accompanying agents for the implementation of complex tourism services makes it difficult to establish trust between the seller and the buyer. The gamification of the authenticity of the tourist experience can turn into a simulation of the quality of the services provided to the tourist as a whole. The need to develop rules and standards for the provision of this service leads to an understanding of the phenomenon of tourism as a special social institution, which is fully realized within the framework of a sociological approach to analyzing the functioning of the tourism sector [19, Appakova-Shogina N.Z., Gut A.V., Zinurova R.I.; 20, Kushchev N.P.].

Representing tourism as a social institution, researchers focus on the issues of its structure, the definition of the main parties involved in tourism, their needs and resources to meet these needs; the peculiarities of functioning of both individual structural elements and in interrelation with each other; the analysis of the value-normative system that regulates the functioning and interaction of structural elements of tourism, etc. is carried out. Issues of transformation of this social institution under the influence of modern challenges, including the COVID-19 pandemic, are addressed. For example, as a result of digitalization processes, which have significantly changed consumer behavior patterns, the emergence of a new direction in tourism— smart tourism — is noted [21, Ovcharenko L.A., Lebezova E.M.]. The peculiarity of “smart” tourists is their implementation of innovative consumer patterns based on digital communication channels.

Modern theoretical and applied sociological studies of tourism as a social institution reveal the features of certain types of tourism, identified on various grounds (youth, social, cultural, event, industrial, international, domestic, etc.) [22, Kononov A.Yu.; 23, Trubilin A.G.; 24, Lysikova O.V.]. A sociological analysis of the main trends and factors of tourism development at the level of individual territories is being actively carried out; problems of tourism potential and attractiveness of Russian regions are revealed [25, Frolova E.V., Kabanova E.E.; 26, Boldyreva S.B.; 27, Zotkin D.V., Akaev D.V.]. Particular attention is paid to the specifics of tourism activities in the northern (including Arctic) territories, both in Russian society and at the level of other countries [28, Lukin Yu.F.; 29, Zhigunova G.V.; 30, Karhu Y., Osipov A.Yu.].

A comprehensive analysis of the situation in the tourism sector at the level of the entire Russian society deserves special attention. At the same time, a quantitative (mainly economic) approach to the problem is quite widely presented in the scientific literature [31, Valkova

T.M., Kruzhalin V.I., Kruzhalin K.V., Shabalina N.V.; 32, Sharikov V.I.; 33, Abramova T.]. In this regard, the need for a qualitative analysis of the current situation in tourism at the present stage of development of Russian society has been updated. One of the most important sources of information that allows giving a qualitative assessment of the problems and prospects for the development of tourism in Russia are representatives of business, science and government, who are carriers of expert knowledge.

Materials and methods

In order to identify factors that hinder and promote the development of tourism in Russian regions, in 2021, the authors, as part of a research team led by E.N. Sharova, conducted a study among Russian and foreign experts in this field. During the survey, the method of in-depth interviews was used, followed by a qualitative analysis of the data obtained. The number of respondents was 31 people from different areas of the tourism industry in Vologda, Moscow, Murmansk and the Murmansk Oblast (Apatity, Kirovsk, Nikel), St. Petersburg, Tver, as well as Norway (Oslo, Spitsbergen). By area of activity, the experts represented: authorities (10 people); science and education (5 people); business sector (16 people, of which 7 people are hotel services, recreation and entertainment centers, 6 people are tour operators; 3 people are catering) (the distribution of number designations and areas of activity of experts are given in parentheses in the text).

Research results

Based on the results of the expert survey, the main difficulties in the development of the tourism industry in Russia and the Arctic territories (using the example of the Murmansk Oblast) at the institutional level were identified.

Experts identified **the instability of the tourism industry and, accordingly, business in this area as a fundamental problem at the institutional level**. The dependence of the sector on the state of the economy, on seasonality, on the political and social situation in the world and the country was noted. The vulnerability of the entire sector has been particularly acutely demonstrated by the coronavirus pandemic:

During the pandemic, we didn't work for six months, but we paid taxes (8, hotel service, Murmansk);

We really had a very difficult period. ... Until the last moment we tried to remain standing. This is lost profit, which amounts to hundreds of thousands of rubles. We just sorted out the debts and credit obligations. Plus, we purchased equipment on lease and we had to make monthly payments on it. We had nothing to pay... We were left with loans, with debts, and all summer we tried to survive this difficult period (8, hotel service, Murmansk).

During the period of self-isolation and pandemic restrictions, hotels and other accommodation facilities, exhibition centers and cultural leisure facilities suffered the most. The only

less vulnerable areas in tourism are catering, which works with food delivery, and extreme tourism:

... extreme sports enthusiasts don't care whether there is a pandemic or not. They are ready to overcome these obstacles from regulations, prohibitions, and otherwise get to the place where the service is provided. But the mass tourists, those with children, they are, of course, afraid to go; those who are elderly or have health problems, of course, will not go (9, hotel service, Murmansk).

But still, experts note that in 2021 the situation began to change for the better:

...now there is a reverse reaction. ... People are not able to travel abroad and they now have money to spend in Russia. As a result, the service has improved (8, hotel service, Murmansk).

Despite the financial and organizational difficulties during the pandemic period, experts note that a "reboot" occurred during the pandemic; there was an understanding that it was necessary to develop domestic tourism, fill it with a meaningful component, and the level of trust in tour operators increased.

The next significant problem was **the low level of professionalism of tourism industry personnel**.

Professionalism is determined by the level of competence, experience, knowledge, including the characteristics of life in the region, its history; the desire to convey interesting, accurate and truthful information (for guides, tour guides); constant training and development together with the region; as well as a responsible attitude to business and the level of involvement in the provision of tourism services:

You need to constantly keep your "ear to the ground", especially if it is a private business... It is necessary to monitor tourists along the entire route — track their path and help with problems. The tour operator does not abandon the person all the way home (5, tour operator, Murmansk).

The lack of professional knowledge does not allow tour business entities to understand how tourism is organized in the world and to be guided by trends and norms of the world market development, which, in turn, does not allow improving the quality of services in this sphere.

One of the reasons for this, according to experts, is the low quality of personnel training in the country and, as a consequence, the lack of professional knowledge. At the same time, experts note a steady trend of decline in the quality of educational training observed over the past few decades:

At some point, the situation began to improve, in the 2000s, as it seemed to me, but no... nothing changed in the 2000s. On the contrary, the level of training of specialists has become worse; graduates do not understand anything (6, tour operator, Spitsbergen).

Another reason for the low level of professionalism of tourism industry personnel is due to the ease of entry into the profession, which does not require any special education and even licensing of activities. Here are the statements of informants on this matter:

You can enter the tourism industry at low cost, that is, to start a business, you don't need a lot of investments, it's enough to have a personal car, you can even do without it (4, science, Murmansk);

If there is an opportunity to make money somehow — they make money. If you have a car, take people to Teriberka. Nobody asks a guide for a license... — this is a wild business here (17, hotel service, Murmansk).

Due to the lack of license checks and quality control of services on excursion routes, many "uneducated self-employed" appear in the tourism sector, driven by the desire to make a quick profit. Experts have repeatedly given examples of how such "specialists" distorted the facts and history of the region, which negatively affected the regional image.

A similar situation is observed in the Lovozerskiy district of the Murmansk Oblast, where Sami villages, created as a tourism project, are presented as amusement parks that have nothing in common with the true culture of the Sami. The ongoing "Disneyfication" causes negative emotions and disappointment among both experts and guests seeking local authenticity.

Experts noted that in our country, **a serious problem in the tourism industry is the lack of development of the regulatory framework**. This problem, according to experts, is directly related to the long-term absence of a systematic state policy in the field of tourism, the inconsistency of regulatory documents with international standards, as well as the competence of local officials. As a result, security issues suffer and "grey" business develops.

Experts note that at the present stage in Russia, an effective mechanism for ensuring the safety of tourists has not yet been created. Due to the lack of mechanisms for monitoring and checking compliance with security measures in tourism, and the lack of legitimate training courses in the field of security in tourism, this aspect is often ignored by tourism business entities.

In addition to security issues, experts point to the need to solve existing problems at the legislative level, especially relevant in the Arctic regions, in particular in the Murmansk Oblast, for the implementation of fishing, crab fishing, water, geological, industrial, mountain and other types of tourism; resolving issues with obtaining permits to enter closed territorial entities for tourism purposes, renting snowmobiles (driving rules and insurance apply only to public roads, while snowmobiles are used on off-road routes), etc.

Almost all experts talk about **insufficient support for the tourism business by the state and regional authorities**, which became acutely evident during the COVID-19 pandemic. Businessmen were faced with the need for financial support for their business, the need to defer monthly payments, tax payments, but they either did not receive assistance from the state or received insignificant help:

We sold everything we could in the family to save the office. Nobody helped us with anything, not even a ruble. They gave us loans, we took 5-6 million, now in six months we have to pay them back. ... Now we are taking the next loan to close this one... (7, tour operator, Murmansk).

Another aspect of insufficient support from the authorities, which experts paid attention to, is **the lack of consulting support for tourism businesses in the process of applying for funding under government programs**:

The state has various funds for the development of tourism…. But... they (companies — author) cannot take it.... Specialists, economists who work in our departments, all with good diplomas, but there is no practice, no experience, no desire... That is, there is money, but they can't take it (7, tour operator, Murmansk).

The downside of the presented problem is the ineffective use of state support resources, which was noted by experts representing government authorities. This problem is expressed in the lack of competence of representatives of the tourism business to correctly fill out applications, draw up a business plan, and come up with a new original product. Perhaps the organization of consulting support for business, the need for which was mentioned by businessmen, can solve this problem.

Experts noted **the need for a constructive attitude of the state towards small business**. *Since many tourism practices are implemented through small businesses, it is important to prevent its development "underground" or "in the grey zone"* (6, tour operator, Spitsbergen). Experts also talk about the state's understanding of the specifics of tourism and the corresponding attitude:

Previously it was said that tourism should bring a lot of income and pay taxes. But there will be no tourism tax, because everyone is trying to save money, not to pay something to the general budget. The effect of tourism is different: the more tourists come, they bring money, they spend money in restaurants, shops, on transport, visiting parks, in hotels. This money remains in the region (7, tour operator, Murmansk).

The next important barrier to tourism development is **the logistical difficulties and the underdevelopment of transport infrastructure**.

The underdevelopment of transport infrastructure includes, according to experts, poor-quality roads or their absence within regions; lack of public transport routes to tourist locations, long and uncomfortable trips on public buses, which leads to a search for ways to move around the region, dependence on private drivers, high cost of travel on all types of transport; absence or ill-conceived nature of organized pickups of tourists from airports to certain locations; non-compliance of airports and railway stations in many Russian cities with standards for receiving a larger flow of tourists; lack or insufficiency of equipped public transport for organized transportation of children and people with disabilities in accordance with existing requirements.

The next barrier is **the underdevelopment of tourism infrastructure**. It includes the lack or complete absence of hotels, cafes, public toilets both on routes and in locations, and much more. A striking example is Teriberka, Murmansk Oblast, where for a long time the massive flow of tourists was not provided with the services necessary for travelers, both in the location itself and along the route to it. In this regard, there is a huge need to establish the following along routes and locations: public toilets, including in natural tourism sites; places for stopping and parking of vehicles at places of travel in the region, observation platforms; cafes along the routes; souvenir shops and stores; gas stations; places to rest and spend the night:

... interchanges are needed, "pockets" are needed so that tourist buses can stop and maneuver at certain locations of objects (30, authorities, Murmansk);

When you are travelling, you should have good transport, a good road, you want to go to the toilet — and here is a sanitary stop — this can be either a petrol station or some toilets in these "Georgian houses". This includes roadside infrastructure: some cafes where you can have a snack, or shops where you can buy something, and places of accommodation such as campsites, hostels, hotels, etc. But in order for all this to appear, it has to be worked with. And, accordingly, those structures that are responsible for the tourism sector in the region work, or... a city-forming company that aims to develop a particular area and support the population (13, tour operator, Moscow).

As for accommodation, regional locations often lack the opportunity to accommodate even small flows of tourists:

Teriberka is actively growing in terms of flow. Tourists are coming: Chinese, Thai. If they arrive by plane, they should travel in this group. And we don't even have anywhere to house them here. That's why only Murmansk. They come to Murmansk, settle down and make radial trips. They left in the morning, drove to Teriberka and came back. The next morning they left, drove to the "Snow Village" and somewhere else and came back. We need them to come, live here, leave money here... (9, hotel service, Apatity, Murmansk Oblast).

Experts note the lack of places to accommodate tourists, the old rooms, the lack of basic services (breakfast) in hotels, and the high cost, as, for example, in the city of Apatity, Murmansk Oblast:

We do not have modern hotels. I don't know any. They are all from the 1990s, 1980s, 1970s. The Severnaya Hotel, of course, maintains itself in decent condition and even receives stars, and even does renovations, but our tourists cannot afford it (9, hotel service, Apatity, Murmansk Oblast).

In order to open new hotels, mini-hotels or hostels, there are a large number of difficulties both financial and normative:

Now it is impossible to open a hotel or hostel. Let's look at the requirements for these rooms: the ceiling height must be no lower than the value, the distance from the ceiling to the bed, etc. Where to find such premises? They simply do not exist. You can't do it in the base-

ment, the ground floor — you need permission from almost the entire house to open anything there. All houses in Murmansk were built decades ago ... they do not comply with any GOSTs or standards. …. And if you build it, there is no sewage system, no electricity, all this needs to be supplied. What money is needed! To take a loan for an entrepreneur, you need collateral. That is, there is no easy, cheap money. But how to start a business if it gives a profitability of only 10–12%, and the loan rate is 18–25%... There is an idea, there is a desire, but there is no money. ... What kind of development can we talk about (17, hotel business, Murmansk).

An important barrier to organizing a successful trip is **the insufficient coverage of locations with telephone and Internet connections, lack of Wi-Fi**, which are necessary both in terms of notification in case of danger and for prompt exchange of tourists' impressions in social networks and messengers. For tourism as an industry of impressions, communication and the Internet become a channel for promoting the area and tourist products. At the same time, it is important to give tourists the opportunity to share their emotions in the moment:

What is the impression industry: ... received an impression, took a photo and immediately posted it on social networks. ... And friends say: "I want to go there too" ... If she takes this photo, but she doesn't have the Internet, then it's not a fact that she will post it in the evening. At best, she will show it when she comes back. But... there will be no such emotions (9, hotel service, Apatity, Murmansk Oblast).

Experts also note **a lack of information in logistics and content plans in the regions**, which creates a sense of uncertainty, risk and fear among tourists. In this regard, experts emphasize the importance of developing a tourist's understanding of what types of transport he can get to the place, where to spend the night, where and what to eat, where to go and what to see. At the same time, information is needed on different tourist destinations for groups of different ages and social status:

For example, I want to understand whether I want to go to the Murmansk Oblast. How can I make the best route, ... how to get there, what to see.... That is, I need some kind of ... navigator, a hint. ... Or the Teriberka — everyone knows it. How to get there? What will you do there? Where will you be there? Where will you go? Yes, the place is interesting, but wouldn't it turn out that you drive five hours one way, see it for two hours, and then drive back for five hours? (28, authorities, Tver).

According to experts, any region should have a branded route that is not only interesting for the traveler, but also carefully thought out, accessible all year round and has a low cost. A successful route is determined by the demand among tourists; it should be easily travelled by at least 50 people per weekend (20, authorities, Oslo, Norway).

Another problem is **the lack of branding of territories taking into account their holistic image**. This problem, in turn, contributes to the lack of unity among tour operators in positioning the region. As a result, the tourist does not develop a clear image of the territory and does

not form a desire to come again to immerse himself in the depths of the culture and life of the local community.

At the socio-group and personal levels, experts noted **the low substantive level of tourism products and their inability to give a rich experience to tourists as problems**, observed in all Russian territories:

Neither territories nor cities have been able to create a tourism product that will contain a large number of impressions (11, authorities, Moscow).

When there is no focus on content in a region, and the product itself is of the same type and is not aimed at a specific audience, then it is not interesting for more than one visit. At the same time, the Chinese, as experts note, are ready to pay for nature, which is observed annually in their trips to the territory of the Murmansk Oblast just for the northern lights ("they are ready to pay for nothing" (20, authorities, Oslo, Norway)). But on the domestic market, Russian tourists need content:

Russian tourists don't understand why they should pay money just to look at nature... Russians are more practical, they want to pay for content... (20, authorities, Oslo, Norway).

In order to interest Russian tourism, this informant recommends constantly identifying what people are willing to pay money for.

To get away from the uniformity of tourism products within any region, experts suggest that each municipality should find its own specifics, identify "anchors", insignia (14, authorities, Murmansk Oblast); fill tours with activities in accordance with local culture and practices — weaving baubles in Pomor style, making jam... (2, science and education, Murmansk).

Moreover, it is important **to match tour products with modern trends and ways of their presentation**. For example, nowadays, according to the respondents, interactivity is important, especially in gastronomy, local history.

This is also **the lack of focus of tour operators on a specific consumer, the correct packaging of tourism products** in accordance with the requests of tourists and their internal needs:

For example, it is a very big disappointment when a romantic couple, a family with screaming children and some grandparents — historians — find themselves in the same group on a trip. These three categories have very different travel motivations. And they are trying to "shove" them into the same product. And the global trend we see is to take this internal motivation into account and... "tailor travel" to the individual needs and motivation of consumers. This is related to the psychology of consumption (20, authorities, Oslo, Norway).

All experts note **the low quality of service in tourism, without which success in the tourism business is impossible**. The main reason is the lack of qualified personnel with specialized education, a large number of unofficial "businessmen" and random people involved in the provision of tourism services. In addition, this is the lack of motivated personnel, low wages, especially in the service sector and, accordingly, low requirements for personnel, as well as bad habits:

Nowadays staffing is a problem. The most important thing is to find both an administrator and a waiter. And not management, but precisely the lowest level (28, authorities, Tver).

Experts note that this problem is characteristic of the country as a whole, and is largely due to the lack of prestige of the service sector (*people do not want to work in this area. It is not prestigious...* (28, authorities, Tver)).

The solution to this problem, according to experts, lies in increasing the prestige of the service sector at the institutional level. This requires *"three, four or five successful cases, so that people see that this can be done, that it is not a shame, that it brings income"* (28, authorities, Tver).

Experts note that the Russian tourist is a demanding consumer, as he is an experienced traveler to different countries and is focused on a high level of service. It was noted that high-quality service consists of successful answers to the following questions: *"Where will the tourist live? Where will the tourist eat? What will the tourist do?* (4, education and science, Murmansk). The consequence of a low level of service or its complete absence is a reluctance to come to the region again (*"Looked at something and left"*).

The next barrier is **the low involvement of the local population in tourism development**.

Experts note that residents have not yet realized that this is one of the branches of development, generating income, cultivating respect and love for the region (26, public catering, Kirovsk).

According to experts, there is practically no work with the local population in the regions, as a result of which *"the population does not want tourists"* (7, tour operator, Murmansk), tense situations and conflicts arise due to violation of order, garbage collection in places of visit, different expectations both:

Last summer, there was a big conflict with the local population (in Teriberka — author). Why? Because, unfortunately, there are tourists — normal people who take away everything they brought with them. And there are those who, even if they pack the garbage in bags, leave these bags in the place where they arrived, hoping that someone will clean it all up after them. That is, on the one hand, it turns out that the "newcomers" have brought some money to some small sector of the economy, Teriberka, but the settlement itself cannot invest in rubbish disposal. It has no money for such volumes (19, tour operator, Murmansk);

In my opinion, generally speaking... no one works with the population. No one at all. Neither in Apatity nor in Kirovsk the population wants the tourist. Well, except for those who rent their apartments... And every year I hear the same thing: "They've come in large numbers. It's impossible to buy food". That is, neither the stores nor the city administration are ready. Every time they fail the season at some point (9, hotel service, Murmansk).

Work with the population should include, according to informants, both explanations about the positive effect of tourism for the development of regions, especially subsidized ones (*"they just don't understand that it's money. They don't understand that we… are subsidized"* (9, hotel service, Murmansk)), as well as support for local initiatives and businesses.

In the last question, informants note the inertness of residents and the tendency to rely on visitors, the expectation that *"some businessmen from St. Petersburg or Moscow will come to us and implement their ideas"* (15, science and education, Nikel, Murmansk Oblast). The informants themselves consider the participation of the local population in tourism to be an extremely positive thing, especially in small locations, since they are the bearer of local identity:

In small territories, tourism is carried out by those who love their territory, this is an opportunity to tell a story, self-identification... (28, authorities, Tver).

In this case, according to experts, tourism will also contribute to the reduction of outflow from remote territories.

The involvement of the local population in the tourism sector is also manifested through the interesting life of the local community, full of exciting events, "where there is something to show and to be proud of":

Success in the development of tourism is when we stop selling "pictures", and start living in such a way that we have something to show and to be proud of. After all, tourism is, first of all, getting to know the life of people in the place where you come (26, public catering, Kirovsk).

Another aspect of non-involvement manifests itself in the inaccessibility of local products and services for local residents, which form a regional identity and are a key component of any travel. For example, in the Murmansk Oblast, this is observed in expensive Arctic cuisine. Due to the inaccessibility of expensive Arctic products, locals are not aware of their region and cannot promote it (29, public catering, Moscow). Therefore, the promotion of regional cuisine and local crafts among the local population is important.

Among the mental aspects of tourist services consumption, experts noted **the generally low culture of recreation and travel in the country**, which is expressed in the dominant demand for beach holidays and excursions, while a variety of destinations are being actively developed: adventure, ecological, geological, ethnographic, winter and other, allowing interesting and informative time for holidaymakers in any region of Russia, including the Arctic. According to experts, the majority of Russians today do not take advantage of the available opportunities, following traditional ideas about tourist trips.

The problem of **reasonable management of Arctic destinations**, which is the most important condition for the development of tourism in the Arctic, deserves special attention. "Reasonable management" includes the need to take into account weather conditions, respect for the Arctic nature and human safety:

This is a different nature, different natural conditions. Although any nature needs to be protected, this is more noticeable in the Arctic. You can't drive vehicles wherever you want. ... You need to understand that it takes 15 years for lichen to grow 3 cm. Here you need to think about a responsible approach to marketing, about a responsible approach to product development. For example, when we choose photographs for social media, we understand that we cannot show a person balancing on the edge of a cliff. If we show this on the official website, and then someone falls,

then we are the ones who are showing such an example. Or if you show how someone drove somewhere on a snowmobile, you always need to think whether another 50 thousand people can repeat this without damage to nature, without damage to the population. This responsible approach to the Arctic is very important... There is no need to constantly post people in bikinis, but you need to dress properly so that there is no... freezer burn, and generally think that if the guests were cold, they will remember nothing but the cold. And they won't want to buy anything else, they'll want to go to a warm room. I know that the university in Tromsø is working on this specifically, and we need to pay special attention to this in connection with the climate in the Arctic. ... You need to plan 2-3 route options.... When you know all this with reference to the region, it is easier to make some products. You can't just copy what they do in Australia and other regions. You need to know the region and think about what you are doing (20, authorities, Oslo, Norway).

Thus, in the conditions of modern Russian society, the development of tourism is significantly complicated. Obstacles to this are due to the insufficient development of the legal framework, lack of professional personnel, provision of low-quality services and unsatisfactory service, as well as the inability to create meaningful and diverse tourism products and the low culture of recreation and travel of Russians in general.

The elimination of these barriers is a significant step in the socio-economic development of regions at the expense of the tourism sector.

Based on the interviews and analysis of existing difficulties in the tourism sector, the following success factors in tourism can be identified:

- current legislation; mutual understanding between executive authorities and the tourism industry;
- availability of developed infrastructure in the region in general and on tourist routes in particular;
- high-quality service, well-thought-out services;
- thoughtfulness of logistics routes, which includes all-season availability, navigation tips for travelers, reasonable price, provision of convenience and comfort along the route to the location;
- content, attractiveness, diversity and uniqueness of tourism products; territorial and regional distinctiveness of objects; compliance of tourist products with modern trends;
- taking into account the specifics of different target groups of tourists, their needs and motivations, the ability to create travelling based on the psychology of consumption;
- interesting life of the local population (activities, events);
- information sufficiency about the tourism product; advertising;
- professionalism of managers, guides, tour operators;
- involvement of the local population in tourism and understanding of its importance for the region, development of local initiatives.

In addition to the above, it is extremely important, according to experts, to understand the economic component of tourism:

The most important thing is not to mix tourism with culture. Everything is often reduced to "an accordion". This is not "an accordion", it's still an economy... Tourism needs to be formed as a product. I urge everyone to think of tourism as a branch of the economy. Now you have formed a product, you understand that the market needs this product and what is hindering this product: infrastructure, personnel, money, subsidies. If you don't have this, then any money will be wasted. You will build hotels where they are not needed, repair roads where no one will go, because there is nothing to see there. So it's an economy and it's a focus. You can't do everything at once. ... I would choose five points. And then hit them (28, authorities, Tver).

Using the example of the city of Kirovsk, Murmansk Oblast, the expert further explains:

For example, we have a flow to Kirovsk. It's already there, it's easier to work with it. It is easier to persuade a person who went to Kirovsk to spend a day more in the Murmansk Oblast to go, for example, on an excursion somewhere, than to persuade a person who is in St. Petersburg or Moscow to go to the Murmansk Oblast. You need to work with tourists at a point that is already attractive. That is, you need to expand further from these points. Kirovsk has a unique advantage — it snows until May. Few places have this. This is a very big advantage. It is necessary to expand this segment and offer additional entertainment services to people who come to ski. So that they come not for four days, but for seven. They would ski and then do something else (28, authorities, Tver).

The experience of other regions that are successfully developing in certain directions is also useful:

It's clear that Yaroslavl and Vladimir have been in demand since the Soviet period. I'm talking about more or less new places. For example, the village of Mandrogi, Leningrad Oblast, which became a village for servicing cruise ships. I think there are already several hundred cruise ships visiting there. Mandrogi found a market, found understanding, and created a complex product. It is a whole village where you can take a walk and do crafts. ... Although it's not an obvious place for tourism, for a one-time visit. Secondly, I'm not considering the most touristy regions like Kaluga with their theme about astronautics. ... The third thing, I still have to say, is what they did at Krasnaya Polyana. It's clear that the ski slopes are where the money is huge, but there are also a lot of inexpensive package tours (28, authorities, Tver).

Summarizing the success factors, we can say that, first of all, it is a combination of professional personnel, infrastructure and tourism products, implemented with the support of the authorities and the local population, and success itself is determined by a significant tourist flow throughout the year.

Discussion and conclusion

The identified barriers and success factors in the development of tourism business show the importance of interaction with authorities and the local population; increasing the availability and quality of services provided, the necessity to take into account the needs of consumers of tourism products and modern trends, the importance of interaction with the local population and their involvement in the tourism industry.

If we talk about the problems of tourism development in Russia in general and in the Arctic in particular, the most serious difficulties, according to experts, are at the level of organizing the tourism business, the lack of "reasonable" laws and regulations, insufficient state support and quality training of industry specialists. And only then, in terms of importance, are the problems of content of tourist products, development and functioning of tourist infrastructure and services in the course of tourist services realization.

The tasks of providing tourists with access to locations through affordable transport, infrastructure and well-designed routes, content of services and quality service will contribute to return tourism and increase income in the tourism business, as well as the development of related industries, improving the comfort and quality of life of local residents in the Arctic territories and in Russia as a whole.

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Tourism in the Subjects of the European North of Russia after the COVID-19: Assessment of the State and Prospects of Development

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Abstract. The European North of Russia has a significant potential for the creation of unique tourism products. The COVID-19 pandemic and the subsequent geopolitical turbulence have had an impact on the functioning of tourism. The relevance of the study is determined by the need to identify current trends of the industry. Its purpose was to assess the state and prospects of tourism development of the subjects forming the European North of Russia in the post-crisis period. The study is based on the results of the work of authors studying the problems of the functioning of regional tourism, engaged in the search for promising areas that contribute to the growth of demand for tourist services in this market segment. Diagnostics of tourism trends in the European North of Russia, identification of strategic threats and substantiation of priorities for its development were carried out on the basis of retrospective analysis, comparison, synthesis, analogy, generalization. The features of the consumption of services of the tourism sector in the post-pandemic period are determined, threats are identified and priorities for its further development are formed. The study revealed a trend towards a decrease in the demand for hotel services in the region, which may affect the contribution of tourism to the economy of the territories. The results of the conducted research can be used as a reference point in the justification by public authorities of the ways of regional tourism development, contributing to the growth of demand for tourism products among the population and increasing their competitiveness.

