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Impact of Economic Factors on Sustainability of the Fishing Industry of the Russian Arctic Zone

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Abstract. The analysis of the influence of actual external and internal economic factors on the work of the fishing industry in general and in the Arctic zone in particular shows the stability and ability of the Russian fishery complex to fulfil the tasks of implementing the Food Security Doctrine of the Russian Federation and other strategic regulatory documents. Timely work of the state legislative bodies in decision-making at all levels of management in the current situation is noted. Key economic factors (export and import, supply and demand, shipbuilding and ship repair, logistics, etc.) that have direct and indirect impact after the introduction of sanctions are considered. The paper analyses the key performance indicators of the Russian fishery complex, provides an analytical review of the demand for fresh-frozen fish in the North-West region, the relationship between the population's income and the consumption of fish and fish products in the country. The primary role of scientific support of the fishing industry in the successful realization of the general goals and achievement of the set tasks is emphasized. An assumption about opening of new logistic routes and expansion of geography of fish and fish products supplies to African and Latin American countries, countries of Asia-Pacific region is made on the basis of assessment of modern international relations. It is determined that the construction and repair of the fishing fleet in modern conditions is of concern to the state structures and fishing business community. The measures of state support of shipbuilding plants of the country are considered, the proposal on creation of ship repair cluster in the Arctic zone of the Russian Federation is substantiated.
Keywords: *economy, fishing industry, food security, fishery science, fishing fleet, state support*

Introduction

In the new economic conditions, the fishing industry has demonstrated the strength of its functioning and the ability to adapt to changes in the internal and especially external environment. The application of a situational approach in the management of the fisheries complex (FC) of the country made it possible to bring the industry functionality to an optimal state, to create conditions for the stable operation of fishing, processing and other segments of the industry. During the implementation of the Food Security Doctrine of the Russian Federation [1], the State Pro-

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[1] Food Security Doctrine of the Russian Federation. URL: https://mcx.gov.ru/upload/iblock/3e5/3e5941f295a77fdcfed2014f82ecf37f.pdf (accessed 10 February 2024).

gram “Development of the fisheries complex” [2], the Order of the Ministry of Health “On approval of recommendations for rational norms of consumption of food products meeting modern requirements of healthy nutrition” [3], No. 166-FZ “On fisheries and conservation of aquatic biological resources” [4], the investment quota program, the extraction and processing of catches in Russia is actively carried out, the level of self-sufficiency of the domestic fish products market has increased, conditions have been created for increasing the catch and economic efficiency of the fishery.

Under conditions of sanctions pressure, the fisheries complex (FC) of Russia was able to successfully compete and expand its presence in the world fish products market. The current foreign economic situation has made significant adjustments to the assessment of the impact on the industry of such economic factors as logistics, export, import, quotas, demand and price, shipbuilding, import substitution, science, government support and many others.

As a result of the sanctions changes, the fishing industry management made a number of amendments to the current legislation, and the business community demonstrated a timely transition to a model of more efficient use of aquatic biological resources (ABR). Nevertheless, the events of February 2022 entailed certain challenges: the technological component in equipping the fishing fleet, export orientation of fishing companies, ship repair, etc., became subject to sanctions. The consequences of the sanctions impact of unfriendly countries towards Russia lead to decisions on the transition to the model of change management in the extraction, processing and trade of ABR in the country and abroad.

Analysis of the FC functioning and food security: facts and factors

The strategic development of the country’s fisheries complex is carried out taking into account global political and economic trends, increasing geopolitical and sanctions pressure on the fishing industry and the entire Russian economy. The Food Security Doctrine of the Russian Federation is a normative act of strategic planning, in which the goals and objectives of the state socio-economic policy are professionally developed, considering in-depth analysis of key indicators, directions and factors for ensuring the country’s food security are identified [1].

Food security of the Russian Federation (hereinafter referred to as food security) is a state of socio-economic development of the country, which ensures the food independence of the Russian Federation, guarantees physical and economic accessibility for every citizen of the country of

[2] Resolution of the Government of the Russian Federation of April 15, 2014 N 314 "On approval of the state program of the Russian Federation "Development of the fisheries complex" (with amendments and additions). URL: https://base.garant.ru/70644222/ (accessed 10 February 2024).
[3] Order of the Ministry of Health of the Russian Federation dated August 19, 2016 No. 614 "On approval of recommendations for rational norms of consumption of food products meeting modern requirements of healthy nutrition". URL: https://www.garant.ru/products/ipo/prime/doc/71385784/ (accessed 10 February 2024).
[4] Federal Law "On fisheries and conservation of aquatic biological resources" dated December 20, 2004 No. 166-FZ. URL: https://www.consultant.ru/document/cons_doc_LAW_50799/ (accessed 10 February 2024).

food products that meet mandatory requirements, in quantities no less than rational norms of consumption of food products necessary for an active and healthy lifestyle [5].

The Ministry of Agriculture notes the balance of the fish products market: according to the results of 2022, the consumption of fish and fish products in the country amounted to 22.6 kg per person with the recommended consumption rate of fish products of 22 kg/year/person [6], developed to improve the health of children and adults. Provision of fish and fish products of domestic production in 2022 amounted to more than 153.3%, which is 1.8 times higher than the threshold value presented in the Doctrine: "maintaining the level of self-sufficiency in fish and fish products (in live weight — raw weight) of at least 85% per year". Table 1 shows the dynamics of key performance indicators of the fishing industry.

Table 1

Key performance indicators of the fishing industry in 2018–2022.

Year	Extraction (catch) of aquatic biological resources without withdrawal of commercial aquaculture, thous. tons	Level of self-sufficiency in fish and fish products (live weight — raw weight), %	Average consumption of fish and fish products in households per consumer, kg
2018	5 054	159	21.7
2019	4 983	152.8	21.9
2020	4 975	160.7	22.2
2021	5 053	153.7	21.7
2022	4 920	153.3	22.6

In general, the fishing industry in 2022 demonstrated the ability to promptly adapt to changing political and economic conditions, establish sustainable production, sales and financial components. The turnover of specialized enterprises increased by 8% and reached 866 billion rubles, while the federal budget revenue amounted to about 62.7 billion rubles [2].

The total volume of ABR production in 2022 amounted to 4.92 million tons. The following were produced in Russian fishery basins: Far Eastern — 3.49 million tons; Northern — 527 thousand tons; Western — 82 thousand tons; Azov-Black Sea — 38 thousand tons; Volga-Caspian — 102 thousand tons; in exclusive economic zones of foreign states, convection areas and the open part of the World Ocean — 576 thousand tons [3].

The fishing industry occupies key positions in the structure of the agro-industrial complex (AIC) of Russia, and situational changes arising in the process of economic management make it necessary to analyze with special attention the emerging external economic factors influencing the economy of the industry [4, 5]. In general, the system functions in three directions: 1) biological — the volume of ABR caught; 2) economic — income and other financial indicators; 3) social — domestic consumption, jobs, etc. [6].

[5] Food Security Doctrine of the Russian Federation. URL: https://mcx.gov.ru/upload/iblock/3e5/3e5941f295a77fdcfed2014f82ecf37f.pdf (accessed 10 February 2024).
[6] Order of the Ministry of Health of the Russian Federation dated August 19, 2016 No. 614 " On approval of recommendations for rational norms of consumption of food products meeting modern requirements of healthy nutrition". URL: https://www.garant.ru/products/ipo/prime/doc/71385784/ (accessed 10 February 2024).

Demand and price. Steady and positive dynamics in fish production are maintained, despite the anti-Russian sanctions: in 2022, fishing companies caught 4.9 million tons, a slight decrease compared to the 2021 figure, for example, is due to such a factor as a poor salmon fishing season. Currently, industry science has taken a number of measures to organize the salmon fishing season for a more rational and efficient development of this volume of ABR, and comprehensive management measures have been carried out. The volume of ABR production has remained at the level of 5 million tons for the last few years, which allows Russia to be among the TOP-5 main fishing countries in the world [7], but in terms of consumption of fish products, our country is far from the world leaders. Price is a fundamental factor limiting the purchase of fish. More than 80% of the country's population buys fish or fish products every month, and 30% of Russians refuse to buy it because of the high cost [8]. Stable demand is noted for the following types of fish: mackerel — 33%, herring — 32%, pink salmon — 27%, trout — 25%, salmon — 21%, pollock — 20%.

The analytical review of the wholesale market for some popular types of fresh-frozen fish in the cities of Murmansk and St. Petersburg for January 2023 and February 2024 shows that: 1) prices of January 2023 and February 2024 have insignificant deviation, comparative price deviations towards "+" and "-" have insignificant limits, and the higher price of January 2022 for foreign currency types of fish — cod, herring, mackerel — is determined by the export component; 2) prices for the period January 2023 – February 2024 showed a slight increase, which is due to either active demand or limited volumes in the warehouse of this product, the exception was an increase in prices for halibut [7]. Tables 2 and 3 present an overview of wholesale prices for fresh-frozen fish in the cities of the Northwestern Federal District of Murmansk and St. Petersburg.

Table 2

Overview of wholesale prices for fresh-frozen fish in Murmansk

Product	Range of sizes	Country of origin	Jan. 2022 Price including VAT, rub.		Jan. 2023 Price including VAT, rub.		Feb. 2024 Price including VAT, rub.		deviation 2023/2024 rub.
			from	to	from	to	from	to	
Cod, fresh-frozen gutted headless	1000–2000	Russia	295	315	265	275	280	300	+9
Haddock, gutted headless	500–1000	Russia	195	210	165	167	170	180	+8
Spotted wolffish, headless	1000–3000	Russia	235	255	210	220	290	298	+35

[7] The world's leading fishing countries (Russia in the top 5). URL: https://dzen.ru/a/Y8rCy0IEN0exSPFP (accessed 10 February 2024).

[8] Analytical center NAFI. "Russians and fish: choice, purchase, consumption of fish, fish products and seafood". URL: https://nafi.ru/analytics/rossiyane-i-ryba-vybor-pokupka-i-potreblenie-ryby-rybnykh-izdeliy-i-moreproduktov-/ (accessed 10 February 2024).

Atlantic wolffish	1000–3000	Russia	175	185	140	145	170	170	+25
Halibut	1000–2000	Russia	505	515	580	600	935	935	+56
Herring	300+	Russia	130	137	98	105			-
Mackerel	300+	Russia	250	265	240	260			-

Table 3

Overview of wholesale prices for fresh-frozen fish in St. Petersburg

Product	Range of sizes	Country of origin	Jan. 2022 Price including VAT, rub.		Jan. 2023 Price including VAT, rub.		Feb. 2024 Price including VAT, rub.		deviation 2023/2024
			from	to	from	to	from	to	
Salmon, fresh-frozen	5000–6000	Chile	800	795	840	900	1150	1210	+34
Haddock, gutted, headless	500–1000	Russia	195	220	180	205	170	185	-10
Pollock, headless	25+	FE	117	125	105	110	122	130	+18
Cod, gutted, headless, Atlantic	1000–2000	Russia	245	265	275	280	285	305	+9
Halibut	1000–2000	Russia	535	555	550	580	825	930	+60
Herring, whole, Atlantic	300+	Russia	132	140	90	108	120	135	+25
Mackerel, headless, Atlantic	300+	Russia	282	295	228	275	320	375	+36
Spotted wolffish		Russia	240	255	245	265	303	315	+19
Sprat, fresh-frozen	9–12	Baltic	80	102	90	105	105	125	+19

Pricing for fish and fish products has a complex structure and depends, for example, on fishermen's wages, household income, fish stocks, exports, development of fisheries science, vessel construction and many other costs.

In the Fishing and Fish Farming industry, fishermen's wages increased by more than 20% in 2022. A significant increase in wages is one of the key factors that influenced the growth of industry costs and the decrease of financial indicators at the end of the year. Fishermen from Murmansk, Petropavlovsk-Kamchatskiy and Vladivostok are the leaders in terms of salaries [9]. Nevertheless, the growth rate of income in the fishing industry reflects its stability, development opportunities, and attraction of young specialists.

[9] Association of Fishing Fleet Owners. URL: https://fsarf.ru/ (accessed 10 February 2024).

According to experts, the increase in the cost of fish and fish products is associated with logistics and markups in retail chains and "brand" shops.

Analytical studies conducted by the Association of Fishing Fleet Owners show a significant increase in the cost of fish products in relation to the revenue of companies by an average of 27 percentage points (Fig. 1). With a cost increase of 19% in 2022–2023, an increase in producer prices was noted by only 4%, and the level of consumer prices for fish is twice as high as the prices of fishing companies [10] (Fig. 2).

The All-Russian Association of Fisheries Enterprises, Entrepreneurs and Exporters (VARPE), which accounts for more than 90% of the national catch of the aquatic biological resources, also notes a decrease in the level of industry profits — more than 30%, to 158 billion rubles, with stable catch volumes over the past few years at about 5 million tons.

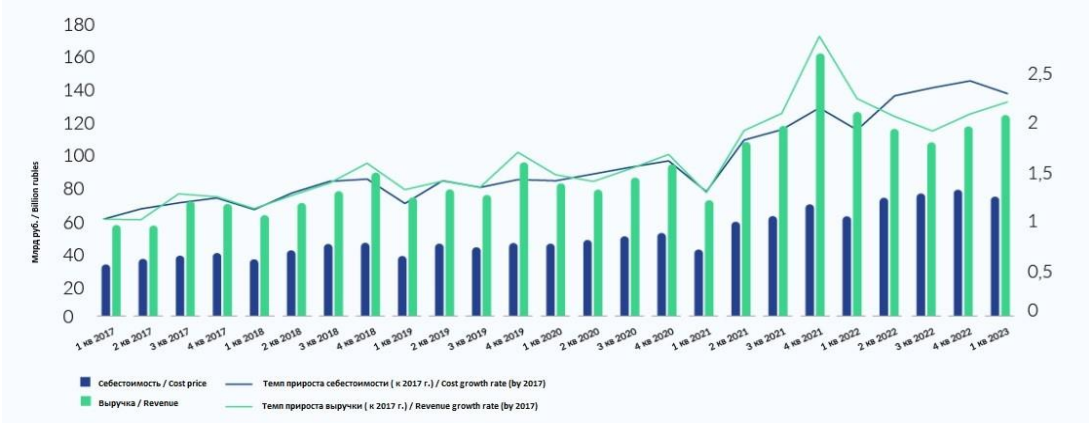

Fig. 1. Indicators of foreign economic activity "Fishing and fish farming". Cost price — revenue.

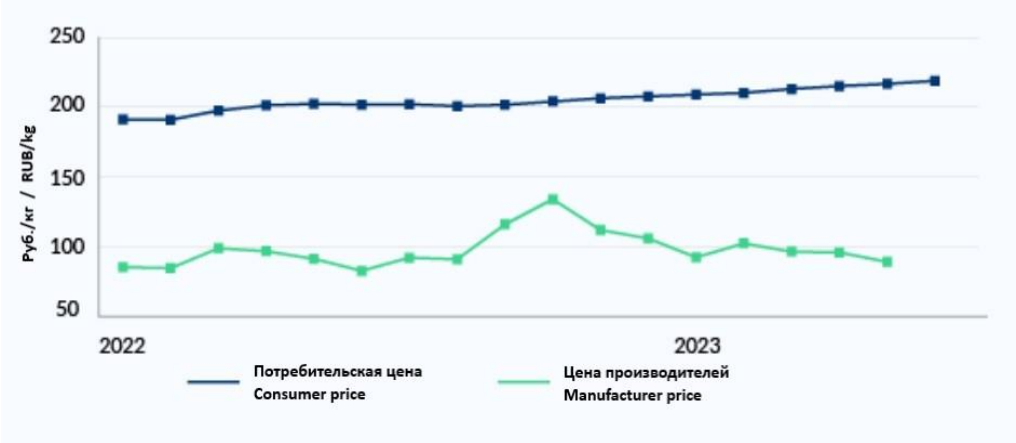

Fig. 2. Prices for frozen fish on the domestic market.

Analytical centers (AC) note the inequality of incomes of the Russian population. Analysis of the results of AC research shows that the largest number of consumers of fish and fish products are among the economically active population of the country, which has a high income level — 62%, less often fish products are purchased by Russians with a low income level — 22% [8].

[10] Analysis of the growth rate of prices for frozen fish on the domestic market — analytics and research from ASRF. URL: https://fsarf.ru/analytics/analiz-tempov-rosta-tsen-na-vnutrennem-rynke/ (accessed 10 February 2024).

Fisheries science. Fishing and fishing industry are processes aimed at achieving the key goals of the industry, and not only at satisfying consumer demand, this is a complex and labor-intensive process associated with high risks and the qualifications of the fishing community [9]. The Russian Federal Research Institute of Fisheries and Oceanography (VNIRO) performs risk mitigation, rational use of ABR and many other aspects of scientific support, as well as the creation of conditions for effective management of the fisheries industry. Fisheries science is the main driver in the successful implementation of the main goals and objectives of the industry. In particular, the renewal of the research fleet alone will create a foundation for new resource research, increase the competitiveness of the domestic research fleet, and provide additional workload for Russian shipyards. The Russian Government plans to allocate 23 billion rubles for the renewal of research vessels by 2030 (for reference: in 2020, 28 billion rubles were allocated for the creation of 2 research vessels, and the keels of these vessels were laid in 2021). The construction of the fishing research fleet is being implemented within the framework of the Strategy for the Development of the fisheries complex of the Russian Federation [11].

The data obtained by scientists as a result of monitoring, assessing the state of populations, studying migration routes and analyzing other specific information make it possible to justify the quotas and fishing areas allocated for production, as well as to reduce the negative impact on the environment [10; 11; 12; 13]. The activities of research scientists result in a number of directions: economic — “cost optimization” is combined with “loss minimization”; ecological — environmental protection and the guarantee of food security of the country [14; 15].

Russian scientists closely cooperate with international scientific institutes. Thus, according to the Norwegian Institute of Marine Research, in the north-eastern part of the Arctic, it is recommended to reduce the quota for cod fishing in the Barents Sea for 2024, thereby reducing the total allowable catch (TAC) to 453,427 thousand tons (in 2023 — 573,784 thousand tons, in 2022 — 715,480 thousand tons). This issue is resolved by the Joint Russian-Norwegian Fisheries Commission (JRNFC), which, taking into account the recommendations of scientists, sets the TAC of aquatic biological resources in the Barents and Norwegian Seas, determines national catch quotas for Russia, Norway and third countries. Table 4 shows the JRNFC’s distribution of the national quota of Russia from 2018 to 2023 [12].

[11] Order of the Government of the Russian Federation of November 26, 2019 No. 2798-r "On approval of the strategy for the development of the fisheries complex of the Russian Federation for the period until 2030 and the action plan for its implementation". URL: https://www.garant.ru/products/ipo/prime/doc/72972854/ (accessed 10 February 2024).

[12] Protocols of the sessions of the Joint Russian-Norwegian Fisheries Commission. URL: https://www.jointfish.com/rus/O-KOMISSII/PROTOKOLY.html (accessed 10 February 2024).

Table 4

National catch quota of Russia according to the decision of the 47th–52nd sessions of the JRNC (t)

National quota of the Russian Federation								
Types \ Sessions	47th session of the JRNFC, quota For 2018	48th session of the JRNFC, quota For 2019	49th session of the JRNFC, quota For 2020	50th session of the JRNFC, quota For 2021	51th session of the JRNFC, quota For 2022	52th session of the JRNFC, quota For 2023	Deviation of 2020 to 2021	Deviation of 2021 to 2023
Cod	331 159	309 697	315 277	378 635	302 605	241 782	+63 358	–136 853
Haddock	86 230	72 080	92 159	100 348	75 130	71 177	+8 189	–29 171
Greenland halibut	11 475	11 475	11 475	11 475	10 335	10 575	0	–900
Sebastes (S. mentella)	7 878	11 676	12 055	13 908	14 098	14 020	+1 853	+112

Quotas. The trend towards a decrease in TAC and the agreed bilateral distribution of national quotas negatively affects the economic activity of fishing and fish processing companies in the Northern Basin, which is an external economic factor affecting the stable operation of the Russian FC [16]. Analysis of the data in Table 4 shows that the largest reduction in fish species was received by cod, which in turn is in the greatest demand among the population of the northern coastal regions of Russia, and is also one of the highest currency objects of aquatic bio-resources. According to forecasts, in 2024–2025, a 20% reduction in TAC in the Barents and Norwegian Seas is possible.