Keywords: *European North of Russia, region, tourism, tourism economy, domestic tourism, COVID-19*

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Introduction

The coronavirus pandemic has had a significant negative impact on the dynamics of the tourism industry in the world. Thus, according to the United Nations World Tourism Organization (UNWTO), at the end of 2022, the international tourist flow was 37% lower than the pre-pandemic

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value in 2019, amounting to 900 million tourists [1]. However, the figure doubled compared to 2021, which is caused by the easing of pandemic restrictions in many countries. This indicates the rapid recovery of the industry after the crisis, which confirmed the high resilience of tourism to turbulent conditions noted by researchers [1, Skare M., Soriano D.R., Porada-Rochoń M.]. Russia is also showing signs of improvement in tourism, which has been hit hard by COVID-19 restrictions [2]. The driving force of the industry was domestic tourism: the tourist flow at the end of 2022 was only 5% less than the level of 2019. In addition to the unfavorable influence of the medical and biological factor, the development of tourism in the country in 2022 was negatively affected by the geopolitical situation and economic turbulence, as a result, the volume of incoming and outgoing tourist flows decreased. Thus, epidemiological and sanctions restrictions update research aimed at assessing the state of Russian tourism in order to find ways to ensure its sustainable development. The tourism potential of many Russian regions remains untapped to the fullest extent, which is associated with existing imbalances in the distribution of demand for recreation between territories [2, Leonidova E.G.; 3, Lukin E.V., Leonidova E.G., Sidorov M.A.; 4, Leonidova E.G., Sidorov M.A.]. In post-pandemic conditions, it is important to understand how the demand for tourism services has changed in regions promising for tourism, in order to increase their competitiveness in the country's tourism market. These include the European North of Russia (ENR), formed by the republics of Komi and Karelia, the Arkhangelsk, Vologda, Murmansk oblasts, as well as the Nenets Autonomous Okrug. The ENR is distinguished by the similarity of tourist and recreational resources, which are the basis for the creation of unique tourism products. Thus, many types of tourism are developing on the territory of the ENR: cultural and educational, environmental, business, water, cruise, Arctic, event, rural, religious, ethnographic, railway and others [5, Grushenko E.B., Lisunova E.A.; 6, Kondratyeva S.V.], which allows talking about the diversification of tourism activities in the region. Thus, the purpose of the study was to assess the state of tourism in the constituent entities of the European North of Russia in the post-Covid period 2021–2022, based on an analysis of the population's demand for accommodation services, in order to determine the further vector of development of the industry. The information base was the works of domestic and foreign scientists dealing with the problems of tourism development in the post-Covid period, assessing its impact on economic parameters, information from state statistics bodies characterizing the population's demand for accommodation facilities, data from the World Bank, the World Tourism Organization, and the NAFI analytical center.

[1] Barometr mirovogo turizma YuNVTO i statisticheskoe prilozhenie [UNWTO World Tourism Barometer and Statistical supplement]. URL: https://www.e-unwto.org/doi/abs/10.18111/wtobarometereng.2023.21.1.1 (accessed 01 February 2023).

[2] Rosturizm raskryl poteri otrasli iz-za pandemii i otsutstviya turistov [The Federal Tourism Agency has revealed industry losses due to the pandemic and lack of tourists]. URL: https://www.rbc.ru/society/19/10/2020/5f8de4329a7947c66bdf1521 (accessed 10 February 2023).

Theoretical and methodological aspects of the study

The analysis of works of foreign authors revealed an increased interest in the study of domestic tourism after the COVID-19 pandemic — it became not only a catalyst for the recovery of the tourism sector in many countries [7, Rogerson C.M., Rogerson, J.M.], proved to be more resistant to the impact of COVID-19 than international tourism [8, Duro J.A., Perez-Laborda A., Fernandez M.], but also acted as an essential element of economic recovery as a whole after the pandemic [9, Arbulú I., Razumova M., Rey-Maquieira J. , Sastre F.; 10, Gössling S., Scott S., Hall M.; 11, Kreiner N.C., Ram Y.; 12, Woyo E.]. Some works indicate that domestic tourism is characterized by domestic demand and domestic supply, which are relatively independent of international shocks, which, along with its benefits to the economy (job creation, contribution to investment and production), is a factor in reducing economic vulnerability [13, Nguyen C.P., Su T.D.].

Recently, there has been interest in the study of domestic tourism and its economic assessment in Russia. The authors raise the problem of finding new strategic vectors for its development in the changed geopolitical conditions. It is stated that without a targeted increase in citizens' incomes, it will hardly be possible to fulfill the goal of the national project "Tourism and hospitality industry" to achieve a twofold increase in the number of trips across the country by 2030: due to the low level of incomes, the demand for tourism does not yet have grounds to increase, and fulfillment of the stated indicators is possible only due to an increase in the frequency of trips of the solvent population [14, Simonyan G.A., Saryan A.A.]. The fact that a decrease in purchasing power remains a limiting factor for the development of domestic tourism is also stated in other studies [15; Donskova L.I., Barannikov A.L., Makovetskiy M.Yu.]. There are differences between territories in terms of the availability of tourism services for the population [16, Moroshkina M.V., Kondratyeva S.V.], intraregional disproportions between the amount of tourist flow and the development of tourism infrastructure [17, Ivanov I.A., Vasilyeva T.V., Krasilnikova I.N., Manakov A.G.].

Russian scientists have paid quite a lot of attention to revealing the prospects for the development of tourism in the European North of Russia. S.V. Kondratyeva emphasizes that one of the limitations hindering the growth of tourist flow to the region is the poor recognition of the tourism product in the domestic market [18, Kondratyeva S.V.]. She notes the importance of meeting the recreation and tourism needs of the local population based on the tourism resources of the region [19]. Other studies indicate that the tourism market in the region is at a stage of development, which is hampered by poor transport accessibility [20, Orlova V.S.], lack of tourism infrastructure, high cost of tourism services and difficult climatic conditions [21, Yakovchuk A.A.].

However, many researchers have identified attractive growth points for tourists that contribute to the influx of tourists into the region. These include the potential of gastronomic and ethnographic tourism [22, Pospelova S.V., Kutyeva E.R.], the creation of interregional tourist routes [23, Kozhevnikov S.A., Sekushina I.A.].

Summarizing the work on assessing the demand for tourism resources in the region by the population, it should be noted that they are mainly based on official statistics characterizing the state of the industry's infrastructure (accommodation facilities, travel agencies, catering establishments, transport, tourist information centers). Information from Rosstat remains the main source of information on the development of tourism, although it needs to be expanded and detailed [24, Leonidova E.G., Sidorov M.A.; 25, Ovcharov A.O.; 26, Ovcharov A.O.]. At the same time, many authors often use absolute indicators in their analyses, which do not always objectively reflect the state of the subject under study. The analysis of the few works on the problems of the tourism industry of the subjects forming the European North of Russia, in which the calculation of relative indicators was used, taking into account the area and population, showed that the conclusions are formulated by the authors either on the basis of incomplete data characterizing the objects of tourism infrastructure [17, Ivanov I. A., Vasilyeva T.V., Krasilnikova I.N., Manakov A.G.], or on a narrow time interval that does not include an assessment of the state of tourism in the region in the post-pandemic period [2, Leonidova E.G.]. Thus, the above-mentioned actualizes the problem of assessing the recovery of the tourism industry of the ENR subjects after the COVID-19 pandemic in order to identify new trends and formulate a further vector of development.

It is known that statistics reflecting the development of Russian tourism are imperfect. The main source of information about the dynamics of regional tourism development is the data provided by collective accommodation facilities, which register travelers staying overnight. The study assumes that accommodation facilities are used mainly for tourism purposes, and the indicators characterizing them make it possible to adequately assess the dynamics of tourist demand for recreation in the region. To solve this problem, the following indicators were used:

- the number of people staying in collective accommodation facilities;
- the number of overnight stays in collective accommodation facilities;
- tourist load on the territory, allowing a more objective assessment of the tourist attractiveness of the region. It is defined as the ratio of tourist flow to the number of residents of the territory receiving tourists [28, Ivanov I.A.]. In this case, the tourist flow was estimated by the number of people staying in collective accommodation facilities.

To diagnose trends in the development of the tourism industry in the post-pandemic period, identify limitations and determine vectors for its further development, general scientific research methods were used: retrospective and comparative analysis, synthesis, analogy, generalization.

Research results

The coronavirus pandemic reduced the contribution of gross value added created by tourism to the economy of the Russian Federation (Fig. 1).

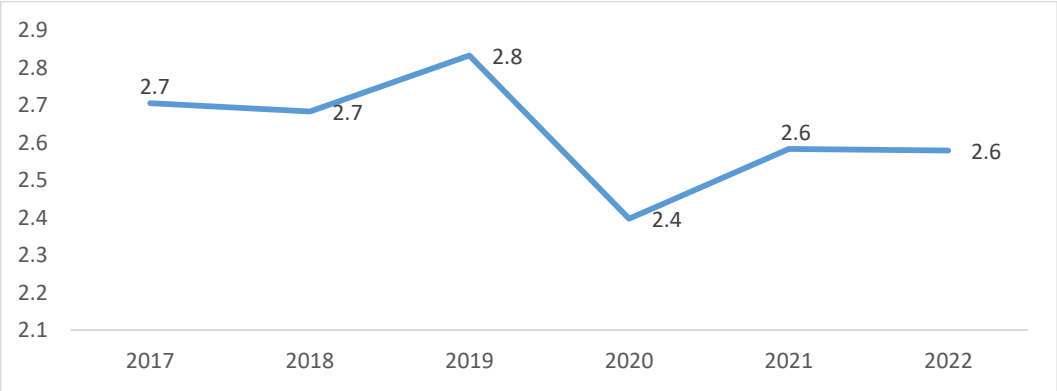

Fig. 1. Dynamics of the contribution of GVA created by tourism to GDP in the Russian Federation, in % of the total [3].

In 2021, the indicator showed positive dynamics, demonstrating the recovery of the industry. At the end of 2022, its value remained the same, not exceeding the pre-pandemic level. It is worth noting that the work of tourism enterprises in 2022 was strongly influenced by the geopolitical situation in the world, which led to a reduction in the volume of outbound tourism due to the introduction of visa restrictions, the lack of direct flights, difficulties with servicing Russian aircraft due to sanctions, as well as to a significant reduction in the number of incoming tourists to Russia. Thus, their number for 2019–2022 decreased by 25.5 times and amounted to about 200 thousand people at the end of 2022, which is much less than in the "Covid" years of 2020 and 2021. [4] This negatively affected the work of tourism enterprises, reducing their contribution to the economy. In these conditions, the main driver of industry development has become domestic tourism, which has recently been given special attention by the authorities in connection with the implementation of the national project "Tourism and hospitality industry". In this regard, the assessment of the use of the potential of territories promising for tourism development, including the European North of Russia, is being updated, which will reduce the existing imbalances in the consumption of tourist services in the country [27, Leonidova E.G.].

One of the key indicators that allow assessing the demand for tourism infrastructure and the demand for tourism services in the region is statistical data characterizing the activities of collective accommodation facilities (CAFs).

The analysis showed that the dynamics of population demand for the services of hotels, hostels and sanatoriums of the ENR [5] in the post-pandemic period was multidirectional (Fig. 2).

[3] Source: Rosstat data.
[4] Inostrannyy turpotok v Rossiyu v 2022 godu sokratilsya na 96,1% [Foreign tourist flow to Russia in 2022 decreased by 96.1%]. URL: https://www.atorus.ru/node/51298 (accessed 01 February 2023).
[5] For comparison: for the Northwestern Federal District as a whole for 2021–2022, the figure decreased by 15%.

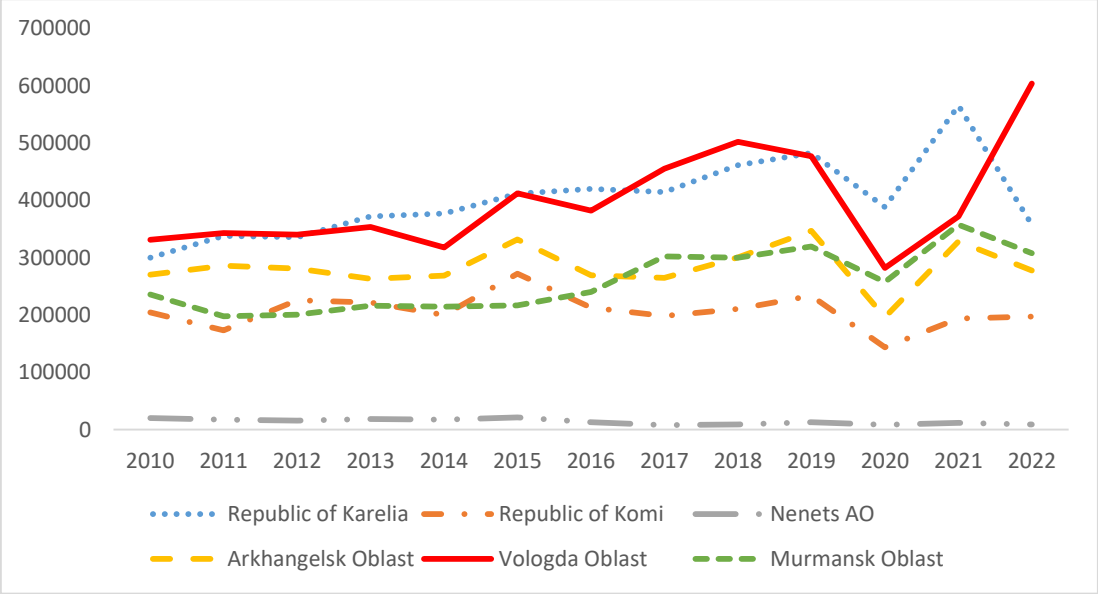

Fig. 2. Dynamics of the number of persons staying in collective accommodation facilities in the constituent entities of the European North of Russia [6].

In 2021–2022, the most noticeable growth of the indicator was in the Vologda Oblast (62.4%). In 2022, the majority of the ENR subjects, except for the Komi Republic, showed a negative dynamics of demand for accommodation services compared to the previous year. The sharpest decline was recorded in the Republic of Karelia (-36.8%). In the Nenets Autonomous Okrug it was 22%, in the Arkhangelsk and Murmansk oblasts — 16 and 14%, respectively.

In general, in 2022, the leading region in terms of the number of people accommodated in the hotel sector was the Vologda Oblast, which received 604 thousand people. Almost half as many hotel service clients were served in the Republic of Karelia (357 thousand people), Murmansk (307 thousand people) and Arkhangelsk (277 thousand people) oblasts.

Thus, it can be stated that in the post-pandemic period, among those staying in the CAF, accommodation facilities of the Vologda Oblast were in high demand, which accounted for the main flow of visitors among the subjects under consideration. The question arises: what caused this popularity and is it related to the intensification of tourism activity in the region? The outflow of guests from accommodation facilities in the Republic of Karelia, the number of which at the end of 2022 did not exceed the values of the pandemic year 2020, as well as from other subjects of the ENR, also requires assessment.

Analysis of data on the activities of collective accommodation facilities in the Vologda Oblast by months showed that the peak of demand for them was in March and August (Fig. 3).

[6] Source: Rosstat and EMISS data.

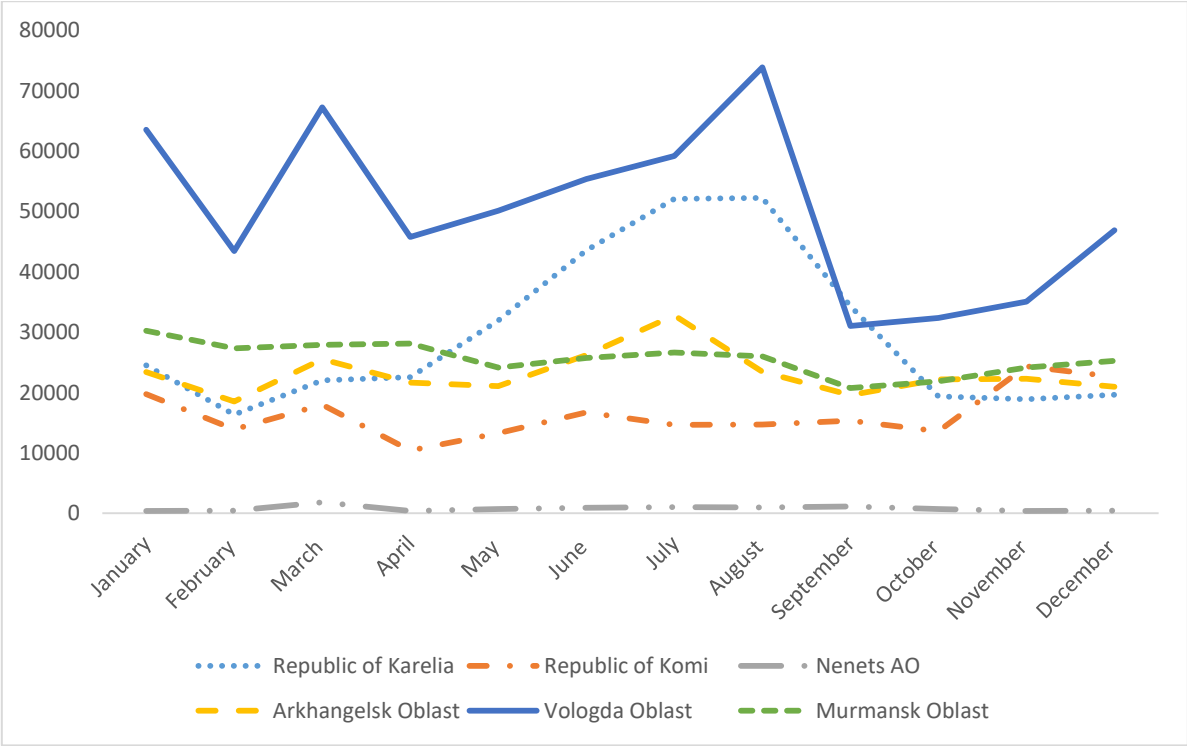

Fig. 3. Dynamics of the number of persons staying in collective accommodation facilities in the constituent entities of the European North of Russia in 2022 [7].

It should be noted that the dynamics of the indicator growth in March, which is not the most "tourist" month of the year, was also observed in the Arkhangelsk Oblast and the Nenets Autonomous Okrug. The probable reason for this is the popularity among Russians of tours under the tourist cashback program, which also applied to trips taken in March. Three non-working days (from 6 to 8 March) fell on the period of the program due to the 8th of March holiday.

The reason for the increased demand for accommodation facilities in the Vologda Oblast in August may be the opening of the Arkhangelskiy Bridge in Cherepovets on August 10, 2022. As part of this event, a seven-hour festive program was organized, which was attended, according to estimates, by about 150 thousand people [8]. This large-scale event could attract not only city dwellers, but also residents of neighboring areas, which created a demand for accommodation services.

The decline in demand for the hotel sector in most subjects of the ENR, the most noticeable among which was noted in the Republic of Karelia, can be explained by the all-Russian trend: in 2021–2022, the number of people accommodated in the CAF decreased from 66.5 to 64.5 million people. One of the reasons for this may be the growing popularity of outbound tourism, as evi-

[7] Source: Rosstat data.
[8] Prazdnik v chest' novogo mosta stal samym grandioznym v istorii Cherepovtsa [The celebration in honor of the new bridge became the most grandiose in the history of Cherepovets]. URL: https://cherinfo.ru/news/123046-prazdnik-v-cest-novogo-mosta-stal-samym-grandioznym-v-istorii-cerepovca (accessed 10 February 2023).

denced by a 22.6% increase in the number of trips by Russians abroad for tourism purposes during this time interval [9].

The calculations have shown that the territories with high tourist load in the region [10] include the Republic of Karelia, the Vologda and Murmansk oblasts, while the rest of the subjects have a significant potential for increasing the tourist flow (Table 1).

Table 1

Dynamics of tourist load in the subjects of the European North of Russia [11]

No.	Subject	2019	2020	2021	2022	Change
1	Nenets Autonomous Okrug	0.30	0.19	0.26	0.21	-0.09
2	Komi Republic	0.28	0.18	0.24	0.25	-0.03
3	Arhangelsk Oblast	0.32	0.18	0.30	0.26	-0.06
4	Murmansk Oblast	0.43	0.35	0.49	0.43	0
5	Vologda Oblast	0.41	0.24	0.32	0.53	0.12
6	Republic of Karelia	0.78	0.63	0.93	0.59	-0.19

The leadership of the above-mentioned regions is explained by developed infrastructure, more favorable climatic conditions for tourism activities, and high transport accessibility. The most noticeable decrease in the indicator for the analyzed period was noted in the Republic of Karelia. It should be emphasized that by the end of 2021, the number of tourists there was almost equal to the number of residents, which indicates its high tourist attractiveness.

The growth of tourist consumption and, accordingly, the contribution of tourism to the economy of the territories depend on the duration of stay of travelers, which can be judged by the number of overnights in accommodation facilities.

Almost in all the ENR subjects [12], except for the Arkhangelsk Oblast, the indicator according to data for the third quarter of 2022 increased compared to the pre-pandemic level of 2019 (Fig. 4). The most positive dynamics were demonstrated by the Nenets Autonomous Okrug (+39%), which, taking into account the poorly developed tourist infrastructure, low transport accessibility and harsh climatic conditions, can be considered a good result. However, it is worth noting that, given the specifics of the region, the number of people staying in accommodation facilities may include not only tourists, but also business travelers and shift workers. In terms of the number of overnight stays in the third quarter of 2022, the leaders were the Vologda Oblast and the Republic of Karelia.

[9] V kakie strany ezdili rossiyskie turisty v 2022 godu [Which countries did Russian tourists travel to in 2022?]. URL: https://www.atorus.ru/node/51287 (accessed 10 February 2023).
[10] For comparison: at the end of 2022, the tourist load in the Russian Federation was 0.44.
[11] Source: calculated by the author.
[12] For comparison: in general for the Northwestern Federal District for 2021-2022, the figure increased by 60%.

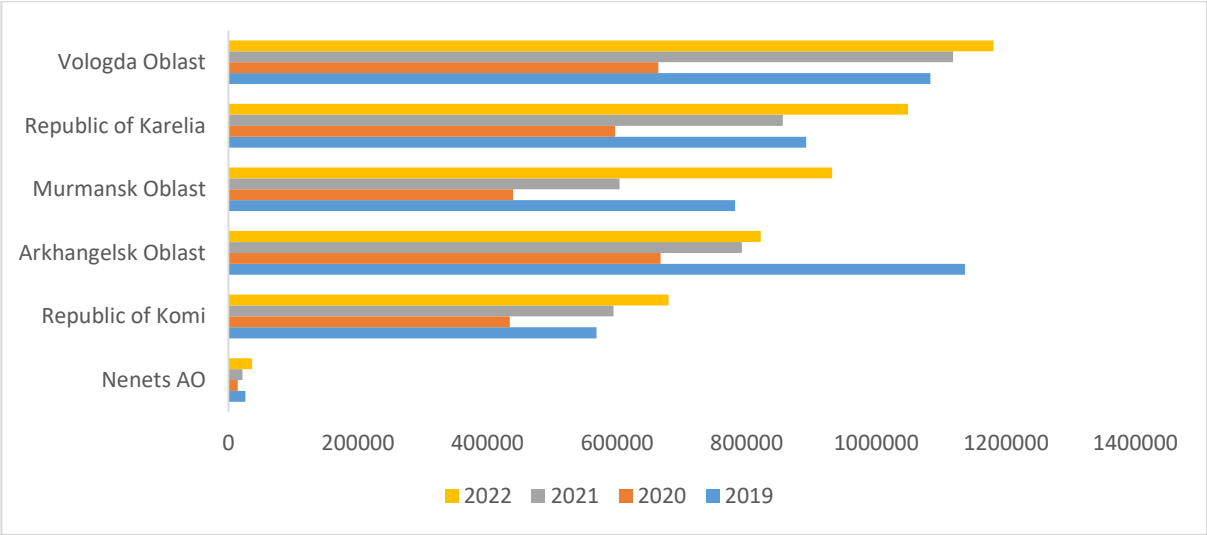

Fig. 4. Dynamics of the number of overnight stays in collective accommodation facilities of the ENR subjects, units [13].

It should be noted that the uniqueness of the European North of Russia is associated, among other things, with the presence of subjects included in the Arctic Zone of the Russian Federation, located in the Murmansk and Arkhangelsk oblasts, the Komi Republic and the Nenets Autonomous Okrug. It is possible to develop Arctic tourism there, which involves traveling to observe the northern lights, diving, snowmobiling, sleigh rides pulled by huskies, reindeer, etc.

One of the problems is the low awareness of tourists about their tourism opportunities. Data from a sociological survey [14] showed that almost 40% of Russians know very little or practically nothing about the Arctic (Fig. 5).

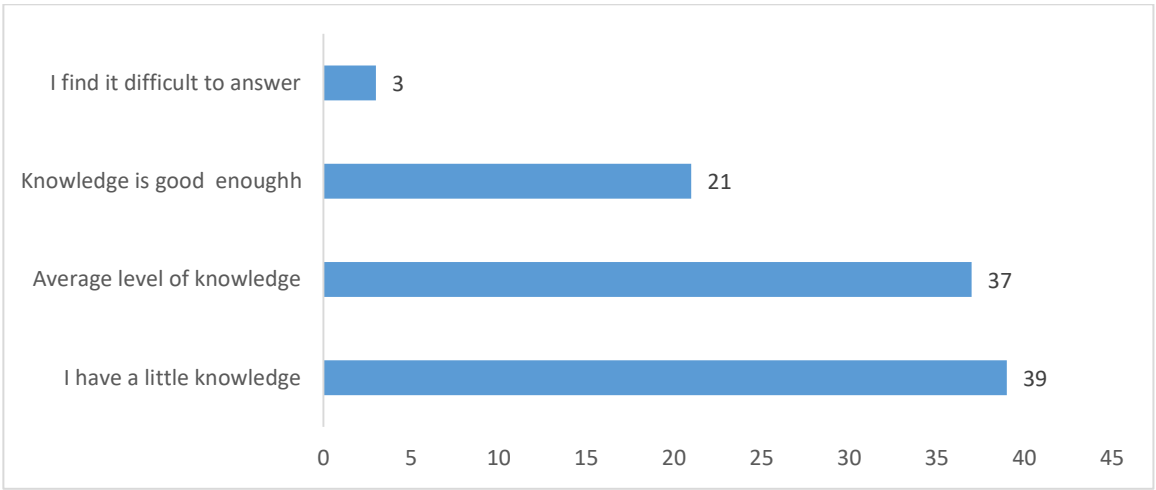

Fig. 5. Distribution of the answer to the question “How do you assess your knowledge about the Arctic zone of Russia as a whole?”, in % of all respondents [15].

[13] Source: Rosstat data.
[14] The all-Russian survey was conducted by the NAFI Analytical Center in December 2022. 1600 people 18 years old and older were surveyed in 53 regions of Russia. The sample is based on official statistics from Rosstat and represents the adult population of the Russian Federation by gender, age, level of education and type of settlement. The statistical error of the data does not exceed 3.4%.
[15] Source: NAFI sociological survey.

Moreover, representatives of the most economically active group of the population — Russians aged 35 to 44 (47%) — have heard the least about it. This requires an active information campaign to promote Arctic tourism.

A vivid example of Arctic tourism is the case of the village of Teriberka in the Murmansk Oblast on the shores of the Barents Sea, which has become a point of attraction for tourists from all over Russia. Currently, 11 projects are being implemented in the village for a total amount of over 1 billion rubles [16]. It seems that the active development of other promising territories in the Arctic zone of the European North of Russia can provide no less social and economic effect.

Thus, the analysis revealed the peculiarities of the functioning of the tourism industry of the subjects of the European North of Russia in the post-pandemic period, identified the main trends in demand for tourist services from the population. It can be stated that in the near future, the development of tourism in the ENR will largely be determined by the activity of domestic tourists and the efforts of regional authorities and businesses to increase the competitiveness of the regional tourism product. Solving this problem requires identifying threats that could have a negative impact on the tourism market of the ENR and the volume of domestic tourist flow. Taking into account the current economic and political situation in the country, it seems that the following can be attributed to such threats for the subjects of the European North of Russia:

- decrease in the purchasing power of the population and growth of prices for vacations;
- unstable economic situation in the country;
- active development of tourism in neighboring regions of the Northwestern Federal District;
- high level of uncertainty in the functioning of the tourism industry in Russia and high degree of risk in running a tourism business;
- growing popularity of outbound tourism.

The emergence of identified threats can lead to a decrease in tourist flow and a reduction in the time tourists spend at their destinations, the reorientation of tourists to other regions with more attractive tourism products and developed transport and infrastructure, and a reduction in spending on tourism services.

In this regard, it seems important to highlight the priorities that determine the development of the tourism industry in the near future:

1. Providing support to promising types of tourism that have high development potential and are able to attract mass tourist flow. Thus, one of them is industrial tourism, which involves tourists visiting production facilities. In Russia, this type of tourism has recently been developing very dynamically. For example, in 2022, one of the successful in this direction was the case of Nizhny Novgorod Ob-

[16] V Murmanskoy oblasti nazvali samuyu massovuyu otrasl' po chislu proektov [The most massive industry in terms of the number of projects was named in the Murmansk Oblast]. URL: https://murmansk.rbc.ru/murmansk/01/12/2022/63884f389a7947ddffc3a13a?from=from_main_4 (accessed 10 February 2023).

last, the industrial enterprises of which were visited by 78.8 thousand tourists, which is 13% more than last year [17]. A prototype of a possible route through industrial enterprises of the Nizhny Novgorod Oblast was also created, uniting 15 municipalities. In the Republic of Karelia, according to experts, potential points of growth of industrial tourism may be the park "White Mountain. Tivdi Marble" park in the Kondopoga district, Yuven Island in the Pitkyaranta district, and the mine of the Tulomazerskiy Plant in the Pryazhinskiy district [18]. For the active development of this direction in the constituent entities of the European North of Russia, it is necessary to create a register of enterprises open to tourists and formulate a program for the development of industrial tourism in the regions. This can be achieved by consolidating the efforts of regional authorities, business representatives and attracting experts from the Agency for Strategic Initiatives, on the basis of which, with the support of the Ministry of Industry and Trade of the Russian Federation, a special acceleration program has been created, aimed at implementing an industrial tourism model.

Ecological tourism is another promising area that can ensure the growth of tourist flow. The European North has a significant potential for its development: specially protected natural areas, serving as an eco-tourism resource, occupy 13.1% of the Komi Republic, which is explained by the location of the largest natural park "Yugyd Va" — a UNESCO site. The main reason hindering its development is the poor legislation. In the near future, a draft law on tourism in specially protected natural areas is expected to be adopted, which will significantly increase the attendance of the region.

Event tourism, which receives significant financial support from federal authorities, can become a driver for the development of territories. For example, the Russian government allocated 638 million rubles for its development in 2023 to support and promote such projects. Moreover, only 2 subjects of the European North of Russia were among the recipients of subsidies: the Arkhangelsk Oblast and the Republic of Karelia. At the same time, the other territories also have a high potential for its development.

2. Targeted subsidies for tourist trips within the region for certain categories of citizens (children, pensioners, low-income families, etc.). Currently, the Russian government has allocated 1 billion rubles for a program of free school trips as part of the national project "Tourism and hospitality industry" for 29 Russian regions. The Vologda Oblast is the only participant in the school tourism program among the constituent entities of the European North of Russia. At the end of 2022, about three thousand schoolchildren were sent on trips as part of the project. In 2023, it is planned to double their number. Financial incentives for travel for retirees are promising. Thus, in the Republic of Bashkiria, within the framework of the project "Bashkir Longevity. Tourism", free travel is available for pension-

[17] V tri raza vyroslo chislo turistov na predpriyatiyakh vos'mi regionov-uchastnikov promyshlennogo akseleratora ASI [The number of tourists at enterprises in eight regions participating in the ASI industrial accelerator has tripled]. URL: https://asi.ru/news/192207/ (accessed 10 February 2023).

[18] Eksperty nazvali perspektivnye lokatsii dlya turistov v Karelii [Experts named promising locations for tourists in Karelia]. URL:https://karelia.rbc.ru/karelia/22/05/2022/628510589a7947839882ad7b(accessed 10.02.2021) (accessed 10 February 2023).

ers [19]. At the end of 2022, 10 thousand pensioners became participants in the program, which is 2.5 times more than in 2021.

3. Intensification of interaction between the ENR subjects within the framework of the implementation of the interregional historical and cultural project "Silver Necklace", uniting 11 regions of North-West Russia.

Despite the pool of tourist routes formed over a ten-year period, not many interregional routes have been created. Basically, within the framework of the project, each entity promotes tours within its region, without including the proposals of its neighbors in the program, as a result of which the meaning of the project is lost — the general promotion of tourist opportunities of the territory. In addition, information and marketing support needs to be improved. The currently existing single resource with a description of the project's tourist routes offers only reference and introductory information. There is no option to book a tour directly.

The implementation of these directions for the development of tourism in the European North of Russia will make it possible to mitigate the identified risks of a decline in tourism activity and increase the volume of domestic tourist consumption. It should be noted that the success of their implementation largely depends on the activity of regional authorities in attracting federal funding and creating favorable conditions for investors.

Conclusion

The study made it possible to identify the following trends that determine the development of tourism in the European North of Russia after the coronavirus pandemic:

- the majority of the ENR subjects have not reached the level of 2019 in terms of the volume of demand from the population for hotel sector services;
- the revival of demand for tourism resources in the European North of Russia in the post-pandemic period was significantly facilitated by the tourist cashback program, which increased hotel occupancy;
- the most attractive territories for tourists are the Republic of Karelia, Vologda and Murmansk oblasts, which account for 72% of all overnight stays in the region;
- the length of stay in accommodation facilities has increased compared to the 2019 level.

Thus, the study allowed us to conclude that the development of the tourism industry of the European North of Russia in the post-Covid period in terms of key indicators did not reach pre-pandemic levels, which requires the identification of new vectors for its development and the active use of the existing unique tourism potential.

Taking into account the significant financial support provided to tourism at the federal level within the framework of the national project "Tourism and hospitality industry", it is necessary to

[19] Project "Bashkir longevity. Tourism". URL: https://долголетие.соцтуризмрб.рф (accessed 10 February 2023).

strengthen local work on the inclusion of tourism projects of the ENR subjects in the number of recipients of subsidies within the framework of the project.

The study confirmed the adequacy of the approach to analyzing the assessment of tourism development in the regions, based on the diagnosis of indicators characterizing the functioning of the tourism infrastructure in general and the hotel sector in particular. The proposed approach allows assessing the tourism industry in terms of supply and demand to identify threats and develop measures to improve its development, and can be tested on the example of any region and municipality due to the availability of data.

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Tourist Attractiveness Based on the National and Territorial Identity of the Northern Region: The Example of the Republic of Karelia

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Abstract. This article raises an extremely relevant for Russia topic of domestic tourism as a driving factor of regional development at the socio-economic level. The region of study is the Republic of Karelia (RK). The object of the research is both external and internal tourists, and the subject of the study is economically and socially significant innovative forms of domestic tourism in the territory of the RK. In the course of the research the following objectives were set: to identify the peculiarities of ethnic identity of the RK, to confirm the attractiveness for tourists and local residents of the cultural and historical features of the region and its impact on the economy of the region. The paper presents a comparative analysis of two empirical studies using a formalized interview (sociological survey of exploratory type). The results of the work allowed us to conclude that both for tourists visiting the region and for the inhabitants of the region, toponyms and other names have a high level of attractiveness and significance and the support of this has a positive impact on the economic condition of the territories. The paper presents project ideas regarding the practical application of linguistic features of indigenous peoples and cultures, which will be a driving force for the development of innovative forms of domestic cultural and historical tourism in the territory of the Republic of Karelia. For this direction, of course, the drivers are the following representatives of the community of the region under study: public authorities at the regional level; business, showing or wishing to show itself as socially responsible; various active social groups and groups of professionals; bearers of cultural symbols.
Keywords: *regional economy, tourism, culture, regionalism, social responsibility, rural economy*

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Relevance of ethno-cultural tourism for socio-economic development of northern territories

In the last few decades, the population in many northern regions of Russia has been rapidly declining. For example, in the region considered below — the Republic of Karelia (RK), the rural population decreased from 179 thousand people in 2002 to 110 thousand people in 2020, and

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from 716 thousand people in 2002 in the whole of the RK to 609 thousand in 2020. [1] One of the reasons for this decline is not only the aging of the population, but also weak social infrastructure and lack of jobs. Now, thanks to state support, the situation with infrastructure in some rural settlements is changing, but the problem of employment remains relevant. One of the options for solving this issue could be the development of cultural and educational tourism in these territories. This is especially interesting considering that cultural codes are preserved more often in rural areas and, in addition to the economic growth of these territories, the preservation of the cultural diversity of Russia is expected. The local population often does not have finances or sufficient awareness of state support for small businesses in rural areas. In many large tourist sites, business comes from other regions. In RK, for example, it is often business from St. Petersburg and Moscow. This is not always a negative point, since such business fulfils the functions and adheres to the principles of social responsibility [1]. Further we will consider some concepts from this sphere and conduct a study of the opinions of tourists about whether they are interested in this type of tourism.

Ethnographic tourism is characterized as a type of tourism that solves the problem of meeting the needs of the spiritual spectrum of both individual travelers and organized tourist groups. Ethnographic tourism assumes acquaintance with culture and traditions of various ethnic groups, with a system of values, norms of behavior and principles on which relations between people in the state are built. Since one of the most important features of the Russian population is multinationality, the global development of the sphere of domestic tourism will make it possible to introduce the peoples of our country to each other, strengthening ties between representatives of different ethnic groups at the horizontal level, which will, in turn, contribute to enhancing the sense of unity the entire multinational population of Russia. Considering the fact that the main ideological and practical tasks in the field of interethnic relations are the preservation and strengthening of Russia as a single and indivisible state, tourism in this area can fully play an invaluable and vital role. Tourism is a type of human activity that is closely related to the achievement of such positive results for society as national harmony and peaceful existence [2].

To give a qualitative definition of the concept of ethnic tourism, let us turn to the position of the domestic researcher of interethnic relationships and ethnic groups N.A. Berkovich. He believed that ethnic tourism differs significantly from other types of tourism primarily in its focus on satisfying the needs of individuals and groups for ethnicity and ethnosocialization. He noted that this type of tourism is more aimed at allowing tourists to “touch” the relict, anachronistic past, the diachronic and intergenerational sources of archetypicality, behavioral stereotypes and unique mentality. Thanks to ethnic tourism, modern civilization has a unique opportunity to uncover lost or half-forgotten semiotic, symbolic codes of the meanings of ethnicity, to study and comprehend its genetic and cultural codes, genealogy, to reconstruct historical memory and, as a result, to form its own ethnonational identity [3].

[1] According to the All-Russian Census of 2002 and 2020. Kareliastat data.

Ethnic tourism is an immersion in the culture and history of a people or ethnic group with the aim of getting to know and studying the otherness of its cultural and historical characteristics and traditions, as well as the perception of specific unique features of culture and way of life. Thanks to this, a system of images and ideas about the life and culture of this people is formed in the researcher's mind, as well as an awareness of the meanings of their most important identifications: religious, ethnic and civil. According to O.V. Chistyakov, thanks to this understanding of tourism, we can talk about the presence of the diversity of culture in the modern world with the remaining uniqueness of the religious and ethnic life of various peoples and ethnic groups, even despite the modern trend towards the globalization of the unification of cultures [4].

It should be noted that tourism is a separate social institution with its own stratification and infrastructure, which performs several functions in the dialogue of cultures:

- promotes the establishment and expansion of interreligious, interethnic and social communications on a global scale;
- contributes to the mutual value enrichment of different peoples and ethnic groups;
- economically and socially supports the territory of indigenous peoples and other rural areas.

In the context of the trend towards globalization, the modern world initiates and even assumes the openness of ethnic and subethnic groups in relation to each other, which promotes the mutual exchange of scientific knowledge and ideas for further development, cultural artifacts, secular and religious ideas and achievements in the information and technological spheres of human activity. Thanks to tourism, travelers can get acquainted with the political, economic, religious and other realities of different territories even in the conditions of post-modernization of society. It should be noted that mass media structures are responsible for the created images of societies receiving tourists [5].

Every year the number of regions taking an active part in state programs aimed at developing the tourism industry increases, both in terms of increasing the attractiveness of their region for various types of tourism, and encouraging companies involved in organizing domestic and foreign tourism.

It is interesting to note that ethnographic tourism is an independent type of tourism, which also performs a number of important social functions:

- supporting the economy of rural areas;
- preservation of cultural elements of different peoples;
- ensuring the preservation of historical and ecological diversity;
- strengthening regional self-identification;
- increasing the intellectual and cultural level of the population of certain territories;
- prevention of interethnic relations;
- acquaintance with local cultures of tourists;
- revival of traditions, rituals, local cuisine and crafts.

Being engaged in organizing tourism at this level, it is not enough to simply carry out a selection of group and individual tours, which includes visits to ethno-recreation sites. Ethnic tourism is a unique type of tourism that always carries a cultural and educational load; it is, in fact, a part or element of mass or individual tourism, which is often considered one of the most attractive in the region, but not the only one. That is why a tourism product of this type should be characterized primarily by complexity; for example, a tour package may consist of the following services:

- movement through an ethnic zone;
- accommodation in significant historical places (for example, accommodation of a tour group in a Karelian settlement);
- lunch consisting of dishes traditional for this ethnic group in the past (for example, open pies with berries, which have been the traditional food of Karelians for many centuries);
- folklore events (for example, visiting the agricultural festival “Ukko Bowl”, etc.).

All these elements are somehow involved in the economic turnover.

In addition, attention should be paid to the possibility of forming tours based on the needs and interests of tourists. For this purpose, tour operators often include in tours not only different places of visit, but also various parts of ethnic and sports tours: ecological and ethnographic, nostalgic, hiking and horseback riding, etc. [6]

In 2020, domestic tourism declined due to the COVID-19 pandemic. But already in 2021, 56 million people travelled within the country, which indicates that domestic tourism volumes have been recovered by almost 90% compared to 2019.

Now relevant researchers in the field of ethno-cultural tourism are Maslennikova E.G. (et al.) [7], Vintaikina E.V. [8], Dashkova E.V. [9], Safarova T.R. [10], Lysikova O.V. [11] and others. In the Republic of Karelia, issues of ethno-cultural development from the perspective of regional economic development are studied at the Institute of Economics of the Karelian Scientific Center of the Russian Academy of Sciences by various authors: Morozova T.V., Belaya R.V., Vasilyeva A.V., Morozov A.A. [12], Kondratyeva S.V. [13].

Since the modern information society is in constant and continuous development, the process of globalization is becoming more and more active, due to which a number of economic processes also receive an additional impetus for development. However, it should be noted that in the field of national culture and history, globalization processes often cause crises of national consciousness and identity. One such example is the escalating confrontation between various theories of regionalization and globalization, that is, the development of new regionalism [14].

In the last 15 years, the vector of development of the Republic of Karelia has begun to turn towards tourism. This is often reported in the headlines of scientific and media articles. Many visitors associate Karelia with tourism and trout farming. The extraction of timber, stone and minerals is relegated to another plan.

Traditionally, the tourism potential of the Republic of Karelia is associated with the famous large sites located on Kizhi Island, Valaam Island, and Ruskeala quarry. Over the last decade, many local museums and other interesting venues were opened (Bastion, Zaonezhskiy museums, etc.). There was a transformation of the organizational and legal status of these objects according to the "outsider" model, which led to the irreversible withdrawal of the economic benefits obtained as a result outside the region. This problem is as relevant as it was in the 2000s. Representatives of Karelian business are no longer the main managers and owners of many large companies in Karelia.

There are already existing achievements of scientists in the field of development of cultural and historical destinations in the Republic of Karelia. Over the past twenty years, various issues related to the development of tourism in the border municipal areas of the RK have been studied. There is an information base that includes elements of regional and municipal statistics, data from republican websites, sociological studies and various materials from scientific and practical conferences.

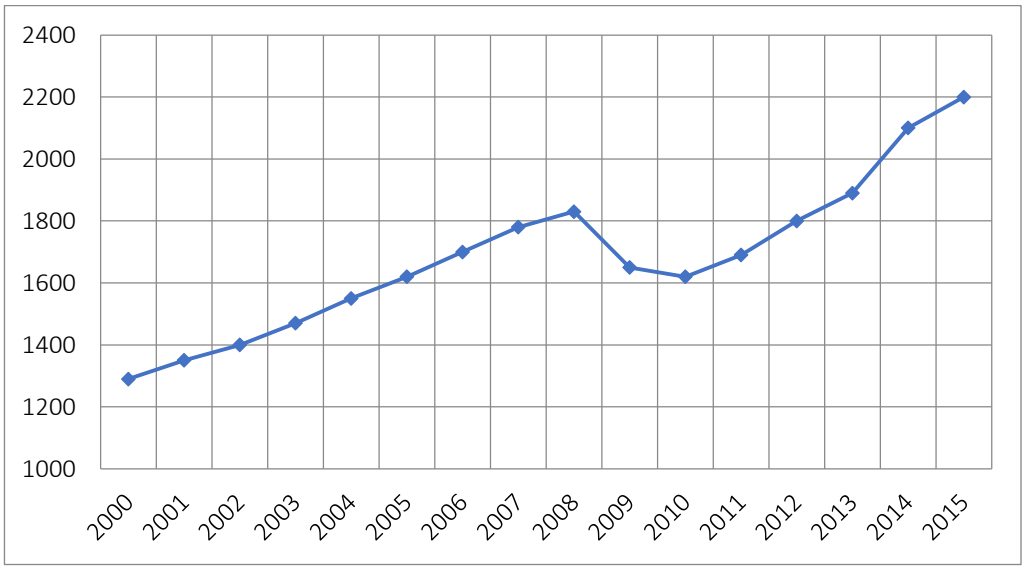

Fig. 1. Approximate number of people who visited the Republic of Karelia (thousand people) [2].

According to the data in Fig. 1, there was no decline in the number of people visited Karelia from 2010 to 2015. In the author's opinion, there was no decline until 2023. An exception may be 2020, but it is not as significant as it was in 2009–2011. Based on the author's personal interviews with representatives of the tourism business, the pandemic year left its mark on business, but not critical. Gastronomic facilities suffered the most, many of them were closed down.

[2] Data on tourism development in Karelia. URL: http://gov.karelia.ru (accessed 20 January 2023).

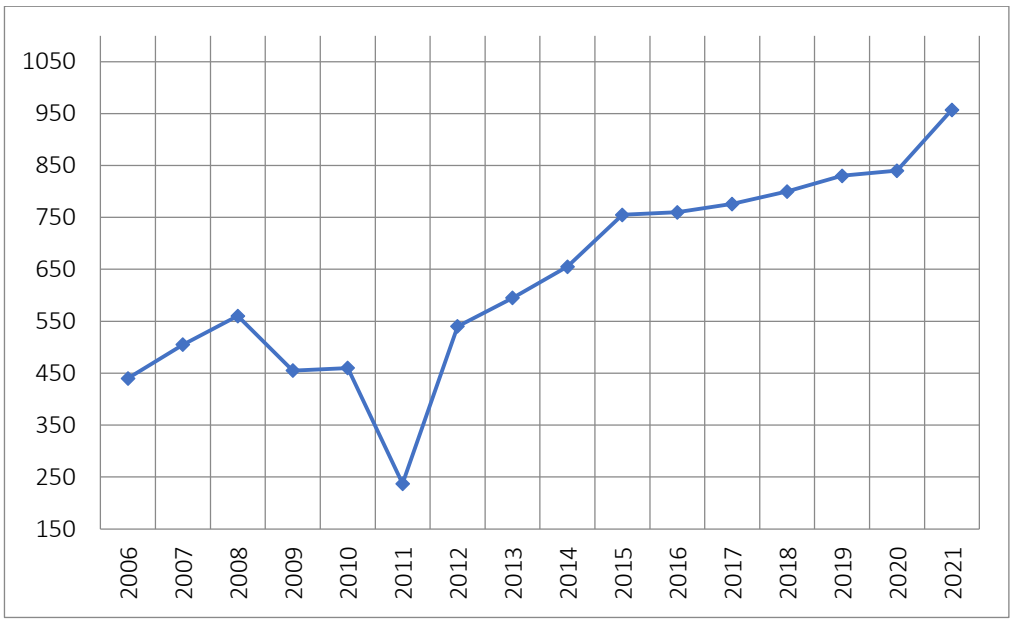

Fig. 2. Number of organized tourists in the Republic of Karelia (thousand people) [3].

Fig. 2 shows the number of organized tourists for 2006–2021. This indicator is easier to calculate and the data are freely available. The figure shows a sharp decline in organized tourists in 2011 due to economic and political crises. In 2013, the number of organized tourists in Karelia was about 600 thousand people and this exceeded the pre-crisis level of 2008. The flow to the main sites (for example, to Kizhi Island) increased [4]. During the pandemic period, the development and support of domestic tourism was strong, and the number of tourists grew. Data for 2022 are still in the formation stage, but it can be assumed that the number will not decrease. Karelia has lost foreign tourists, but the bulk of them have always been from St. Petersburg and Moscow. Taking into account the development of rail buses, air service and other means of transport in 2021–2022, the growth of infrastructure at organized sites has increased significantly. The vector of tourism development in the Republic of Karelia as early as 2020 was redirected sharply towards domestic tourism.

Karelia also attracts both organized and independent tourists with its wild nature. It is worth noting that the number of tourists of the latter type is estimated with great variation. That is why networks of guest houses have now become so widespread and developed, regardless of their location, that is, this applies to both networks of guest houses in remote places and in close proximity to rural settlements and towns. Various accommodation options are also being developed within national parks and reserves. At the same time, the problem of poor development of cities and villages, namely the low level of development of their infrastructure, is quite acute, as a result of which the interest of tourists in the region is decreasing. This may be another reason for the development of "wild" tourism, and this, in turn, has a significant impact on the environmental situation in the region. This question is now becoming more relevant due to the many lakes in the

[3] Source: compiled by the author on the basis of data from the Tourism Administration of the RK and Kareliastat.
[4] Tourism. Official Karelia — the official Internet portal of the RK. URL: http://www.gov.karelia.ru/gov/Info/2013/eco_tourism13.html (accessed 20 June 2022).

region. Most of these lakes are domestic for local residents; they "feed" cities such as St. Petersburg, Novgorod, etc. Pollution of coastal zones is growing significantly.

In the current circumstances, the progressive development of various forms of ethno-tourism and cultural tourism [15] of villages and towns in the region can become a force for their economic development, increasing the multifunctional effect of tourism. Tourists who come to Karelia and neighboring territories are interested in the names of towns, villages, and geographical objects. For tourists, this is a feature of the White Sea–Baltic cultural region. The development of forms of national-territorial identity will increase the level of its uniqueness, complementing the Russian tourism sector with important economic assets, which can contribute to the favorable position of Karelia among other, especially more southern, regions of Russia. Social responsibility of business plays an important role in this matter. New forms of business support based on national-territorial characteristics involve the local population in the work, thanks to which elements of the real culture of certain places can be preserved longer.

The concept of "indigenous cultures/peoples of Karelia", used by the author in this article, means the cultures of the Vepsians, Karelians, Pomors, Finns, Pudozhans and Zaonezhans. From the perspective of cultural studies, there are many similar or identical cultural elements among the indigenous cultures (with the exception of Sami) in the White Sea–Baltic region, for this reason the author evaluates this region as one cultural space with a slight difference in cultures, supporting the ideas of Finno-Ugric and Baltic roots, regardless of language and nationality. Besides, the author excludes formal statistical data regarding the national composition due to the fact that a fairly large number of people are formally recorded as Russian (from the author's personal example).

Empirical research

In 2016, the author had already written material on the topic of ethno-cultural tourism based on toponymy and ethno-futurism [16]: an attempt to conduct a sociological research of the reconnaissance type was made. Certain conclusions were made, which the author of this article will discuss below. The study itself was carried out in 2015, and the author conducted a similar survey in 2022 with a similar "tourist-local" layout with the addition of some new questions.

As part of this study, an exploratory type empirical study was conducted by the author in 2015 [5], which included an online questionnaire survey. The study involved 101 participants, among whom 45 were residents of the Republic of Karelia, 35 had visited the RK and 21 had never been there.

[5] Exploratory research solves problems limited in content. It covers, as a rule, small survey populations and is based on a simplified program and condensed instruments. Exploratory research is used for preliminary examination of a certain process or phenomenon. The need for such a preliminary stage, as a rule, arises when the problem has been little studied or not studied at all.

In 2023, the author conducted a similar study with additional questions. It also involved 101 people, among whom 48 were residents of Karelia, 33 had visited it, and 20 had never been there.

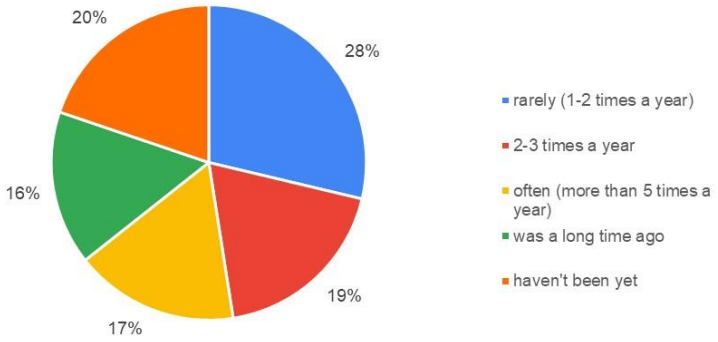

Fig. 3. Frequency of visits to Karelia by external and internal tourists (share of answers, %) [6].

Fig. 3 shows the share of responses of tourists travelling to Karelia or having such an intention. In the 2015 study, the author received only 60 responses, in the current one — 101. Comparing in relative terms, it can be noted that people have started travelling more often. More people have become aware of Karelia, and if in 2015, 41% of respondents answered "rarely, 1-2 times a year", then in 2022, this is already 28%. Similarly, the answer "have not been there yet": 37% for 2015 and 20% for 2022. The indicator "often, more than 5 times a year" increased insignificantly.

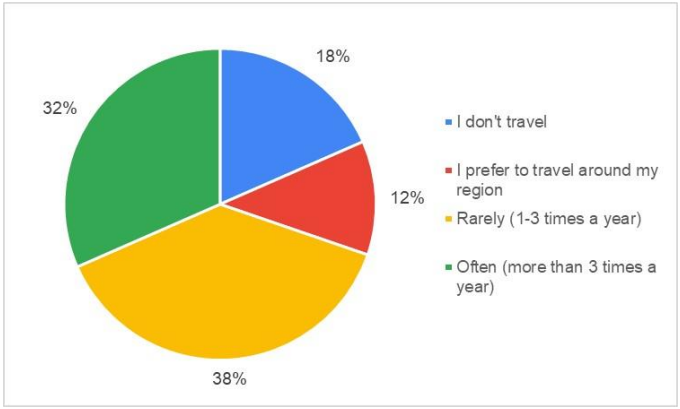

Fig. 4. Frequency of tourists' visits to other regions of the North-Western and Central Federal District of the Russian Federation (share of answers, %) [7].

Based on the results presented in Fig. 3 and 4, Karelia has a great chance to attract tourists who have already been there or are planning to visit. Comparing data for 2015 and 2022, one can see that the frequency of the answer "often, more than 3 times a year" has increased significantly, almost doubling.

The problem related to pricing remains. Many travel companies focus on the incomes of richer strata of the population, as well as the incomes of residents of St. Petersburg and Moscow,

[6] Source: compiled by the author.
[7] Source: compiled by the author.

without taking into account the level of wages of the local population. It is worth noting here: the question is not even about the income of the residents of Petrozavodsk, but of local groups, i.e. villages, small towns. As a result, some of the local tourists are forced to look for other more affordable ways of leisure, and the region narrows the segment of domestic tourism. “Wild” tourism continues to develop.

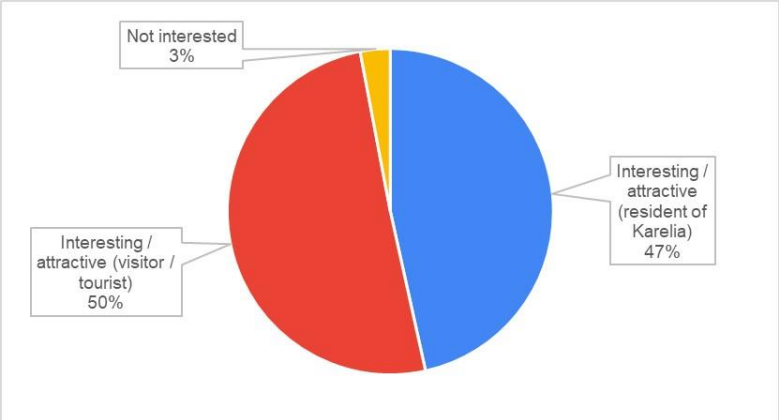

Fig. 5. Attitude of tourists to toponyms (names) of the Republic of Karelia (share of answers, %) [8].