Export. Trade of fish, fish products, any type of goods or raw materials to other countries is especially important for the country's economy. Table 5 presents data on fish, fish products and seafood export and its monetary value.

Table 5

Export of fish products, 2018–2022

Export	Year				
	2018	2019	2020	2021	2022
Volume, thousand tons	2 238	2 118	2 237	2 055	2 300
Monetary value, million $	5 117	5 381	5 287	6 630	6 100

The volume of Russian fish and seafood exports in 2022 increased compared to 2021 and amounted to 2.3 million tons, however, in monetary terms, exports decreased to 6.1 billion US dollars. The reason for the multidirectional dynamics is the decrease in prices for the main types of exported ABR due to high risks of sanctions for fish market participants. The main importers of Russian products remain the People's Republic of China, the Republic of Korea, Japan, the Netherlands and Germany. Current relations with the European Union (EU) did not limit the supply of Russian fish and fish products to the EU market; in 2022, the volumes increased by 18.7% and

amounted to 198.8 thousand tons. A significant share of exports was taken by Russian whitefish: cod — 57% by weight and 54.7% in value terms, and pollock products — 41% by weight and 32.3% in money terms. The Netherlands and Poland were the leaders in importing Russian cod, and Germany was the leader in importing pollock.

Analyzing the export deliveries of the Russian FC in the first quarter of 2023, we can note an increase in the export of fish products by 10% compared to 2022; in terms of value indicators, there is a decrease due to the fact that fish is traded at a noticeable discount. For example, about 274.5 thousand tons of Russian fish and fish products worth 676.7 million US dollars were delivered to the PRC, compared to the same period in 2022, the volume of imports increased by 32.9%, in value terms it grew by 28.4%. In general, experts predict positive dynamics in Russian exports of fish products, and modern technological equipment of ships and coastal processing plants contributes to the development of deep processing of fish, which is the driver of export growth.

International relations with Western countries are forcing Russian fish industry to open new logistics routes for the export of their products. Expanding the geography of fish product supplies is becoming a priority for export-oriented companies. According to the Federal State Information System (FSIS) "Argus" [13], Russian fish and fish products were supplied to 53 countries in 2022. The real trading partners are the United Arab Emirates, Saudi Arabia, Vietnam, Iran, Nigeria and others.

Fishing fleet: reality and challenges

The stability and sustainability of the industry is ensured by the fishing fleet — it is the guarantor of the economic and social development of all stakeholders. Currently, the domestic fishing fleet operates in normal mode in Russian waters and outside the economic zone of Russia. However, the state of the fishing fleet (wear and tear, aging) has been a matter of concern for fishermen, industrialists and managers for decades [17].

According to VARPE data, 744 vessels were built at foreign shipyards for the Russian fishing fleet (Russian shipyards have not built fishing and crab-fishing vessels for several decades), the age structure of fishing vessels built outside of Russia is in the range from 50 to 1 year, the average age is 31 years. Over the past 10 years, foreign shipyards built 32 vessels for the Russian fishing fleet.

The state program, developed in 2015 and aimed at modernizing the fishing fleet, developing fish processing plants and coastal infrastructure, provided fishermen with investment quotas in exchange for building vessels at Russian shipyards. This program was launched in 2017 — the first stage of investment quota allocation began — 20% of the total allowable catch was allocated under the obligation to build new fishing vessels at Russian shipyards and processing plants. The start of crab auctions in 2019 helped enterprises that received quotas for crab fishing: 50% of quotas were allocated for the construction of new crab fishing vessels.

[13] Federal State Information System (FSIS) "Argus". URL: https://argus.vetrf.ru/ (accessed 10 February 2024).

The amendments introduced in No. 644-FZ "On amendments to the Federal Law 'On fisheries and conservation of aquatic biological resources'" [14], signed by the President of the Russian Federation on December 29, 2022, opened the second stage of the investment quota reform. This stage is planned to attract private investments — 300 billion rubles, including 160 billion rubles from auctions for herring and pollock and 140 billion rubles — for crab. It is planned to build 12 fish processing plants, in addition to the 25 already built, plus the construction of 25–30 fishing vessels. The goal is the subsequent reconstruction of production capacities of the Russian fishing industry.

At the first stage of the "quota under keel" program, it was planned to build 105 high-tech vessels at domestic shipyards: 64 fish processing vessels and 41 crab fishing vessels. The laying down of the first hulls of the fishing fleet at domestic shipyards in 2018 revealed a number of difficulties that were resolved through the joint efforts of customers, shipbuilders and suppliers of ship equipment. As a result, 10 fishing and 4 crab fishing vessels out of 105 vessels were delivered to the customer in 2022, the total loss of domestic shipyards from the construction of 105 vessels amounted to approximately 42 billion rubles. There are many reasons for this: from lack of competences to tough sanctions and refusal of Western countries to work with Russia, all of which prevented shipyards from fully fulfilling their obligations to build a fishing fleet under commercial orders within the established time frame. The declared industry investments amount to about 300 billion rubles, the credit part of which is about 80%, therefore, fishing companies are under a great financial burden, as the deadlines for delivery of vessels are shifting to the right, prices are rising, and loans are still remaining. The delay from schedules is from six months to two years. The program of the first stage has been completed by 7%, and the forecast is not optimistic either: 25% of the planned vessels will be built by 2025.

State authorities, together with the shipbuilding business, find new priorities for the development of domestic shipbuilding in the new economic and geopolitical conditions. According to the Russian Maritime Register of Shipping (RS) and the Russian Classification Society (RCS) [15]:

- in 2022, 367 vessels were under construction at Russian shipyards, 117 vessels were delivered to customers, including 35 offshore vessels (RS) and 82 floating objects (RCS);
- in 2021, 406 vessels were built, 89 vessels were delivered to customers: 50 for inland waterway navigation and 39 under the RS class;
- in 2020, customers received 116 vessels.

Assessing the activities of the United Shipbuilding Corporation (USC), it is necessary to recognize that the results of the shipbuilders' work for 2022 seem stable. Domestic shipyards building fishing vessels perform a difficult task — construction of a complex type of fleet. One of the reasons is the desire of customers to provide their vessels with modern high-tech equipment. The

[14] No. 644-FZ "On amendments to the Federal Law 'On fisheries and conservation of aquatic biological resources'". URL: https://admin.fishnet.ru/upload2/File/Ф3%20644.pdf (accessed 10 February 2024).
[15] Russian Classification Society. URL: https://rfclass.ru/ (accessed 10 February 2024).

process of improving the quality of vessels by adjusting various parts and mechanisms leads to changes in documentation, therefore, increases the working time. Nevertheless, shipbuilders build fishing vessels at domestic shipyards; the "quota under keel" program is implemented by 16 shipbuilding enterprises. For example, the Vyborg Shipyard delivered the vessels "Barents Sea" in 2020 and "Norwegian Sea" in 2021 of the KMT01 project to the Arkhangelsk Trawl Fleet (North-West Fishing Consortium). The high quality of construction was noted by the customer's company and international representatives. The LFFT "Mekhanik Sizov", built at Admiralty Shipyards for the Russian Fishery Company in August 2023, set course for the port of Vladivostok; the vessel departed to its home port along the Northern Sea Route. The start of the trawler's fishing trials is scheduled for September. This is the third vessel of the ST-192 project (the technical design of the ST-192 was developed by the Marine Engineering Bureau – St. Petersburg Company). These are the largest and most technologically advanced Russian fishing vessels; the productivity of vessels of this project is 2.5 times higher than the productivity of vessels forming the basis of the fishing fleet in the Far East.

The conditions under which the orders were fulfilled remain very tense, primarily for the plant's design departments and the procurement and supply departments of ship component equipment (SCE). During the previous ten years, the dependence of domestic shipbuilding and ship repair industry on foreign SCE was high.

Having the information on the issues of supplying shipbuilders with SCE, the federal center, together with business community, promptly implemented a system of subsidies to stimulate the activities of Russian industrial organizations to perform work on SCE development within the framework of the complex project implementation, taking into account the reconstruction of production and sale of the obtained products. The plans include reimbursing companies for 80% of their research and development (R&D) costs on SCE. The competition for subsidies is held by the Ministry of Industry and Trade of the Russian Federation, the volume of funding in 2022 amounted to 7 billion rubles, in 2023 — 14 billion rubles. According to updated data from the Ministry of Industry and Trade, in 2023–2024, subsidies of 15 billion rubles were provided for financial support for the costs of implementing comprehensive projects for the development, creation and implementation of SCE into serial production. Agreements on the provision of these subsidies in 2022 were concluded by 32 enterprises for 64 types of equipment, the total amount of financing was approximately 3.4 billion rubles. The implementation of complex projects in the domestic market will make it possible to produce new types of critical equipment starting from 2025. Therefore, there is an understanding of the necessity to actively involve supplies of SCE from friendly countries; at this stage, the share of the cost of foreign components in the cost structure of SCE for the civil fleet ranges from 40 to 85%.

For the same reasons, domestic ship repair industry requires a comprehensive solution to the issues of supplying SCE and spare parts, which can be realized with the development of shipbuilding and all related industries, as well as government support [18].

Effective operation of the fishing fleet in the Arctic Zone of the Russian Federation (AZRF) is associated with difficult climatic conditions, and the age of the fleet requires increased attention and maintenance [19]. According to the RS register book [16], 307 units of the sea fleet are registered to the port of Murmansk, and 186 units — to the port of Arkhangelsk. The average age of a vessel is 29 years. The modern ship repair capacities of the ports of Murmansk and Arkhangelsk, including the open ports of northern Norway, make it possible to service up to 80% of the fleet registered in Murmansk and Arkhangelsk. A 20% deficit in ship repair work affects the profitability of fishing and processing companies; vessels are sent for repairs to the ports of Kaliningrad and St. Petersburg, which increases the duration and cost of repair work and reduces the fishing time of the vessel. The volume of ship repair work with lifting into the dock is about 100 intermediate and 100 regular inspections per year.

The geopolitical situation in the region — possible closure of the northern ports of Båtsfjord, Tromsø, Kirkines by Norway (the rest were closed in 2022 by the Norwegian government) for entry of Russian-flagged vessels — will complicate the situation related to ship repair. Consequently, new opportunities and a stable market for future development in providing technological services to the needs of the fleet in AZRF are opening up for the ship repair industry. According to forecasts, in the period from 2023 to 2035, about 177 vessels of various classes will be commissioned for the port of Murmansk and 80 vessels — for the port of Arkhangelsk. The change in the number of fleet units will lead to an increase in the required dockings — up to 135 intermediate and 135 regular inspections annually. Large companies can create their own servicing bases for the fishing fleet, which can be an effective basis for optimal planning of vessels' repairs based on the working schedule. According to experts, the cost of building a ship repair enterprise even with a partial repair cycle in the ports of Murmansk and Arkhangelsk may amount to 10–16 billion rubles. Related dredging work, acquisition of the necessary machinery equipment and many other things cause the necessity to attract investments into such projects and, possibly, investments from the state. It can be assumed that there is a timely need to build state ship repair clusters in the Arctic zone of the Russian Federation, taking into account the change in the direction of cargo flows and the increase in average operating distances on the lines of the Northern Sea Route (NSR).

State support. The state authorities have updated the plans for the next 5 years for the construction of the domestic civil fleet using the National Welfare Fund (NWF). The total investment volume is 231 billion rubles, with NWF funds amounting to 136 billion rubles. The State Transport Leasing Company (GTLK) acts as the customer for the construction of vessels. The vessels will be leased to companies for up to 25 years, the rate for fishing vessels will be 4.51% [20].

Currently, a draft law on tax incentives for ship repair is in the process of adoption — "zeroing" VAT rates for the provision of repair services for fishing vessels, sea vessels, inland waterway vessels, and mixed navigation vessels. Government authorities are making investments in the

[16] Classification Society Russian Maritime Register of Shipping (RS, Register).

ship repair industry, including direct ones. For example, the Onega Shipbuilding and Ship Repair Plant will receive support from the Ministry of Industry and Trade of up to 2 billion rubles for the modernization of the slipway, construction and equipment of a new paint shop. This project of large-scale reconstruction of the Petrozavodsk shipyard started in 2022 and will create Russia's first digital shipyard — a production system that integrates all processes into a single digital ecosystem [21; 22]. Completion of the reconstruction of the basic enterprise in Karelia for the production of ships up to 140 meters in size will increase the number of ships by 2.5 times — from 4 to 10 per year. The goal is to increase the competitiveness of domestic shipyards.

Conclusion

The fishing industry occupies an important place in the Russian agro-industrial complex and, despite its stability and rapid adaptation to the current operating conditions, is forced to increase additional volumes of production and processing of aquatic biological resources. Providing the country's population with high-quality and healthy fish products is a necessary condition for the implementation of the Food Security Doctrine of the Russian Federation. Stability of the fishing industry, wage growth, new high-tech vessels and other socio-economic factors cause interest and desire of young specialists to work in the industry, increasing interest in maritime professions in educational organizations.

Modern conditions are changing the logistics of the industry. If in the last decades Russia exported fish products mainly to the EU, North America and Asia, today the markets of African and Latin American countries, as well as the Asia-Pacific countries are considered as alternatives. The change in logistics entails the need to build vessels for ocean fishing, which is a showcase of the Russian fishing industry. All changes will be evolutionary in nature, taking into account the interests of the Russian Federation and the readiness of potential markets to build economic partnerships.

The complication of the political situation in the Arctic zone leads to uncertainty about the future development of the Norwegian fishing business. There is a debate in Norway about the complete closure of Arctic ports to Russian vessels, but some political forces defend Russian-Norwegian cooperation in the fisheries sector, while Norwegian business opposes a complete ban on the use of its ports. Ignoring the geopolitical (population decline in the northern regions of Norway) and economic situation (multiple job losses over the next two to three years), the prudent Norwegian fishing community has emphasized collective responsibility to protect cod stocks in the Far North. Thus, by the decision of the Joint Russian-Norwegian Fisheries Commission (JRNFC), the quotas for cod fishing in the Barents Sea will be reduced since 2022 (Table 4), as a result, the TAC of aquatic biological resources in the Barents and Norwegian Seas will be reduced. This external economic factor of reducing quotas for aquatic biological resources in the north-eastern Arctic is of significant importance for the participation of the Russian FC in the implementation of the Food Security Doctrine of the country.

The domestic fishing fleet serves as the vanguard of the country's aquatic biological resources extraction, and the construction of the newest fleet is a large-scale task that is solved jointly by the state and private fishing companies. Consequently, food security is being strengthened, since each new domestic vessel is a significant contribution to the quality of nutrition and health of Russians. The sanctions restrictions have created a precedent for revising plans for the delivery of new fishing vessels at Russian shipyards, and the refusal to repair ships for Russian fishermen is undoubtedly one of the external economic factors.

At the current stage, specialists of enterprises and shipyards of the United Shipbuilding Corporation (USC) have noted significant progress in both the construction of the newest fishing fleet and the production of ship repair equipment. The solution to this large-scale task is being implemented in conjunction with the development of shipbuilding, all related industries and with government support. State support measures for the fishing industry include the following subsidies: to reimburse part of the costs of building fishing vessels; to reimburse part of the costs of building crab fishing vessels at shipyards in the Far Eastern Federal District (FEFD), various benefits, in particular, a benefit for payment of the fee for ABR use at a rate of 15% for city- and town-forming fishing enterprises, and others. An important measure of state support is, of course, the investment of the National Welfare Fund for the construction of fishing vessels by the State Transport Leasing Company and their leasing to fishing enterprises. Moreover, this step allows us to make a preliminary conclusion about the first groundwork in the construction of the state fishing fleet.

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Assessing the Efficiency of Cogeneration Power Plants in the Arctic and Northern Regions of Russia

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Abstract. In a significant part of the territory of Russia, due to harsh climatic conditions and low population density, there is either no centralized energy supply at all, or the electricity supply is characterized by low reliability and quality because of the large length of power lines. This is especially typical for the Arctic and northern regions of Russia. Economically justified energy tariffs in such territories are many times higher than the statistical average. The purpose of this study is to assess the efficiency of transferring heating boiler houses in the Arctic and northern regions of Russia to the cogeneration mode. The article presents and analyses the prices for the main energy sources in the northern and Arctic regions of Russia. It is shown that the key factor in the efficiency of energy sources in such territories is the cost of fuel. Possible measures to reduce the fuel component in the cost of energy are: 1) replacement of expensive imported fuel with local fuel and 2) transfer of energy sources to the mode of combined heat and power generation. Using the example of the village of Erbogachen (Katangskiy district, Irkutsk Oblast), technical and economic assessment of the effectiveness of these measures was carried out. It was established that the transfer of the boiler house to the cogeneration mode leads to a reduction of the economically justified tariff for electric power almost twofold while keeping the tariff for heat power at the same level. The results of the study can be used to adjust and formulate investment programs at the state and municipal levels, as well as in the energy development strategies in the northern regions of Russia.
Keywords: *Arctic energetics, energy source, power supply, isolated energy systems, fuel, thermal power station*

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Introduction

In a significant part of the territory of Russia, due to low population density, highly dispersed settlements, poorly developed transport infrastructure and harsh climatic conditions, there is either no centralized energy supply at all, or the electricity supply is characterized by low reliability and quality because of the large length of power transmission lines (PTL). This situation is

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especially typical for the northern part of the country, including the Arctic, which occupies 28% of Russia's territory [1]. In the area of decentralized power supply, autonomous power sources are used; as a rule, these are expensive to operate and environmentally unfavorable diesel power plants (DPP) [1, Sivtsev A.I., Sivtsev N.A., p. 1]. Centralized heat supply is provided by low- and medium-capacity boiler houses. In private houses, individual stove heating is used [2, Maisuk E.P., Ivanova I.Yu., p. 27]. A frequent problem for such areas is the untimely delivery of fuel.

Possible solutions to the above problems are:

- combined generation of electricity and heat at mini-heat and power plants (mini-CHPs) [3, Khokhlov A.];
- use of local types of fuel that do not require expensive transportation.

Cogeneration is more efficient than separate production of heat and electricity due to the reduction of total fuel consumption. In both separate and combined energy supply schemes, the cost of purchasing fuel prevails in the economically justified tariff for electric and thermal energy. Fuel saving from cogeneration is estimated at about 30%.

The purpose of this work is to assess the efficiency of transferring heating boilers in the Arctic and northern regions of Russia, where transport and energy infrastructure is underdeveloped, to cogeneration mode.

Research methods

In order to select the most cost-efficient energy supply option, it is common to use the levelized cost of energy (LCOE) indicator [4, Hansen K.; 5, Sheryazov S.K., Ptashkina-Girina O.S., Nizamutdinova N.S.; 6, Veselov F.V., Pankrushina T.G., Zolotova I.Yu.]. This indicator is increasingly used as the main tool for comparing economic assessments of energy projects. This indicator is the ratio of the sum of all costs (capital and current) during the project's life cycle to the amount of energy produced over the entire life cycle. The levelized cost of energy reflects the energy tariff at which the investor is guaranteed break-even. This indicator is determined by the formula:

$$LCOE = \frac{\sum_{t=0}^{n}(C_t + I_t)\cdot(1+r)^{-t}}{\sum_{t=0}^{n}E_t\cdot(1+r)^{-t}},$$

where C_t — operating costs of the project per year t, million rubles; I_t — capital costs of the project per year t, million rubles; r — discount rate; E_t — amount of electricity produced per year t, Gcal; t — life cycle of the technology, number of years.

When producing two or more types of energy in a single cycle, there is a problem of distributing costs between them. Taking into account the fact that the reduction in the amount of fuel used leads to a reduction in the tariff burden on consumers [7, Sukhareva E.V.], this problem is not only technical, but also an important social one [8, Beloborodov S.S.; 9, Biev A.A., p. 30]. The

[1] Arctic Council. Russian Chairmanship. Arctic Regions of Russia. URL: https://as.arctic-russia.ru/useful/ (accessed 18 December 2023).

discussion on the distribution of costs between the production of electric and thermal energy at a combined heat and power plant (CHPP) has been going on for almost 100 years, since the IV All-Union Heat Engineering Congress, held in 1928 as part of the I All-Union Energy Congress [10, Gorshkov A.S.].

There are many methods for distributing costs to solve the problem under consideration. All methods can be divided into two groups: those based on technological (or thermodynamic) principles and those based on economic principles. In the first group, the most well-known are physical, boiler, exergy, normative and proportional methods; in the second group — the shutdown method (Ginter triangle method), the method of cost reduction factors, the method of alternative energy production, the method of distributing savings and risks [11, Lyubimova N.G., Fomina V.N.].

In this paper, the shutdown method is used to assess the efficiency of combined production of electric and thermal energy. According to this method, it is assumed that under conditionally separate production of electric and thermal energy at a CHPP in the absence of heat supply, the CHPP will operate in the condensation mode of electricity production. This means that all costs will be related only to the production of electric energy. In this case, the economically justified tariff for electric energy will be maximum, and for thermal energy — zero. And vice versa: if the CHPP does not generate electrical energy, but only produces thermal energy from peak boilers, then all the costs of the CHPP will be fully attributed to the supply of thermal energy. In this case, the economically justified tariff for thermal energy is maximum, and for electrical energy is zero [12, Gitelman L.D., Ratnikov B.E.].

This method can be illustrated graphically using the so-called Ginter triangle (Fig. 1). The Ginter triangle is constructed by plotting the marginal values of economically justified tariffs for electrical and thermal energy at the CHPP and connecting the resulting points (A and B). With its help, it is possible to determine the values of economically justified tariffs for electricity and heat from CHPP for different modes.

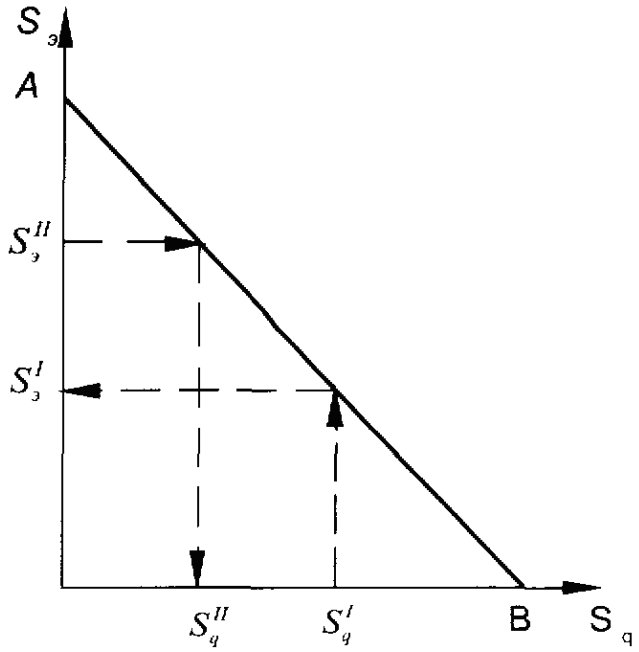

Fig. 1. Ginter triangle.

In the conditions of competitive markets of electric and thermal energy, the shutdown method allows comparing the values of tariffs for electric and thermal energy in combined and separate production. For example, if the economically justified tariff for thermal energy generated in a boiler house is known, then the shutdown method can be used to determine the economically justified tariff for electric energy at a CHPP while maintaining the specified tariff for thermal energy.

Fuel prices

In order to assess the cost indicators of fuel used in the northern regions of the Russian Federation, we collected and analyzed data on purchases from the official website of the Unified Information System in the Sphere of Purchases [2]; responses to inquiries from relevant ministries and executive bodies of the relevant constituent entities in the field of state regulation of tariffs.

The prices presented below include not only the price of the energy source itself, but also its delivery, transloading and storage at all stages of transportation, VAT.

In most northern and Arctic settlements located in remote and hard-to-reach areas with underdeveloped energy infrastructure, the main type of fuel is diesel.

According to GOST 305–2013 [3], diesel fuel must withstand the following temperature values:

- summer diesel fuel must be suitable for use at temperatures up to –5°C and above;
- winter diesel fuel is recommended for use up to –35°C and above;
- arctic diesel fuel — up to –45°C and above.

[2] Official website of the Unified Information System in the Sphere of Purchases. URL: https://zakupki.gov.ru/epz/main/public/home.html (accessed 15 February 2024).
[3] GOST 305–2013. Diesel fuel. Technical conditions. Introduced on 01.01.2015. Moscow, Gosstandart of Russia, 2014. 15 p.

Therefore, only winter and arctic grades of fuel are used year-round in the study areas. Data on the cost of diesel fuel of these grades are presented in Table 1. The average price of diesel fuel in the study area is: winter fuel — 60–90 thousand rubles/t, arctic fuel — 63–142 thousand rubles/t. There is no data on the purchase of winter fuel for the purposes of electricity and heat supply in the Republic of Sakha (Yakutia), Magadan Oblast and Chukotka Autonomous Okrug (probably due to extremely severe climatic conditions in these constituent entities of the Russian Federation). The official website of the Unified Information System in the Sphere of Purchases does not contain information on the purchase of arctic diesel fuel for electricity and heat supply in the Republics of Karelia and Komi. The highest prices for diesel fuel are observed in the Arctic regions of the Arkhangelsk Oblast, Nenets Autonomous Okrug and Krasnoyarsk Krai.

Table 1

Winter and arctic diesel fuel prices in northern regions of Russia with poorly developed energy infrastructure in 2022

Subject of the Russian Federation	Diesel fuel prices, thou. rub./t	
	winter	arctic
Murmansk Oblast	67–74	70–97
Republic of Karelia	67–72	–
Arkhangelsk Oblast	63–71	66–116
Komi Republic	62–75	–
Nenets Autonomous Okrug	64–72	67–154
Yamal-Nenets Autonomous Okrug	61–90	67–94
Krasnoyarsk Krai	60–73	65–142
Irkutsk Oblast	67–80	85–114
Republic of Sakha (Yakutia)	–	63–98
Magadan Oblast	–	75–115
Chukotka Autonomous Okrug	–	87–91

Coal is one of the most common fuels for heat supply and is used almost everywhere in the northern and Arctic territories of Russia, especially in eastern Russia. The exception is hard-to-reach settlements of the Magadan Oblast and the Chukotka Autonomous Okrug, where coal delivery is logistically impractical. Detailed data on coal prices in the Arctic and northern regions of Russia are presented in Table 2. Of all the western regions of Russia, coal is mined only in the Komi Republic, which is the main source of supplies to the north-west of the country. From the Yamalo-Nenets Autonomous Okrug to the east, coal is mined in almost all regions of the country (Krasnoyarsk Krai, Irkutsk Oblast, Republic of Sakha (Yakutia), Magadan Oblast, Chukotka Autonomous Okrug). The high cost of coal in the northern and Arctic territories of these entities is mainly due to the complexity of transportation.

Table 2

Coal price in the northern regions of Russia with poorly developed energy infrastructure in 2022

Subject of the Russian Federation	Coal price, thou. rub./t	
	brown coal	hard coal
Murmansk Oblast	8.5–8.8	9.5–66.4
Republic of Karelia	7.8	8.1–9.9
Arkhangelsk Oblast	–	8.8–15.7
Komi Republic	–	7.3–14.7
Nenets Autonomous Okrug	–	27.1–43.3

Subject of the Russian Federation	Coal price, thou. rub./t	
	brown coal	hard coal
Yamal-Nenets Autonomous Okrug	–	9.4–10.1
Krasnoyarsk Krai	3.3–12.0	23.4–63.7
Irkutsk Oblast	3.1–12.0	3.2–12.2
Republic of Sakha (Yakutia)	–	4.0–23.0
Magadan Oblast	–	–
Chukotka Autonomous Okrug	30.1	–

In the Arctic and northern regions of Russia, the main type of fuel for electricity generation is diesel fuel, and for heat production — coal. But other types of fuel are used along with them: liquefied petroleum gas (LPG), oil, fuel oil, and even wood fuel. Detailed data on the prices of these types of fuel in the territories under consideration are presented in Table 3.

Table 3

Prices for other types of fuel in the northern regions of Russia with poorly developed energy infrastructure in 2022

Subject of the Russian Federation	Oil, thou. rub./t	LPG, thou. rub./t	Fuel wood, thou. rub./m^3	Fuel pellets, thou. rub./t
Murmansk Oblast	–	147	3.5	13.6–16.3
Republic of Karelia	–	29	2.8–4.2	–
Arkhangelsk Oblast	–	33–73	2.4–5.0	11.8
Komi Republic	–	–	–	8.5–18.9
Nenets Autonomous Okrug	–	–	17.3–18.2	–
Yamal-Nenets Autonomous Okrug	50.5–75.0		–	–
Krasnoyarsk Krai	27.8–64.8	–	–	–
Irkutsk Oblast	80.0	–	–	–
Republic of Sakha (Yakutia)	64.1	24–45	–	–
Magadan Oblast	–	–	–	–
Chukotka Autonomous Okrug	–	–	–	–

Crude oil is rarely used for heat and electricity supply, mainly in production areas: Yamalo-Nenets Autonomous Okrug, Krasnoyarsk Krai, Irkutsk Oblast, and the Republic of Sakha (Yakutia). Its cost varies from 30 to 80 thousand rubles/t and depends on the distance and complexity of transportation.

In a number of subjects of the Russian Federation, autonomous gas supply is carried out. LPG is supplied to settlements of the Murmansk and Arkhangelsk Oblasts, the Republics of Karelia and Sakha (Yakutia). The cost of local LPG in the Republic of Karelia, the Arkhangelsk Oblast and the Republic of Sakha (Yakutia) varies from 24 to 73 thousand rubles/t depending on the transport component of the cost. The cost of LPG in the north of the Murmansk Oblast in 2022 was 147 thousand rubles/t (deliveries from the Komi Republic).

In the eastern regions of Russia, biofuel (represented by firewood, fuel chips and fuel pellets) is rarely used for heat supply in boiler houses. At the same time, in the Northwestern Federal Okrug (primarily in the Republics of Komi and Karelia, in the Arkhangelsk Oblast), there are state programs for modernization of small and medium-capacity boiler houses and their conversion to biofuel.

The analysis of Tables 1–3 showed that for all the territories under consideration, the highest fuel prices are observed in the Arctic. Prices for local types of fuel are significantly lower than for imported ones.

Current power supply of the village of Erbogachen, Katangskiy district, Irkutsk Oblast

The efficiency of cogeneration plants operating on local fuels in the Arctic and northern regions of Russia was assessed on the example of the village of Erbogachen, Katangskiy district, Irkutsk Oblast. The climate of the territory under consideration is characterized by sharply pronounced continentality, which is manifested in very low winter and high summer air temperatures, as well as in large differences between day and night temperatures. The absolute amplitude of air temperature reaches 100°C (absolute minimum — -61.2°C, absolute maximum: +38.8°C) [4]. The duration of the period with an average daily air temperature of ≤0 °C is 213 days [5].

Erbogachen village is located in the decentralized power supply zone. Currently, electricity is supplied by 5 autonomous diesel power plant units. The total installed capacity of the diesel power plant is 3.5 MW, the average annual electricity generation is 9,548 MWh.

Over the past few years, the village of Erbogachen, Katangskiy district, has been experiencing regular disruptions in electricity supply. From October 10 to December 31, 2022, as a result of an accident, there was a restriction on electricity supply for the entire population of up to 7 kW per household. The reasons were the lack of operating capacity and the pre-emergency state of the DPP. Lack of fuel is a frequent problem due to poor transport infrastructure and seasonality of importation.

The required gross revenue for the electricity supply to consumers in the Erbogachen village in 2022 amounted to 471.2 million rubles. As can be seen from Fig. 2, the main expense item is the purchase of diesel fuel (87%). The economically justified tariff was 54.83 rubles/kWh, the standardized cost of electricity was 56.2 rubles/kWh.

[4] Weather and climate. Erbogachen. URL: http://pogodaiklimat.ru/climate/24817.htm (accessed 15 February 2024).
[5] SP 131.13330.2012 "Construction Climatology" updated version of SNiP 23-01-99*. Ministry of Regional Development of Russia, introduced on 01 January 2013. Moscow, FAU "FCS", 2012. 115 p.

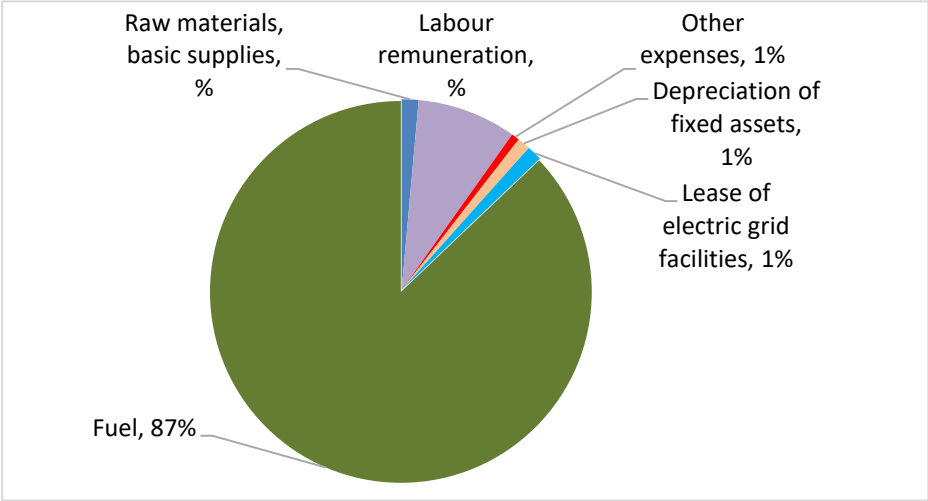

Fig. 2. The main expense items for electricity supply in the village of Erbogachen in 2022 [6].

A boiler house with an installed capacity of 3.5 Gcal/h operates in the village of Erbogachen to provide heat and water supply for the population and social institutions. The average annual heat consumption in the settlement is 5,939.51 Gcal. Crude oil is used as fuel in the amount of 800 tons/year, supplied from a local oil and gas field.

The required gross revenue for heat supply to consumers in the Erbogachen village in 2022 amounted to 57.9 million rubles. As can be seen from Fig. 3, the main expense item is the purchase of fuel (61%). The economically justified tariff is 14,607 rubles/Gcal, the standardized cost of thermal energy is 16,534 rubles/Gcal.

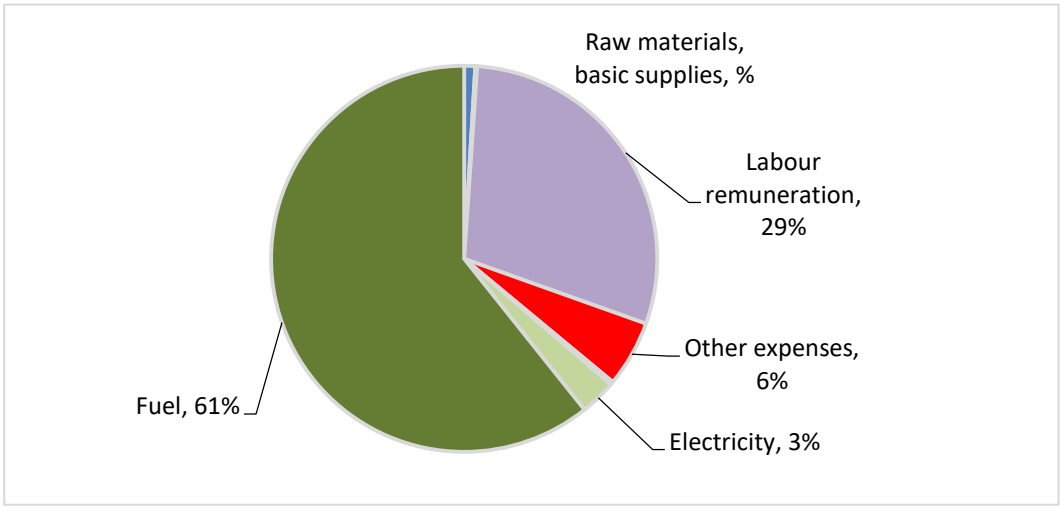

Fig. 3. The main expense items for heat and water supply in the village of Erbogachen [7].

Table 4 summarizes all the initial data on the existing scheme of electricity and heat supply in the village of Erbogachen for further calculations.

[6] Source: energy supply organization.
[7] Source: energy supply organization.

Table 4

Initial data on the existing scheme of electricity and heat supply in the village of Erbogachen

Indicator	Electrical energy	Heat energy
Capacity, MW/Gcal/h	3.5	3.5
Output, MWh/Gcal	9 548	7 425
Fuel type	diesel fuel	crude oil
Fuel price, thou. rub./t	114	80
Fuel consumption, tons/year	3600	800
Economically justified tariff, rub./kWh/rub./Gcal	56.2	16 534

Fuel for the DPP is delivered by a complex transport scheme. Since cargo is delivered to the Katangskiy district by winter road, there are often supply disruptions and fuel shortages. Oil for the boiler house is supplied from the Verkhnechonskoe oil and gas field, which is one of the largest in Eastern Siberia. Its recoverable reserves of ABC1 and C2 categories are estimated at 201.6 million tons of oil. Currently, Verkhnechonskneftegaz OJSC supplies about 800 tons of oil per year.

Based on the above, it seems reasonable to conduct a study to assess the efficiency of replacing separate production of heat and electricity with cogeneration of the same amount of these types of energy using oil.

In order to adequately compare separate and combined heat and electricity generation, it is proposed to compare the costs of the following energy supply options:

- existing separate energy supply scheme;
- separate power supply scheme when replacing existing DPPs with new diesel generator units (DGU) fueled by crude oil;
- combined production of electricity and heat at the CHPP, fueled by oil.

Assessment of the efficiency of separate generation with replacement of the existing DPPs

A classic diesel generator cannot use crude oil as fuel. A conventional internal combustion engine is designed in such a way that it requires fuel with certain parameters for normal operation of all components. Therefore, the consideration is not to replace the fuel in the existing diesel power plants, but to replace them with oil-fueled DGUs.

Power plants running on oil and fuel oil require mandatory preliminary fuel preparation. To ensure this, a fuel preparation container is provided in the system, the main task of which is to ensure the purification of fuel from water and mechanical impurities and its supply to the circulation modules.

It is planned to replace five existing DPPs with three DGUs with a nominal capacity of 1.25 MW. When replacing the DPP, capital expenditures will amount to 270 million rubles, of which: assembled DGU — 97.2 million rubles; fuel preparation units — 82.8 million rubles, transportation services and construction and installation work — 90 million rubles. The required gross revenue will amount to 295.0 million rubles per year. Its main components are shown in Fig. 4. Compared with the existing scheme, fuel purchase costs will decrease by 76.1 million rubles per year; depre-

ciation charges will increase by 8.3 rubles million per year; tax deductions will increase by 1.4 million rubles per year. Thus, when replacing the existing DPPs in the village of Erbogachen with new DGUs running on crude oil, the economically justified tariff will decrease by 20.5 rubles/kWh and will amount to 34.33 rubles/kWh. The standardized cost of electricity in this case will decrease by 16.81 rubles/kWh and will amount to 39.36 rubles/kWh.

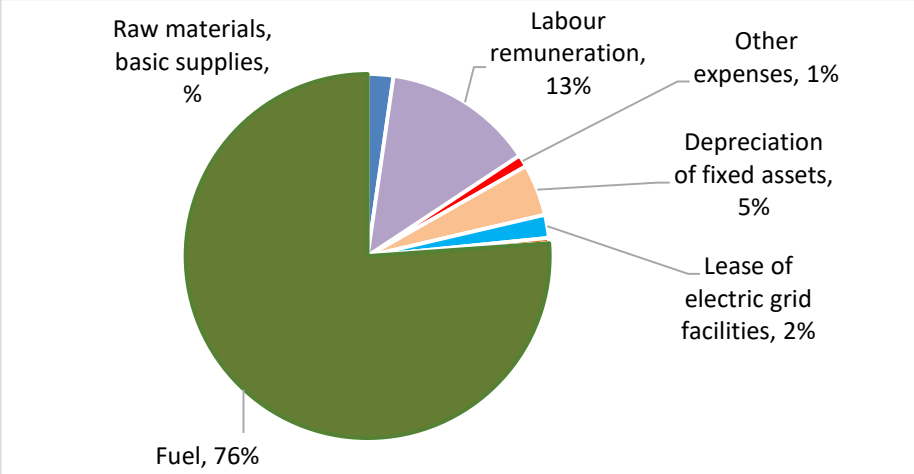

Fig. 4. Main items of expenditure on electricity supply in the village of Erbogachen when replacing DPPs with new oil-fueled DGUs [8].