As can be seen from the research results, for the majority of tourists and locals, the names of geographical places are attractive. The 2015 questionnaire included an “other” column, where people offered various options reflecting predominantly positive emotions, and only one person expressed a neutral position. Most people define toponyms as interesting, creating flavor, features of the region.

In the current questionnaire, it was decided to abandon this question. In comparison, the situation for 2015 and 2022 has not changed, the absolute ratio is almost the same.

One of the interesting options for development in the field of tourist attraction based on toponyms could be the introduction of QR codes near various settlements with a rich history. When asked in a 2015 survey regarding such an initiative, about 90% of respondents answered positively.

In the 2022 questionnaire, 84% of respondents responded positively. In the author’s opinion, this is due to the development of the information society; before visiting a particular geographical place, people independently find information in advance. On the other hand, it could be a coincidence.

[8] Source: compiled by the author.

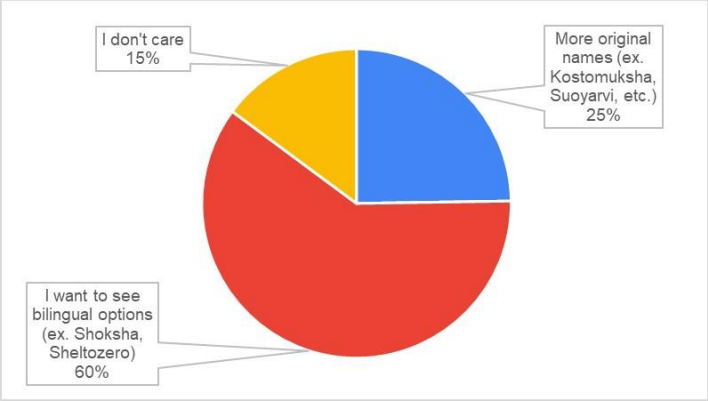

Fig. 6. Attractiveness of variability of names of settlements and other places (cultural and geological) (share of answers, %) [9].

The figure above shows the respondents' answers about the type of toponyms they would like to see. The results of the 2015 questionnaire showed that slightly more than half of those surveyed would like to see bilingual names on roadside signs of settlements and in geographical names (e.g. Sheltozero —Šoutjärv), and only a quarter responded that they would like to see the original name (e.g. Sortavala, Kondopoga).

In the 2022 questionnaire, there are slightly more responses about bilingual names. According to the results of the survey, we can confirm that for the majority of respondents in both questionnaires, Baltic–Finnish names are attractive, and people would like to see bilingual signs. In addition, there is a problem that is repeatedly mentioned by toponymists from ILLH KarRC RAS — road workers who use the atlas of toponyms and hydronyms are often mistaken due to inaccuracies in these atlases. ILLH KarRC has been working on this problem for a long time and despite the fact that the issue is not so complicated, contacts with officials are very difficult and the issue is still relevant [17]. One of the solutions to this problem could be such bilingual roadside signs on the main highways of Karelia.

A similar format (bilingual signs) can arouse deeper interest in the stories of certain areas and expand tourist routes. It is especially important to increase interest and appeal among the younger generation of local residents. Unfortunately, there is a tendency to reduce and filter the information presented in schools and non-core universities, and this includes elements of local history and culture. Science does not stand still, but the teaching system often does not include the modern developments of scientists. The most popular element of teaching local history is the study of its flora and fauna and the Soviet period in the history of Karelia. However, the territory itself is more than 1000 years old.

The Republic of Karelia is different in its characteristics. The north and the south have their own historical and geographical features. Tourism should be developed in different directions, in a union of natural, historical and cultural elements.

An important issue is bilingualism on signs in the city of Petrozavodsk during the Soviet period. Until the 1980s, despite the decline in the share of indigenous peoples in the national-ethnic composition, this was the norm. Many visitors of the city noted that they liked it, it gave a certain

[9] Source: compiled by the author.

flavor to the area. In the 1990s, this cultural element of the urban environment was important due to the wide opening of borders. People from other countries began to visit Petrozavodsk more often. For Finns, for example, it was a very important element. Bilingual names attracted not only foreign neighbors, but also tourists from Russia.

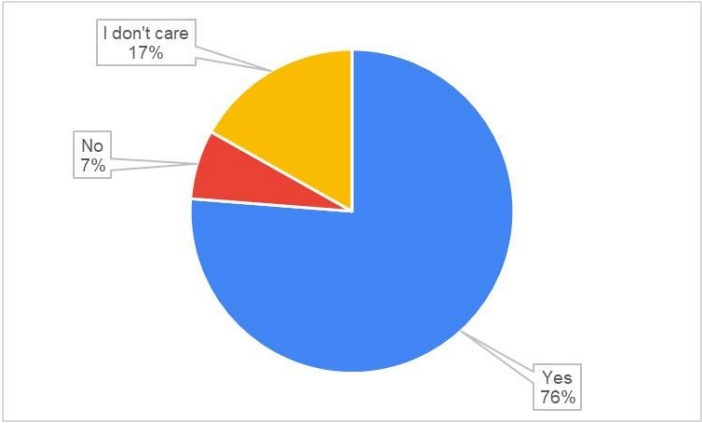

Fig. 7. Attractiveness of Finnish names/signs in Petrozavodsk of the Soviet and late Soviet period (share of answers, %) [10].

Fig. 7 presents answers about signs that could still be found on the streets of Petrozavodsk during the perestroika period. According to the results of the comparative analysis of the two arrays, we see an insignificant difference in the answers (+\-3%).

Since 2020, bilingual signs with street names and house numbers began to be installed in Petrozavodsk. The design of the signs was chosen to be almost the same as in Soviet times.

In addition to this question, the current 2022 questionnaire contained two questions that were not in the 2015 questionnaire. The first of them was “Several years ago, signs with street names in two languages appeared in Petrozavodsk, how do you feel about this?”

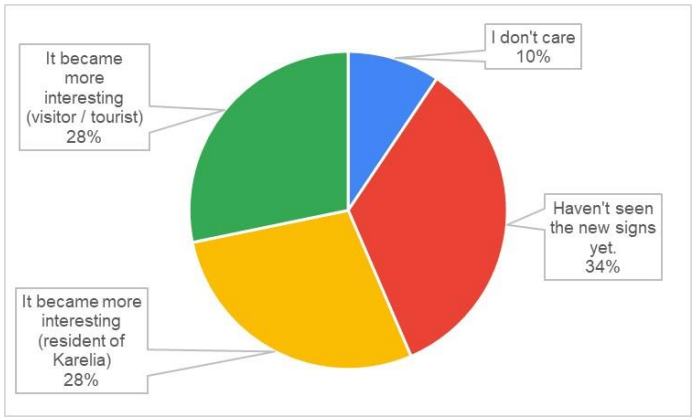

Fig. 8. Attractiveness of bilingual names/signs in Petrozavodsk in modern times (share of answers, %) [11].

As can be seen from Fig. 8, this practice is positively assessed by both tourists and local residents. Indeed, when you come to another city, you can “touch” a piece of local culture, these are

[10] Source: compiled by the author.
[11] Source: compiled by the author.

positive aspects. This question was with the "other" item, where people criticized the design of signs, the choice of the Karelian language dialect and other points. However, there were very few such responses. Despite the fact that the historical parts of the city are almost completely equipped with such signs, the percentage of people who have not seen them remains high. In the author's opinion, these signs are well made: white letters on a blue background are clearly visible.

Another additional question in the 2022 questionnaire was the respondents' opinion regarding the need for such signs in other major cities of the Republic of Karelia. The study showed that 61% of respondents consider this necessary, but only for large cities, such as Kondopoga, Sortavala, Belomorsk, Olonets, Kostomuksha; 21% of respondents answered that they do not care.

In the current situation, despite the introduction of signs, the presence of a department at Petrozavodsk State University, a school and a kindergarten, the overall situation with bilingualism is in poor state. Indigenous cultures are perceived as somewhat archaic. There is practically no contemporary art and music left.

This survey was carried out in order to study the respondents' opinions about what exactly they mean by the concept of "Karelian identity of the region". As a result of the survey, different answers were received, which were subsequently combined into the following blocks:

- natural and geographical features: animals, lakes, swamps, forests, waterfalls, etc.;
- cultural features: language (multilingualism), traditions and customs, folk cuisine, mentality, architecture, bathhouse, national character of each nationality, folklore, history, petroglyphs, unique culture of the region; the presence of Karelian, as well as Karelian-Finno-Vepsian elements in the modern way of life, etc.;
- social and emotional-psychological characteristics: the level of self-awareness of the population, the uniqueness of the region, the similarity of Karelia with other regions of the Russian Federation, the community of the population, pride in the residents, the desire to help the development of their region, etc.

Compared to the responses in 2015, in the current study, people increasingly spoke about the preservation of the language, commitment to culture and local traditions, local people's awareness of their roots, and identification of people with the indigenous population of this region.

In addition to the study of bilingualism and toponyms, a very important issue in the development of culture remains its elements: art, music, literature.

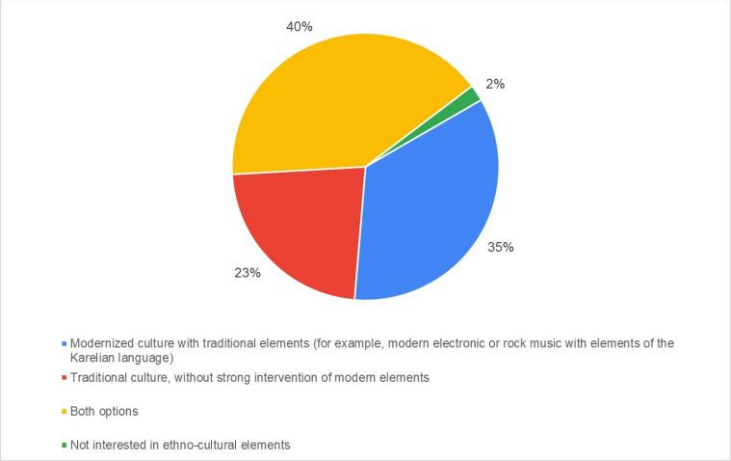

Fig. 9. Attractiveness of traditional forms of culture among tourists (share of answers, %) [12].

Fig. 9 presents answers to the question "What do you like most of all?" regarding the form of culture. Compared to 2015, the current questionnaire contains more answers about ethno-futuristic elements and about the same percentage regarding traditional forms. This result is understandable: visitors prefer to perceive traditional culture more. However, there can be no development without modern elements of expression. A region that supports only traditional values, rejecting modern forms, will stand still in terms of intellectual and cultural development.

When studying models of ethno-futurism, it is worth noting that one of the difficult issues is defining the framework between the traditional, intermediate and modern stages in the expression of cultural elements (art, music, literature).

The situation with literature in national languages in Karelia is not so bad. Various journals, newspapers, and books are often published. The situation is worse in art and music. Art has long ago become integrated, elements of indigenous cultures are hidden under a common globalization "mask". In the field of fine arts of Karelia, there are still representatives engaged in traditional crafts. However, contemporary art with a national flavor is receding into the background. There are not many new projects in the musical sphere in the Republic of Karelia. Young authors more often use English in their works, which reduces the historical and cultural uniqueness of Karelia. In the field of fine arts, artists also rarely use these elements. Over the past 10 years, interest among designers has actively increased. However, this new ethno-futuristic design has become a kind of peculiarity rather than an everyday occurrence. Simply making an interior design, for example, in the Karelian style has become financially difficult for ordinary citizens. There are representatives of the cultural sphere who do not live in Karelia, but are involved in the development of Karelian, Finnish and Vepsian cultures. A lot of such representatives live in St. Petersburg.

The survey included a question about understanding ethno-futurism and about Karelian artists, writers, and musicians in this area. About 80% of respondents do not know any. According to the author, this is primarily due to the fact that people are not familiar with the concept of "ethno-futurism". Indeed, when asked the corresponding question, 76% answered that they did

[12] Source: compiled by the author.

not know. Respondents listed some ethno-futurists: Ondrei, Ilmu, Myllarit (not relevant), Arto Rinne and Sattuma, Yarga sound system, as well as some artists who have these elements.

In order to develop the sphere of cultural tourism, it is necessary to support young talented artists, designers, musicians, writers. It is advisable to highlight the fact that this support can be provided by both state agencies and private foundations and business representatives. Thanks to the development of the cultural layer of ethno-futurists, the tourism sector in Karelia will receive a new impetus for development. More specifically, this can be expressed in the following aspects:

- revival and popularization of history;
- revival of cultural traditions;
- revival of the language of various Karelian nationalities, its use in modern conditions.

Conclusion

The development of a region is usually a long process, but the time and effort put into it will have a positive effect in the future. The main goal is to preserve and transmit information about the diverse forms of authentic indigenous cultures of the region and to introduce new forms based on these elements.

The tourism sector is one of the fastest growing in Karelia. State authorities and business should focus on how the region can be developed so that it retains its originality, different from other regions. People always like to come to other places and see other cultures.

Karelia shows how many peoples, including those who are quite similar culturally at certain stages of history, can live together, develop a common economy, culture, architecture, etc. without forgetting their individuality. An example is Zaonezhye, where 3 large nationalities coexist: Vepsians, Karelians and Russian settlers from Novgorod, Pskov and the Vladimir–Suzdal land. However, the cultural elements of these peoples are quite similar due to historical ties. Much of the history of the influence of the Baltic-Finnish peoples on the common, mixed culture has already been lost, and the history of the region is poorly transmitted to the younger generation of the Republic and neighboring regions.

Brief results of comparative analysis can be seen in Table 1. Compared to 2015, respondents often give more formulated answers to the question of understanding what the ethnic identity of the region and ethno-futurism are.

Table 1

Indicators of the survey results for 2015 and 2021 on the main questions [13]

Questions	The most important indicators for 2015	The most important indicators for 2022	Result
Frequency of travelling in NWFD and CFD of the Russian Federation (Fig. 4)	51% of answers – rarely, 18% of answers – often.	38% of answers – rarely, 32% of answers – often.	Respondents began to travel within the country more often.
Knowledge about the	Encountered	Encountered	Increased direct

[13] Source: compiled by the author.

traditions and culture of the peoples of Karelia	personally – 31%. Not familiar — 14%.	personally – 48%. Not familiar — 4%.	contact with elements of indigenous cultures. Increased interest in indigenous cultures.
Frequency of travelling in Karelia (Fig. 3)	Have not been to Karelia — 48%. Travel often — 10%. Visit 2–3 times a year — 7%.	Have not been to Karelia — 19%. Travel often — 17%. Visit 2–3 times a year — 19%.	Increasing tourist flow to the Republic of Karelia.
Attractiveness of toponyms and hydronyms in Karelia (Fig. 5)	Attracts tourists — 42%.	Attracts tourists — 50%.	Attractiveness has increased. The responses of local residents remained at the same level.
Attractiveness of the form of using toponyms on roadside signs and other places (bilingual, original Russified, etc.; Fig. 6)	Bilingual — 59%. Original and Russified names — 22%.	Bilingual — 60%. Original and Russified names — 25%.	There is almost no difference, but the option with bilingual signs still prevails.
Tourists' interest in the offered ethno-cultural services (ethno-futuristic, traditional; Fig. 9)	Modern (ethno-futuristic) culture with traditional elements — 24%.	Modern (ethno-futuristic) culture with traditional elements — 35%.	Forms of expression using modern instruments have become of greater interest to tourists.

Based on the survey results, it can be argued that both visitors and tourists liked elements of indigenous languages in the urban environment of the late Soviet era. After the appearance of such signs in Karelian and Russian in modern times, people also note increased interest, including among tourists. However, it is worth noting that the Karelian language is the only indigenous language of Russia (among 22 republics) that is not the state language in its native Republic [14]. People travelling through Prionezhye always pay attention to the signs with toponyms Shoksha, Vehruchei, Sheltozero.

As a result of the study, data was obtained that allows drawing conclusions about the high attractiveness and importance of toponyms and hydronyms for residents of the region and tourists. The multiplicative effect of the introduction of cultural elements of the indigenous peoples of the Republic of Karelia is manifested in the development of the national and regional identity of the community. It is an important component of the model of national identity of Russian society in general and the northern territories in particular [16].

According to the results of the study, it can be seen that tourists started travelling more often both to Karelia and to the regions of the North-West. People became more attracted by this national-cultural diversity. People more often want to see local dishes on the menus of gastronomic facilities, often in two languages or in the local language. Slightly more people have become interested in various modern types of cultural expressions with ethnic elements. All this is already

[14] Constitution of the Republic of Karelia. Ch. 1. Art. 11. P. 1.

having a positive effect on the economic situation of the region. The results of this study only confirmed this, which means that the main actors should pay more attention to this and support rural initiatives.

In terms of positive factors that can affect the social and economic development of Karelia, the development of historical and cultural tourism based on ethno-futurism and toponyms can become one of the most important directions for this process. The main drivers of development in this aspect include various representatives of the local community: regional and municipal authorities, socially responsible businesses, and most importantly, active professional and social groups, bearers of cultural symbols. Regional authorities should consider cultural initiatives more carefully. More attention should be paid to ethno-futuristic projects.

It is required to develop innovative forms of regional identity in their modern form, thanks to which there will be development of the regional community as a whole, as well as economic and social development of rural areas. An important element is the strengthening of interethnic ties, which will contribute to the development of Russian society as a whole.

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Employers' Assessment of Competences of the Employees of the Shipbuilding, Forestry and Fishing Industries of the Arkhangelsk Oblast in the Context of the Development of Digitalization and Automation of Production

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Abstract. The article is devoted to the study of employers' perceptions of the competences of employees in the shipbuilding, fishing and forestry industries of the Arkhangelsk Oblast in the context of digitalization and automation of production. As part of the sociological research, the team conducted a questionnaire survey and semi-structured interviews among representatives of enterprises in these industries. The results of the research allowed drawing conclusions that the professional competencies of employees, as well as abilities to work independently, in non-standard situations and under stress are currently the most in demand for employers. There is also a very high demand for qualities associated with discipline and the desire to develop in the profession. In terms of the size of enterprises, the higher requirement for almost all competences in small and medium-sized enterprises compared to large employers is noteworthy. The authors conclude that about half of the enterprises in the shipbuilding, forestry and fishing industries of the Arkhangelsk Oblast have implemented automation and digitalization into all key production processes. In the near future, more than 50% of employers expect a high demand for employee competencies related to the use of new production technologies. The survey revealed a gap between employers' expectations and the actual level of professional training and skills of recent graduates of educational institutions of higher and secondary vocational education, including with regard to the most in-demand knowledge, skills and abilities. In the context of industries, it is noteworthy that the level of satisfaction with the training of graduates of shipbuilding industry is much lower, except for those who received education through the "Plant-University" system (Severodvinsk).

Keywords: *staffing, competences, Arctic zone of the Russian Federation, digitalization, automation, Arkhangelsk Oblast*

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Introduction

Bringing the system of vocational and professional education into line with the projected staffing needs of employers in the economy and social sphere of the Arctic zone of the Russian Federation (hereinafter referred to as AZRF) is one of the important tasks of the Strategy for the development of the Arctic Zone of Russia and ensuring national security for the period until 2035 [1]. Research conducted by scientists from Petrozavodsk State University show the insufficiency of internal labor resources of the Arctic territories to meet the future staffing needs [1, Gurtov V.A., Pitukhin E.A., pp. 130–161]. The expected staffing needs of the Russian Arctic by 2024 in the amount of 66 thousand people can be met by a little more than 50% at the expense of graduates of Russian educational organizations, retraining of unemployed citizens and vocational training of people without education [1, pp. 130–161].

However, this task provides not only quantitative, i.e. training and retraining of the required number of specialists for industries, but also a qualitative dimension: ensuring compliance between the qualifications of employees and the requirements of employers, taking into account rapidly changing external conditions.

The problem of staffing in the Russian Arctic is actualized by complex changes in labor markets, which are determined by the specifics of the economic development of the region (dependence of mining projects on world prices for resources), the influence of sanctions from Western countries in 2022–2023 (restrictions on export of goods produced in the region, increased demand for import substitution), as well as the widespread introduction of automation and digitalization in production processes and the growing demand for supra-professional (universal, flexible, soft) competencies. The specificity of the Russian Arctic is in the heterogeneous development of the AZRF regions in terms of economic specialization and regional educational systems; therefore, it is important to conduct research on staffing in regional and industry contexts.

The satisfaction of enterprises with the level of graduates' training is an important marker for both the labor market and educational organizations. Changing requirements to employee competencies create a demand for improving existing and creating new educational programs. Thus, regular monitoring of competencies demanded by employers and compliance of graduates of educational organizations of higher education (HE) and secondary vocational education (SVE) with these requirements are necessary for the formation of a sustainable personnel policy in the region.

State of research of the issue

A large number of scientific publications are devoted to the study of the demand for competencies. Works on this topic reveal approaches to the definition and classification of supra-professional skills [2, Marin-Zapata S.I., Román-Calderón J.P.; 3, Parlamis J., Monnot M.J., pp. 225–

[1] Ukaz «O Strategii razvitiya Arkticheskoy zony Rossiyskoy Federatsii i obespecheniya natsional'noy bezopasnosti na period do 2035 goda» [Decree "Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035"]. URL: http://kremlin.ru/acts/news/64274 (accessed 10 September 2022).

227], their relationship with professional competencies [4, Lyu W., Liu J.], trends towards the demand for competencies in the context of digitalization of the economy [5, Schislyaeva E.R., Saychenko O.A.] and various industries [6, Munir F., pp. 294–305].

Monitoring studies of the Higher School of Economics make a great contribution to the research of the system of competencies and employers' demand for them in Russia. The work of N.V. Bondarenko et al. revealed significant qualification deficits of both professional and universal skills (soft skills) [7]. The monitoring study by N.V. Bondarenko (2017) noted the differentiation of employers' demand for various skills among graduates of training programs for skilled workers, office workers and mid-level training programs. For the latter, the range of priority skills turned out to be more diverse and included both professional and social skills [8, Bondarenko N.V.].

The comparative analysis of high-tech sectors of the economy in 2017 revealed trends in the interaction between employers and the system of secondary vocational education, including in the qualification assessments of recent graduates. The authors note that most young specialists needed additional training to adapt to production processes. The main claims of employers were the lack of practical professional competencies and cognitive skills (in particular, decision-making and independent work skills) [9, Bondarenko N.V.].

The authors of the monograph "Young professionals for the new economy: secondary vocational education in Russia", based on the data of employers' surveys, note the necessity of formed cognitive and social skills. The demand for these skills is well expressed and addressed to all categories of workers: from management to ordinary performers [10, Dudyrev F.F., Romanova O.A., Shabalin A.I., Abankina I.V.].

In 2021, the Department of assessment and methodology of the Autonomous NGO "Russia — Land of Opportunities" conducted a study to identify supra-professional competencies demanded by leading employers in the Russian Federation. The authors compiled a competency profile of graduates and fledgling specialists that meets the requirements of employers. The list of competencies included partnership/cooperation, customer focus, self-development and others. The authors of the study note that "on a number of competencies, university representatives and students are unanimous with the opinion of employers, but there are many competencies that university representatives and students overestimate or underestimate, which creates a dangerous discrepancy for the labor market between the requirements that employers have for young specialists and the development of which non-professional skills universities and students pay attention to" [11, Stepashkina E.A., Sukhodoev A.K., Guzhelya D.Yu.].

A similar study was carried out by the Plekhanov Russian University of Economics. According to the results of a survey of more than 500 leading Russian companies, a demand for "soft" skills was identified. Based on the results of the study, the ability to work with information, resistance to stress, knowledge of a foreign language, self-organization skills and presentation and visualization skills, communication skills, leadership qualities, creative skills, knowledge of the regulatory

framework, and data analytics skills were put at the top of the ranking of in-demand supra-professional competencies [2].

As part of the development of the national qualification system, the National Agency for the Development of Qualifications and the All-Russian Public Opinion Research Center Foundation collected data on existing and future qualifications in the Russian economy. More than 13 thousand employers were surveyed. In addition to the current list of qualifications, popular general professional competencies were identified, as well as measures taken by enterprises to train employees. Among general professional competencies, teamwork, self-education, business communication, initiative, and the use of information and communication technologies are in greatest demand [3].

A review of scientific research on this issue shows that the questions of assessing employers' demand for employee competencies, including those related to the development of digitalization and automation of production processes, as well as employers' satisfaction with the level of training of recent graduates of higher and vocational education institutions in the context of individual regions and industries of the AZRF remain poorly studied.

Research methodology

In 2022, the Institute for Strategic Development of the Arctic of NArFU named after M.V. Lomonosov conducted an applied sociological research on the topic "Staffing of the shipbuilding, forestry and fishing industries of the Arkhangelsk Oblast in the context of digitalization". The purpose of the study was to analyze the perceptions of the management of the shipbuilding, forestry and fishery enterprises of the Arkhangelsk Oblast about the staffing situation, as well as strategies for meeting the personnel needs of these enterprises [12, Saburov A.A., Minchuk O.V., Tsikhonchik N.V., et al., pp. 215–216].

Within the framework of the present work, the following aspects of the study are considered:

- assessment of employers' demand for professional and general (supra-professional, universal) competencies of employees;
- analysis of employers' demand for employee competencies related to the development of digitalization and production automation processes;
- employers' satisfaction with the level of training of recent graduates of educational institutions of higher and secondary vocational education.

Primary data collection was carried out using questionnaires and in-depth interviews.

[2] Issledovanie Plekhanovskogo universiteta: kakie spetsialisty nuzhny rabotodatelyu segodnya [Research by Plekhanov University: what specialists do employers need today]. URL: https://rg.ru/2021/06/21/issledovanie-plehanovskogo-universiteta-kakie-specialisty-nuzhny-rabotodateliu-segodnia.html (accessed 25 October 2023).

[3] Rabotodateli opredelili trebovaniya k kandidatam: top-5 vostrebovannykh kompetentsiy na rossiyskom rynke truda [Employers have determined the requirements for candidates: top 5 in-demand competencies on the Russian labor market]. URL: https://wciom.ru/analytical-reviews/analiticheskii-obzor/rabotodateli-opredelili-trebovaniya-k-kandidatam-top-5-vostrebovannykh-kompetenczij-na-rossijskom-rynke-truda (accessed 25 October 2023).

The questionnaire survey was conducted in electronic form using LimeSurvey software. The survey was conducted from August 3 to September 6, 2022. The questionnaire included 36 questions, divided into three main blocks:

- forecasting staffing needs;
- demanded competencies and satisfaction with the level of graduates' training;
- interaction with educational organizations.

The general population of the study included enterprises of the shipbuilding, forestry and fishing industries of the Arkhangelsk Oblast, taking into account the main and additional types of economic activities in accordance with the All-Russian classifier of types of economic activities (Table 1).

Table 1

Types of economic activity

Economic sector	Types of economic activities
Forestry industry	02 Forestry and logging 16 Manufacture of wood and products of wood and cork, except furniture, manufacture of articles of straw and plaiting materials
Fishing industry	03 Fisheries and fish farming 10.2 Processing and preserving of fish, crustaceans and molluscs
Shipbuilding industry	25.99.26 Production of ship propellers and paddle wheels 30.1 Construction of ships, vessels and boats 33.15 Repair and maintenance of ships and boats

The general population of the survey comprised 90 legal entities of various organizational and legal forms. The total number of completed questionnaires is 21, which corresponds to 50 enterprises that were surveyed. The difference in values is explained by the specifics of the employers' survey: several large organizations filled out the questionnaire for their subsidiaries and branches, which are separate legal entities.

All industries are represented in the sample population: fishing, shipbuilding, forestry. The survey covered large (46%), as well as medium and small (54%, hereinafter referred to as SMEs) industrial enterprises. The distribution of the surveyed enterprises by industry is shown in Fig. 1.

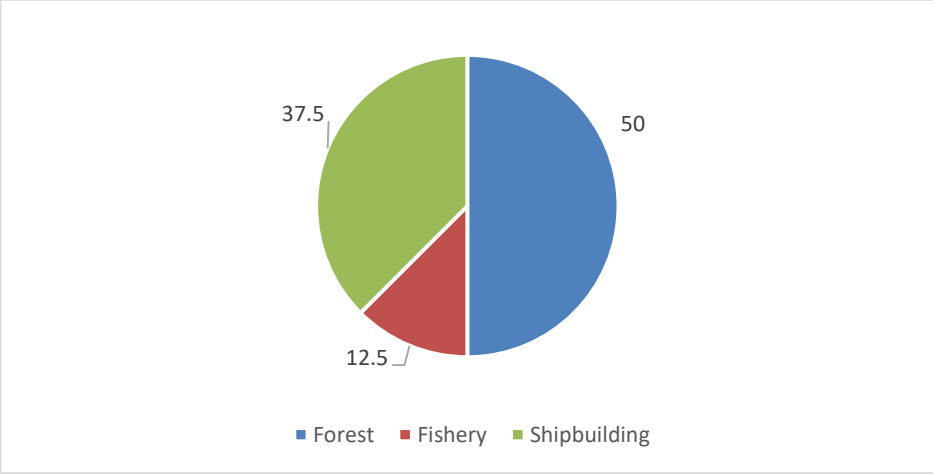

Fig. 1. Distribution of surveyed enterprises by industry, %.