Assessment of the efficiency of combined generation

Based on the electric and thermal capacities of existing energy sources in the village of Erbogachen and the existing equipment for mini-CHPs on the market, it is proposed to build a cogeneration source with an installed electric capacity of 0.5 MW and an installed thermal capacity of 3.5 Gcal/h. In this case, it is assumed that a DGU with an installed capacity of 1.25 MW will operate simultaneously. The fuel used in the DGU is crude oil.

For effective and economical operation of the entire mini-CHP, two DE-4-14-225GM-O steam boilers with a total installed capacity of 3.5 Gcal/h and two TGU-500K block steam turbogenerator units were chosen. The turbine parameters were selected in strict accordance with the generator capacity, steam temperature from the steam boiler and pressure. It is assumed that the CHPP is located in the existing boiler house and all its systems of electricity, water, heat and fuel supply are used. This mini-CHPP will fully provide the village of Erbogachen with thermal energy for heat and water supply of the population and social institutions. To provide the village of Erbogachen with electricity, it is assumed that a diesel generator with a nominal capacity of 1.25 MW will additionally operate. To ensure the reliability of power supply in case of emergencies, existing DPPs can be used.

Data on the volumes of electricity and heat generation at the mini-CHPP by months are presented in Table 5.

[8] Source: author's estimations.

Table 5

Volumes of electricity and heat generation at the mini-CHPP by months

Type of energy	Month												Year
	1	2	3	4	5	6	7	8	9	10	11	12	
Heat energy, Gcal	1037	880	841	712	532	146	168	187	528	697	974	1021	7722
CHPP electricity, MWh	372	336	372	360	372	298	351	380	360	372	360	372	4305
DGU electricity, MWh	808	769	671	405	291	0	0	0	252	413	771	863	5243
Total electricity generation, MWh	1180	1105	1043	765	663	298	351	380	612	785	1131	1235	9548

When replacing the existing DPP with a mini-CHPP and a diesel generator running on oil, capital expenditures will amount to 179.3 million rubles, of which: mini-CHPP — 89.3 million rubles; assembled DGU — 90.0 million rubles. The required gross revenue will amount to 338.7 million rubles per year, its main components are shown in Fig. 5.

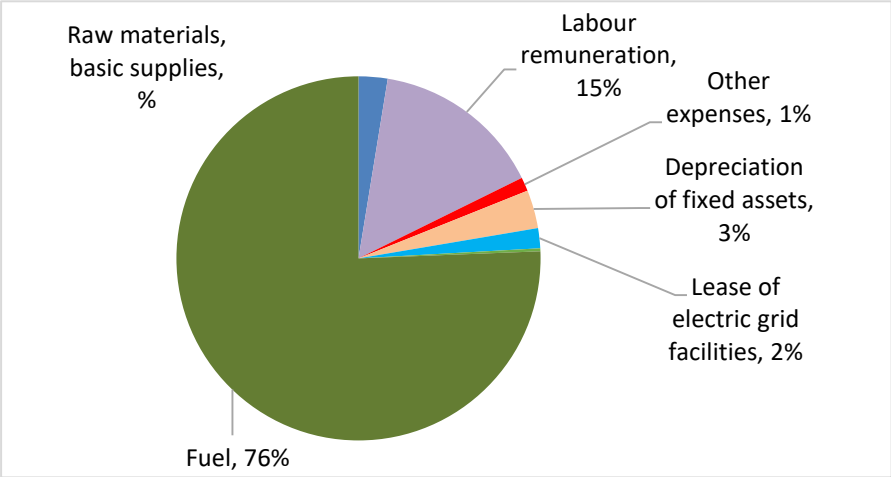

Fig. 5. Main items of expenditure on electricity supply in the village of Erbogachen when replacing DPPs with mini-CHPs [9].

The shutdown method was used to allocate the CHP costs to electric and thermal energy. With the existing heat generation costs, the economically justified tariff for electricity from the CHP is 25.28 rubles/kWh, the standardized cost of electricity is 28.63 rubles/kWh. Compared with the existing energy supply scheme, the economically justified tariff for electricity will decrease by 29.55 rubles/kWh due to a decrease in total fuel costs by 188.5 million rubles per year.

Discussion of results

The key component in the economically justified tariff for both heat and electrical energy is the cost of fuel. Since in the Arctic and northern regions of Russia the cost of fuel increases significantly due to the high cost of transportation, it is necessary to look for ways to reduce the fuel

[9] Source: author's estimations.

component in the cost of energy of both types. This can be achieved by increasing the efficiency of power plants and using local types of fuel (especially since huge hydrocarbon reserves are concentrated in the north of Russia).

Three options of energy supply isolated from the unified energy system in the village of Erbogachen, located in the north of Irkutsk Oblast, were compared:

- existing energy supply scheme;
- separate generation, in which thermal energy is still generated by a boiler house running on local oil, and electricity is generated from new DGUs, also running on local oil;
- combined generation of heat and electric power by burning local fuel (oil).

The results of the study are presented in Table. 6. It has been established that at a fixed economically justified tariff for thermal energy, the highest economically justified tariff is typical for electric energy generated by an existing DPP operating on imported diesel fuel. Replacing an existing DPP with a DGU operating on local oil would reduce the economically justified tariff by 20.5 rubles/kWh. Introduction of mini-CHP with simultaneous operation of oil-fueled DGU would reduce the economically justified tariff for electricity by 26.55 rubles/kWh compared to the existing scheme.

Table 6

Economic indicators of energy production

Energy supply method	Indicator	Electricity, rub./kWh	Heat energy, rub./Gcal
Existing energy supply scheme	Economically justified tariff	54.83	14 607
	Standardized cost	56.18	16 534
Separate generation on oil	Economically justified tariff	34.33	14 607
	Standardized cost	39.36	16 534
Cogeneration on oil	Economically justified tariff	28.28	14 607
	Standardized cost	28.63	16 534

Conclusion

The possibility of cogeneration of heat and electricity is one of the promising directions in the electric power industry, an important way to improve energy efficiency and reduce harmful emissions through fuel saving.

A study of fuel prices in the Arctic and northern regions of Russia has shown that the highest prices are observed in the eastern Arctic, especially in areas extremely remote from major transport routes. Due to the transport component, prices for local fuels are always significantly lower than for imported ones. Therefore, in the Arctic and northern regions of Russia, rich in such minerals as coal, oil and natural gas [13, Kovalenko M.S., Sibileva E.V.], it is simply necessary to use them instead of expensive imported fuel [14, Morgunova M., Kovalenko A., p. 42]. Another way to reduce fuel costs can be the use of wood waste for energy purposes, as it is done in the Republic of Karelia, the Komi Republic, the Arkhangelsk and Murmansk Oblasts.

The example of the village of Erbogachen in the Katangskiy district of the Irkutsk Oblast shows that the key factor of energy source efficiency in remote hard-to-reach areas is the cost of fuel. The assessments demonstrate that the conversion of existing energy sources to local fuels is cost-effective. Even greater economic effect can be achieved by transferring these energy sources into cogeneration mode. The value of the economically justified tariff for electric energy after such conversion is reduced by almost half.

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Assessment of Long-Term Socio-Geo-Ecological Consequences of Lead-Zinc Ore Mining on Vaygach Island

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Abstract. The article evaluates possible negative geo-ecological consequences for the inhabitants of Varnek settlement from the development of polymetallic ore deposit in the southwest of Vaygach Island in the first half of the 20th century. Accumulation of heavy metals in algae of lagoonal estuaries of the Krasnaya (control site) and Varkutsyakha (background site) rivers was considered. There is an abandoned lead-zinc ore mine on the watershed of the Krasnaya River, where dumps of lead-zinc ore were left. The data were obtained that in the mouth of this river there is a significant accumulation of heavy metals in filamentous algae and fucus compared to the background site. At the same time, the content of lead in algae of the control site exceeding the permissible sanitary norm by 4.8 times was recorded. It is assumed that when waterfowl and fish use algae as food (through zooplankton and zoobenthos), lead in excessive concentrations may enter the organisms of local Nenets, for whom fishing and hunting have become the main occupation in the conditions of observed unemployment. To prevent possible negative effects of polymetallic ore mining on the human body, recommendations are given on what areas on the island should be avoided when setting up stations and bases for activities within the framework of the Vaygach State Nature Reserve and for tourism development.
Keywords: *Vaygach Island, ore mining, river mouths, lead, algae, accumulation, human health*

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Introduction

The remoteness of the Arctic territories ensures a certain degree of environmental protection from anthropogenic pollution. Despite this, the problem of pollution of Arctic ecosystems is very acute [1]. It should be taken into account that the development of mineral resources of the Russian Arctic territory in the first half of the 20th century and in the 1950s and 1960s was carried out with virtually no regard for the interests of the indigenous population. Such economic activity was carried out without the necessary consideration of the interests of the indigenous population. There was a danger to human health from the migration of toxic substances in the natural envi-

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ronment. They entered the human body through the consumption of meat and fishery products, berries, mushrooms, as well as snow and ice for drinking with a high content of anthropogenic aerosols. In this regard, the greatest attention was paid to assessing the impact of radionuclides on the population of the Russian North during the nuclear tests on Novaya Zemlya [2–3]. However, for other toxic substances, including a number of heavy metals, research in this area has been conducted on an extremely limited scale. Currently, the Russian Arctic has a large number of abandoned or mothballed mining sites developed several decades ago without any reclamation. Their impact on the health of residents of the Russian North has been poorly studied, and the existing researches on this topic are descriptive in nature without mentioning specific levels of toxic substances in the natural environment. Current knowledge of Arctic estuaries is mostly based on studies of several large systems [4].

In the Nenets Autonomous Okrug, the mining of lead-zinc ores could cause possible negative consequences for the Nenets, the indigenous inhabitants of the Varnek settlement. It was carried out in the period from 1931 to 1934 in the southwest of Vaygach Island. The Razdelnyy mine, part of the Gulag system, operated here and was the first place in the Arctic for industrial extraction of polymetallic ores. The volume of their extraction amounted to about 11 thousand tons of ore [5]. In 1935, ore extraction was stopped due to the flooding of mines with groundwater as there was no system of pumping water from the mines in those years. The deposit was developed during the period of short-term warming in the western sector of the Russian Arctic, observed in the 1920–1940s [6], and most likely this factor was not taken into account when calculating the level and volume of groundwater. In addition, exploratory shafts and trenches for justifying the extraction of copper ore are located in the area of the Dyrovataya Bay, and for justifying the extraction of copper-zinc ores — in the area of the Dolgaya Bay in the northern part of Vaygach [7]. Extraction and exploration of polymetallic ores was carried out without any environmental protection measures or reclamation activities.

The threat to human health in the presence of high concentrations of heavy metals in the environment usually occurs when they enter the human body through food. Fish (omul, char, grayling, pink salmon, whitefish, Arctic flounder) and game (various species of geese and ducks) play a major role in the diet of the residents of Varnek settlement. In recent years, venison has been losing its position in this respect due to the small number of reindeer grazing on Vaygach and the increasing cost of their meat. Lead, zinc and other heavy metals enter the tissues of fish and waterfowl when they consume contaminated hydrobionts: zooplankton and zoobenthos. Accumulation of toxic substances in zooplankton and zoobenthos occurs when they consume products of destruction of algae and aquatic vegetation. Geese and herbivorous ducks can also consume filamentous algae and aquatic vegetation.

Heavy metals are transported from polymetallic ore mining sites through a network of drainage micro-watersheds. They then flow into the rivers and streams of Vaygach Island and waters of the Barents Sea. Maximum accumulation of heavy metals in aquatic ecosystems during

their transit from land to sea, according to the model of Academician A.P. Lisitsyn [8], should be observed at the coagulation-sorption stage of the marginal filter in the frontal section in the mixing zone of river and sea waters. The maximum accumulation of heavy metals in bottom sediments and aquatic vegetation should occur at the localization area of this frontal section.

In recent years, interest in Arctic resources has increased. Projects for the development of Arctic deposits, and not only oil and gas ones, are emerging. For example, the Pavlovskoe deposit on Yuzhnyy Island, Novaya Zemlya archipelago, is one of the largest lead and zinc deposits, and is also rich in silver. The project for the development of the deposit, which will be carried out by the First Ore Mining Company, a subsidiary of Rosatom, has already successfully passed an environmental assessment. In order to implement the principle of rational nature management, it is necessary to have information on the state and possible changes in the environment not only of the territory to be developed, but also of the surrounding areas. The results obtained in this work may be useful in assessing the consequences of lead-zinc ore mining in the Arctic.

Materials and methods

In the summer of 2023, the staff of the North-West Branch of the Shirshov Institute of Oceanology of the Russian Academy of Sciences conducted comprehensive hydrological, hydrochemical and hydrobiological expeditionary studies of two lagoon mouths of the small rivers Krasnaya and Varkutsyakha (Fig. 1). They are located in the southwestern part of Vaygach Island at approximately the same distance from the village of Varneka (about 5 km) and flow into the Yugorsky Shar Strait, which separates the Barents and Kara Seas.

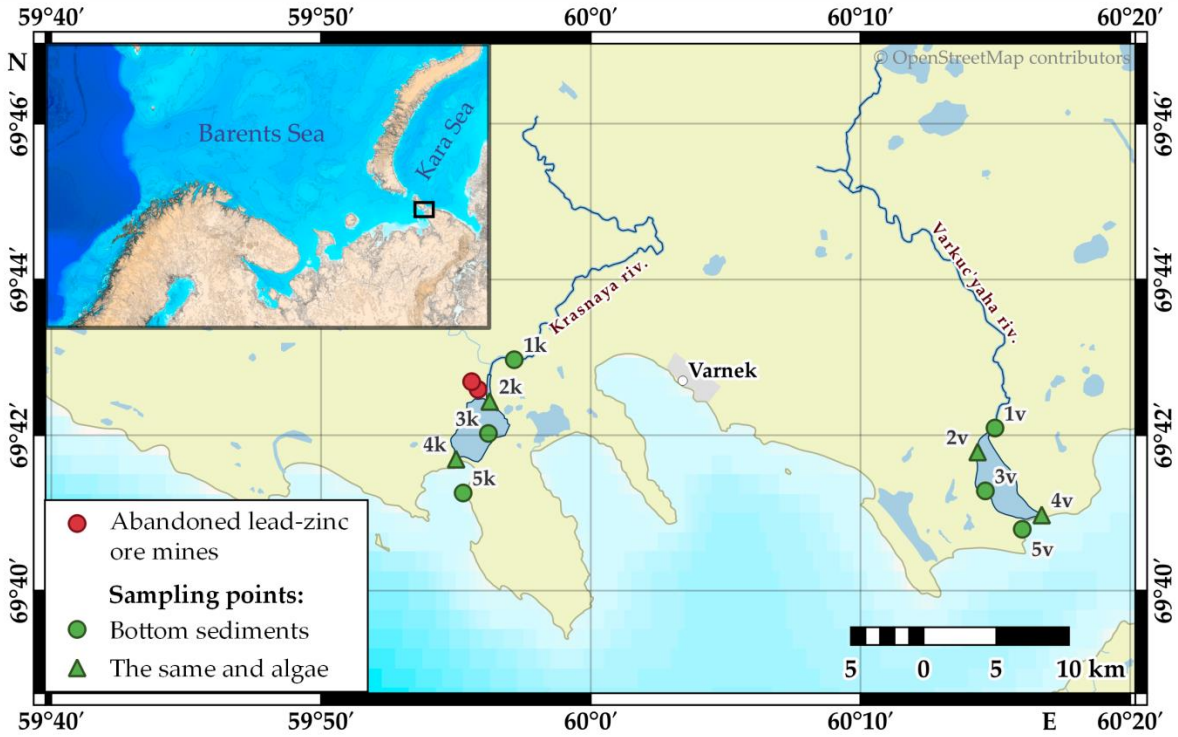

Fig. 1. Map-scheme of the location of the work areas.

Algae sampling was carried out at two stations at each river mouth. The first station was located at the river boundaries of the estuarine lagoons. The second station was located at the sea boundaries of the lagoons.

After sampling, the algae samples were dried and crushed. Concentrations of heavy metals were determined using the method of PND F 16.2.2:2.3.71-2011 at the Center for collective use of scientific equipment “Arctic” of the Northern (Arctic) Federal University named after M.V. Lomonosov.

For measuring water level fluctuations at semi-daily stations, water gauges with reference to the conditional zero point of the station were used. For observations of water temperature, salinity (mineralization) and oxygen, a multi-parameter liquid analyzer Multi 3420 from WTW (Germany) was used).

Results and discussion

In the watershed area of the Krasnaya River, industrial mining of lead-zinc ores was carried out in the last century. In 2023, two destroyed mines (Fig. 2) with waste dumps of ore and 10 trenches (micro-quarries) 5–19 m long each were discovered at the lead-zinc ore mining site. Drainage (storm water) and groundwater flow from the territory of the destroyed mines into the Payhayakhato River, which in turn flows into the mouth of the Krasnaya River.

There was no economic activity in the Varkutsyakha River watershed area. This river was considered as a background river.

Fig. 2. Destroyed mine with waste dumps of lead-zinc ore in the Krasnaya River watershed area (July 2023).

Water salinity at the river boundaries of the estuarine lagoons (the first observation station) during the tidal cycle ranged from 18.1–24.8‰ at the mouth of the Krasnaya River and 7.8–23.3‰ at the mouth of the Varkutsyakha River. Water salinity at the sea boundaries of the lagoons (the second observation station) during the tidal cycle remained practically unchanged and was 25.2‰ at the mouth of the Krasnaya River and 25.4‰ at the mouth of the Varkutsyakha River.

Information on the content of heavy metals in algae samples in the considered river mouths is given in Table 1.

Table 1

Heavy metal content in algae of the river mouths of Vaygach Island, summer 2023

Distance from the sea boundary of the river mouth	Macrophyte species	Metal concentrations, mg/kg					
		As	Cu	Mn	Ni	Pb	Zn
The mouth of the Krasnaya River							
1 km	*Fucus distichus*	15.0	0.89	99	4.3	0.34	13
3 km	*Ulva prolifera*	3.4	2.5	830	4.7	2.4	50
The mouth of the Varkutsyakha River							
1 km	*Fucus distichus*	5.6	1.1	360	4.0	<0.25	20
3 km	*Ulva prolifera*	8.7	1.4	440	4.0	0.46	31

According to the data obtained, a noticeable excess of all the studied metals, with the exception of arsenic, in the filamentous estuarine algae Ulva prolifera is observed at the mouth of the Krasnaya River (control site). However, the arsenic content in the seaweed at the mouth of the Krasnaya River (control site) was significantly higher than at the mouth of the Varkutsyakha River (background site). It should be noted that the maximum difference between the metal content in the algae at the background and control sites was observed for lead, which is part of the mined polymetallic ores. As a result, it should be assumed that we have recorded long-term negative consequences of lead-zinc ore mining for the ecosystem of the Krasnaya River, which could have a negative impact on the health of the residents of the Varnek settlement, but they avoid visiting this site for fishing due to the lack of fish stocks. At the same time, there is a fishing hut at the mouth of the Varkutsyakha River, and they annually catch fish (char, omul, in odd years — pink salmon) and hunt here. It should be taken into account that fishing and hunting have become the main occupation for the local Nenets in conditions of high unemployment.

Lead and other metals enter the ore site in two ways. It can occur due to the flow of highly acidified drainage waters from numerous ore dumps, not removed for processing after the mines stopped working, into the mouth of the Krasnaya River. Acidified rain and melt water contribute to the gradual leaching of lead and other metals from ore dumps into surface and ground waters.

According to the data of the snow cover studies of Vaygach, conducted in March 2024, the snow on the island was strongly acidified: pH ranged between 4.38 and 4.80, with the lower range of the maximum permissible pH for surface water being 6.5.

The second way of migration of significant concentrations of metals into the estuary of the Krasnaya River is the discharge of groundwater from the site of the developed polymetallic ore deposit. It is increasing due to the climate warming in the Arctic in recent decades. According to some forecasts, this process may continue in the coming decades [9]. At the ore mining site under consideration, the destruction of permafrost rocks enriched with lead and zinc is increasing due to the penetration of warm air through the destroyed mines.

The maximum permissible lead content in algae, according to the Technical Regulations of Customs Union [1], is 0.5 mg/kg. It turns out that the recorded maximum concentration of lead in algae of the Krasnaya River mouth exceeds the above-mentioned standard 4.8 times.

The Nenets do not use algae as food, but it is possible that they may ingest excess lead concentrations in the area of the island under consideration while eating fish and waterfowl that consume these algae or aquatic organisms. According to hygienic standards, lead has the first hazard class: when it enters the human body, it increases blood pressure, disrupts the functioning of the nervous system, liver, kidneys, reduces reproductive function, and can affect all parts of the brain.

Conclusion

Thus, in the areas of polymetallic ore mining on Vaygach Island, increased levels of heavy metals may be observed in various types of aquatic flora and fauna. However, their high concentrations are likely to be observed only in localized areas with characteristic dimensions of tens to hundreds of meters.

In general, the problem raised is not of particular relevance to the permanent residents of Varnek village and their relatives from the mainland who come here for vacation. Nevertheless, given the potential involvement of the local population in activities associated with the Vaygach State Nature Reserve and the planned expansion of tourism on the island, it is possible that they will stay in the polymetallic ore mining areas for a relatively long period of time (several weeks or more) each year.

In order to eliminate negative consequences of staying in such areas, it is recommended not to create any permanent facilities and bases (camps) at the mouths of rivers and near lakes where drainage runoff from the areas of exploration and industrial mining of polymetallic ores flows.

The following sites should be referred to them:

- the coast of the peninsula on which the Razdelnyy mine was located (the area of Cape Razdelnyy in the Yugorsky Shar Strait);
- the mouth of the Krasnaya River;
- Lake Paipahto;
- the mouth of the Krasnyy Yar River;
- the mouth of the Yangorey River;
- Lake Heheto;
- the coast of the Dyrovataya Bay.

[1] TR CU 021/2011. Technical Regulations of the Customs Union "On the Safety of Food Products" (as amended on July 14, 2021). 173 p.

It should be noted that the planned organization of a tourist base in the northeast of Vaygach in the area of Bolvanskiy Nos Cape (on the site of the former border outpost) will not be endangered by the migration of heavy metals into the environment.

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Export Diversification of the Arkhangelsk Oblast's Forestry Complex

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Abstract. The decrease in the volume of exports of forest products from the Arkhangelsk Oblast is a significant problem for the region's economy. This study aims to conduct a comprehensive analysis of the current situation and identify the prospects for development of forest products exports in the region. The export volume of forest products from the Arkhangelsk Oblast in 2023 significantly decreased compared to 2021. In the conditions of sanctions pressure, Russian forestry enterprises have to look for alternative markets. Despite the steps being taken to diversify exports, companies face difficulties in establishing business ties with foreign partners due to fears of secondary sanctions. This leads to a reduction in supply volumes and, as a result, a decrease in income from export activities. In addition, the domestic market is experiencing a negative impact due to a decrease in exports. Reduced external demand for wood creates an oversupply in the domestic market, which leads to a drop in prices. Such changes have a destructive impact on the financial well-being of enterprises in the Arkhangelsk Oblast, the economy of which depends on the forestry sector. In 2021, the Arkhangelsk Oblast exported timber to Asia, Europe, Africa, North and South America and even to the countries of Oceania. After the sanctions restrictions, the country structure of timber exports has changed dramatically. China became the main importer of timber from the Arkhangelsk Oblast. In the course of the study, the key directions of export diversification were identified and effective measures for their implementation were developed. Diversification of production and development of new markets will allow the Arkhangelsk forestry complex to overcome the negative consequences of export specialization and keep the leading positions in the Russian forestry sector.
Keywords: *forestry complex of the Arkhangelsk Oblast, export of forest products, export structure, export diversification, export dependence, new sales markets*

Introduction

The forestry complex of the Arkhangelsk Oblast is the core of the regional budget. Forest products account for 40% of the total industrial production of the Pomorye region. However, the forestry economy of the Arkhangelsk Oblast has long been associated with the export of products to European markets. The Arkhangelsk Oblast is famous for its vast forest areas, which provide raw materials not only to local enterprises, but also to export markets. Forestry products such as sawn timber, plywood, cellulose, cardboard are in high demand abroad. But the sanctions imposed on the Russian economy have had a significant impact on the entire forestry complex of the country, and especially on forest-producing regions. Under the conditions of limited export poten-

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tial and access to foreign markets, the forestry complex of the Arkhangelsk Oblast has faced and continues to face a number of serious challenges in the past two years. The export potential of the Arkhangelsk Oblast is determined by its favorable geographical location, richness of natural resources and developing infrastructure. Export orientation and high export specialization of some types of forest products of the Arkhangelsk complex negatively affected the results of 2022–2023.

Export diversification has become a strategic direction for the preservation of the forestry sector of the Arkhangelsk Oblast. This is a process that includes the search for new market segments within the country and on the international market, expanding the range of exported forest products in the direction of their deeper processing, which reduces export dependence and ensures the sustainable development of the forest complex of the Arkhangelsk Oblast. In the context of a constantly changing and increasingly complex global market, increasing competition in the world and domestic markets, where price fluctuations and changes in consumer preferences can significantly affect the economy, diversification of forest product exports of the Arkhangelsk Oblast is becoming critically important. However, export diversification requires significant efforts, including investments in innovation and infrastructure development. State support, well-planned tax policy and export promotion programs determine diversification processes. It is also important to take into account the increase in logistics costs, the emergence of market risks that may be associated with different product standards, consumer differences, environmental restrictions, legal barriers, etc.

Object and methods of research

The object of the study is the export of forest products of the Arkhangelsk Oblast in the context of sanctions pressure and limitations of a number of segments of the world market. The aim of the work is to assess the current state of forest exports, identify diversification opportunities and key areas for reducing the region's export dependence.

Within the framework of this study, the analysis of available analytical materials, reports of specialized organizations and scientific literature was conducted. The analysis of the data obtained during the study in the context of previously conducted studies and existing theoretical concepts made it possible to clarify the interpretation of the results and identify the main factors stimulating the growth of the implementation of the export potential of the forest sector of the Arkhangelsk Oblast. The methodological foundation of the study was built on the integration of qualitative and quantitative approaches. Qualitative methods include: observation, interviews and expert assessments of specialists from forest industry enterprises. Among the quantitative methods, the methods of statistical analysis of customs database and data on exports and imports of the Russian Federation by goods were used. A set of methods was used to analyze heterogeneous data, including analysis and synthesis, comparative analysis, and empirical research.

Review of scientific research

The author V.D. Terentyeva [1] presented an analysis of foreign trade operations related to forestry products, including sawn timber, pellets, cellulose and sanitary paper in the scientific publication in 2022. The purpose of the analysis was to determine potential losses for exporters of forestry products in the context of current economic sanctions. In addition, the possibilities of diversifying sales markets by reorienting sales to the domestic market and countries with which Russia continues to develop active economic cooperation were studied. An analysis of timber exports showed that China's share in the overall structure of forestry exports is quite significant. Based on the data obtained, it was concluded that the dynamics of prices for forestry products on the domestic market can be developed according to two main scenarios. Scientists A.I. Biryukova and D.V. Dzizinskaya [2] analyzed in 2023 the state and development prospects of the woodworking industry in the Irkutsk Oblast. The authors examined the issues of economic efficiency and export potential of wood processing products, identifying the key factors that determine the development of the industry in the region. Particular attention was paid to structural changes in the export of forestry products. A multifactor index model was used to assess the currency efficiency of exports, as well as the analysis of relative values of the export structure. N.M. Shum [3] presented an assessment of the efficiency of forestry complex exports. The author analyzed existing methods developed by various researchers, which rely on qualitative and quantitative criteria, as well as factor analysis, taking into account the specifics of the industry. The author identified both the advantages and disadvantages of each model and justifies the need for authorial adjustments. As an example of the application of the considered models, the export potential of the Khabarovsk Krai was assessed. In this paper, based on the models proposed by K. Pearson and C. Spearman, a new model for evaluating the export potential of the forestry complex was presented. P. Kondrashov [4] considered two main aspects of increasing the efficiency of using the export potential of the Russian forestry industry. Firstly, it is necessary to diversify the export structure by increasing the supply of products with a high share of added value. Secondly, it is necessary to optimize the distribution of export flows across various geographic areas. This direction can also be interpreted as structural diversification. O.O. Rezanova [5] analyzed the role of the forestry complex in the implementation of the export strategy of the Russian Federation. At present, the Russian forestry complex is focusing its efforts on developing the production of high added value products. This is facilitated by a number of factors, including significant reserves of raw materials, production of various exported products and the availability of modern production technologies. Despite this, the industry faces a number of problems that hinder its development: technological backwardness, insufficient diversification and weak government incentives. To ensure the effective development of the forestry complex, it is necessary to provide comprehensive state support at all stages of the production cycle, improve logistical accessibility and create a favorable infrastructural environment. In the course of the analysis, K. A. Fedorov [6] identified export opportunities for Russian companies operating in the forestry complex. Despite the extensive forest resources

available to the Russian Federation, their economic potential has not yet been sufficiently realized. In order to overcome the existing problem, the Government of the Russian Federation developed and adopted the Strategy for the Development of the Forestry Complex until 2030. This strategy sets targets for replacing imported products with domestic analogues and expanding exports of timber and timber products. The study by I.V. Goncharuk [7] analyzed the impact of government regulatory measures on Russian timber exports from 2006 to 2016. The scientist assesses the effectiveness of the tariff policy. L.I. Ipatko [8] examined the current state and ways of further development of timber exports in Russia. The author presented the specifics and difficulties associated with timber and timber products exports in various historical periods, identified key factors influencing the current situation in timber exports, indicated promising areas for its development in a difficult political and economic environment, and concluded that it is necessary to improve the efficiency of timber product exports. L.V. Shubtsova [9] assessed the role of the timber complex in the socio-economic progress of the Russian Federation. The author analyzed the current situation in the forest industry in the context of the aggravation of the international situation and identified areas for the development of the forest sector, which is considered one of the priorities in the country's economy. O.E. Noskova [10] showed that at the beginning of 2022, Russian forestry producers faced a number of serious challenges. Restrictions on the export of products to European and American countries, as well as disruptions in the logistics chains of sea, road and railway transport led to a significant reduction in sales markets. Attempts to reorient to the domestic market proved to be ineffective due to weak demand from key consumers. This led to a drop in prices for forest industry products and the formation of surpluses on the market. Low price conditions force producers to work with minimal profits, and in some cases to stop harvesting timber. Such a situation may provoke a shortage of raw materials on the market. O.E. Kosheleva and A.S. Pustovalova [11] examined the methods of state and customs regulation of timber exports from the Russian Federation and predicted the consequences of the proposed ban on the export of unprocessed timber. The findings of the study make it possible to develop recommendations for improving and increasing the efficiency of state and customs control over timber exports, which in turn will contribute to strengthening the economic security of the Russian Federation. I. Sun and E. Yu. Barmina [12] noted that Russia and China are currently significant economic partners demonstrating a steady increase in trade turnover. The authors analyzed the main factors that determine mutually beneficial cooperation between the two countries and examined the existing problems in the timber industry market.

Scientists V.N. Myakshin, V.N. Petrov, T.N. Pesyakova [13] considered the problems of foreign economic activity of the regional forestry complex. G.I. Burdakova, A.S. Byankin and A.S. Meshkov [14] studied the demand and supply of forest products in the context of external sanctions pressure. A.P. Gevraseva [15] presented the methodological basis for analyzing the export potential of the region. V.O. Moseiko, Yu.M. Azmina [16] conducted a multifactorial assessment of the export potential of small and medium-sized forestry enterprises in the region. An interesting

study is the work of S.I. Ultan, N.Yu. Rogovskaya [17], who defined the methodological basis for studying the export potential of non-ferrous metallurgy. The work of A.M. Razgon [18] presented the foreign economic activity of the forestry complex of Khabarovsk Krai. Scientists E.B. Nazarenko and O.V. Gamsakhurdia [19] studied the export potential of the Russian forest industry complex.

Research results

Against the backdrop of sanctions, Russian forestry companies are faced with the need to look for new markets. However, despite efforts to diversify exports, companies are experiencing difficulties in establishing connections with foreign buyers, as many of them are afraid of secondary sanctions. This leads to a decrease in supply volumes and, as a result, a decrease in trade revenues. In addition, the domestic market is also feeling pressure due to the decline in export volumes. A decrease in demand for timber from abroad creates an oversupply within the country, which in turn leads to a drop in prices. These changes negatively affect the financial condition of companies operating in the forestry industry and threaten jobs in regions that depend on the forestry industry.

The export volume of forest products from the Arkhangelsk Oblast in 2023 has significantly decreased compared to 2021. The weight volume of exports has decreased by 50%, which is 1,032 thousand tons, over a two-year period (Fig. 1). The value volume of the Arkhangelsk Oblast exports in 2023 decreased more significantly — by 60% or by $495 million (Fig. 2).

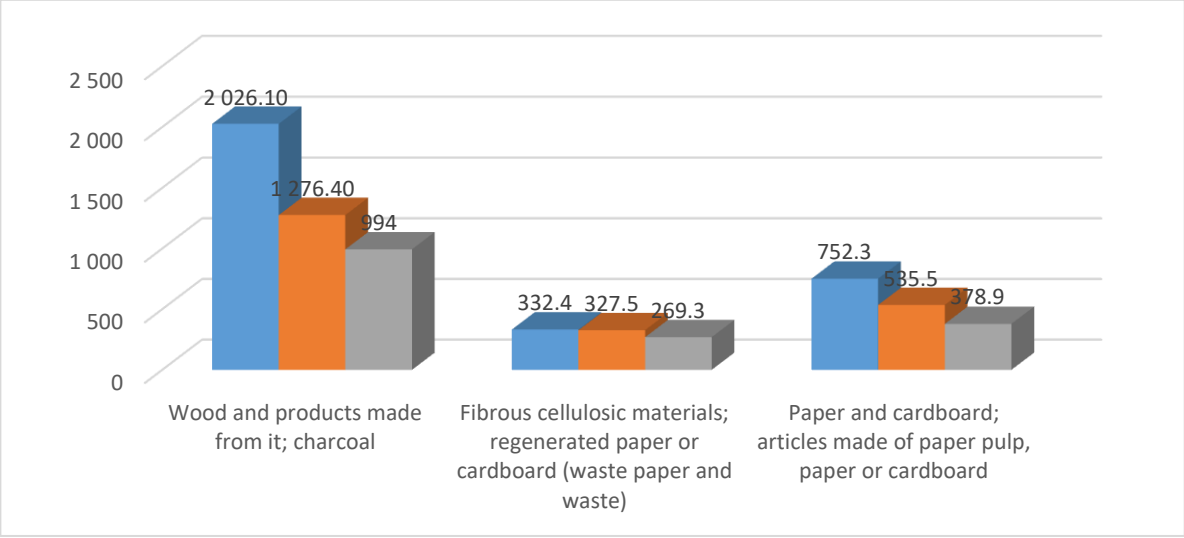

Fig. 1. Arkhangelsk Oblast forest products exports in 2021–2023, thousand tons [1].

[1] Source: compiled from data: Export and import of the Russian Federation by goods. URL: https://customs.gov.ru/statistic (accessed 11 August 2024).

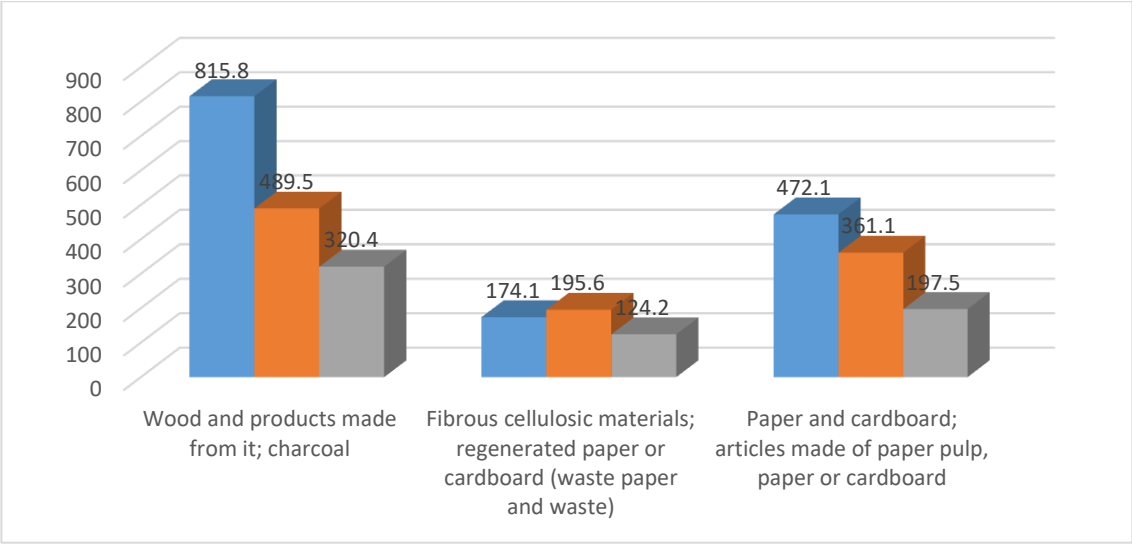

Fig. 2. Arkhangelsk Oblast forest products exports in 2012–2023, million dollars [2].

The structural analysis of exports of forest products commodity groups shows a significant predominance of supplies of wood and wood products to the world market. In 2021, 65% of raw and processed wood, sawn timber, plywood, chipboard and fibreboard by weight were exported from the Arkhangelsk Oblast. In 2023, this figure was 60%. Despite the significant volume, the value share of this group of forest products in the region's total exports remained relatively low, reaching 56% in 2021 and 51% in 2023. This is due to the relatively low price of the products sold. The export of cellulose materials (group 47) accounted for about 11% in 2021, and the share increased to 16% in 2023. The share of paper and cardboard exports has slightly changed over the past three years (by tonnage): 2021 — 24%, 2023 — 23%.

Table 1

Structural analysis of exports of forest products commodity groups of the Arkhangelsk Oblast

EAEU CN of FEA code	Product	2021		2022		2023	
		weight, t	price, USD thous.	weight, t	price, USD thous.	weight, t	price, USD thous.
44	Wood and wood products; charcoal	65.1	55.8	59.7	46.8	60.5	49.9
47	Pulp from wood or other fibrous cellulosic materials; recycled paper or cardboard (waste paper and scrap)	10.7	11.9	15.3	18.7	16.4	19.3
48	Paper and cardboard; products made from paper pulp, paper or cardboard	24.2	32.3	25.0	34.5	23.1	30.8

Such a significant decrease in exports in 2022 and 2023 is due to the sanctions restriction of forest products supplies to the world market. As traditional supply routes became unavailable,

[2] Source: compiled from data: Export and import of the Russian Federation by goods. URL: https://customs.gov.ru/statistic (accessed 11 August 2024).

timber industry companies began to look for alternative routes, which led to the diversification of logistics routes. As a result, dependence on certain geographic regions decreased, which should ultimately ensure the stability of the timber business.

In 2021, the Arkhangelsk Oblast exported timber to Europe, Asia, Africa, North and South America, and even to Oceania (Fig. 3). Most of the timber was sold to European countries (67%). A fifth of Arkhangelsk timber was sold to China. After the sanctions restrictions, the country structure of timber exports changed dramatically. China became the main importer of timber from the Arkhangelsk Oblast, increasing its purchase volumes fourfold compared to 2021. China currently accounts for more than 60% of the region's total timber exports. Export volumes to other countries in Asia and the Middle East, as well as to the countries of the Near Abroad, have increased significantly.