The survey was completed (from the general population of legal entities of each of the industries under consideration) as follows: the fishing industry — 40% of enterprises; the forestry — 64% of enterprises; the shipbuilding — 44% of enterprises. In the forestry industry, 36 enterprises were surveyed, employing more than 54% of the employees of the entire industry. In the fishing industry, 10 enterprises were surveyed, employing more than 54% of the employees of the entire industry. In the shipbuilding industry, 4 enterprises were surveyed, employing 93% of the employees of the entire industry.

Thus, it can be stated that the survey data meets the criterion of representativeness and can be used to assess each of the industries under consideration [4].

From November 2022 to July 2023, a survey of enterprises from the selected sample was conducted using a semi-structured interview method. 24 representatives of employers and educational institutions were interviewed. The informants were mainly managers, deputy managers for personnel issues and heads of personnel services and other structural divisions of enterprises, as well as experts from the education sector.

The interview guide included 3 sets of questions. The first block of questions concerned the problems of staffing of enterprises. The second block was aimed at identifying the attitude of informants to the level of training of graduates of educational organizations. The third block of questions was devoted to the processes of interaction between employers and educational organizations.

Competencies demanded by employers

Among the most important competencies of employees of production departments, employers identified the following as priorities [5] (Table 2):

- compliance with labor discipline: work schedule, fulfilling instructions from management, etc. (average score for the sample — 4.7 out of 5);
- basic theoretical knowledge (fundamentals) in the specialty (4.4 points);
- knowledge and practical skills of working with professional devices/equipment/working methods (4.3 points);
- ability to work independently (4.1 points);
- ability to solve non-standard problems that arise during work, search for non-standard solutions and approaches (4.0 points);
- resistance to stress (4.0 points).

The survey results show a moderately high demand of employers in the shipbuilding, forestry and fishing industries for supra-professional competencies related to communication, self-

[4] Data on the average number of employees at enterprises was obtained from the following sources: the results of a survey of employers as part of a study of the personnel needs of employers operating in the territories included in the Arctic zone of Russia "Personnel for the Arctic" and data from the B2B.House service (https://b2b. house/).
[5] These competencies are rated 4.0 points or higher on a 5-point scale, where 1 is not important, and 5 is critically important.

organization, the ability to analyze information, and general legal literacy. The least demanded competencies with an average score below 3.0, according to surveyed enterprise representatives, are:

- understanding of the main trends in the development of the industry, knowledge of forecasts and directions of scientific and technological progress in the industry (average score 2.8);
- knowledge of a foreign language (average score 1.6).

Table 2

Employers' assessment of the importance of general and professional competencies for getting a job in a company on a scale from 1 to 5 points (1 – not important, 5 – critically important) by enterprise size

Competencies	Entire sample	Small and medium enterprises	Large enterprises
Compliance with labor discipline (work schedule, fulfilling instructions from management, etc.)	4.7	4.7	4.6
Basic theoretical knowledge (fundamentals) in the specialty	4.4	4.4	4.3
Knowledge and practical skills of working with professional devices/equipment/working methods	4.3	4.6	4.1
Ability to work independently	4.1	4.3	3.9
Ability to solve non-standard problems that arise during work, search for non-standard solutions and approaches	4.0	4.3	3.6
Stress resistance	4.0	4.4	3.6
General computer skills (including basic office programs)	3.9	4.4	3.4
Ability to interact/cooperate with other people, communication culture	3.8	3.7	3.8
Skills in planning, organizing, managing and evaluating work	3.7	3.8	3.5
Critical thinking, ability to analyze information	3.5	3.8	3.3
General legal literacy, incl. in matters of labor relations	3.5	4.0	3.1
Professional and social activity in the workforce and professional communities	3.4	3.6	3.2
Commitment to corporate values	3.4	3.4	3.4
Advanced IT skills (including use of professional software)	3.0	3.2	2.9
Understanding of the main trends in the development of the industry, knowledge of forecasts and directions of scientific and technological progress in the industry	2.8	3.1	2.5
Knowledge of foreign language	1.6	1.7	1.5

In terms of enterprise size, small and medium-sized enterprises have a higher demand for almost all the listed competences compared to large employers. The average score of importance of each competence for SMEs is 3.8 points, for large enterprises — 3.4 points. In particular, it is worth noting the significantly higher demand for the ability of SME employees to work under stress and to search for new, non-standard approaches to solving problems. This is probably a

consequence of the wider functionality of SME employees and their lower substitutability in production processes.

In the sectoral context, no significant differences in the demand for professional and general professional competences of employees between shipbuilding, forestry and fishing industries were revealed in the course of the research (Table 3).

Table 3

Employers' assessment of the importance of general and professional competencies for getting a job in a company on a scale from 1 to 5 points (1 – not at all important, 5 – critically important) by industry

Competencies	Entire sample	Shipbuilding industry	Forestry industry	Fishing industry
Compliance with labor discipline (work schedule, fulfilling instructions from management, etc.)	4.7	4.8	4.6	5.0
Basic theoretical knowledge (fundamentals) in the specialty	4.4	4.8	4.2	5.0
Knowledge and practical skills of working with professional devices/equipment/working methods	4.3	4.3	4.3	4.5
Ability to work independently	4.1	4.0	4.1	4.5
Ability to solve non-standard problems that arise during work, search for non-standard solutions and approaches	4.0	4.3	3.9	4.0
Stress resistance	4.0	4.3	3.9	4.0
General computer skills (including basic office programs)	3.9	3.5	3.9	4.5
Ability to interact/cooperate with other people, communication culture	3.8	3.8	3.9	3.0
Skills in planning, organizing, managing and evaluating work	3.7	3.8	3.6	4.0
Critical thinking, ability to analyze information	3.5	3.8	3.5	3.5
General legal literacy, incl. in matters of labor relations	3.5	3.3	3.7	3.0
Professional and social activity in the workforce and professional communities	3.4	3.5	3.3	4.0
Commitment to corporate values	3.4	2.8	3.5	4.0
Advanced IT skills (including use of professional software)	3.0	2.5	3.1	3.5
Understanding of the main trends in the development of the industry, knowledge of forecasts and directions of scientific and technological progress in the industry	2.8	2.8	2.8	3.0
Knowledge of foreign language	1.6	2.0	1.5	1.5

The informants particularly highlighted the ability to work in a team as an important supra-professional competence. At the same time, not all representatives noted the importance of "soft skills": *"If he is a harvester operator, then, of course, he needs professional skills. If he doesn't know how to do it, this planning and leadership won't help him. Therefore, probably, working spe-*

cialties are professional competencies, of course. If they are line managers who have to manage a team, and this is especially true on a foreman's shift, at a logging site, group isolation for 15 days, they are there with each other, and, of course, management skills, communication skills are very important. Maybe even more important than professional skills" (informant No. 12, large enterprise, forestry industry).

Among the options not proposed in the questionnaire, employers often noted during interviews that one of the key qualities of an employee is the desire to learn and develop in the profession:

"Whoever has a desire to retrain is probably the best employee. ... We found a ship electrician, he actually worked as a sales representative, and he came and said: "Look, I'm an electrician and I'm good at it and I'd really like to be a ship electrician, it's more interesting to me." We assigned him to ship electricians, and he really showed good results" (informant No. 2, medium-sized enterprise, shipbuilding industry);

"If the eyes don't shine, then retraining is pointless. I am convinced that a person with interest and passion is the best investment for an employer" (informant No. 23, medium-sized enterprise, fishing industry);

"People come who have completed a bachelor's degree, for example, in a field of pedagogy, and then completed a master's degree in forestry, and I'm immediately told not to ask him anything about taxation, he doesn't know anything anyway. …. Well, he comes, we teach him. The main thing is determination, desire to work and such a big task as stress resistance. Ability and desire to learn... It is clear that you cannot learn everything, but there is a base, and if you are ready, we are always ready to teach you the details" (informant No. 19, medium-sized enterprise, forestry industry);

"We teach people everything that is required on the spot, because we really use a lot of modern equipment... We value an initiative employee... who wants to understand all these innovations" (informant No. 16, medium-sized enterprise, fishing industry).

Automation and digitalization of production and their impact on the in-demand employee competencies

According to the survey data, 52.4% of the enterprises that took part in the research have implemented automation and digitalization (hereinafter referred to as A&D) processes in all key production processes; 23.8% of the enterprises implement A&D elements in certain production processes, 9.5% noted that A&D is practically not implemented (Fig. 2). In the non-production sphere, automation and digitalization processes have been implemented to a slightly lesser extent: 42.9% of enterprises have implemented A&D in almost all non-production processes, 33.3% — in particular processes.

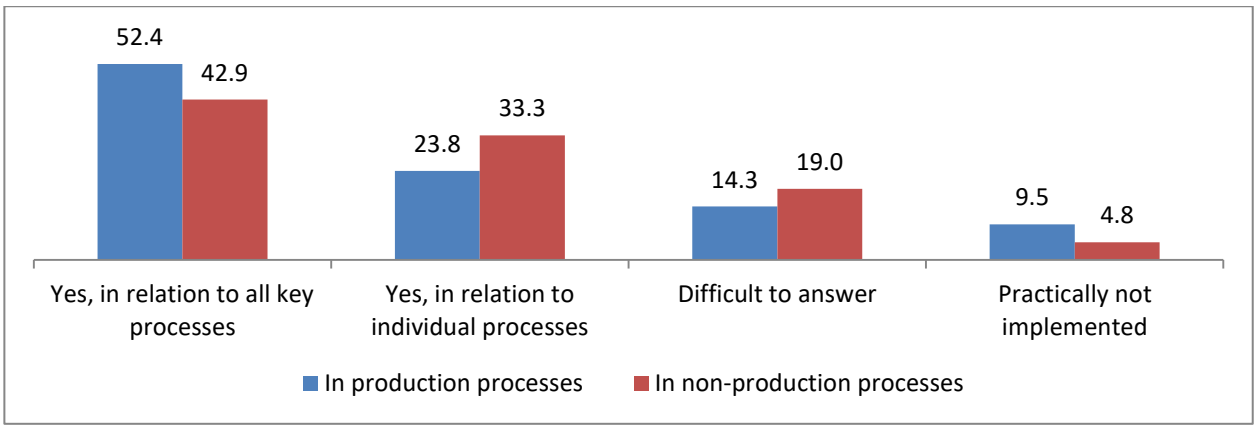

Fig. 2. Introduction of automation and digitalization processes at enterprises in various industries based on the results of a questionnaire survey, %.

During the interviews, the massive introduction of automation and digital technologies was most often mentioned by representatives of the forestry industry, particularly in the context of the widespread use of drones, automated data collection and processing systems and GIS systems to solve production tasks:

"The digital transformation of the forestry industry is the transition from the exchange of paper documents to the exchange of data, the introduction of registry models, and the rejection of duplicate and unnecessary information. Our company is actively involved in the production of information in digital form... In the next 5 years, competency requirements should change towards obtaining more extensive skills in working with GIS systems and working with UAVs" (informant No. 15, medium-sized enterprise, forestry industry).

"...now, instead of the foreman running round the forest, we use quadcopters... Then new programs for wood accounting, related to legal requirements... There are sensors on all vehicles: you can see where it went, how long it was on the road, what the efficiency is. All this is collected by the control office into reports, the reports are analyzed monthly, and the heads of separate departments can see, they can even look at it in real time, compare the plan with the fact" (informant No. 12, large enterprise, forestry industry).

"... in terms of forest fire detection, we are increasingly developing such a system as video detection from permanent video surveillance cameras that are located on the towers of mobile providers. There is fairly advanced software in terms of automatic detection... Unmanned aerial vehicles (quadrocopters) are already being actively used in the survey of existing forest fires to determine firefighting tactics and techniques... Ideally, the existing trend of digitalization of forestry in the future should track a plantation from its birth to its maturation, its cutting, then its boarding and practically almost a wood product" (informant No. 19, medium-sized enterprise, forestry industry).

"If we talk about forests, for example, construction, the same unmanned systems are no longer the future, but a necessity today, and we can't go anywhere without it. This is filming of forest plantations, floorings, construction, when the survey is carried out from a copter" (informant No. 24, representative of the regional executive authority).

Employers of shipbuilding and fishing industry in the interviews more often mentioned A&D of individual production processes (automation of plasma cutting, digitalization of technical documentation). At the same time, one of the respondents expressed the opinion that automation and digitalization in the shipbuilding industry is limited: "*Enterprises in the shipbuilding industry — little has changed there. We recently worked with them on a request for robotics — they say that today we do not need any such specialists...*" (informant No. 24, representative of a regional executive authority). A representative of a medium-sized enterprise in the fishing industry noted that when it comes to cutting fish fillets, manual labor remains a priority due to its higher accuracy and cost-effectiveness compared to an automated machine.

Among the most in-demand competencies that enterprise employees will have to possess in the near future, the following was mentioned: new production technologies (52.4%), system administration (33.3%), big data (33.3%), cybersecurity and data protection (28.6%), strengthening the capabilities of electronics and radio engineering (28.6%), programming and creation of IT products (19%). Other digital and end-to-end technologies seem less in demand to respondents, and a quarter of respondents found it difficult to answer this question (Fig. 3).

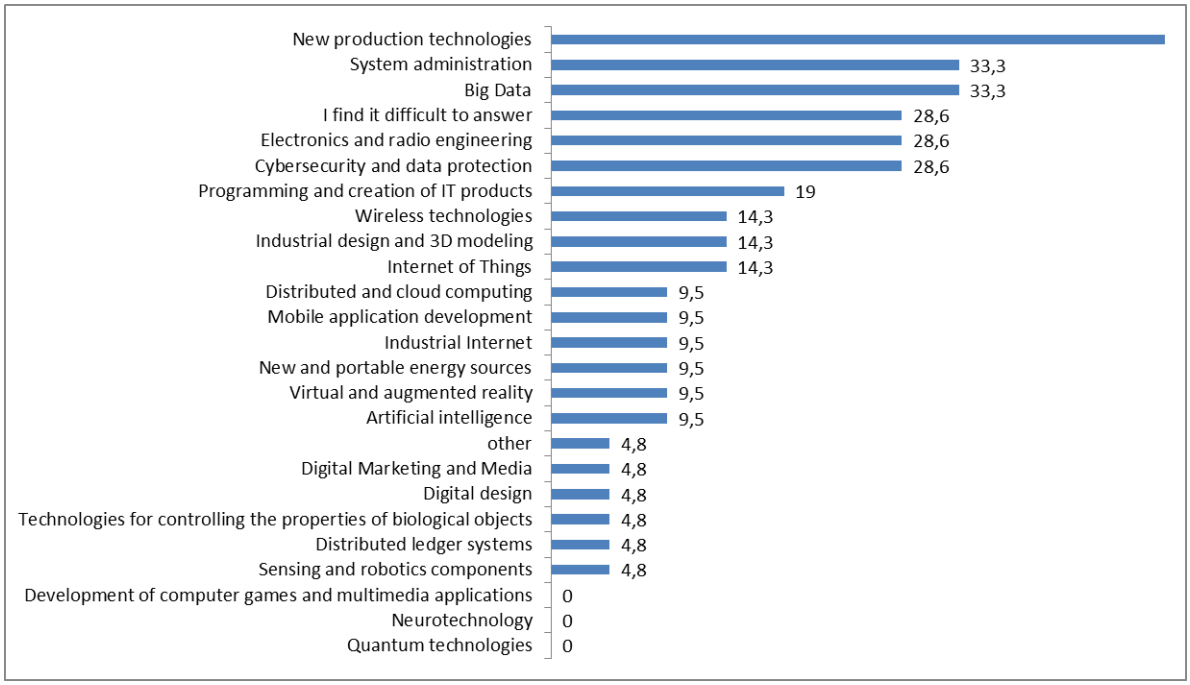

Fig. 3. In-demand employee competencies expected in the near future by employers related to automation and digitalization, %.

Employers' satisfaction with the training level of graduates of secondary vocational and higher education

The overall level of employers' satisfaction with the competencies of recent graduates is at an average level: the average score for the sample is 3.2 on a 5-point scale (Table 4). The highest score (3.7) was given to the following competences: (1) ability to interact/collaborate with other people, communication culture; (2) general computer skills (including basic office programs) and (3) adherence to work discipline (work schedule, carrying out instructions from management, etc.).

If we consider 3 points as the minimum level at which the employer is satisfied with the quality of the graduate's training, then the most demanded competencies presented above meet this requirement.

- Compliance with labor discipline: work schedule, fulfilling instructions from management, etc. (average score — 3.7 out of 5);
- Basic theoretical knowledge (fundamentals) in the specialty (3.5 points);
- Knowledge and practical skills of working with professional devices/equipment/working methods (3.3 points);
- Ability to work independently (3.1 points);
- Ability to solve non-standard problems that arise during work, search for non-standard solutions and approaches (3.0 points);
- Stress resistance (3.0 points).

In terms of enterprise size, the survey showed a difference between SMEs and large enterprises: the latter are less satisfied with the training of graduates (the average value is 3.5 and 2.9 points, respectively). Skills of independent work and working with non-standard problems and approaches were rated relatively low by large employers — 2.7 points each.

Table 4

Employers' satisfaction with the level of training of employees working in production departments and recent graduates of educational organizations on a scale from 1 to 5 points, where 1 is completely dissatisfied, 5 is completely satisfied, by enterprise size

Competencies	Entire sample	Small and medium-sized enterprises	Large enterprises
Ability to interact/cooperate with other people, communication culture	3.7	4.0	3.4
General computer skills (including basic office programs)	3.7	3.9	3.5
Compliance with labor discipline (work schedule, fulfilling instructions from management, etc.)	3.7	3.7	3.6
Basic theoretical knowledge (fundamentals) in the specialty	3.5	3.8	3.2
Knowledge and practical skills of working with professional devices/equipment/working methods	3.3	3.6	3.1
Professional and social activity in the workforce and professional communities	3.3	3.8	2.9
Advanced IT skills (including use of professional software)	3.1	3.8	2.5
Ability to work independently	3.1	3.5	2.7
Commitment to corporate values	3.1	3.4	2.9
Understanding of the main trends in the development of the industry, knowledge of forecasts and directions of scientific and technological progress in the industry	3.0	3.5	2.5
Ability to solve non-standard problems that arise	3.0	3.3	2.7

during work, search for non-standard solutions and approaches			
Critical thinking, ability to analyze information	3.0	3.1	2.8
Stress resistance	3.0	3.2	2.9
General legal literacy, including in matters of labor relations	3.0	3.2	2.8
Skills in planning, organizing, managing and evaluating work	2.9	3.0	2.7
Knowledge of foreign language	2.5	2.4	2.5
Average value	*3.2*	*3.5*	*2.9*

In terms of industries (Table 5), it is noteworthy that employers of the shipbuilding industry have a much lower level of satisfaction with the training of graduates (average satisfaction score of 2.3 versus 3.2 points on average for the sample). Shipbuilders rated above 3 points only such qualities as the ability to interact/cooperate with other people, communication culture; general computer skills. Compliance with labor discipline and basic theoretical knowledge (fundamentals) in the specialty were assessed at 2.8 points.

In general, the assessment data in the questionnaire correspond to the data obtained from the interview:

"If I say I'm happy, then everyone will throw rotten tomatoes at me... there is a minimum sufficient level, yes, it corresponds, but there is certainly a desire to have better training" (informant No. 9, large enterprise, shipbuilding industry);

"I am not satisfied, because what is taught at the university in theory does not match with practice at workplaces... The basic lack of competencies lies in the fact that they cannot apply basic knowledge, skills and abilities in production" (informant No. 20, large enterprise, shipbuilding industry);

"I can say this unofficial, but probably true, real version — we are very dissatisfied. They think that guys come with very low skills... we are not talking about higher educational, but about secondary educational institutions. And they say that if someone knows how to do something, it is thanks to either some talents, or their own interest, or the parents have invested something in them. The general opinion is that they actually are very inexperienced, they don't understand what's going on here, they don't even know any basics" (informant No. 22, expert, shipbuilding industry).

Good reviews about the quality of training of students are associated with the "Plant–University" system, which provides engineering and technical education for specialists at shipbuilding and ship repair enterprises in Severodvinsk. Students under the "Plant–University" system are full-time students, but are employed by these enterprises from the first semester. *"If this is a graduate of Sevmashvtuz, then this is ... a one hundred percent ready specialist in all char-*

acteristics. Why? Because we do the practice ourselves. Studying — about three semesters they work at our plant... The level of training of our technical schools, of course, leaves much to be desired... They receive a diploma, but, as they say, as in the film "Interns": "Forget everything you have been taught for 6 years, let's start all over again." (informant No. 10, large enterprise, shipbuilding industry).

Table 5

Employers' satisfaction with the level of training of employees working in production departments and recent graduates of educational organizations on a scale from 1 to 5 points, where 1 is completely dissatisfied, 5 is completely satisfied, by industry context

Competencies	Entire sample	Shipbuilding industry	Forestry industry	Fishing industry
Ability to interact/cooperate with other people, communication culture	3.7	3.0	3.9	3.5
General computer skills (including basic office programs)	3.7	3.3	3.8	3.5
Compliance with labor discipline (work schedule, fulfilling instructions from management, etc.)	3.7	2.8	3.9	4.0
Basic theoretical knowledge (fundamentals) in the specialty	3.5	2.8	3.7	3.0
Knowledge and practical skills in working with professional devices/equipment/working methods	3.3	2.3	3.7	3.0
Professional and social activity in the workforce and professional communities	3.3	2.3	3.7	3.0
Advanced IT skills (including use of professional software)	3.1	2.0	3.6	2.0
Ability to work independently	3.1	2.3	3.3	3.5
Commitment to corporate values	3.1	2.0	3.4	3.5
Understanding of the main trends in the development of the industry, knowledge of forecasts and directions of scientific and technological progress in the industry	3.0	2.0	3.3	2.0
Ability to solve non-standard problems that arise during work, search for non-standard solutions and approaches	3.0	2.0	3.3	3.0
Critical thinking, ability to analyze information	3.0	2.0	3.3	2.5
Stress resistance	3.0	1.8	3.4	3.0
General legal literacy, including in matters of labor relations	3.0	2.0	3.3	3.0
Skills in planning, organizing, managing and evaluating work	2.9	2.0	3.2	2.5
Knowledge of foreign language	2.5	1.8	2.7	2.0
Average value	*3.2*	*2.3*	*3.5*	*2.9*

Informants — representatives of enterprises in the forestry and fishing industries — more often noted the low or minimally sufficient level of training of recent graduates:

"In general, to be honest, we are not satisfied with those who came. Because, firstly, few of them came, and those who came are, probably... people who most often go there by a leftover principle. That is, "I didn't get anywhere, so I'll go there to study as a forest engineer..." That is, their motivation is most often low, they don't really understand what's going on there and what's expected of them, and their competencies, to be honest, ... not to say that everything is bad, but it's not enough" (informant No. 12, large enterprise, forestry industry);

"On a five-point scale, 3.5–4 with a minus. You can do nothing with it. Most of them come only with theoretical training" (informant No. 13, medium-sized enterprise, fishing industry);

"There are personnel, but they are incompetent, there is no one to choose from. Technologists come, but after the interview you understand that they are not ready to work" (informant No. 23, medium-sized enterprise, fishing industry).

Of particular note is the fact that several employer representatives noted high salary expectations along with low readiness for hard physical work as a significant characteristic of recent graduates:

"Over the past two decades, a situation has developed that the goal of most qualified students is to obtain a high level of income in a fairly short period of time and with a low workload. So, the forestry industry, which in its practical activities is not only difficult but also dangerous, with the average income of a qualified engineer with experience, becomes unattractive" (informant No. 15, medium-sized enterprise, forestry industry);

"I explain to all young specialists that we are ready to train you, why do you only demand a higher salary? They all want more, without experience, they want us to pay them a lot right now" (informant No. 2, medium-sized enterprise, shipbuilding industry);

"The opportunity to see prospects in work and try to work as long as possible, rather than chasing money at once. When finding a job, everyone dreams of receiving a high salary, which is unrealistic at the initial stage" (informant No. 20, medium-sized enterprise, shipbuilding industry — answer to the question about recommendations that the informant could give to educational organizations);

"Boys need to go into the forest, but they don't want to go to the forest... so the specialty is either for money in oil and gas, or, unfortunately, the aspiration to become an economist, lawyer is not outdated" (informant No. 19, medium-sized enterprise, forestry industry).

As in the case of the shipbuilding industry, employers noted that the quality of training of students depends on the educational organization and, in particular, mentioned a higher level of graduates with secondary vocational education:

"The guys working for us from (college name) come well. By the way, with a quality education. They come there, as a rule, from villages. Those who want and are ready to work in the forest" (informant No. 19, medium-sized enterprise, forestry industry);

"The level of training of students from SVE at the moment is often higher than students from HEO (note: Higher Education Organizations), which is associated with a more in-depth study of professional activities by college students than by university students" (informant No. 15, medium-sized enterprise, forestry industry).

Identification of factors determining the quality of students' training was not the purpose of this study, however, in interviews, some informants raised this issue and associated the insufficient level of competencies with low volumes of practical training, poor development of the material and technical base of educational institutions and the low level of qualifications of teaching staff.

"... out of a group of students, only 10% of them get to practice on a fishing vessel. The rest go to other fleets, transport, tanker fleets, somewhere else" (informant No. 13, medium-sized enterprise, fishing industry);

"This is the lack of qualified teaching staff. Qualified specialists don't come to them for such a salary, and young people don't come. And the material and technical base is very low... I can give a simple example: they teach CNC machine operators for us, but they don't even have a CNC machine. They ask for the exam to be held at our base..." (informant No. 10, large enterprise, shipbuilding industry).

Conclusion

The conducted research allows us to draw a number of conclusions regarding employers' perceptions of the competencies of employees in the shipbuilding, fishing and forestry industries of the Arkhangelsk Oblast.

1. The most demanded for employers are professional competences of employees (knowledge and practical skills of working with equipment and methods, basic knowledge of the specialty), as well as supra-professional competencies associated with the ability to work independently, in non-standard situations and under stress. There is also a very high demand for qualities associated with discipline and the desire to develop in the profession. The demand for employee training and adaptability is likely due to changes in the content of work activity due to the development of automation and digitalization of production, the insufficient level of training of graduates by educational organizations, as well as rapid changes in the labor market.

2. In terms of enterprise size, attention is drawn to the higher demand for almost all competencies among small and medium-sized enterprises in comparison with large employers. This is likely a consequence of, on average, the wider functionality of SME workers and their lower substitutability in production processes.

3. About half of the enterprises in the shipbuilding, forestry and fishing industries of the Arkhangelsk Oblast have introduced automation and digitalization into all key production processes. In the near future, about half of employers expect high demand for employee competencies related to the use of new production technologies. A&D are most widely used in the forestry in-

dustry: unmanned aerial vehicles, automated data collection and processing systems, and geographic information systems are widely used to solve production problems.

4. In general, the study allows us to record the existence of a gap between employers' expectations and the actual level of professional training and supra-professional competencies of recent graduates of higher and secondary vocational education, including in relation to the most in-demand knowledge, skills and abilities. In terms of industries, it is noteworthy that employers of the shipbuilding industry, except for the graduates educated under the "Plant–University" system (Severodvinsk), have a much lower level of satisfaction with the training of graduates.