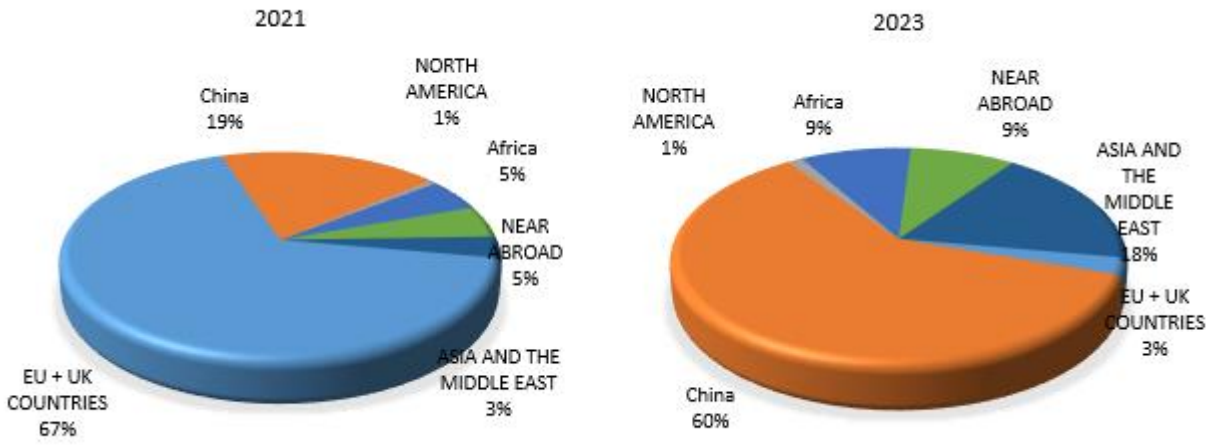

Fig. 3. Continental structure of timber exports (code 44) of the Arkhangelsk Oblast [3].

The Russian pulp market is characterized by a high dependence on external supplies. In the period from 2021 to 2023, the share of exports in the total volume of Russian pulp production amounted to 35%–40%. The main importer of Russian pulp is China, which purchased almost 90% of the total export volume in 2023. Pulp exports from the Arkhangelsk Oblast until 2022 were distributed evenly between the countries of the continent. The main consumers of Arkhangelsk pulp were not only countries with highly developed economies, countries of the Near Abroad, but also developing countries in Africa and Asia. A third of the pulp from the Arkhangelsk Oblast was supplied to Europe and North America. Pulp supplies to China until 2022 were insignificant — only 1% of total exports (Fig. 4). After 2022, there has been a significant reorientation of pulp exports. In particular, the volume of deliveries to the People's Republic of China has increased more than 50 times over the past two years.

[3] Source: compiled from data: Export and import of the Russian Federation by goods. URL: https://customs.gov.ru/statistic (accessed 11 August 2024).

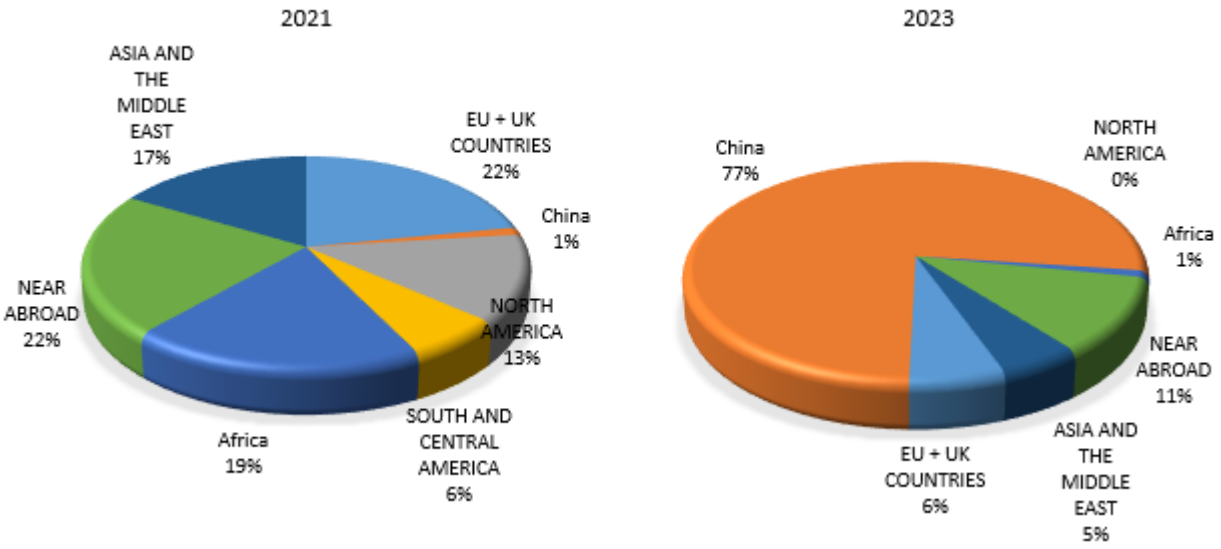

Fig. 4. Continental structure of pulp exports (code 47) of the Arkhangelsk Oblast [4].

The introduction of external restrictions in 2022 led to significant changes in the logistics chains and geography of paper product exports. In the pre-sanction period, Europe was the main market for half of all paper and cardboard exports. In 2021, the Arkhangelsk Oblast sent 49% of its exports to Europe, 15% to Asia, 7% to Africa, and 12% to South and Central America (Fig. 5). Today, Turkey remains among the European importers of paper and cardboard, securing its position as a significant logistics center ensuring the implementation of foreign trade operations between Russia and European countries. Turkey accounts for 21% of Arkhangelsk paper and cardboard exports. Similar trade flows are also implemented through the United Arab Emirates and third-country jurisdictions. Paper and cardboard exports from the Arkhangelsk Oblast to other countries of Asia and the Middle East have increased. A significant portion of paper and cardboard exports is currently supplied to China (34%).

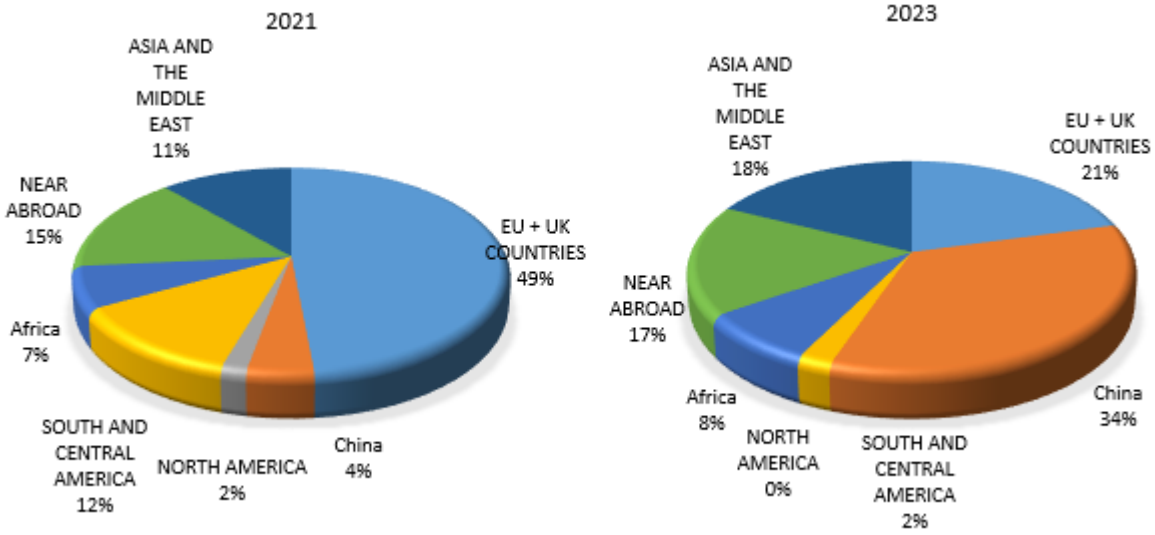

Fig. 5. Continental structure of paper and cardboard exports (code 48) of the Arkhangelsk Oblast [5].

[4] Source: compiled from data: Export and import of the Russian Federation by goods. URL: https://customs.gov.ru/statistic (accessed 11 August 2024).

In addition to changes in the continental structure of forest product exports, there is not only a change in traditional partners, but also a reduction in the number of export partner countries. As a result, new markets require adaptation of forest products to their specific conditions. The number of partner countries for the export of raw and processed timber, sawn timber, plywood, chipboard and fibreboard has decreased by half. Whereas in 2021 there were up to 60 countries exporting wood products, in 2023 there were only 29 ones. The main exporter of wood and wood products in 2023 was China, which accounted for 60% of the volume (Fig. 6).

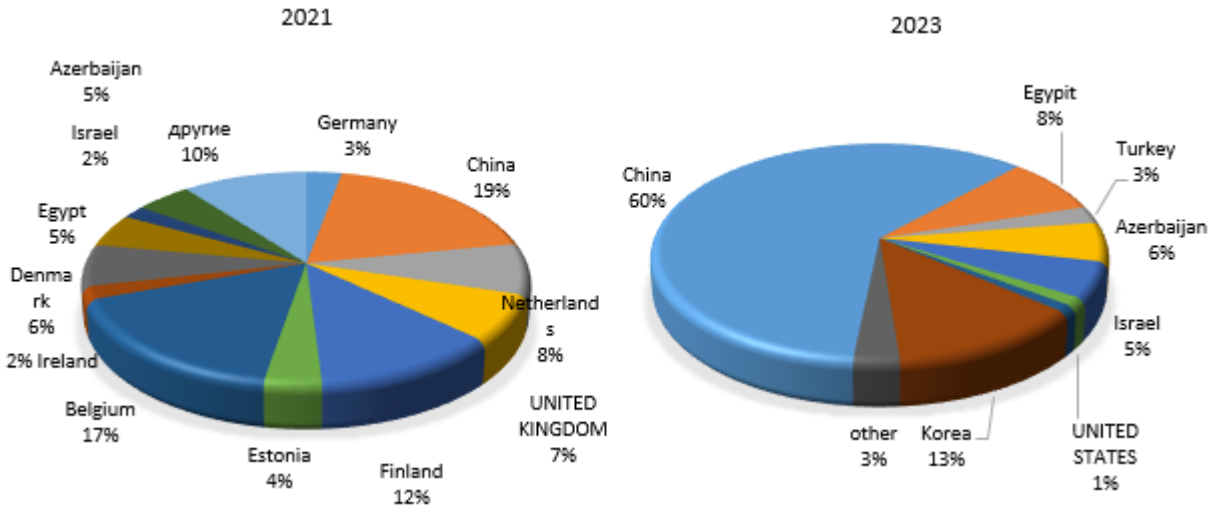

Fig. 6. Structure of timber exports (code 44) of the Arkhangelsk Oblast by countries [6].

A similar situation is observed in the supply of Arkhangelsk cellulose. In 2021, pulp was exported to 36 countries, and in 2023, the list of countries was halved. The main exporter of pulp from the Arkhangelsk Oblast was China (Fig. 7).

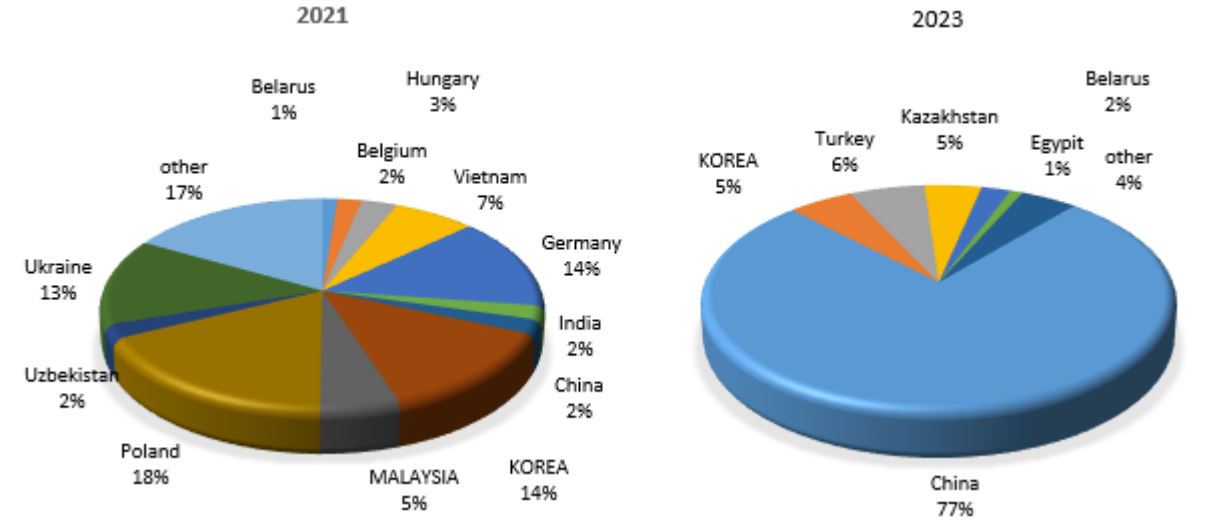

Fig. 7. Structure of pulp exports (code 47) of the Arkhangelsk Oblast by countries [7].

[5] Source: compiled from data: Export and import of the Russian Federation by goods. URL: https://customs.gov.ru/statistic (accessed 11 August 2024).
[6] Ibid.
[7] Ibid.

In 2021, the products of Arkhangelsk pulp, paper and cardboard enterprises were exported to 72 countries. In 2023, the number of importing countries decreased to 30. This may be due to the redirection of supplies through a logistics center in Turkey, as reported earlier. According to data for 2023, the main buyer of products from the Arkhangelsk Oblast was China (Fig. 8), whose share in import volumes previously did not exceed 4%.

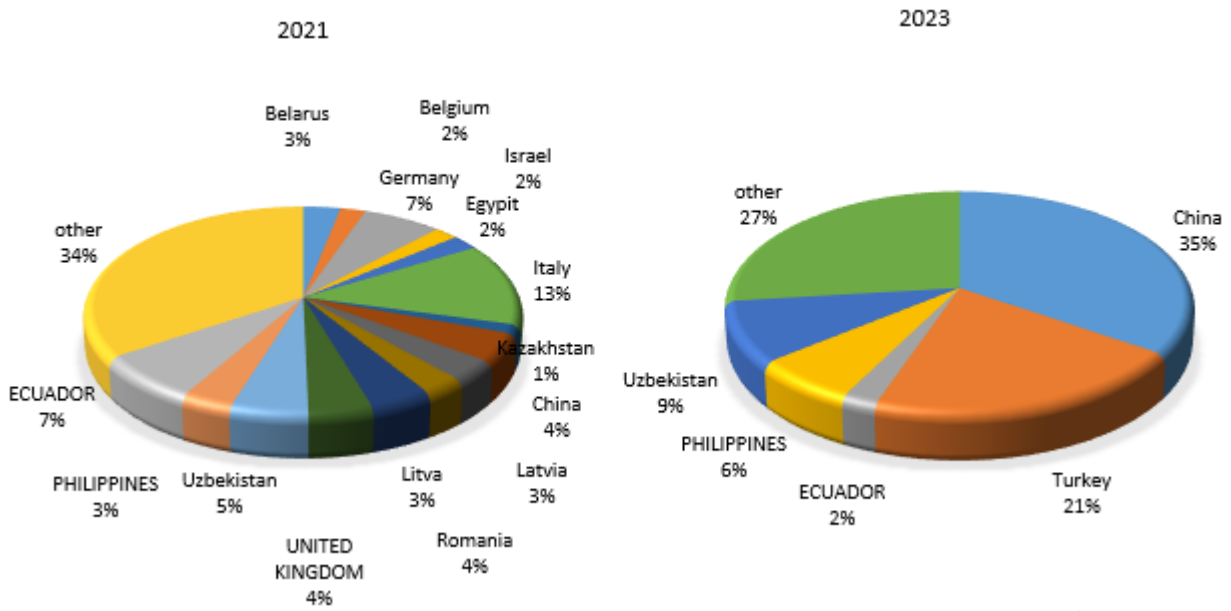

Fig. 8. Structure of paper and cardboard exports (code 48) of the Arkhangelsk Oblast [8].

Thus, the analysis of the Arkhangelsk Oblast forestry exports showed that against the backdrop of sanctions, the forestry business faced the need to diversify its export activities. Timber producers were forced to look for new market niches, new partners, and build new logistics chains. Establishing new logistics and new partnerships requires not only a technical base, but also trust between the parties. Unfortunately, the current international relations and the introduction of secondary sanctions complicate the restructuring of the export process, as new foreign buyers are afraid of new sanctions pressure.

Despite the negative forecasts after the loss of European markets, forestry enterprises managed to replace sales markets from European to Asian and neighboring countries. Nevertheless, the negative consequences for the forestry business were noticeable in 2022–2023. There was a decrease in export volumes, financial losses, and reputational risks for all market agents. At the same time, there was a reorientation of previously exported volumes to the domestic market, which created an excess supply of forest products and increased competition. The export restructuring with increased competition has a particularly significant impact on small and medium-sized forest industry companies, which are already facing high production costs, and some of them are at risk of leaving the market. Another side of increased competition may be a decrease in the quality of manufactured forest products, since companies will seek to reduce costs, which may nega-

[8] Source: compiled from data: Export and import of the Russian Federation by goods. URL: https://customs.gov.ru/statistic (accessed 11 August 2024).

tively affect consumer preferences. The solution to this problem was the development of state support programs. The most important aspect of state support was the provision of subsidies for the transportation of forest products through the seaports of the Northwestern Federal District. According to the resolution, in 2023–2024, exporters of forest industry products will be able to reimburse up to 80% of the costs (up to 50% of the volume of deliveries) for the transportation of their products if they use northern seaports. Another important direction is the need to further stimulate demand for forest products in the domestic market. A good example is the positive dynamics of the domestic sawn timber market in 2023, which grew from 10–12 to 16–17 million m^3, which is due to the increase in housing construction.

Conclusion

Thus, with the increase of international trade restrictions, the geographic structure and composition of forest product exports from the Arkhangelsk Oblast have changed, which will continue in the future. Markets that were previously secondary began to acquire strategic importance. For example, China, East Asian and African countries have become new centers of attention for export deliveries, which created favorable conditions for the expansion of foreign economic activity and contributed to the development of new business partnerships. However, this transition has revealed a number of challenges associated with the need to develop new logistics chains. Increased transportation costs and difficulties in establishing interactions with new counterparties require additional time and resources.

The results of the analysis showed that in 2022–2023, the forestry complex of the Arkhangelsk Oblast was gradually adapting to difficult political and economic conditions, which can open up new horizons and ensure long-term growth in the context of a changing international market. The decrease in the volume of forestry product exports from the Arkhangelsk Oblast had a negative impact on the region's economy. One of the main consequences of forestry product export restrictions since 2022 is a decrease in tax revenues to the regional budget, which in turn has a negative impact on the financing of social programs and infrastructure projects, and on the implementation of investment projects in the forestry complex in the region. In order to overcome the negative consequences in the region's forestry complex, it is necessary to strengthen the directions for reducing the export dependence of the forestry complex of the Arkhangelsk Oblast (Fig. 9) and the system for ensuring the implementation of these directions (Fig. 10).

Market diversification of exports.	•It is necessary to look for new markets, including in Asia and Africa, where demand for wood remains high.
Technological development of timber production.	•Increasing the volume of deep processing of wood will create more valuable products, increasing added value and reducing dependence on exports.
Innovations in the forest complex.	•They are associated with the development of new types of forest products and the processing of low-grade wood and wood waste. One of the most promising areas is the production of bioplastics from wood waste, new building materials (wood-polymer composites), biofuels, biofertilizers, wood fillers, biochemicals, etc.
State support for the forest complex.	•It is necessary to ensure state support for the forestry sector, including through tax incentives, subsidies and investment programs.

Fig. 9. Directions for reducing the export dependence of the Arkhangelsk Oblast forestry complex [9].

Develop the scientific and technological base	•It is necessary to invest in research and development in order to create new, high-tech production facilities.
Create a training system	•Highly qualified specialists are needed to work at modern deep processing enterprises.
Ensure the availability of financing	•The development of new industries requires significant investments, therefore it is necessary to ensure access to loans and grants.
Create a favorable investment climate	•This includes simplifying administrative procedures, reducing the tax burden and increasing the transparency of business processes.

Fig. 10. Ensuring directions for reducing export dependence of the Arkhangelsk Oblast forestry complex [10].

[9] Source: compiled by the authors.
[10] Source: compiled by the authors.

Diversification of the Arkhangelsk forestry complex and development of new markets will allow overcoming the negative consequences of export specialization and maintaining leading positions in the Russian forestry sector.

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Assessment of the State of the Information and Communication Technology Sector in the Northern Regions of Russia Using Multidimensional Grouping

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Abstract. The paper analyzes the state of the information and communication technologies (ICT) sector in the northern regions of Russia. The main research methods are multidimensional grouping and comparative analysis of ICT development. The relevance of the study is due to the lack of knowledge about the state of information and communication technologies in the northern regions of Russia. At the same time, ICT has a great potential to stimulate the economic development of the North of Russia and the Arctic in particular. The novelty of the work lies in the development of a methodological approach to the comparative analysis of the ICT sector in the Russian regions, aimed at identifying problem areas of development. An original set of indicators is created — criteria for the state of ICT at the regional level. The validity of this set is proved by the method of factor analysis. Multidimensional grouping of all subjects of the Russian Federation according to the selected indicators is performed with an emphasis on the northern regions. It is revealed that the northern regions have higher values of ICT indicators compared to other regions of Russia due to the social sphere and the state of ICT at the household level. The leaders are the Yamalo-Nenets Autonomous Okrug, the Khanty-Mansi Autonomous Okrug and the Republic of Karelia. Practical recommendations for ICT development in the northern regions are formulated. The main reserves of ICT development in the North are identified — growth of state and municipal services provision in electronic form and digitalization of health care institutions.
Keywords: *clustering, information society, digital technologies, social infrastructure, interregional analysis*

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Introduction

The socio-economic development of society as a whole is currently closely linked to the development of the information and communication technology (ICT) sector. The effects of the rapid development of information processing and dissemination technologies are extremely diverse. This is evidenced by the fact that technological changes outpace their legal regulation [1, Aspray W., Doty P.], which is one of the reasons why they are rather poorly studied. Nevertheless, country studies have proven that the creation of ICT infrastructure and support for the use of digi-

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tal technologies in the activities of small firms is no less a source of growth than external demand [2, Masenyetse R., Manamathela M.]. The development of ICT has a positive effect on employment [3, Ahuru R.R., Osabohien R., Al-Faryan M.A.S., Sowemimo E.J.], and the inter-firm flow of information associated with ICT, taking into account the nuances, contributes to the growth of the potential for creating new products and bringing them to market [4, Liu Y., Wang L., Yuan C., Li Y.]. Moreover, ICT is most effective in terms of productivity growth in creating new inter-firm links affecting research and development (R&D) issues [5, Minetaki K.]. Thus, in general, it is possible to talk about the favorable impact of ICT evolution on economic development. The gradual formation of elements of the digital economy and information society on a global scale contain the potential for the formation of an increasingly complex economic system based on knowledge as the main productive force. Similar processes are taking place in Russia, including at the regional level. *This makes it important to develop adequate methodological tools for understanding digitalization processes and the possibility of analyzing emerging trends.*

The development of the ICT sector is given considerable attention at the federal level of government. This is largely due to the concern of government bodies about the low demand for ICT in terms of human capital development and the relatively small role it plays in the national economy as a whole. *At the same time, the successful implementation of the whole set of measures is closely related to understanding the depth of interregional differences in ICT development in Russia and the degree of importance of this sector for the country's socio-economic development.*

In this paper, the study of the ICT sector within the framework of the analysis of individual indicators is focused on examining its state in the subjects of the Russian Federation that belong to the **northern** group. These are the territories that, in accordance with the current Resolution of the Government of the Russian Federation No. 1946 [1], which replaced the previous Resolution of the Council of Ministers of the USSR No. 12, are classified as the Far North or equated to the North areas [2].

The ICT sector, gradually forming a full-fledged virtual (information) infrastructure, becomes part of the supporting production infrastructure, which ensures the transition to a new technological mode in the Arctic zone of Russia [6, Pilyasov A.N., Tsukerman V.A.]. This is accompanied by an increase in information flows, digitalization of production processes, creation of the supporting physical underwater and air telecommunications infrastructure. At the same time, the

[1] On approval of the list of regions of the Far North and localities equated to regions of the Far North, for the purpose of providing state guarantees and compensation for persons working and living in these regions and localities, declaring certain acts of the Government of the Russian Federation to be invalid and declaring certain acts of the Council of Ministers of the USSR not valid on the territory of the Russian Federation: Decree of the Government of the Russian Federation of November 16, 2021 No. 1946. URL: https://www.consultant.ru/cons/cgi/online.cgi?req=doc&base=LAW&n=400590&cacheid=9F6A4551E2D0BA5EB7C9B2B96963570A&mode=splus&rnd=TQKjDAUaej4JRx5U3#p6MjDAUIpH0tUm3p (accessed 17 April 2024).

[2] The Republics of Karelia, Komi and Sakha (Yakutia), Kamchatka Krai, Arkhangelsk, Magadan, Murmansk and Sakhalin Oblasts, Khanty-Mansiysk, Yamalo-Nenets, Nenets and Chukotka Autonomous Okrugs. The Republic of Tuva is excluded from the analysis due to its geographical isolation.

demographic situation in the North continues to deteriorate [7, Fauzer V.V., Smirnov A.V., Fauzer G.N.]. *The ambiguity of the qualitative assessment of the development of the northern territories of Russia, along with their special climatic conditions and strategic importance, actualizes a comparative interregional analysis in the North.*

The relevance of ICT development determined the purpose of the work, formulated in its initial form earlier [8, Timushev E.N.] — to determine the state and problems of the information and communication technology sector in the northern regions of Russia. The assessment is carried out in comparison with the average Russian indicators and within the northern regions themselves, identifying the leading regions and those ones that are still lagging behind in terms of certain indicators.

Quite a lot of studies have been devoted to assessing the level of digitalization and ICT development in the regions of Russia. An increasing number of works are focused on the analysis of digital traces of objects of interest, especially on the Internet. Modern works increasingly use research methods that rely on the use of modern data processing technologies (see, for example, [9, Kurilo A.E., Prokopyev E.A., Shkiperova G.T.; 10, Mikhailova A.A., Khvalei D.V.]). However, the analysis of scientific databases allows us to draw conclusions, also shown earlier (see [8, Timushev E.N.]), that a comparative assessment of the degree of ICT development among the northern regions of Russia, as well as an attempt to group them by the level of development specifically in the aspect of ICT development and with an emphasis on identifying the main problem areas, have not yet received sufficient attention in the literature. This paper is intended to supplement the theoretical and methodological base of ICT research in the northern regions of Russia, presenting an original methodological approach to comparative analysis aimed at identifying problem areas for development [11, Timushev E.N.]. This distinguishes this work from already published studies. L. Kuratova [12], for example, analyzes the process of digitalization of the economy and social sphere in the northern regions of the Russian Federation, thereby complementing the still small group of works on this topic. What this study and the cited work have in common is a fundamental approach to the problem of identifying emerging trends in the ICT sector in the North, as well as the coverage of statistical indicators. However, this work differs in the methodology of calculating the integral indicator and the set of primary data. In this paper, there is no explicit integral indicator (although it is calculated by software to determine the Euclidean distance and clusters) and a smaller number of indicators are used, but such indicators, which, in our opinion, cover the main aspects of ICT development in the region. This article differs from other works on a similar topic by comparative analysis of indicators not only for the northern regions, but also for Russia as a whole, i.e. taking into account the main federal problems. In addition, its peculiarity is the breadth of the objects of analysis (the number of regions), in contrast, for example, to the work of A.V. Kozlov [13], where only the Murmansk Oblast and the Yamalo-Nenets Autonomous Okrug are analyzed. But the main difference still lies in the composition of the analyzed indicators. For example, R.R. Sadyrtdinov [14] examines only the use of the Internet, software, and electronic data exchange.

A.V. Kozlov, A.B. Teslya, and A.A. Ivaschenko [15], in addition to the corporate and social spheres, also consider the external conditions for the development of ICT (for example, income level), but do not pay sufficient attention to ICT in public administration and at the household level. V.V. Kamneva and D.A. Baeva [16] also pay much attention to the external environment of the development of ICT and the availability of digital technologies, but almost do not touch upon the sphere of households. In this work, the ICT sector is presented in different aspects to ensure the comprehensiveness of its characteristics.

Research methodology

In order to conduct an interregional analysis of the ICT sector in the northern regions, as in [8, Timushev E.N.], multifactor cluster analysis (multidimensional grouping) is applied using the Euclidean distance method based on the selected indicators. The object of application of this method is a certain integral non-dimensional indicator that is not explicitly taken into account and is calculated as a conditional distance for all selected indicators, taking into account the proximity of the values of the indicator vector for each region. Calculations are performed using the R computing environment, version 4.0.4. As in [11, Timushev E.N.], built-in calculation packages are used, including the functions that calculate the Euclidean distance — "dist()" and divide objects into clusters — "hclust()". A standard package for plotting graphs — "plot()" is also used. Preliminary, a factor analysis of the indicators is carried out on the basis of the built-in calculation packages using the "factanal()" function. Statistical verification of sufficiency of groups of indicators is carried out.

The peculiarity of the approach is the primary assessment of the state of ICT in all regions of Russia, since relatively homogeneous groups are identified among all subjects of the Russian Federation, and the analysis continues exclusively for the regions of the North among the selected groups. Multidimensional grouping significantly simplifies and provides the necessary basis for conducting an analysis of ICT in each northern subject, helps to identify its strengths in terms of the development of the ICT sector and, conversely, the aspects of ICT in which it lags behind. It also allows for a reasonable grouping of regions based on a particular aspect of ICT development (at the level of households, corporations or public administration), and not on all indicators together. A similar method — multidimensional grouping — was used, for example, in the work [17, Mikheykina L.A.] when analyzing the level of training and attracting personnel in the information technology sector in Russia. For purposes similar to those of this paper, clustering is also used in the works of Yu.N. Solovieva and G.F. Feigin [18] and Yu.A. Kuznetsov et al. [19]. At the same time, the clustering results critically depend on the selected indicators, and the indicators used in the presented study differ significantly from those used previously. Thus, Yu. N. Solovieva and G. F. Feigin used the following indicators: the share of regions in investments in the ICT sector, the amount of investment in the ICT sector per capita and the share of people employed in ICT in the population. In turn, Yu. A. Kuznetsov and co-authors used such indicators as the use of computers

and the Internet, the use of a website and electronic document management in organizations and ICT costs, respectively.

The originality of the work lies in the fact that the grouping/clustering method is used for a small set of collected informative indicators and in two stages: for all regions of Russia and then only for the northern regions [20, Timushev E. N.]. Without analysis for all regions of Russia, but only, for example, for the northern regions, a different result is obtained than in the case of clustering involving all regions of Russia. As far as we know, works on the northern topics are usually limited to the analysis of data from only a few regions and do not use all-Russian data. In [8, Timushev E.N.] it is emphasized that this is the methodological idea, that clustering is carried out with the participation of all regions, from which the regions of the North are then compared separately as being included into different groups. In this respect, the presented work is similar to the work of V.V. Stepanova and co-authors [21] — one of the best on this topic with a review of foreign methods and the creation of its own, and based on an original system of indicators that comprehensively characterizes the development of ICT. But, unlike the cited work, this work, after analyzing all regions, focuses on identifying problem areas of ICT development exclusively in the regions of the North.

A number of auxiliary indicators are used to explain the quantitative values of the indicators and the relationships found, as well as to conduct a comparative analysis. The share of non-federal transfers in the budget revenues of the subject serves as an indicator of financial capabilities, fiscal capacity, and subsidization of the regional budget and, at the same time, the presence of incentives for state authorities of the subjects. For a quantitative assessment of the spatial distribution of the population and settlements in the regions, coefficients calculated by the Ministry of Finance of Russia within the framework of the distribution of federal equalizing transfers are used [3]: settlement and transport accessibility coefficients. The settlement coefficient depends on the proportion of the population living in settlements with a population of up to 500 people. The transport accessibility coefficient depends on the density of railways and paved roads, the share of settlements that do not have a connection via paved roads and are not provided with a connection to the nearest station, sea or river port, airport, as well as the proportion of the population living in areas with limited delivery times for goods and in mountainous areas. Rosstat data on the level of urbanization is also used — the share of the urban population in the total population according to data for 2022.

[3] On the distribution of subsidies for equalizing the budgetary provision of the constituent entities of the Russian Federation (together with the "Methodology for the distribution of subsidies for equalizing the budgetary provision of the constituent entities of the Russian Federation"): RF Government Resolution of 22 November 2004 No. 670 (as amended on 26 December 2023) (accessed 20 April 2023).

Principles and procedure for data selection

For the purposes of this study, the Rosstat database "Monitoring of information society development in the Russian Federation" is of interest [4]. It is quite in-depth, although in general the problem of information support for the development of ICT, especially at the level of municipalities, is acute [22, Voroshilov N.V.].

The choice of the indicators presented in this study is subjective, but at the same time it is conditioned by the contribution of the phenomena reflected by them to the overall socio-economic development (Table 1) [11, Timushev E.N.]. Thus, the use of computers and the Internet in organizations reduces transaction costs, which has a positive effect on labor productivity. In households, in turn, the use of computers and access to the World Wide Web increase the availability of education and allow spending leisure time in a useful and diverse way. Despite the fact that there are certain risks associated with some digital content, the use of ICT achievements is extremely important for the accumulation of human capital. Due to the rapid development of specialized portals (marketplaces), delivery services and the overall growth of digital content consumption, household computerization contributes to the development of retail trade. Finally, the state of human capital depends on the development of communications with government agencies and the amount of costs in the social sphere.

Table 1

Indicators [5]

Indicator	Indication	Minimum	Average	Maximum	Coefficient of variation, in % of average value
Corporate sector					
Share of organizations using personal computers, %	corp_1	48.7	90.5	100.0	8
Share of organizations using Internet access, %	corp_2	29.0	79.1	97.7	13
Number of personal computers with Internet access, units/100 people	corp_3	14.0	31.9	77.0	22
Share of organizations using electronic document management systems, %	corp_4	5.8	65.6	99.1	14
Households					
Share of households with a personal computer, %	house_1	18.9	69.9	96.5	12
Share of households with access to the Internet, %	house_2	52.2	75.5	98.5	11
Share of households using the Internet every day or almost every day, %	house_3	29.3	64.2	94.9	19
Public administration (public sphere)					
Share of state authorities and local governments using fixed (wired and wireless) Internet, %	public_1	65.6	93.5	100.0	6
Share of population aged 15–72 years using the	public_2	1.8	58.3	97.5	39

[4] Information society. URL: https://rosstat.gov.ru/statistics/infocommunity (accessed 20 April 2023).
[5] Source: Rosstat. Note: in [8, Timushev E.N.] a similar set of indicators was described.

Internet to receive state and municipal services in electronic form, % of the population receiving state and municipal services					
Social sphere					
Number of computers used for educational purposes in general education institutions, units/100 students	social_1	3.0	14.4	83.0	54
Share of healthcare institutions using the Internet, %	social_2	56.4	96.5	100.0	5
Volume of the library's electronic catalog available on the Internet, units/thousand people	social_3	0.0	1.3	34.3	126
Share of the number of computerized places with access to the library's electronic resources, %	social_4	0.0	9.4	41.7	69
Number of museum items included in the electronic catalog, units/thousand people	social_5	0.0	0.3	2.0	124

For the purpose of the work, a summary analytical table was created containing data for each region for 2014–2021 [8, Timushev E.N.]. The exceptions were the indicators "corp_4" and "social_4" in Table 1 — data for them are available only for 2014–2019 and 2015–2021, respectively. Table 1 presents their quantitative characteristics in the form of descriptive statistics.

Based on the results of the correlation analysis, "corp_2" — the share of organizations using the Internet, and "house_2" — the share of households with access to the Internet were excluded from further work. These indicators had the highest correlation with others within their group. After the above-mentioned adjustment of the composition, the strongest paired linear relationship acceptable for the purposes of further analysis remained between "corp_1" and "corp_4" (the correlation coefficient is +0.62).

In general, the choice of indicators is determined by two principles: minimizing their number and reflecting the main aspects of information and communication technologies. Since more than a hundred indicators are available for both groups in "Monitoring of information society development...", the choice of individual indicators for subsequent analysis ensures not only the "debatability" of the selection made, but also the originality of this study.

Results and discussion

The implementation of **factor analysis** allows identifying homogeneous groups of indicators. The results show that a total of four groups of (artificial) indicators can be distinguished from the twelve considered ones (Table 2). Together, they explain more than 58.1% of the total variation in the values of the twelve indicators.

First of all, the indicators of computer equipment with Internet access among employees ("corp_3") and in social institutions — culture ("social_3", "social_5") and vocational education ("social_4") — have a similar variation. They cover the largest share of variability (16.6%). The indicators of the share of organizations that use computers and electronic document management ("corp_1" and "corp_4"), and the share of government bodies that use the Internet ("public_1") (16.1%); the share of households that have computers and use the Internet ("house_1" and

"house_3"), and the degree of equipment of general education with personal computers ("social_1") (15.0%) are close in the distribution of values among Russian regions. The share of the population that uses the Internet to receive services in electronic form ("public_2") stands out, which explains 10.3% of the total variation.

Thus, the factor analysis made it possible to determine the interrelated indicators.

Table 2

Results of factor analysis [6]

Indicator	Factor 1	Factor 2	Factor 3	Factor 4
corp_3	0.61 *	…	…	0.23
social_3	0.73 *	…	0.14	-0.14
social_4	0.59 *	0.10	0.26	0.25
social_5	0.59 *	0.22	0.27	-0.14
corp_1	…	0.94 *	…	-0.11
corp_4	…	0.75 *	-0.13	0.23
public_1	0.31	0.56 *	…	…
house_1	0.39	0.11	0.69 *	0.15
house_3	0.30	…	0.76 *	…
social_1	0.11	0.13	0.63 *	0.18
public_2	…	0.14	0.15	0.97 *
social_2	…	0.23	-0.40	0.12
Share of the factor in the total variation of indicators	16.6%	16.1%	15.0%	10.3%
Accumulated proportion of variation	16.6%	32.7%	47.7%	58.1%

Multifactor cluster analysis for indicators characterizing the ICT sector (see Table 1) allows grouping regions of Russia on the basis of the integral value of their deviations from the average value for each indicator, taking into account the proximity of individual values of indicators in regions. In this paper, the Euclidean distance between indicators is calculated (Fig. 1). Let us explain this figure. The numbers on the vertical axis are data on the Euclidean distance between indicators for each region. They denote the units of distance between regions by the selected features, while the mutual arrangement of regions on the dendrogram depends on the similarity of the vector of values for the corresponding indicators (see Table 1). In multidimensional grouping, the square root of the sum of squared differences is calculated to assess proximity, and the resulting value is the Euclidean distance.

[6] Source: author's calculations. Note: * — the most influential indicators of the corresponding factor.

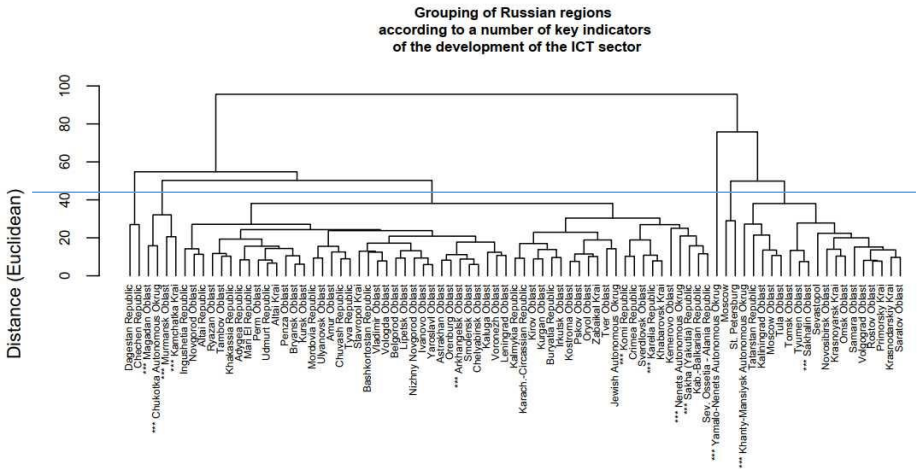

Fig. 1. Results of multidimensional grouping of subjects of the Russian Federation by the main indicators of the ICT sector[7].