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Nikiforov A.S. — research methodology, text revision

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"Digital Twin" of the Arctic Population in Demographic Research and Territorial Development Management

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Abstract. The article considers "digital twins" of the population as a tool for socio-demographic research and territorial management. The experience of creating digital twins of the population and interactive websites devoted to demographic issues is systematized. A methodology for creating a digital twin of the Arctic population is proposed, based on three methodological principles: consideration of the hierarchy of territories, spatial representation of data, and combining demographic statistics with new digital data sources. The author has developed the Digital twin of the Arctic population — an interactive website (dashboard) containing detailed data on the Arctic population, including municipal and settlement levels. It includes demographic statistics, census results and data from digital platforms. The Digital twin of the Arctic population covers such issues as the size, dynamics and composition of the population, resettlement, natural and migration movement, labor and employment, transport movements, science and education, and the impact of the pandemic on demographic processes. Tools of ranking, multivariate analysis, clustering and forecasting of indicator values are implemented for researchers. From the viewpoint of state and municipal management, the main interest is the demographic profiles of regions and territories, reflecting up-to-date information about the demographic situation. Using the Digital twin of the Arctic population, the author draws conclusions about the spatial patterns of the demographic development of the Russian Arctic.
Keywords: *population, demography, digital twins, dashboard, data source, governance, Arctic*

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Introduction

In the modern world, digital technologies have a great impact on all spheres of people's lives [1, Lundgren A., Randall L., Norlén G. et al., p. 52]. Due to their high remoteness and urbanization, the Arctic territories are leaders in terms of Internet penetration and use of digital technologies [2, Smirnov A.V., p. 260]. Today, public and private information systems accumulate a huge amount of information about the population [3, Kitchin R., p. 62], which can be used in scientific research and public administration. However, with regard to the Russian Arctic, this information is scattered, fragmentary, and requires systematization and processing [4, Dmitrieva T.E.,

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Chuprova I.A.]. One approach to solving the problem could be the creation of a digital twin of the population — a detailed electronic profile that reflects the characteristics of the Arctic population and allows to analyze them without the use of additional tools.

The object of the study is the population of the Russian and global Arctic. The purpose of the article is to develop and test an interactive web application "Digital twin of the Arctic population". The first part of the article is devoted to a review of existing experience in creating digital twins of the population and interactive websites containing detailed demographic data. The second part proposes a methodology for creating a digital twin of the Arctic population, based on three methodological principles: consideration of the hierarchy of territories, spatial representation of data, and combining demographic statistics with new digital data sources. The third part of the article is devoted to a description of the capabilities of the "Digital twin of the Arctic population" created as part of the study [1]. The work draws some conclusions about the socio-demographic problems of the Russian Arctic and presents detailed demographic profiles of the Arctic territories.

Digital twins of the population and demographic dashboards

A digital twin is an evolving digital profile of the historical, current and future behavior of a physical object or process that helps optimize management efficiency [2]. The term is most often applied to physical systems and processes. For example, there is a "Digital twin of Northern delivery", developed at the Eastern Center for State Planning. This is an information system for optimizing the cost, timing and logistics of delivering vital cargo to hard-to-reach areas of the Far Eastern Federal District and the Arctic zone of the Russian Federation [3]. Recently, the term "digital twin" has also been applied to social systems.

The "digital twin" of the population characterizes the population of countries, regions, cities or areas, considers the population through the prism of academic research, business or public administration using big geospatial data, spatial analysis methods, data science, artificial intelligence [4]. An example of a digital twin of a population is the QUANT model developed at the Alan Turing Institute. It models urban development, including demographics, location of jobs and transport interactions in the UK [5, Batty M., Milton R.]. The model was created to support management decision-making, including during epidemics.

Technically, "digital twins" of the population are most often created in the form of interactive web applications — dashboards. The use of charts, tables, cartograms, and infographics in combination with various control elements allows analyzing data in various ways and arranging them [6, Wickham H.]. Dashboard is a working tool for specialists, allowing getting the necessary

[1] Digital twin of the Arctic population. URL: https://digital-arctic.ru/ (accessed 01 March 2023).
[2] Industry 4.0 and the digital twin. Deloitte. URL: https://www2.deloitte.com/us/en/insights/focus/industry-4-0/digital-twin-technology-smart-factory.html (accessed 01 March 2023).
[3] Digital twin of Northern delivery. Eastern Center for State Planning. URL: https://vostokgosplan.ru/projects/cifrovoj-dvojnik-severnogo-zavoza/ (accessed 01 March 2023).
[4] Birkin M. Demographic Twins for 'What if?' Scenario Planning. URL: https://digitaltwinhub.co.uk/media/dt-talks-2/demographic-twins-for-%E2%80%98what-if%E2%80%99-scenario-planning-r18/ (accessed 01 March 2023).

data in a convenient form. In public administration, dashboards of cities and regions are aimed at increasing the security, transparency and accountability of government activities [7, Matheus R., Janssen M., Maheshwari D.], as well as improving the quality and validity of decisions made [8, Nochta T., Wan L., Schooling J.M., Parlikad A.K.].

Some of the most detailed demographic dashboards include interactive maps of the 2021 UK Census [5]. The maps allow visualization of data on demography, education, health, housing conditions and employment in England and Wales, not only at the level of districts and settlements, but also for individual statistical observation areas consisting of just a few houses. The population of almost every of the 189.000 sites ranges from 100 to 625 people, providing users with highly detailed data. The City Population website [6], created by Thomas Brinkhoff, a professor at the Institute for Applied Photogrammetry and Geoinformatics in Oldenburg, contains regularly updated dashboards about the population of cities and territories around the world.

Another area of application of demographic dashboards is demonstration of modelling and forecasting results. For example, the Austrian Wittgenstein Center for Demography and Global Human Capital has developed a dashboard [7] that allows forecasting the dynamics and educational composition of the world's population up to 2100 under five forecast scenarios. Gender and age pyramids with details by education levels and cartograms are available [9, Lutz W., Goujon A., K.C. S., Stonawski M., Stilianakis N.].

In Russia, interactive demographic databases containing some elements of dashboards (for example, the ability to build graphs) include the Unified Interdepartmental Information and Statistical System [8] and the Demoscope Weekly website application [9]. The BI-portal of Rosstat, where it is planned to publish the results of population censuses in the future, has a wider functionality [10], including the construction of maps. The project "Virtual population of Russia" [11] is an interesting project, which is a kind of digital census of the population of Russia [10, Zamyatina N.Yu., Yashunskiy A.D.]. On the basis of the data from the profiles of users of the social network VKontakte, the authors reflected information about gender and age composition, popular names, education, migration and friendship networks in the interactive atlas at the regional and municipal levels.

Demographic dashboards were most developed during the COVID-19 pandemic, when the rapidity of information dissemination was particularly valued. In the early months of the pandemic, media attention around the world was focused on the Johns Hopkins University dashboard [12],

[5] Census maps. Office for National Statistics. URL: https://www.ons.gov.uk/census/maps (accessed 01 March 2023).
[6] City Population. URL: https://www.citypopulation.de/ (accessed 01 March 2023).
[7] Wittgenstein Centre Human Capital Graphic Explorer. URL: http://dataexplorer.wittgensteincentre.org/wcde-v2/ (accessed 01 March 2023).
[8] EMISS. URL: https://www.fedstat.ru/ (accessed 01 March 2023).
[9] Demoscope Weekly. Application. URL: http://www.demoscope.ru/weekly/pril.php (accessed 01 March 2023).
[10] BI-portal. Rosstat. URL: http://bi.gks.ru/biportal/contourbi.jsp?allsol=1&solution=Dashboard (accessed 01 March 2023).
[11] Virtual population of Russia. URL: http://webcensus.ru/ (accessed 01 March 2023).
[12] COVID-19 Dashboard by the Center for Systems Science and Engineering at Johns Hopkins University. URL: https://coronavirus.jhu.edu/map.html (accessed 01 March 2023).

which published data on infections and deaths by country. Subsequently, dashboards with more detailed data were developed. For example, Edward Parker from the London School of Hygiene and Tropical Medicine developed a dashboard [13] that reflects other major epidemics of the 21st century: SARS-2003, H1N1-2009, Ebola-2014. At the University of Northern Iowa, dashboards on the ArcGIS platform were developed [11, Petrov A.N., Welford M., Golosov N. et al.] on infections and deaths from coronavirus in Arctic countries and regions. In Russia, the Yandex dashboard is the most famous [14], where data is presented at the level of countries and constituent entities of the Russian Federation. In addition to infections and deaths, it published data on compliance with self-isolation in Russian cities and on the popularity of search queries related to coronavirus. Statistics on search queries about coronavirus treatment, loss of smell, or calling an ambulance can be used to predict outbreaks of infections [12, Ahmad I., Flanagan R., Staller K.].

Despite the extensive experience in creating demographic dashboards, there are no examples of sufficiently developed solutions covering various aspects of demographic development in the Arctic.

Methods and data

Three methodological principles were used to develop the "Digital twin of the Arctic population".

Firstly, the hierarchy of territories was taken into account. The Arctic zone of the Russian Federation consists of territories of different levels: municipalities, constituent entities of the Russian Federation, macro-level (AZRF as a whole). Five constituent entities of the Russian Federation and one municipality (Evenki district) are partly included in the Arctic zone, which complicates the formation of a uniform information base. Therefore, almost all statistics were collected at the local municipal level and then aggregated to higher levels. This approach is consistent with the principles of Arctic space development. "Regional and zonal development is assembled from the "atoms" of local development. "Big" development of megaprojects and federal development routes can only be successful when relying on "small" development, on development "from below" through the efforts of local communities and entrepreneurs" [13, Zamyatina N.Yu., Pilyasov A.N., p. 17]. At the municipal level, it was possible to collect statistics on more than 50 indicators characterizing the size and composition of the population, natural and migration movements, employment and economic activity, education and quality of life.

Secondly, all data has a spatial representation. This is important because almost all aspects of life in the Arctic depend on the remoteness from the main centers of settlement. These patterns are best demonstrated by the "Atlas of population, society and economy in the Arctic" [14, Jungsberg L., Turunen E., Heleniak T. et al.]. A key role in the "Digital twin of the Arctic population"

[13] COVID-19 tracker by Edward Parker. URL: https://shiny.rstudio.com/gallery/covid19-tracker.html (accessed 01 March 2023).
[14] Coronavirus: dashboard. Yandex DataLens. URL: https://datalens.yandex/7o7is1q6ikh23?tab=X1 (accessed 01 March 2023).

is also given to cartographic materials: each region or district is represented by its borders on schematic maps. Settlements are shown as points with their coordinates. The Albers equal-area conic projection was used in the cartograms, centered at a point with coordinates (71°N, 107°E) in the north of the Krasnoyarsk Krai. This projection is convenient for depicting territories elongated in the latitudinal direction, like the Arctic zone. The dashboard reflects not only geographical, but also social space. In graph visualizations of migration networks, territories are closer to each other the greater the number of people who have moved between them.

Thirdly, traditional and new data sources that emerged due to digital transformation were combined — digital traces. Digital traces are understood as the results of social interaction using digital tools and spaces, as well as digital records of other culturally significant materials [15, Cesare N., Lee H., McCormick T., Spiro E., Zagheni E., p. 1980; 16, Smirnov A.V., p. 60]. They allow obtaining more detailed and timely data on demographic processes. The main sources of traditional statistical data of the "Digital twin of the Arctic population" were the Database of indicators of municipal entities of Rosstat [15] and the results of population censuses of 1939–2021. Among the new digital sources used, there were the data from the above-mentioned project "Virtual population of Russia" (migration), the ticket sales service Tutu.ru [16] (movement of people by trains and planes, the number of flight passengers restored to 100%), Yandex (morbidity, mortality, self-isolation and search queries during the pandemic), the Research data infrastructure project [17] (settlement). These data complement traditional statistics and reveal various aspects of demographic problems.

All datasets are in an organized format. The ordered or tidy data format is organized in such a way that each variable has its own column of a certain type, each observation has its own row, each value has its own cell, and each observation type has its own table [17, Wickham H., p. 10]. Columns of the same table are of equal size, but may contain missing values. Reducing data to this format provides a uniform approach to accessing data. For example, it allows representing any marker on a graph or map as a separate independent row, which simplifies the definition of color, size and other attributes of data points [18, Dabbas E.]. In our case, each row represents a combination of territory and year (for example, the urban district of Arkhangelsk in 2019). Each variable corresponds to exactly one column (population, number of births, migration growth, etc.).

The "Digital twin of the Arctic population" dashboard has client-server browser architecture. The main technologies used are shown in the diagram (Fig. 1). First of all, this is the Dash web framework in the Python programming language. Most of the graphs and cartograms were created using the Plotly software, and the migration network visualizations were created using Cytoscape. The scikit-learn, NumPy and pandas software packages were used for clustering and fore-

[15] Database of indicators of municipalities. Rosstat. URL: https://rosstat.gov.ru/storage/mediabank/Munst.htm (accessed 01 March 2023).
[16] Tutu.ru dataset and Open Data Science model data. https://story.tutu.ru/dataset-tutu-ru-i-dannye-modeli-open-data-science/ (accessed 01 March 2023).
[17] Research data infrastructure. URL: https://www.data-in.ru/data-catalog/ (accessed 01 March 2023).

casting; NetworkX was used to analyze network data structures; GeoPy was used to analyze spatial data. User interaction with the dashboard is carried out through the Nginx web server and the Gunicorn WSGI server. The source code and data files are publicly available in the project repository on GitHub [18].

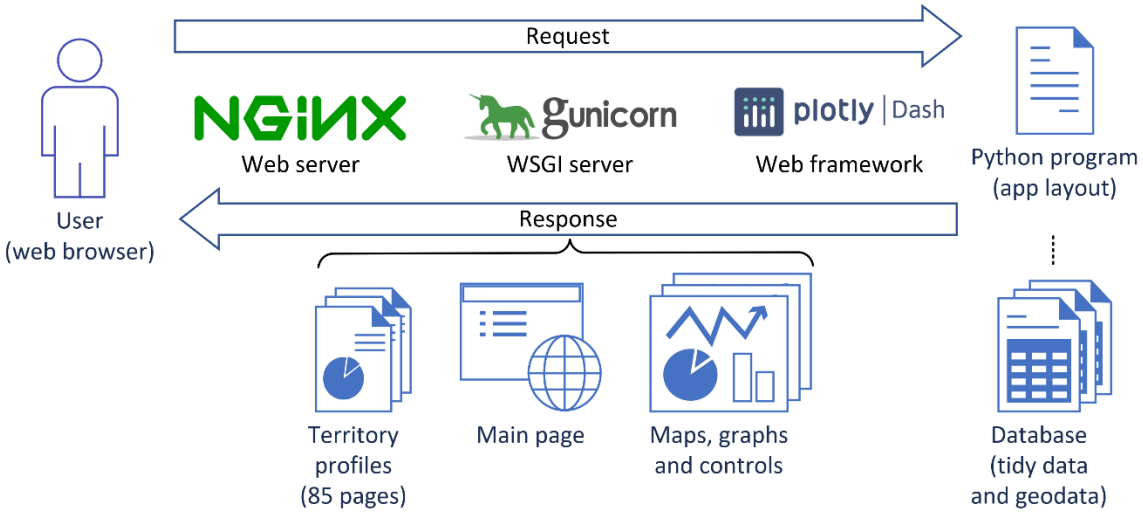


Fig. 1. Architecture of the dashboard "Digital twin of the Arctic population".

Application of the "Digital twin of the Arctic population"

Let us consider some of the problems that can be solved using the developed toolkit. The dashboard allows us to determine the spatial boundaries of socio-demographic problems at a certain point in time, that is, to perform problem zoning of the Arctic [19, Lazhentsev, V.N., p. 40]. Table 1 presents the most and least prosperous territories according to some socio-demographic indicators for 2019–2021. For most indicators (fertility, mortality, migration, demographic burden, wages, production volume), the best values are demonstrated by the territories of new development in the Asian part of the Arctic. The situation is not so clear with the worst values. In terms of some indicators, the outsiders are rural areas and cities of old development of the European part of the Arctic (birth rate, gender and age composition, wages), and in others — some Asian territories (mortality, migration within the region). The COVID-19 pandemic had the least impact on mortality in remote and isolated areas. The only indicator in which the largest cities of the European part of the Arctic (Arkhangelsk and Murmansk) are leading is the share of students in the population.

Table 1

Leading and outsider territories by socio-demographic indicators, 2019–2021 [19]

Index	Best values	Worst values
Special fertility rate	MD Yamalskiy, MA Olenekskiy, MA Chukotskiy	CD Inta, CD Arkhangelsk, CD Anadyr
Standardized mortality rate	CD Gubkinskiy, MO Nadymskiy, CD Novyy Urengoy	MA Chukotskiy, MA Zhiganskiy, CD Providenskiy

[18] Digital Arctic. GitHub. URL: https://github.com/av-smirnov/digital-arctic (accessed 01 March 2023).
[19] Source: Digital Twin of the Arctic Population. URL: https://digital-arctic.ru/ (accessed 01 March 2023).

Excess mortality during the pandemic	CATU Ostrovnoy, MA Krasnoselkupskiy, MA Ust-Tsilemskiy	MA Abyyskiy, MA Belomorskiy, MA Kemskiy
Intraregional migration growth rate	CD Egvekinot, MA Primorskiy, CD Naryan-Mar	MA Chukotskiy, MA Srednekolymskiy, MA Krasnoselkupskiy
Interregional migration growth rate	CD Pevek, MA Anadyrskiy, MD Nadymskiy	CD Anadyr, CD Vorkuta, CD Usinsk
International migration growth rate	CD Pevek, MA Bilibinskiy, MA Anadyrskiy	CD Gubkinskiy, MD Priuralskiy, MA Lovozerskiy
Sex ratio (population equality is considered optimal)	MA Srednekolymskiy, MA Verkhoyanskiy, MA Anabarskiy	CD Pevek, CD Novodvinsk, CD Arkhangelsk
General demographic load	CD Norilsk, CD Anadyr, CD Gubkinskiy	MA Leshukonskiy, MA Mezenskiy, MA Loukhskiy
Ratio of wages to the cost of a set of goods and services	MD Nadymskiy, CD Norilsk, CD Novyy Urengoy	MA Onezhskiy, MA Kalevalskiy, MA Lovozerskiy
Goods shipped, work and services performed per person	MD Yamalskiy, MD Tazovskiy, MA Turukhanskiy	MA Leshukonskiy, MA Kalevalskiy, MA Ust-Tsilemskiy
Number of students of universities and vocational education institutions per 1000 inhabitants	CD Arkhangelsk CD Salekhard CD Murmansk	33 municipalities have no HE and VE institutions

A more detailed idea of the spatial differentiation of territories for each of the considered indicators can be obtained by constructing the corresponding cartograms (Fig. 2a). The dashboard automatically ranks all territories according to the selected indicator for the selected year. A multivariate analysis tool has been developed to identify patterns between various indicators. It allows, based on a bubble chart, to compare Arctic territories simultaneously by four variables: the value of the first is reflected along the X-axis, the second — along the Y-axis, the third — through the size of the circle, and the fourth — through its color (Fig. 2b). The tool allows identifying a variety of patterns by combining variables, using logarithmic scales and trend lines. For more detailed analysis by external tools, data files can be downloaded from the project repository.

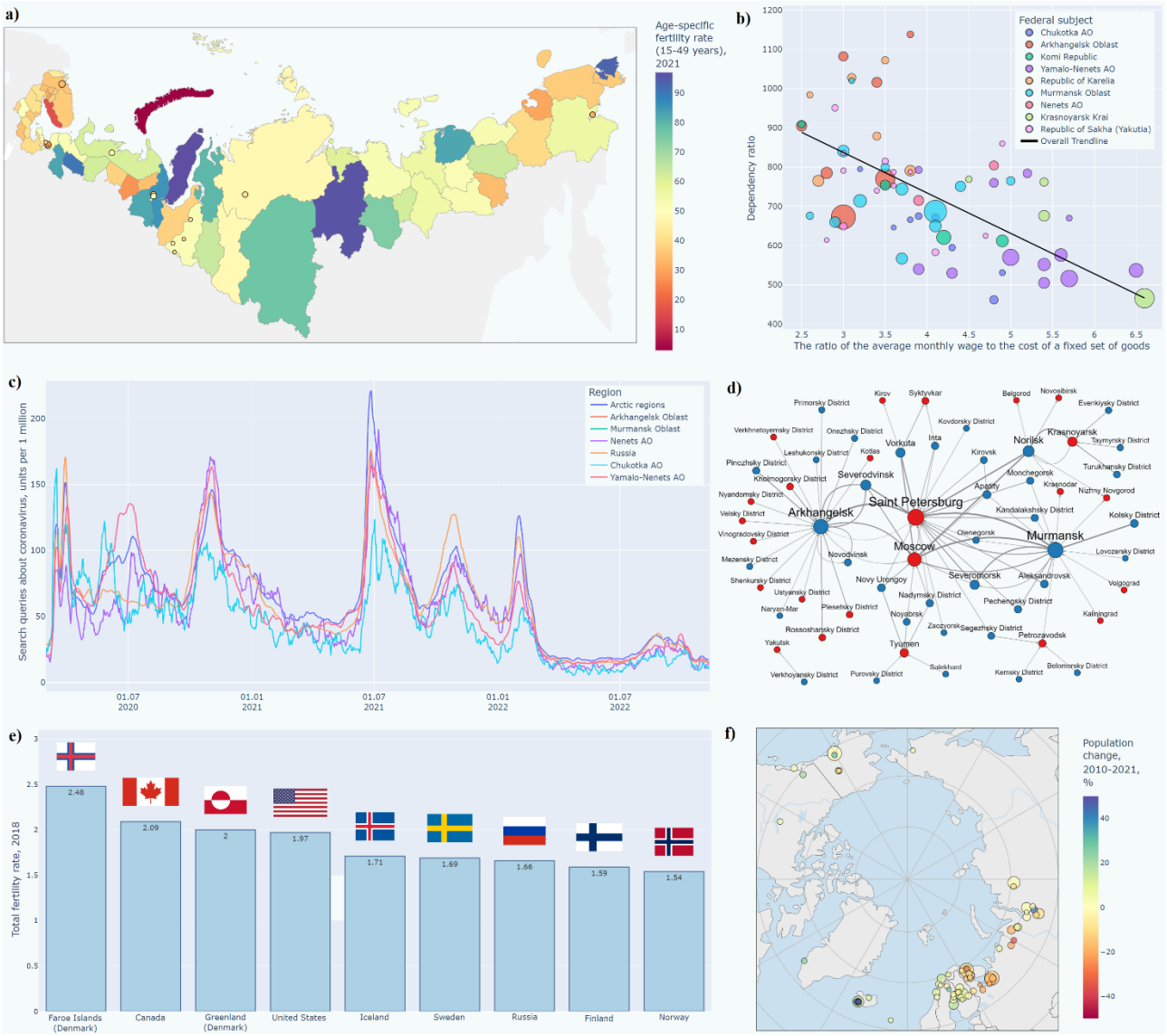
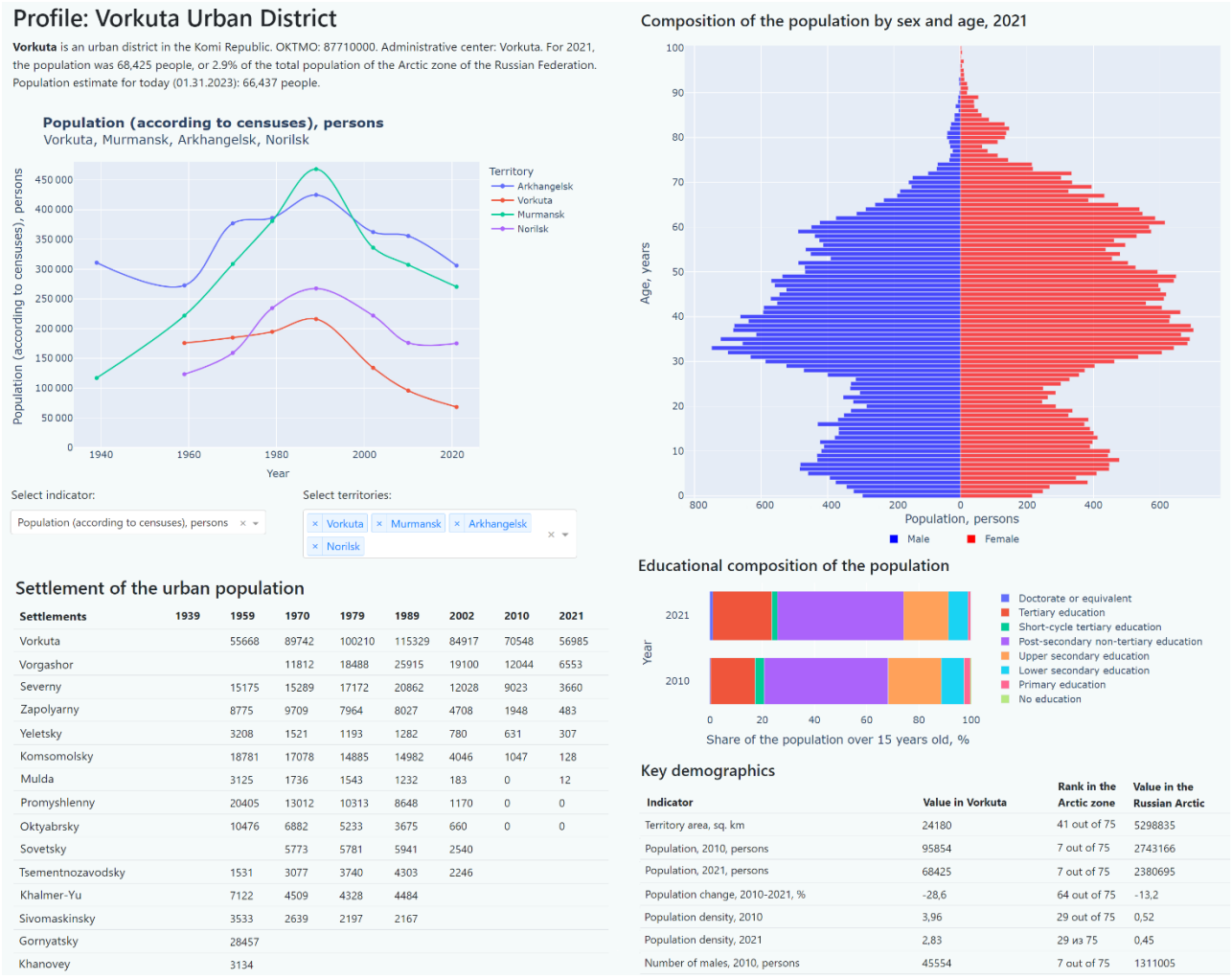


Fig. 2. Some elements of the dashboard: a) zoning by indicator; b) multivariate analysis; c) dynamics of search queries about the pandemic; d) the largest flows of the migration network; e) ranking of countries by birth rate; f) map of the global Arctic settlement [20].

The dashboard provides for clustering of territories, including multivariate clustering, using the k-means method; predicting indicator values; analyzing the settlement system, e.g., estimating the population size within a certain radius of a settlement; visualizing time series of pandemic indicators (Fig. 2c), including the dynamics of search queries and the self-isolation index [2, Smirnov A.V.]; study migration networks [20, Danchev V., Porter M.A.] (Fig. 2d) and transport passenger flows in the Arctic [16, Smirnov A.V.]; analyzing the indicators of scientific and educational organizations located within the Arctic zone. Special attention in the "digital twin" is paid to the global Arctic. A comparison of Arctic countries according to main demographic indicators has been implemented (Fig. 2e). An interactive population distribution map of the global Arctic is available (Fig. 2f) [21].

[20] World Arctic. Digital twin of the Arctic population. URL: https://digital-arctic.ru/ (accessed 01 March 2023).
[21] World Arctic. Digital twin of the Arctic population. URL: https://digital-arctic.ru/Мировая%20Арктика (accessed 01 March 2023).

The "Digital twin of the Arctic population" contains demographic profiles of all 75 urban districts, municipal districts and areas, as well as 9 regions of the Arctic zone of the Russian Federation. The choice of territory is carried out in the menu in the upper right corner of the dashboard. The profile includes a brief description of the territory, graphs of the dynamics of demographic indicators with the possibility of comparison with other territories, information on the population of all cities and towns since 1939, an age pyramid for 2021, the educational composition of the population and the values of the main demographic indicators. As an example, Figure 3 shows a fragment of the profile of the urban district of Vorkuta — one of the fastest decreasing municipalities in the Russian Arctic [21, Fauzer V.V., Lytkina T.S., Fauzer G.N., p. 47].



Settlements	1939	1959	1970	1979	1989	2002	2010	2021
Vorkuta		55668	89742	100210	115329	84917	70548	56985
Vorgashor			11812	18488	25915	19100	12044	6553
Severny		15175	15289	17172	20862	12028	9023	3660
Zapolyarny		8775	9709	7964	8027	4708	1948	483
Yeletsky		3208	1521	1193	1282	780	631	307
Komsomolsky		18781	17078	14885	14982	4046	1047	128
Mulda		3125	1736	1543	1232	183	0	12
Promyshlenny		20405	13012	10313	8648	1170	0	0
Oktyabrsky		10476	6882	5233	3675	660	0	0
Sovetsky			5773	5781	5941	2540		
Tsementnozavodsky		1531	3077	3740	4303	2246		
Khalmer-Yu		7122	4509	4328	4484			
Sivomaskinsky		3533	2639	2197	2167			
Gornyatsky		28457						
Khanovey		3134						

Indicator	Value in Vorkuta	Rank in the Arctic zone	Value in the Russian Arctic
Territory area, sq. km	24180	41 out of 75	5298835
Population, 2010, persons	95854	7 out of 75	2743166
Population, 2021, persons	68425	7 out of 75	2380695
Population change, 2010-2021, %	-28,6	64 out of 75	-13,2
Population density, 2010	3,96	29 out of 75	0,52
Population density, 2021	2,83	29 из 75	0,45
Number of males, 2010, persons	45554	7 out of 75	1311005

Fig. 3. Fragment of the demographic profile of Vorkuta: brief information, population dynamics in comparison with other territories, settlement in 1939–2021, age pyramid, educational composition, main indicators [22].

Conclusion

As part of the study, the "Digital twin of the Arctic population" dashboard was implemented — an interactive website containing detailed data on the Arctic population down to the municipal and settlement levels. The "digital twin" covers such issues as the size, dynamics and composition of the population, settlement, natural and migration movements, labor and employment,

[22] UD Vorkuta — Digital twin of the Arctic population. URL: https://digital-arctic.ru/ГО%20Воркута (accessed 01 March 2023).

transport movements, science and education, and the impact of the pandemic. Tools for ranking, multivariate analysis, clustering and predicting indicator values have been implemented for researchers. From the perspective of state and municipal administration, as well as local businesses, the main interest is in demographic profiles of regions and territories, reflecting information about the existing demographic situation.

In the future, it is planned to improve the digital twin in several directions. Firstly, by adding new indicators and updating data. Secondly, based on the results of the 2021 population census, it is planned to develop a detailed demographic forecast, taking into account, among other things, the educational composition of the population, which will make it possible to predict the size and qualitative composition of the labor force in the Arctic territories.

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Overview of International Standards and Russian Legislation on Climate Change Adaptation

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Abstract. The article provides a brief overview of international legal standards and Russian legislation in the field of climate change adaptation. Currently, states are adopting the so-called "climate adaptation plans" and "strategies", each of which has its own specifics depending on the country, economics, population and the challenges they are caused by. The author aims to reveal the key provisions of the Convention on Climate Change, the Kyoto Protocol, the Paris Agreement in the context of climate change adaptation, the role of UNEP in the UN system on this issue, as well as the standard forms of "national plans", which are proposed as framework by international organizations. It is concluded that the majority of international treaties do not attempt to impose a single standard of climate adaptation commitments for all countries without exception, but adopt a flexible approach for specific groups of countries. A review of existing practices on this issue is made, depending on the climatic zone and existing domestic institutions. A separate part is devoted to the Russian legal system in the field of climate adaptation, from legal support to the stages of implementation of the national plan.
Keywords: *climate adaptation, convention, climate adaptation plan, climate strategy, national law, international law*

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International standards for climate change adaptation

Climate change requires the implementation of climate adaptation plans, which should enable states to quickly respond to the challenges associated with global climate change, which affects not only the biodiversity of ecosystems and infrastructure, but also the health, safety and livelihoods of people. Currently, international law has accumulated quite extensive experience in the field of climate adaptation, and documents of a conventional, declarative and technical nature have been adopted. Russia, as one of the leading global actors, is a country that pursues its own climate adaptation policy, and one of the latest documents, adopted on March 11, 2023, is the "National action plan for the second stage of adaptation to climate change for the period up to

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2025”[1], which will be discussed in the second paragraph of the article after a review of international acts and current global practice on this issue.

a. The Convention on Climate Change: key provisions

The main document of the United Nations (UN) in the field of the environmental agenda related to global climate change is the 1992 UN Framework Convention on Climate Change [2], which has been ratified by 198 states [3], that is, the vast majority of states in the world. The Convention consists of 26 articles, the first 14 of which are directly devoted to terminology, principles, obligations, mechanism and settlement of disputes between states, while the rest deal with technical issues related to amendments, ratification, etc. The first and perhaps most important term mentioned in the Convention is “adverse effects of climate change”, which refers to several “hotspots” of negative impacts on the physical environment and biota, namely: ecosystems, socio-economic systems, health and human well-being. The Convention defines “climate change” as the transformation of the climate system, which is caused exclusively by anthropogenic impact. That is, the Convention does not address issues of natural climate change on the planet, but points to the unconditional human factor. The negative impacts themselves affect not only the biological environment, but also the economy, society and the individual. However, the term “greenhouse gases” under the Convention indicates gaseous constituents of the atmosphere, both anthropogenic and natural, although, as noted above, the treaty focuses on the role of human activity in the global “climate conversion” scenario. The goal of the agreement is to stabilize greenhouse gas emissions into the atmosphere. The key principles are:

- “the principle of equity”, that is, the responsibility of all participating states, without exception, to future generations;
- “the principle of taking into account the needs of developing countries”, obviously due to colonial or other forms of dependence in the past, for which the reduction of air emissions is an economically sensitive topic;
- “the precautionary principle” and refusal to use insufficient scientific uncertainty to justify delaying important actions and decisions;
- “the principle of sustainable development”, which lies in the balance of economic development, and therefore maintaining the quality of life of the population, as well as environmental protection;

[1] Rasporyazhenie Pravitel'stva RF ot 11 marta 2023 goda №559-r “Natsional'nyy plan meropriyatiy vtorogo etapa adaptatsii k izmeneniyam klimata na period do 2025 goda» [Order of the Government of the Russian Federation of March 11, 2023 No. 559-r “National action plan for the second stage of adaptation to climate change for the period until 2025”]. URL: http://government.ru/docs/47971/ (accessed 29 March 2023).

[2] UN Framework Convention on Climate Change. URL: https://www.un.org/ru/documents/decl_conv/conventions/climate_framework_conv.shtml (accessed 29 March 2023).

[3] Status of Ratification of the Convention. United Nations Climate Change. URL: https://unfccc.int/process-and-meetings/the-convention/status-of-ratification-of-the-convention (accessed 29 March 2023).

- "favorable and open international economic system", that is, obviously, an international economy without sanctions pressure and politically motivated decisions that interfere with cooperation between states in the field of business.

The most interesting part of the Convention is undoubtedly the section on the international obligations of states. Since the wording of Article 4 is quite lengthy, it seems important to present them in the most acceptable form, preserving the key ideas and meanings. The following actions are among the obligations of the participating states (not referring to the obligations under the Montreal Protocol [4] and outside the framework of its regulation) (with corresponding brief comments):

- submission of "national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases", which are based on the methodology agreed upon within the framework of the Conference of the Parties;
- introduction of national and regional programs to mitigate the consequences of climate change due to anthropogenic emissions by sources and removals by sinks of all greenhouse gases, that is, a gradual transition to a "green" or otherwise "blue" economy;
- development and transfer of technologies to limit the anthropogenic load associated with greenhouse gases in most sectors of the economy, including energy, transport, industry, agriculture, forestry and waste disposal, that is, a gradual and consistent move away from the "hydrocarbon economy";
- promoting the use of sinks and reservoirs of all greenhouse gases, including biomass, forests and oceans, and other terrestrial, coastal and marine ecosystems, as well as their protection;
- development of preparatory measures for adaptation to climate change, development of comprehensive plans for management of the coastal zone, water resources and agriculture, protection and restoration of areas, especially in Africa, affected by droughts and desertification, as well as floods;
- use of special techniques for assessing the consequences of a potential threat to the environment when implementing socio-economic policy, that is, the so-called "precautionary approach";
- conducting comprehensive scientific research of a wide range of profiles: from technological to socio-economic and, as a result, the creation of data banks related to the climate system in order to prevent negative consequences for the ecosystem in the future;
- exchange of information obtained as part of the research with partner states within the framework of the Agreement;
- international cooperation in the field of education, training, public education.

[4] Montreal Protocol on Substances that Deplete the Ozone Layer. UN. URL: https://www.un.org/ru/documents/decl_conv/conventions/montreal_prot.shtml (accessed 29 March 2023).

These provisions apply to all countries without exception. However, further one can see points that relate specifically to the obligations of developed countries, and the Convention divides them into 2 groups: in Annex I and Annex II. At the same time, obviously based on the events associated with the collapse of the USSR, individual countries of the former Union and the "socialist camp" are marked with a note that concerns their economic "status", namely: "Countries that are undergoing the process of transition to a market economy". In particular, these are countries such as Belarus, Bulgaria, Hungary, Latvia, Lithuania, Poland, the Russian Federation, Romania, Ukraine, Czechoslovakia, Estonia. By 2022, in all likelihood, such a transition has long been completed, since the privatization process in these countries has long been finished.

In general, the Convention does not give an understanding of what criteria are used to determine a country's "development" status, however, at the UN level there is indeed a certain classification created within the framework of UNCTAD (UN Conference on Trade and Development). As noted on the UNCTADstat portal, "all target countries are also divided into developing (1400) and developed (1500) countries". At the same time, it is stated that this categorization was made on the basis of the distinctions between developing and developed regions within the M49 standard. However, the organization states that: "The classification of economies by development status is intended for statistical convenience and does not express a judgment about the level achieved by a particular country or region in the development process. As of December 2021, the United Nations Statistics Division (UNSD) no longer supports the classification of developing and developed regions in M49, but believes that this classification can continue to be applied" [5].

A special group of obligations is defined for the developed states, namely:

- pursuing a national policy to limit the anthropogenic load from greenhouse gas emissions and improve the quality of their sinks and reservoirs of greenhouse gases, in the spirit of leadership as an example for other countries;
- informing about measures taken within the framework of national policy;
- emphasis on the best knowledge of actual absorbent capacity in accordance with the methodology agreed by the Conference of the Parties;
- accountability to the Conference of the Parties;
- coordination of economic and administrative documents between the parties;
- identification of national policy issues related to practices.

The Convention gives the right to any party that is not included in Annex I to accede to the obligations mentioned above, relating primarily to national policies and information.

The Parties that are mentioned in Annex II also have their powers and obligations, in particular:

- provide financial support to developing countries within the framework of obligations under Article 12;

[5] Country classification. UNCTADstat. URL: https://unctadstat.unctad.org/en/classifications.html (accessed 29 March 2023).

- provide financial support to developing countries, which are particularly vulnerable to the negative impacts of climate change, to cover adaptation costs;
- organize the transfer of environmentally friendly technologies and know-how to developing countries.

It notes the role of the Conference in developing a flexible approach towards countries with "transition" economies in order to strengthen their ability to deal with issues related to climate change, including taking into account "historic levels of anthropogenic greenhouse gas emissions". The Convention also identifies a whole group of countries that should receive special attention in the area of financial, economic and other forms of support, as well as on the issue of technology transfer, namely:

- small island countries;
- countries with low-lying coastal areas;
- countries with arid and semi-arid areas, with areas covered by forests and areas where forests are subject to degradation;
- countries with areas prone to natural disasters;
- countries with areas prone to drought and desertification;
- countries with areas of high levels of air pollution in urban areas;
- countries with areas with vulnerable ecosystems, including mountain ecosystems;
- countries whose economies are largely dependent on income derived from the production, processing and export and/or consumption of fossil fuels and related energy-intensive products;
- countries without access to the sea and transit countries.

The Convention pays particular attention to countries whose economies are largely dependent on income derived from the production, processing and export and/or consumption of fossil fuels and related energy-intensive products, and/or the use of fossil fuels in a way that makes it very difficult for such countries to switch to other alternatives. That is, the Convention is not trying to introduce a single standard of obligations for all countries without exception, but approves a flexible approach in relation to groups of countries. Issues of "litigation" when disputes arise between the parties under the Convention are resolved through any means related to the reconciliation of the parties, negotiations, as well as through the International Court of Justice (ICJ) and international arbitration procedures. In addition to country groups, scientists, using sea level rise (SLR) data (which will increase the need for adaptation along low-lying coasts around the world), identify adaptation for 4 "coastal settlement archetypes": urban atolls, Arctic communities, large tropical agricultural deltas, resource-rich cities [1, Magnan A.K. et al.].

b. Kyoto Protocol: emission limits

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (1997) is the second basic instrument for addressing the adverse effects of climate change [6]. It consists of 28 articles and two Annexes (A and B), which specify requirements for the states mentioned in Annex I (first of all) and Annex II of the Convention to emit specific amounts of greenhouse gases at specific times. Appendix A names these greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF^6), and source and sink sectors and categories (from energy to metallurgy and agriculture). Annex B already contains certain quantitative commitments to limit or reduce emissions (as a percentage of the base year or period) for each country party to the Convention. The protocol established the period of validity of these restrictions until 2012. The Conference of the Parties ("Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP)") is responsible for ensuring the implementation of the protocol. After 2012, the Doha Amendment to the Kyoto Protocol was developed, establishing the extension of the Kyoto Protocol for a further period. The amendment entered into force on December 31, 2020 [7].

c. Paris Agreement

Another important document is one of the latest global agreements, namely the Paris Agreement of 2015, which operates within the framework of the UN Framework Convention on Climate Change, which regulates measures to reduce carbon dioxide in the atmosphere from 2020. The Convention consists of 29 articles; Russia joined it without ratification, since for some time there was an acute socio-political discussion about the limit of greenhouse gas emissions to be reached by Russia by 2030. According to the Convention, this is no more than 70% of the 1990 level. However, already in 2018, this level was only 52%. Since the Russian economy is mainly built on a hydrocarbon model, deputies and industrialists opposed the ratification of the agreement, which, in their opinion, could lead to a slowdown in industrial growth and the country's economy. The main goals of the document were identified:

- keeping the increase in global average temperature well below 2°C above pre-industrial levels and working to limit temperature increases to 1.5°C, recognizing that this would significantly reduce the risks and impacts of climate change;
- increasing the ability to adapt to the adverse impacts of climate change and promoting climate resilience and development with low greenhouse gas emissions so that food production is not compromised;

[6] Kyoto Protocol to the UN Framework Convention on Climate Change. UN. URL: https://www.un.org/ru/documents/decl_conv/conventions/kyoto.shtml (accessed 29 March 2023).
[7] The Doha Amendment. UN. URL: https://unfccc.int/process/the-kyoto-protocol/the-doha-amendment (accessed 29 March 2023).

- aligning financial flows with a trajectory towards low-emission and climate-resilient development.

It is noteworthy that the word “adaptation” appears over 30 times in the document. At the same time, Article 9 explicitly refers to the responsibilities of countries to organize the process of formulating and implementing national adaptation plans. As stated on the UN website, the Paris Agreement has three main objectives:

- limit temperature rise to 1.5 degrees;
- review countries’ contributions to emissions reductions every 5 years;
- provide climate finance to developing countries [8].

The ultimate goal is a transition to a “low-carbon world”. The Conference of the Parties is responsible for ensuring the implementation of the Agreement (Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA)).

d. UNEP’s role in climate adaptation

In addition to framework agreements, UN information services provide information to the general public about the adaptation practices of communities and households around the world that help to cope with global climate change. For example, in Vietnam, coastal farmers have moved from harvesting increasingly scarce marine resources (snails and crabs) to developing beekeeping, which is linked to the restoration of mangrove forests. In Bosnia and Herzegovina, farmers have adjusted their crop choices to cope with drought, replacing apples with peaches in warmer weather. In the US, the coastal city of Miami is raising street levels and developing “green infrastructure”. Nigeria has recently experienced a surge in flood-related emergencies, the frequency and impact of which are expected to worsen in the future due to stressors related to land use and climate change. To resolve the issue, planned reforestation, the creation of a reservoir in the city of Dindima and measures for carbon sequestration, that is, the process of transforming carbon in the air (CO2) into soil carbon, are proposed, since carbon dioxide is actively absorbed by plants during the process of photosynthesis [2, Salaudeen A .et al.]. Warming in Sweden affects the movement patterns and grazing of reindeer. Rain and snow significantly worsen the possibilities of adequate nutrition for animals [3, Rosqvist G.C. et al.]. In general, the topic of reindeer husbandry is now more relevant than ever, and this is due to the fact that wild and semi-domesticated reindeer are one of the key species in the Arctic and subarctic regions, and their population dynamics are closely related to winter conditions. Difficult snow conditions reduce calving success and reindeer survival, but the economic impacts of changing winter conditions on reindeer husbandry have not been studied. The results show that severe winters reduce the “net income” from reindeer husbandry. At the same time, they protect lichen grasslands from grazing, thereby increasing fu-

[8] Paris Agreement. UN. URL: https://www.un.org/ru/climatechange/paris-agreement (accessed 29 March 2023).

ture “net income”. Nevertheless, the study shows that variability in winter conditions generally reduces the “net income” of reindeer herders compared to constant winter conditions. Low lichen biomass makes reindeer husbandry more sensitive to the effects of difficult winter conditions. It was also found that it is economically feasible to use supplementary feeding in difficult winters, but net income is still reduced compared to average winters due to the high costs of supplementary feeding. Overall, the analysis shows that increasing variability in winter conditions due to climate change will reduce net income from reindeer herding. This decline will still happen even if the most extreme consequences of climate change do not occur [4, Pekkarinen A.-J. et al.]. Another problem of reindeer husbandry is the closure of national borders in Fennoscandia more than a century ago, which in turn forced reindeer herders to adapt to the new realities. Previously, “transboundary reindeer husbandry” was practiced in this territory. An important adaptation factor is the selection of appropriate food for deer, which could compensate for the lack of natural substances under the conditions of climate change. Local history, strategies of migration and use of pastures by reindeer herders, as well as the biogeography of pastures in summer and winter vary significantly between countries [5, Skarin A. et al.]. Within the framework of UNEP (United Nations Environment Program), about 75 projects on adaptation to climate change have been implemented in more than 50 countries. The total benefits of the projects are reflected in the following points: beneficiaries — 2.5 million people, restored lands — 113.000 hectares, education and new knowledge in the field of adaptation to climate change — coverage of 60 thousand people and 131 institutions, infrastructure — 1.100 watersheds structures, 82 weather stations. The main areas of work in the field of adaptation to climate change are:

- ecosystem adaptation (example: protecting mangrove forests as flood defense; reforestation to combat desertification; protecting rivers and lakes as natural drainage in floods) [9];
- knowledge, analysis, networking (example: “UN Global Adaptation Network”) [10];
- World Adaptation Science Program [11];
- national adaptation plans (example: UNEP supports national plans through the National Adaptation Plan Support Program (NAP - GSP) and the Individual Country Support Program [12]);

[9] Ecosystem-based adaptation. UNEP. URL: https://www.unep.org/explore-topics/climate-action/what-we-do/climate-adaptation/ecosystem-based-adaptation (accessed 29 March 2023).
[10] Global adaptation network. UNEP. URL: https://www.unep.org/explore-topics/climate-action/what-we-do/climate-adaptation/knowledge-analysis-and-networking (accessed 29 March 2023).
[11] World Adaptation Science Programme. UNEP. URL: https://www.unep.org/explore-topics/climate-action/what-we-do/climate-adaptation/world-adaptation-science-programme-0?_ga=2.251391494.1085177075.1667826542-1449996539.1666696331 (accessed 29 March 2023).
[12] National Adaptation Plans. UNEP. URL: https://www.unep.org/explore-topics/climate-action/what-we-do/climate-adaptation/national-adaptation-plans?_ga=2.251391494.1085177075.1667826542-1449996539.1666696331 (accessed 29 March 2023).

- access to adaptation financing (example: broad partnership of three global funds: "Global Environment Facility (GEF)", "UN Green Climate Fund (GCF)", "UNEP Adaptation Fund (AF)", as well as the Recovery Seed Fund, the Tropical Landscapes Finance Facility, the Land Use Finance Program, Agri3 Fund) [13];
- project activities in the field of adaptation to climate change (it is noteworthy that the geography of regions on the UNEP website, where adaptation projects are being implemented, does not include the Arctic, but there is an extremely strong focus on Africa) [14];
- resources and multimedia on adaptation to climate change [15].

In the area of developing national plans for adaptation to climate change, UNEP sees 7 out of 17 sustainable development goals as targets and, accordingly, results [16], namely:

- fight against poverty / no poverty (goal 1);
- affordable and clean energy (goal 7);
- sustainable life in cities and communities / sustainable cities and communities (goal 11);
- responsible consumption and production (goal 12);
- combating climate change / climate action (goal 13);
- marine biodiversity / life below water (goal 14);
- biodiversity on land / life on land (goal 15) [17].

e. Models and "steps" for adopting a national adaptation plan

The Least Developed Countries Expert Group (LEG) [18] analytical review entitled "The National Adaptation Plan Process" suggests models for advancing a national adaptation plan. These include:

- an example of developing a national climate change adaptation plan, where the result is presented in the form of a progress report, technical report, database, strategy, program, etc.;
- specific steps for each element of the plan, which include such elements as assessing climate vulnerability, promoting coordination at the regional level;
- process monitoring, etc.

[13] Access to Adaptation Finance. UNEP. URL: https://www.unep.org/explore-topics/climate-action/what-we-do/climate-adaptation/access-adaptation-finance (accessed 29 March 2023).
[14] Climate Adaptation Project List. UNEP. URL: https://www.unep.org/explore-topics/climate-action/what-we-do/climate-adaptation/climate-adaptation-project-list (accessed 29 March 2023).
[15] Climate Adaptation Resources & Multimedia. UNEP. URL: https://www.unep.org/explore-topics/climate-action/what-we-do/climate-adaptation/climate-adaptation-resources-multimedia (accessed 29 March 2023).
[16] The 17 goals. Department of Economic and Social Affairs. Sustainable development. URL: https://sdgs.un.org/goals (accessed 29 March 2023).
[17] National Adaptation Plans. Ibid.
[18] Least Developed Countries Expert Group (LEG). United Nations Climate Change. URL: https://unfccc.int/LEG (accessed 29 March 2023).

The review then provides an extensive table describing the proposed process for creating a national adaptation plan and the key issues to be addressed at each stage. It seems important to highlight the most interesting of them, which could potentially be applied in our country. In particular, this is a stage "an inventory of all available knowledge about adaptation to climate change." It is noteworthy that in 2021, the Yamal authorities established special awards and grants for scientists who write their master's and doctoral theses on the topic of permafrost science. As TASS notes, "[...] Starting next year, scientists will be able to receive up to 5 million rubles for research in the field of permafrost, the governor of the Yamalo-Nenets Autonomous Okrug Dmitriy Artyukhov told reporters on Wednesday." [19] The importance of these studies is related to the need to protect critical infrastructure, to develop construction technologies that will make it possible to construct buildings as stable as possible and avoid wear and tear of load-bearing structures and pile foundations [6, Melnikov V.P. et al.], to prevent the emergence of epidemics and epizootics associated with climate change, as well as to provide food supply for livestock. The issue of climate adaptation of buildings and structures in similar Arctic latitudes is also on the agenda for foreign partners. In particular, in the city of Longyearbyen on Svalbard, a "techno-fix" adaptation of existing infrastructure to climate change is being carried out. However, many argue that this is definitely not enough, since an environmental approach is needed, including the closure of mines and a focus on an ecologically-safe energy source [7, Meyer A.].

One of the stages of the report is also called a "comprehensive and iterative assessment of needs in the field of climate vulnerability". Based on the questions posed in this step, it is assumed that climate change can have positive consequences that will benefit specific beneficiaries. And these are the ones that are supposed to be identified.

The third table suggests specific activities in the field of the national climate change adaptation plan, which are proposed to include (and this is not a complete list):

- creation of a "road map" in the field of adaptation;
- implementation of specialized adaptation programs, as well as dissemination of information to the widest range of the public and in the education system;
- ranking of risks and vulnerabilities associated with climate change;
- developing individual adaptation options, including the economic, ecosystem and social costs and benefits and potential for unintended (positive and negative) impacts of adaptation measures;
- development of national criteria for determining priorities for the implementation of adaptation measures;

[19] Vlasti YaNAO uchredili premii i granty dlya issledovateley vechnoy merzloty [The authorities of the Yamalo-Nenets Autonomous Okrug have established prizes and grants for permafrost researchers]. URL: https://tass.ru/ekonomika/14853599?utm_source=google.com&utm_medium=organic&utm_campaign=google.com&utm_referrer=google.com (accessed 29 March 2023).

- strengthening and full development of the institutional and regulatory framework for solving adaptation problems in the long term;
- identifying and promoting the possibility of "synergy" with other multilateral environmental agreements in the development of appropriate adaptation plans, etc.

The fourth table of model solutions within the framework of national adaptation plans offers a set of approximate results that can be taken as a guideline in the implementation of state climate policy:

- specific funded project;
- geospatial database in the field of climate change;
- analytical knowledge base in the field of climate change;
- analytical report of gaps and needs;
- scenario of future (or expected) climate change;
- climate risk report, etc.

Finally, another model scheme related to the approval process of a national climate change adaptation plan is proposed. The following scheme for the development and promotion of the national adaptation plan is envisaged:

- A specially created "Initiating body / institution in the field of adaptation" (focus group) sends a report to the Government or Parliament on the proposed adaptation plan based on the Climate Change Convention;
- The government or Parliament, through legislative mechanisms (resolution, order, bill, etc.) prepares the so-called "national mandate" to launch the process of preparing a national plan;
- The "national mandate" descends to the level of a multi-sectoral "National Coordination Centre / Committee / Authority", which should develop a strategy for launching and executing the adaptation plan implementation process; The "National Coordination Centre / Committee / Body" descends the strategy to the level of a multi-sectoral and national "Technical Committee", which in turn prepares "technical support" documents for the strategy (i.e., essentially a mass distribution to the relevant bodies);
- The "technical committee" sends these documents, official letters to the relevant departments and ministries;
- Departments and ministries carry out activities to prepare "sectoral plans" (obviously, with specific deadlines), and send them to the "public, civil society and private sector" for feedback;
- "Public, civil public space and the private sector" (represented by political parties, movements, public organizations, scientific and educational institutions) send their proposals in the form of changes and additions to the "technical committee";

- The “technical committee” in turn prepares “integrated sector plans” with priorities and forwards them to the “National Coordination Centre / Committee / Authority”, which organizes stakeholder feedback and also develops the final draft of the National Climate Change Adaptation Plan ;
- The “National Coordination Centre / Committee / Authority” sends the plan to the Government or Parliament for approval.

These are not all the proposals and formulations that can be found in the analytical review, but the most applied ones are presented here.

One of the main problems in the adoption of such plans is the lack of understanding of what specific “activities” should be carried out at the regional and local levels, since often the central government in a number of countries leaves this issue to the regions, drawing up only a “framework document” with very broad wording [8, Yulandari E.D. et al.].

Russian legislation on climate change adaptation: from federal laws and regulations to state programs and GOSTs

As experts note, unlike the West, Russian climate policy is focused on adaptation rather than mitigation. Detailed recommendations for adaptation to the impacts of climate change issued in 2021 have received increased political attention, but adaptation has largely been framed as a technical challenge. Since 2020, a broader discourse on climate change and adaptation has entered Russian politics, with a focus on the international climate policy and the energy transition. Debate about Russia’s role in the changing energy market has begun, but the Ukrainian crisis and Russia’s subsequent international isolation are likely to weaken its ability and incentives to pursue low-carbon policies. Western countries will have to consider how they can stimulate Russia’s climate policy in the new international situation, since Russia will continue to be important to the success of the climate regime. The importance of science diplomacy can hardly be overestimated [9, Moe A.].

The Russian Federation has a fairly extensive regulatory framework in the field of environmental protection and is consistently taking steps to implement international standards in this area from the legislative and enforcement sides. Among the entire array of acts, it seems important to name the key ones, which are arranged in the framework of the hierarchical principle (from federal legislation to state standards):

- Federal Law dated January 10, 2002 No. 7-FZ “On environmental protection”;
- Decree of the President of the Russian Federation dated February 8, 2021 No. 76 “On measures to implement state scientific and technical policy in the field of environmental development of the Russian Federation and climate change”;
- Decree of the Government of the Russian Federation dated March 24, 2022 No. 455 “On approval of the rules for verifying the results of climate projects”;

- Order of the Government of the Russian Federation dated December 25, 2019 No. 3183-r "On approval of the national action plan for the first stage of adaptation to climate change for the period up to 2022";
- Order of the Ministry of Economic development of Russia dated May 13, 2021 No. 267 "On approval of methodological recommendations and indicators on adaptation to climate change";
- Decree of the Government of the Russian Federation dated February 8, 2022 No. 133 "On approval of the Federal scientific and technical program in the field of environmental development of the Russian Federation and climate change for 2021–2030";
- GOST R ISO 14090-2019 Adaptation to climate change. Principles, requirements and guidelines (September 12, 2019);
- GOST R 54139-2010 Environmental management. Guidance on the application of organizational security controls and risk assessment. Climate Change (December 21, 2010).

Like the national plans of other countries, the domestic one contains information about the potential risks and positive effects of climate change in Russia. In particular, the Plan includes the following negative consequences: increased risk to public health; increased frequency, intensity and duration of droughts in some regions, extreme precipitation, floods and soil waterlogging dangerous for agriculture; increased fire danger in forest areas; degradation of permafrost in the northern regions with damage to buildings and communications; disruption of ecological balance, including the displacement of some biological species by others; spread of infectious and parasitic diseases; increased energy consumption for air conditioning in the warm season.

Regarding the first point, it is important to note that sociological studies show that in a number of Arctic regions and cities, there is a high level of stress among the population, as well as "uncertainty about the future". Therefore, adaptation issues need to be raised not only at the federal, but also at the regional levels [10, da Cunha C. et al.]. A number of scientists also refer to the problems of adaptation in the North of Russia as: lack of access to markets and infrastructure, lack of incentives for the development of products with high added value; unregulated fishing in fragile freshwater ecosystems [11, Konnov A. et al.].

Besides, scientists emphasize the increased nickel concentrations near mining / smelting enterprises in the Arctic among the serious problems. There are no scenarios of nickel exposure in coastal, estuarine and marine waters. The bioavailability of nickel in fresh water depends on spatial trends in dissolved organic carbon content [12, Gauthier P.T.].

The projected positive effects of climate change include: reduction of energy consumption during the heating season; improving ice conditions and, accordingly, conditions for transporting goods in the Arctic seas, facilitating access to the continental shelf of the Russian Federation in the Arctic Ocean; improving the structure and expanding the crop production

area, as well as increasing the efficiency of livestock farming (subject to a number of additional conditions being met and certain measures being taken); increasing the productivity of boreal forests.

The main objectives of the Adaptation plan include the following:

- scientific support for making management decisions;
- implementation of solutions in the field of adaptation;
- implementation of optimal economic decisions in the field of climate-sensitive sectors of the economy;
- updating strategies for the development of economic activities taking into account the climate agenda;
- reducing the risks of foreign economic activity by protecting and encouraging domestic producers;
- ensuring Russia's compliance with international obligations under existing climate change agreements.

According to Ilya Torosov, Deputy Minister of economic development of the Russian Federation, "[...] As of June 2022, regional climate change adaptation plans have been approved in the Republic of Crimea, Belgorod, Volgograd, Vologda, Kemerovo, Kursk and Penza oblasts" [20]. Thus, among the Arctic subjects, taking into account November 2022, when the regional adaptation plan for the Arkhangelsk Oblast [21] was adopted, regional plans were approved for two regions. As an example of the basic directions of work of the regional government in the field of climate adaptation, we can cite the words of Igor Muraev, Minister of Natural Resources And Timber Industry of the Arkhangelsk Oblast, who noted the following: "Currently, the regional plan includes more than twenty relevant activities for the region, aimed, in particular, at stabilizing the forest fire situation, protecting settlements and agricultural lands from waterlogging, increasing the effectiveness of measures to prevent and eliminate emergency situations. The climate change adaptation plan assumes a systematic approach to the implementation of all programs." Among the specific practical steps of the regional plan, the development in 2023 of the state program of the Arkhangelsk Oblast "Improving the rivers of the White Sea basin" should be noted, as well as the implementation of measures to eliminate unauthorized dumps of various types of waste.

In March 2023, the above-mentioned federal action plan for the second stage of adaptation to climate change for the period up to 2025 was adopted. The plan contains 17 measures, which include the following: improving insurance mechanisms in the context of adaptation to climate change; development of national standards for the national standardization system in the

[20] V Rossii zavershena razrabotka otraslevykh planov adaptatsii k izmeneniyam klimata. Departament Rosgidrometa po Privolzhskomu federal'nomu okrugu [In Russia, the development of sectoral plans for adaptation to climate change has been completed. Department of Roshydromet for the Volga Federal District]. URL: http://www.pfo.meteorf.ru/news/2022/v-rossii-zavershena-razrabotka-otraslevyix-planov-adaptaczii-k-izmeneniyam-klimata.html (accessed 29 March 2023).

[21] V Arkhangel'skoy oblasti utverzhden regional'nyy plan adaptatsii k izmeneniyam klimata [A regional climate change adaptation plan has been approved in the Arkhangelsk Oblast]. URL: https://arh.mk.ru/social/2022/11/24/v-arkhangelskoy-oblasti-utverzhden-regionalnyy-plan-adaptacii-k-izmeneniyam-klimata.html (accessed 29 March 2023).

field of climate adaptation; development of adaptation programs at various levels of the education system; identification of the best foreign practices, including within the framework of the corporate governance system; promoting Russian approaches to adaptation at the international level; use of space satellite data; inclusion of adaptation issues in strategic planning documents; updating regional adaptation plans.

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Results of the All-Russian Scientific and Practical Conference "Yenisey Arctic"

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Abstract. In the context of economic turbulence and within the framework of constantly tightening sanctions by Western countries, it is necessary to take into account strategic goals and emerging risks. The most important strategic documents, such as the "Strategy for the development of the Arctic zone of Russia and ensuring national security up to 2035" take into account the macroeconomic and other risks arising while the development of the Arctic water area, which is quite large in Russia. If its western part is sufficiently studied and developed, the eastern part requires more attention from researchers, government and business. The review briefly highlights the results of the All-Russian scientific and practical conference "Yenisey Arctic", held at the end of 2022 in Krasnoyarsk on the basis of the Siberian State University of Science and Technology named after Academician M. F. Reshetnev with the support of the Regional Science Foundation.

Keywords: *Arctic, northern territories, ecological-innovative development, Arctic tourism, infrastructure*

Introduction

Russia's active involvement in the research and development of the Arctic, as well as its chairmanship of the Arctic Council from 2021–2023, has encouraged many stakeholders to cooperate both internationally and within the country.

The events should help to popularize and generate interest in Arctic issues among various segments of the population, especially young people.

However, more attention should be paid to serious research that can not only highlight the problems of the Arctic territories, but also bring real developments in solving complex socio-economic problems of sustainable development of the Arctic [1, Ivachev I.V., Petrov V.O.].

A special role in this process is assigned to research institutes and universities.

It is no coincidence that the leading Siberian University, which has been addressing the Arctic issues in its eastern section for a long time, was chosen as the venue for a large-scale event — the All-Russian scientific and practical conference "Yenisey Arctic".

This review presents the results of the conference held on November 24, 2022 at the Siberian State University named after Academician M. F. Reshetnev (Krasnoyarsk) by the Institute of Management and International Business, the Institute of Advanced Production Technologies with the support of the Regional Science Foundation.

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Fig. 1. Siberian State University of Science and Technology named after Academician M. F. Reshetnev.

Event concept

The conference touched upon a wide range of issues of socio-economic development of the Yenisey water area of the Arctic. Scientists and specialists working in the fields of ecology, history, ethnography, anthropology, programming and design of underwater robots for the Arctic zones, as well as teachers, undergraduates, graduate students, university and technical school students, and schoolchildren were invited to participate.

The partners were the Regional Science Foundation, representatives of the executive authorities of the Krasnoyarsk Krai, regional and capital universities.

The conference concept reflected the following key areas:

- environmental and innovative development of the Yenisey Arctic;
- strategy for environmental safety of the Arctic zones of the Russian Federation and Krasnoyarsk Krai;
- prevention and elimination of environmental damage;
- environmental monitoring of the territories of the Yenisey Arctic;
- environmental safety and waste management in the Arctic;
- scientific and technological development of the Yenisey Arctic, opportunities for the development of an Arctic energy technology hub;
- development and application of remote-controlled robotic systems and unmanned underwater vehicles in the Yenisey Arctic, geographic information systems;
- Russian developments that increase the energy efficiency and safety of studying the polar region;
- technological, design and engineering solutions for the construction, reconstruction and operation of facilities in the Arctic zones of the Krasnoyarsk Krai and other territories of the Russian Federation;
- life support systems in the Far North;
- innovative technologies in construction for the Arctic zones of the Krasnoyarsk Krai and other territories of the Russian Federation;

- environmental and social features of the development of housing and communal services and industrial enterprises in the Arctic;
- priority projects for the development of mineral resources of land and water areas of the Arctic zone and the development of supporting transport infrastructure;
- implementation of innovative and scientific projects for the development of the Arctic territories of the Krasnoyarsk Krai;
- modern labor market in the Arctic zones of the Krasnoyarsk Krai and other territories of the Russian Federation;
- development of Arctic tourism in the Krasnoyarsk Krai;
- directions for attracting investments in the development of projects in the Yenisey Arctic;
- opportunities for public-private partnership in the development of economic activity in the Arctic zones of the Krasnoyarsk Krai and other territories of the Russian Federation;
- development of the Arctic waters of the Yenisey: present and past;
- strategic development of the Arctic zones of the Russian Federation and the Krasnoyarsk Krai.

Event program

The conference program included various formats of events, such as a plenary session, offline and online work in two sections, open lectures, and a discussion platform.

I. The plenary session was opened by the university leadership and representatives of the regional administration. The speeches of the other participants touched on current issues of the development of the Arctic territories, their significance, the Yenisey meridional corridor in the context of the development of the northern and Arctic territories of Russia, the characteristics of tourism resources of the northern territories of the Krasnoyarsk Krai, and eco-tourism in the Arctic.

II. Section 1. Strategic aspects of socio-economic development of the Arctic territories of the Russian Federation.

The work at the section mainly covered those 19 directions that were stated in the conference program and related to determining priorities for the development of research, preparing projects in significant areas of the economy, social sphere for the macro-region of Yenisey Siberia and the Arctic territories of the Krasnoyarsk Krai.

III. Section 2. Issues of ensuring environmental safety in the Arctic zone.

The main trend of work at this section was the determination of priorities for the development of research in the field of ecology. The discussion mainly focused on technological aspects and issues of environmental safety, elimination of environmental damage, environmental monitoring of the territories of the Yenisey Arctic and others.

IV. Open lectures: “Prospects for the development of Arctic tourism and support for indigenous minorities in the Krasnoyarsk Krai”, “Directions for the development of state social policy in

the Arctic zone of the Russian Federation", "Modern problems of the development of the Arctic territories of the Russian Federation".

The lectures were held at the University Boiling Point and were accessible to a wide range of listeners.

V. Discussion platform and competition of student works.

This part of the work was designed for a long period with completion in March of next year and covered mainly a youth audience. The tone of the discussion was set by the report at the plenary meeting "The role of the youth government of the Krasnoyarsk Krai in the formation of youth projects", which was delivered by the Chairman of the Youth Expert Council (Youth Government of the Krasnoyarsk Krai) under the Governor of the Krasnoyarsk Krai.

The program was quite diverse, took place at various venues of the university campus and covered the theoretical and practical aspects of Arctic issues with a clearly expressed regional bias.

Main results of the event

The significance and prospects of the event were appreciated by many conference participants, including the author, who took part in it with a report on the problems of Arctic tourism developing [2, Kazantseva N.V.].

More than 150 people took part in numerous events online and offline, representing mainly the Krasnoyarsk Krai, as well as other Siberian universities. Specialists and scientists from St. Petersburg and Moscow took an active part. Students from China and Vietnam presented reports in English.

Fig. 2. Discussion of reports and debates in the conference hall.

The plenary reports set the tone for further discussions. The welcoming speech of the heads of the university and the regional administration noted the importance and complexity of

the tasks facing the development of the Siberian Arctic, in particular, the Yenisey Arctic. The length of the Arctic territory of Russia does not allow talking about the homogeneity of these problems.

Leading scientists from Moscow and St. Petersburg, noting the high level of regional developments carried out by the university as a driver of economic development of Siberia, introducing breakthrough production technologies into educational and scientific-innovative activities, confirmed the importance of the university's technological and natural science research, which is necessary in the development of the Arctic.

The conference participants paid much attention to the environmental problems of Arctic development. The following reports were devoted to this topic: "Elimination of objects of accumulated environmental damage in the Arctic: oil-contaminated lands"; "Strategic issues of ensuring environmental safety of the Arctic zones of the Krasnoyarsk Krai"; "Some aspects of technosphere risks in matters of environmental safety of the Arctic zone of the Russian Federation"; "Ecological and innovative development of the Yenisey Arctic" and others.

Development of the Arctic is impossible without organizing a life support system and transport accessibility. The following reports by Siberian scientists aroused great interest: "Characteristics of modern life support systems in the northern territories of Russia"; "Life support systems in the Far North"; "Issues of state participation in the modernization of Arctic airports"; "Development of the transport system in the Arctic zone of the Russian Federation" and others.

A significant social orientation of the problems under consideration should be noted. Reports on topics such as "Directions for the development of state social policy in the Arctic zone"; "Health-saving technologies for maintaining active labor activity of the population in the development of the Yenisey Arctic" and others confirm this.

In modern geopolitical conditions, Russian regions have to largely rely on their own resources in their strategic development [3, Kazantseva N.V.]. The reduction in the areas of international cooperation and foreign investment makes practical developments in the Arctic zone particularly relevant. Therefore, the conference participants were interested to learn from the reports "Drivers for the development of creative projects in the Russian north"; "Problems in implementing the strategically important project "Arctic LNG-2"; "Zenit LLC development project in the markets of the northern territories of the Krasnoyarsk Krai" on the implementation of specific projects in the development of the Arctic zone of the Krasnoyarsk Krai.

The development of domestic tourism, natural resources and the cultural heritage of the Arctic are topics that will also attract researchers, as has also been shown by work at various venues where similar problems were considered. The Putorana Plateau, the main Yenisey Arctic attraction, along with the Great Kureyskiy Waterfall and the Red Stones Gorge, fascinated many people even in video format at the presentation.

Main conclusions

Reflecting on the main results of the event, the participants of the All-Russian scientific and practical conference “Yenisey Arctic” could conclude the following.

The goal set by the organizers to study a wide range of issues related to the development of interregional scientific cooperation, creating a platform for the exchange of current results of scientific activity on the problems of the Yenisey Arctic, was achieved. Participants highly appreciated the organizational level and content of the scientific forum.

The main result, according to many conference participants, is the establishment of communication ties through cooperation with leading enterprises, innovative structures, the academic scientific community, leading Russian and foreign partner universities, which is not always achieved when organizing conferences with a narrow focus. The scope of topics discussed at this conference is so wide and interesting to scientists and practitioners that not only internal organizational communications are created at the university between technical and humanitarian areas of study and research, but also external ones [4, Ivashova V., Nadtochiy Y., Anaev M ., Kazantseva N., Rozanova E.]. The participation of state and municipal structures confirms this.

The assessment of the event by the youth who participated in the conference is important. According to students at the university, it was important for them to hear the opinions of scientists from other universities, to get acquainted with Arctic development projects, in particular, with projects aimed at protecting the Arctic ecosystem. Many young people were interested in the topic of the conference and expressed a desire to continue research work and make a presentation at the next conference.

Special mention should be made of the support of the event by the Regional Science Foundation. The presence of such a fund indicates significant attention to scientific research conducted in a large educational and scientific center in Eastern Siberia. The Regional Science Foundation was also an active participant in the Krasnoyarsk Economic Forum (KEF-2023), where cooperation agreements were signed, in particular, with the St. Petersburg Science Foundation to achieve the objectives of the Decade of Science and Technology, which was announced by the President of Russia [1]. This agreement is about involving talented, promising youth in the scientific field, stimulating researchers and developers to solve the most important problems in the development of society and the country. The joint work of the funds will be related to the provision of consulting, organizational and information services, as well as financial support to scientists and enterprises that create and implement scientific and scientific-technical projects, including in the Yenisey Arctic.

[1] Mitrukhin S. Kuda i kak poydet Rossiya v blizhayshie gody [Where and how Russia will go in the coming years]. URL: https://1sibir.ru/news/2023-03-14-kef-2023-kuda-i-kak-poydyet-rossiya-v-blizhayshie-gody/ (accessed 27 February 2023).

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Positions of Russian and Chinese Expert and Analytical Centers on Russian-Chinese Cooperation in the Arctic

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Abstract. Today, Russia and China are each other's most important partners in the international arena. The article discusses such an important area of their relations as interaction in the Arctic region and evolution of its development. In recent years, the role of analytic centers has grown, especially as the world faces complex global challenges such as climate change, economic inequality and political polarization. That is why the positions of the expert and analytical community of the Russian Federation and China on the issue of Russian-Chinese cooperation in the Arctic are of great interest in the article. In particular, the concept of "think tanks" is considered, the expert and analytical communities of Russia and China are studied, the developments of Russian and Chinese "think tanks" in such key areas as the development of natural resources of the Arctic zone of the Russian Federation and the transport infrastructure of the Russian Arctic, including the Northern Sea Route, scientific and technological cooperation. The article identifies similarities and differences in the views of Russian and Chinese scientists on these issues. The article considers the period from the beginning of Russian-Chinese co-operation in the Far North up to the present time, that is, approximately for the last 10 years.

Keywords: *Russia, China, Arctic, Russian-Chinese cooperation in the Arctic, expert and analytical centers, think tanks, development of natural resources in the Arctic zone, development of the transport structure of the Russian Arctic, scientific and technical cooperation*

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Introduction

In recent years, climate change and acceleration of glacier melting have led to an imbalance in the ecological balance In the Arctic region. Currently, there is a trend towards increased integration of global regional development and economic globalization. The Arctic has gradually marked its important position in the fields of environmental protection, scientific research, resource strategy, economic development, waterways and water transport, and has received widespread attention from the international community. The Arctic issue is not only between countries or regions in the Arctic, but also affects the interests of the international community beyond. Cooperation and investment between countries are growing. The Chinese government is encouraging Chinese companies to engage in direct investment in Arctic countries. Disputes in the Arctic

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region continue, but it is worth noting that international cooperation has always affected the development and use of Arctic waterways. This interaction was relatively fragmented, so it has not received the attention it deserves. Expert and analytical centers of both countries play an important role in the development of cooperation between Russia and China.

Expert and analytical centers of the Russian Federation and China

Expert-analytical centers are independent research organizations engaged in analyzing and solving complex social problems. They are composed of experts in various fields, including academia, government, and industry, who work together to produce reports, policy briefs, and other documents that inform and influence public policy. Think tanks play a crucial role in shaping public policy. They provide policymakers with research and analysis on a wide range of issues, from economic policy to international relations. By conducting research, producing reports, and convening experts and policymakers, think tanks help inform the public and shape policy decisions. They also provide a forum for stakeholders to engage in constructive dialogue and develop solutions to complex problems. In recent years, the role of think tanks has become increasingly important in both Russia and China, especially as the world faces complex global challenges such as climate change, economic inequality and political polarization.

Russia has a long history of state-controlled research institutions dating back to the Soviet era. However, since the collapse of the Soviet Union, the number of independent think tanks has increased. According to a report from the University of Pennsylvania, there are currently more than 140 think tanks in Russia [1]. However, most of them still have close ties to the government, and their research is often linked to a political agenda. One example of a government-supported think tank is the Valdai Discussion Club, which was founded in 2004 and is supported by the Russian government. The Valdai Club brings together Russian and foreign experts to discuss issues related to Russia's role in the world. The club has been criticized for being a propaganda tool for the Kremlin, as its events are often attended by high-ranking government officials and its publications tend to support Kremlin policies.

China has a different approach to think tanks than Russia. Although the Chinese government has historically controlled research institutions, there have been recent attempts to establish independent think tanks. According to a report from the University of Pennsylvania, there are currently more than 1400 think tanks in China [2]. However, independent think tanks in China operate in a highly controlled environment, and their research is often censored or suppressed if it contradicts the government's political agenda. One example of an independent think tank in China is the China Development Society, founded in 2007 and focusing on economic and social policy issues. The China Development Society has managed to maintain some degree of independence, but its research is still closely monitored by the government. The Chinese government has also es-

[1] McGann J.G. 2020 Global Go To Think Tank Index Report‹o TTCSP Global Go To Think Tank Index Reports. 2021. 18. P. 46. URL: https://repository.upenn.edu/think_tanks/18 (accessed 05 April 2023).
[2] Ibid. P. 45.

tablished several authoritative think tanks, such as the China Institute of Contemporary International Relations and the Chinese Academy of Social Sciences. These think tanks are closely tied to the political agenda, and their research often supports government policy.

Formation of Russian-Chinese Arctic relations

Russia and China have a long-standing relationship, and one area of growing interest to both countries is the Arctic region. Russian-Chinese dialogue on the region began in 2013. As climate change transforms the landscape and opens up new opportunities for resource extraction and transportation, Russia and China are seeking to increase their presence and influence in the region. The region is believed to have significant oil, gas and mineral reserves. The Russian Arctic region is a storehouse of many minerals. Russia has huge hydrocarbon reserves on the Arctic shelf: about 106 billion tons of oil equivalent, including 69.5 trillion m^3 of natural gas. The Arctic continent is rich in gold, diamonds, mercury, tungsten and rare earth metals. These mineral deposits are the basis for the development of modern technologies in Russia. The development of these regions and the formation of new production capacities will lead to an increase in exports. China has turned into a market with enormous resources and great investment potential, it is ready to participate in investing in new production capacities [1, Kheifets B.A.]. Russia and China have the same interests in developing the transboundary transport potential of Arctic waterways.

Russia has long been present in the Arctic and has invested heavily in infrastructure and military development in the region. Meanwhile, China views the Arctic as a key part of its “One Belt, One Road” initiative and is investing in research and exploration in the region [2, Lukin A.L. et al.]. China, namely the Chinese Academy of Meteorological Sciences and the China Environmental Research Institute, work closely with the University of the Arctic, which brings together universities and training centers engaged in Arctic research [3].

China has participated in several projects closely related to the development of the Russian Arctic region and Arctic waterways. An example of active involvement is the project for the production of liquefied natural gas in Yamal, which is the result of cooperation between Russia’s Novatek, China’s CNPC and the Silk Road Fund. Chinese investors own 29.9% of Yamal LNG in the Arctic (Silk Road Fund — 9.9%, China National Petroleum Corporation — 20%) [3, Tulupov D.].

Positions of expert and analytical centers of Russia and China on Russian-Chinese cooperation in the Arctic

Expert and analytical centers of both countries are analyzing the potential for cooperation in the Arctic. The Russian International Affairs Council (RIAC) and the Chinese Academy of Social Sciences (CASS) are two examples of organizations that regularly produce reports on this topic. Their reports highlight the potential for interaction in areas such as energy development, shipping

[3] Background material for the event “Russian-Chinese cooperation in the field of sustainable development of the Arctic region”. Jointly Russian Congress and Higher School of Economics, 2022. URL: https://roscongress.org/materials/rossii-sko-kitai-skoe-sotrudnichestvo-v-oblasti-ustoi-chivogo-razvitiya/ (accessed 05 April 2023).

and scientific research [4, Kornev K.; 5, Pryakhin V.] [4,5]. In March 2022, a round table "Russian-Chinese cooperation in the Arctic: opportunities and limitations" was held, at which experts from Russia and China tried to come up with a common approach to the development of the region. The results of this project will be presented at the International Arctic Forum in April 2023 [6]. However, these and other centers also point out existing problems, including geopolitical tensions. For example, a report by the Carnegie Moscow Center noted that close cooperation between countries is the result of Russia's geopolitical loneliness and relative technological backwardness, which China actively takes advantage of [7]. The main contradiction is the interests of both countries: for Russia, it is sole ownership of its part of the region, and in the interests of China, it is the internationalization of governance of the region. However, countries avoid conflict and focus specifically on areas of joint cooperation.

Expert and analytical centers face a number of tasks when analyzing and forming Russian-Chinese interaction in the Arctic. One of the biggest problems is access to information. The Arctic region is a remote and often inhospitable area, and obtaining accurate data can be difficult. In addition, geopolitical tensions between Russia and China can make it difficult to conduct research and produce reports that are considered objective and impartial. Another challenge is the need to balance economic development with environmental protection. The Arctic is a fragile ecosystem, and any activity in the region should be carefully controlled to minimize the impact on nature [4]. Think tanks should consider the potential economic benefits of increased cooperation in the Arctic, as well as address concerns about impacts on the environment and indigenous communities.

Analyzing the reports of expert and analytical communities, it can be concluded that the interests of the countries in the Arctic region affect different aspects of cooperation. For example, for Russia, as the largest gas exporter and one of the first oil exporters in the world, the most important aspect of the agreement is the extraction of resources, which, according to experts, account for 30% of the world's undiscovered gas reserves and 13% of oil [5, Kalfaoglu R.]. However, many Russian think tanks have expressed concerns about cooperation in this area with China. On the one hand, Russia needs Chinese technical developments to search for and extract resources; on the other hand, Russian centers, such as Valdai, note that China has strict restrictions on gas

[4] Kornev K. Rastushchee prisutstvie KNR v Arkticheskom regione: vozmozhnosti i ugrozy dlya sopredel'nykh stran [Growing presence of the PRC in the Arctic region: opportunities and threats for neighboring countries]. URL: https://russiancouncil.ru/blogs/kkornev/35821/?sphrase_id=93086898&ysclid=lq3vflmusg717144375 (accessed 29 March 2023).

[5] Pryakhin V. Rossiya i KNR v Arktike. Primer konstruktivnogo sotrudnichestva [Russia and China in the Arctic. An example of constructive cooperation]. URL: https://russiancouncil.ru/blogs/vpryahin/rossiya-i-knr-v-arktike-primer-konstruktivnogo-sotrudnichestva/?ysclid=lq3vfx923g460536576 (accessed 29 March 2023).

[6] Rossiyskie i kitayskie eksperty obsudili razvitie dvustoronnego sotrudnichestva v Arktike [Russian and Chinese experts discussed the development of bilateral cooperation in the Arctic]. URL: https://russiancouncil.ru/news/rossiyskie-i-kitayskie-eksperty-obsudili-razvitie-dvustoronnego-sotrudnichestva-v-arktike/ (accessed 29 March 2023).

[7] Rossiya i Kitay v Arktike: sotrudnichestvo, sopernichestvo i posledstviya dlya evraziyskoy bezopasnosti [Russia and China in the Arctic: cooperation, rivalry and consequences for Eurasian security]. Carnegie endowment for international peace, 2020. URL: https://carnegiemoscow.org/commentary/81384 (accessed 29 March 2023).

imports, which is why Russia, given the sanctions, has to look for other cheaper ways to sell resources.

In the reports of Chinese centers, the Northern Sea Route plays the most important role. China views it as a strategically important element of the "One Belt, One Road" Initiative. An important link in the interests of the two countries is control over the Arctic zone. Chinese think tanks advocate making the Arctic a "Global Commons" and not a zone of ownership of the Arctic states [6, Long Ch.]. At the geopolitical level, the political game between Arctic countries has an impact on the regional and international order, and the potential militarization of the Arctic could also have a profound impact on regional peace and security. At the geo-economic level, the development and use of the Arctic will gradually affect international shipping, biological and non-biological resources, tourism, etc. As an important emerging market and major trading country, China naturally does not want to allow this to happen and therefore often points out in its reports the importance of cooperation with the Arctic states and the Arctic Council in order to create pluralistic governance [7, Sun K., Wang C.].

Guo Peiqing, a professor at the School of International Affairs and Public Administration of Ocean University of China, noted that Sino-Russian cooperation in Arctic exploration is currently at an early stage, and Russia needs to introduce more specific policies to support investment, as well as create more "compelling business models and projects to boost the confidence" of private sector investors [8].

Despite these challenges, think tanks have consistently had a significant impact on Russian-Chinese cooperation in the Arctic. Their research and analysis helped inform the public and shape policy decisions, and provided a forum for stakeholders to engage in constructive dialogue. Reports from think tanks identified potential for cooperation in the region and helped identify areas of mutual interest. The most important areas are the exploitation of the region's natural resources, the development of the transport structure of the Russian Arctic and scientific and technical cooperation. China and Russia organically share the meaning, purpose and value of Arctic cooperation, and there is a high degree of complementarity in the requirements of the interests of Arctic cooperation.

Conclusion

In summary, expert and analytical centers play a crucial role in shaping Russian-Chinese cooperation in the Arctic. By providing policymakers with research and analysis, these organizations help inform the public and promote evidence-based policy decisions. It can be noted that the think tanks of both states point to the need for cooperation and search for compromises in the Arctic region and determine the special significance of the region not only for Russia and China, but also for the whole world. Despite the challenges they face, think tanks continue to have a sig-

[8] There is a huge infrastructure gap in the development of the Arctic waterway. How can Chinese companies take the lead? NetEase. 2019. URL: https://www.163.com/dy/article/EGBN8EI705490TJA.html (accessed 29 March 2023).

nificant impact on society. It is important to support and promote the work of these organizations and recognize the important role they play in shaping the future of the Arctic region.

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