In total, three groups of northern regions can be distinguished, the values of the selected indicators for which are approximately the same, and separately — the Yamalo-Nenets Autonomous Okrug. The results of multidimensional grouping are confirmed by the analysis of actual statistics (Table 3).

First, let us consider the general picture of the state of ICT in the North. In general, in the northern regions of Russia, the information and communication technology sector is formally more developed than on average in other regions [8, Timushev E.N.]. This is due to the high values of the indicators in the Yamalo-Nenets Autonomous Okrug, the Khanty-Mansi Autonomous Okrug and the Republic of Karelia. In fact, this is due to the high urbanization in the North, the ICT sector is much more developed in cities than in rural settlements [12, Kuratova L.A.].

Table 3

Average values of ICT indicators in the northern regions[8]

Region / Indicator	corp_1	corp_3	corp_4	house_1	house_3	public_1	public_2	social_1	social_2	social_3	social_4	social_5
Russia as a whole	90.5	31.9	65.6	70.0	64.2	93.5	58.3	14.4	96.5	1.3	9.4	0.3
Northern regions	92.3	31.7	64.3	77.3	72.6	94.0	55.0	22.8	94.8	2.3	12.5	0.5
Yamalo-Nenets Autonomous Okrug	89.7	27.4	70.7	91.2	84.0	94.5	77.2	70.7	91.1	2.5	23.7	0.7
General group of regions 1												
Khanty-Mansi Autonomous Okrug - Yugra	91.5	25.3	64.7	86.0	81.5	95.0	71.2	20.5	96.7	1.6	19.6	0.4
Sakhalin Oblast	92.4	38.4	65.0	69.3	65.0	94.2	64.8	15.1	98.2	1.7	21.3	0.5
General group of regions 2												
Republic of Karelia	94.3	37.0	72.9	74.0	69.8	95.2	51.7	16.5	99.7	5.1	9.7	0.4
Komi Republic	90.2	30.8	63.0	76.0	68.5	93.6	49.3	15.2	97.1	2.1	12.3	0.3

[7] Source: author's calculations based on data on the indicators used, based on average data for 2014–2021. Note: *** — northern regions of Russia.
[8] Source: author's calculations. Note: based on data for 2014–2021.

Nenets Autonomous Okrug	90.7	30.9	53.7	71.7	60.9	93.8	48.9	21.1	96.9	1.7	8.1	0.1
Arkhangelsk Oblast	91.5	27.4	68.9	74.1	68.7	94.7	64.1	14.2	97.0	1.5	5.7	0.4
Sakha Republic (Yakutia)	92.9	33.3	59.5	66.6	75.6	93.7	53.2	13.9	91.6	1.2	12.9	0.2
General group of regions 3												
Murmansk Oblast	91.5	32.5	66.1	82.7	77.9	90.2	51.3	16.2	87.6	3.1	10.2	0.2
Kamchatka Krai	95.2	35.3	66.4	72.4	71.8	94.8	57.6	28.6	89.7	1.0	12.7	0.2
Magadan Oblast	94.1	33.8	64.4	79.4	71.3	93.8	34.9	18.7	92.6	4.0	4.6	0.9
Chukotka Autonomous Okrug	93.9	28.6	56.8	84.9	76.2	94.0	35.8	22.5	100.0	1.8	8.7	1.5

Next, let us consider the obtained results of the clustering of regions in terms of groups of indicators.

In *the corporate sector*, the regions of group 3 have the highest value of indicators, although the spread of values here is very small. Approximately the same indicator values for Russia as a whole and on average for the northern regions indicate that organizations and enterprises located in the North do not have clear incentives to strengthen digitalization or, on the contrary, maintain low levels of computerization of activities, use of the Internet or electronic document management. Nevertheless, interregional differentiation is present. Among the northern regions, the leader in ICT development is the Republic of Karelia, which has high values for all indicators. Largely because of this, the average values for group 2 are also high, especially for the equipment of employees with computers with Internet access ("corp_3") and the share of organizations with electronic document management ("corp_4"). Enterprises in the Sakhalin Oblast, the Republic of Sakha (Yakutia), the Kamchatka Krai and the Magadan Oblast, where there is a relatively high concentration of entrepreneurial activity with a focus on the extractive industry, use a greater number of computerized workstations and have above-average access to the Internet. In terms of the use of electronic document management, a high level of ICT use, in addition to the Republic of Karelia, is observed in the Yamalo-Nenets Autonomous Okrug and the Arkhangelsk Oblast. This may be due to the development of enterprises not only in the extractive industry, but also in the pulp and paper industry, many of which use a modern enterprise management model. Thus, in the area of ICT development in the corporate sector, the task of government bodies of the constituent entities is to create an attractive environment for the growth of private investment and use other methods of stimulating the entrepreneurial sector to apply modern methods of conducting business processes based on the introduction of digital technologies. In general, the relationship between the sectoral structure of the regional economy and the degree of ICT development in various aspects of the corporate sector may become a promising area of future research.

At *the household level*, the regions of the North have the highest level of ICT development compared to other regions of Russia. This can be explained by the large share of the urban population in the total population (high urbanization) (Table 4). Regions of group 3 have high values of the indicators. These are regions in the Asian part of Russia: the Kamchatka Krai, the Magadan Oblast, the Chukotka Autonomous Okrug and separately — the Murmansk Oblast. These regions are

distinguished by a particularly high level of urbanization even by the standards of northern regions (except for the Chukotka Autonomous Okrug), as well as a low settlement coefficient, which means that a relatively small share of the population lives in settlements with a small population (up to 500 people). In contrast, regions of group 2 — regions of the European North, as well as the Sakha Republic (Yakutia) — have low values of ICT development indicators at the household level. This is due to the nature of settlement — a high settlement coefficient indicates a relatively large share of the population living in settlements with a small population. We are talking about such regions as the Republic of Karelia, the Komi Republic, the Nenets Autonomous Okrug and the Arkhangelsk Oblast. This confirms the results obtained earlier [20, Timushev E.N.]. As in the aspect of corporate development, the Khanty-Mansi Autonomous Okrug also occupies a leading position. It has a low settlement coefficient, which confirms the found pattern: the higher the urbanization and the lower the share of the population living in sparsely populated areas, the higher the ICT development at the household level and vice versa. This pattern is applicable to all northern regions, except for the Sakhalin Oblast and the Chukotka Autonomous Okrug. The former is characterized by a low share of the population living in sparsely populated areas and very low ICT development indicators, while the latter is characterized by a high share of the population living in sparsely populated areas and fairly high ICT development indicators. It is worth noting that the ICT development indicators in the Sakhalin Oblast, although lower than the average for the North, are at the level of the Russian average. Thus, the development of information and communication technologies at the household level will be facilitated by both general measures that promote an increase in population density and the creation of Internet infrastructure in a larger area of the region.

Table 4

Auxiliary indicators [9]

Region / Indicator	Share of urban population in the total population in 2022, %	Settlement coefficient in 2024, units	Transport accessibility coefficient in 2024, units	Share of federal transfers in the subject's budget revenues for 2023, %
Russia as a whole	70.9	1.00	1.00	34.4%
Northern regions	81.1	1.00	2.19	28.1%
Yamalo-Nenets Autonomous Okrug	84.7	0.95	1.59	9.1%
General group of regions 1				

[9] Source: Rosstat, Ministry of Finance of Russia, Electronic Budget portal (for data for 2023). URL: https://budget.gov.ru/Бюджет (accessed 20 April 2023).

Khanty-Mansi Autonomous Okrug - Yugra	92.2	0.95	0.25	11.3%
Sakhalin Oblast	82.6	0.97	0.33	8.2%
General group of regions 2				
Republic of Karelia	79.7	1.02	0.02	43.0%
Komi Republic	77.7	1.02	0.38	13.7%
Nenets Autonomous Okrug	74.5	1.06	3.54	13.4%
Arkhangelsk Oblast	77.8	1.04	0.22	33.3%
Sakha Republic (Yakutia)	67.2	1.00	3.14	35.4%
General group of regions 3				
Murmansk Oblast	93.0	0.95	0.07	13.7%
Kamchatka Krai	78.0	0.97	3.74	65.0%
Magadan Oblast	96.5	0.97	3.41	32.5%
Chukotka Autonomous Okrug	69.1	1.09	9.63	59.0%

In *public administration*, the northern regions have high values of the indicator in terms of Internet use in public institutions and low values in terms of Internet use by the population to receive government services. High rates of Internet use at the level of government agencies can be partially explained by the high fiscal capacity and lower transfer-dependence of most northern regions. The Yamalo-Nenets and Khanty-Mansi Autonomous Okrugs can be an example of this [11, Timushev E.N.]. The popularity of Internet use by the population to receive government services in electronic form can be influenced by problems with access to the network and the ICT infrastructure in general in rural areas. This is confirmed by the low values of “public_2” for the regions of group 2 with a high settlement coefficient and high values of “public_2” for the Yamalo-Nenets, Khanty-Mansi Autonomous Okrug and the Sakhalin Oblast, which have a low settlement coefficient, that is, a relatively small share of the population living in small settlements. The density of transport routes and the share of settlements with low transport accessibility (reflected in the transport accessibility coefficient) also play a role. Theoretically, the infrastructure for providing and receiving government services in electronic form could become an alternative to personal visits to government agencies in remote areas. However, among regions with low density of transport routes, only the Kamchatka Krai has a higher than average share of the population that use the Internet to receive public services; in the Nenets Autonomous Okrug, the Republic of Sakha (Yakutia), the Magadan Oblast and the Chukotka Autonomous Okrug, it is very low. Thus, overcoming the lag in information support for the provision of government services creates a significant reserve for the growth of the ICT sector in the North. This could be facilitated by measures similar to the development of ICT at the household level: creating an Internet infrastructure in a larger area of the region, informing citizens about the availability of relevant services, stimulating their use, including through reduced tariffs for paid services. This will also optimize the stationary network of institutions providing public services in a “physical” form.

In the *social sphere*, one of the leaders among all regions of Russia is the Yamalo-Nenets Autonomous Okrug. However, it is very difficult to form an overall picture here.

In the sphere of general education (indicator "social_1"), the scale of computerization is the highest in the Yamalo-Nenets Autonomous Okrug, as well as in the Khanty-Mansik Autonomous Okrug, the Nenets Autonomous Okrug, the Kamchatka Krai and the Chukotka Autonomous Okrug. The distribution of the indicator obviously does not depend on the level of fiscal capacity of the region, which may be associated with the federal policy of increasing digitalization in general education schools, co-financed through federal intergovernmental transfers. In general, the value of the indicator of the number of computers per student in almost all northern regions is higher than the average for Russia as a whole.

In the sphere of healthcare (indicator "social_2"), in contrast to education, the level of ICT development in the North is much lower. Among a very large number of regions, a relatively low value is observed for the share of healthcare institutions that use the Internet, including in the Yamalo-Nenets Autonomous Okrug. Thus, in the Yamalo-Nenets Autonomous Okrug, the Sakha Republic (Yakutia), the Kamchatka Krai and the Magadan Oblast — regions with low transport accessibility of a large number of populated areas, according to the transport accessibility coefficient — there is a low share of healthcare institutions using the Internet. This may be due to insufficient funding for the transition to digital healthcare institutions, especially in rural areas where feldsher-obstetric stations operate. This situation is unfavorable in all northern regions with a low value of the indicator, including the Murmansk Oblast, but it is most critical in the selected regions due to the nature of the spatial organization of the population distribution. At the same time, the Chukotka Autonomous Okrug is the leader in this indicator among all regions of Russia. Government authorities of the northern regions need to pay special attention to equipping healthcare institutions in sparsely populated areas with digital technologies, which will contribute not only to an increase in the quality of services, but also to the demand for jobs for specialized specialists.

The indicators of digitalization of the cultural sphere — the volume of digitized library catalogues and museum items ("social_3" and "social_5") — show that ICT penetration is higher in regions such as the Yamalo-Nenets Autonomous Okrug, the Magadan Oblast, and the Chukotka Autonomous Okrug. This may be due to the low transport accessibility of settlements in these regions, which encourages the transition "to digital", but, probably, to a greater extent — to the results of the work of regional departments of culture. At the same time, the situation in the cultural sphere is not so unambiguous. The already mentioned Magadan Oblast and Chukotka Autonomous Okrug have rather low values of the related indicator — the share of places with access to electronic library resources ("social_4"). Thus, the northern regions, except for the most financially secure ones, such as the Yamalo-Nenets Autonomous Okrug, are not leaders in all aspects of digitalization of the cultural sphere. Nevertheless, in some aspects, the examples of these subjects can become a reference point for other northern regions in popularization and growth of accessibility of cultural facilities among the population.

Conclusion

The scientific novelty of the paper lies in the development of a methodological approach to the comparative analysis of the information and communication technology (ICT) sector in the regions of Russia, aimed at identifying problem areas of development. This approach includes the creation of an original set of indicators that allow making reasonable conclusions about the state of ICT at the regional level, and the implementation of multidimensional grouping (clustering) of all subjects of the Russian Federation by the selected indicators, and then a comparative analysis of the state of ICT in individual regions with the provision of actual values of primary indicators in the context of the selected clusters. In continuation of the work [8, Timushev E.N.], the state of ICT in the northern regions of Russia is assessed using the method of multivariate cluster analysis by Euclidean distance. Using the developed methodological approach, an analysis of the development of information and communication technologies in the northern regions is carried out, problems are identified and recommendations are proposed.

It was determined that the northern regions have higher average values of ICT development indicators compared to other regions of Russia, which is mainly due to high urbanization in the North. The leaders among the northern regions are the Yamalo-Nenets Autonomous Okrug, as well as the Khanty-Mansi Autonomous Okrug and the Republic of Karelia. The greatest advantage is observed in the social sphere and in the household sector, while the leadership of the northern regions in terms of ICT development in the corporate sector is minimal.

It was found that in the North, the development of digital technologies in the corporate sector is similar to the average Russian level, and the further development of ICT here will be facilitated by the creation of an attractive environment for the growth of private investment in the development of modern business processes. The following pattern was revealed: the higher the urbanization and the lower the proportion of the population living in sparsely populated areas, the higher the development of ICT at the household level, and vice versa. At the same time, the development of digitalization at the household level will be facilitated by the creation of Internet infrastructure in the region. It was concluded that in the field of general education and culture, some northern regions have high indicators in a number of areas and can serve as an example of the introduction of digitalization for other regions.

The practical significance of the study is to identify the main reserves for further ICT development in the North — growth in the provision of state and municipal services in electronic form, increased digitalization and provision of the Internet in healthcare institutions. To increase the provision of state services in electronic form, it is necessary to promote the Internet infrastructure throughout the region and a set of measures to encourage citizens to use them. To improve the quality and accessibility of healthcare in the northern regions, it is necessary to take measures to increase the use of information and communication technologies and the Internet in healthcare institutions, paying special attention to rural institutions with a small population and those that are hard to reach. It is important to record the relevant measures in regional state programs.

Further research directions include expanding the object of analysis in the direction of clarifying the relationship between the selected ICT development indicators and general economic indicators of the regional economy development.

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Digitalization as a Factor for Development of the Target Arctic Subspaces

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Abstract. The Arctic zone of the Russian Federation is a rich, attractive, but hard-to-reach region. The authors of the article believe that the current level of development of digital and data technologies can make a constructive contribution to overcoming some of the challenges of Arctic conquest. Since the Russian Arctic is a complexly structured macro-region, the authors rely on the division of the Arctic into seven target subspaces. The paper identifies the requirements of the target Arctic subspaces for digital technologies that could facilitate the process of Arctic exploration. The paper used the results of previous research by colleagues, traditional methods of scientific analysis combined with an interdisciplinary approach, and an architectural approach to the design of socio-economic systems to identify the requirements of the identified subspaces. Based on the analysis of the collected and summarized materials, seven models of motivational extensions were constructed for each of the identified Arctic subspaces, summarizing information about the goal-setting of each subspace. Among other goal-setting factors, the requirements for digital technology services that would contribute to the development of each subspace were formulated. The resulting requirements contain both digital support needs common to all subspaces and those specific to each subspace due to its characteristics. As a result, the directions for effective implementation and use of digital technologies in the Russian Arctic were summarized.
Keywords: *Arctic, Arctic zone of the Russian Federation, Arctic digitalization, digital technologies, enterprise architecture, motivational aspect*

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Introduction

The Arctic, which is divided among the Arctic countries, has been the object of scientific research for scientists from all over the world for many years. Certainly, the Arctic is of particular interest to the countries that own part of the Arctic territories, one of which is the Russian Federa-

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tion (RF). The level of international interest in the Arctic zone is clearly demonstrated by the fact that even countries located in completely different climatic zones (for example, China, Japan, Singapore) have Arctic strategies.

The Arctic zone of the Russian Federation is a region extremely rich in natural resources. The most important Russian Arctic deposits are located in the Republic of Sakha (Yakutia), the Norilsk region, the Kola Peninsula and the Eastern Siberia [1]. Preliminary estimates of hydrocarbon reserves indicate that the Arctic contains 13% of the world's oil reserves and 30% of the world's natural gas reserves [1]. In addition to minerals, the Arctic zone has unique recreational resources, is a zone of active fishing, and is a unique natural ecosystem. The development of this macro-region is one of the strategic national objectives of the Russian Federation.

To confirm the understanding of the relevance of stimulating research on the development of the Arctic in the Russian Federation, a number of legislative initiatives focused on this zone can be cited. On May 7, 2018, the Decree of the President of the Russian Federation was signed, noting the need to optimize the spatial placement of digital infrastructure in the Arctic zone and in the Far East of the country. The same decree provides a vector for further development of the Northern Sea Route: by 2024, cargo traffic along the Northern Sea Route should reach 80 million tons [2].

In addition, the President of the Russian Federation signed such fundamental documents as the Decree of the President of the Russian Federation of October 26, 2020 N 645, which approves the Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035 [3], and the Decree of the President of the Russian Federation of March 5, 2020 N 164, which approved the Fundamentals of the State Policy of the Russian Federation in the Arctic for the Period up to 2035 [4].

Despite the increased interest in the development of the Arctic zone, this region still remains underdeveloped. This is due to a number of factors that hinder and complicate the organization of human activities in the Arctic: harsh climate, low population density, lack of infrastructure, need to protect nature and biological species living in the Arctic from traces of human activity, high resource intensity of economic activity, as well as the likelihood of geopolitical conflicts arising from determining the ownership of natural resources [2].

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[1] Bird K.J., Charpentier R.R., Gautier D.L., Houseknecht D.W., Klett T.R., Pitman J.K., Moore T.E., Schenk C.J., Tennyson M.E., Wandrey C.J. Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle // USGS Science for a Changing World. 2008. URL: https://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf (accessed 15 September 2023).

[2] Decree of the President of the Russian Federation "On national goals and strategic objectives for the development of the Russian Federation for the period until 2024" dated 07 May 2018, No. 204. URL: http://publication.pravo.gov.ru/Document/View/0001201805070038?index=19 (accessed 15 September 2023).

[3] Decree of the President of the Russian Federation "On the Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035" dated October 26, 2020, No. 645. URL: https://base.garant.ru/74810556/#friends (accessed 15 September 2023).

[4] Decree of the President of the Russian Federation "On the Fundamentals of the State Policy of the Russian Federation in the Arctic for the Period until 2035" dated 05 March 2020, No. 164. URL: https://base.garant.ru/73706526/#block_1000 (accessed 15 September 2023).

Digital technologies can provide an impetus for solving many of the challenges identified above. In addition to ensuring communications in the region, these technologies can replace human labor with machine labor in harsh climatic conditions; information technologies can significantly improve the infrastructure of northern territories, in particular, the use of telemedicine in areas where it is not possible to open stationary medical institutions [3]. In other words, the competent use of digital information technologies can significantly simplify the development of the Arctic, solving or leveling most of the problems listed above.

In order for the use of digital technologies in the development of the Arctic territories to be effective and successful, it is important to take a systematic approach to their application to solve the problems of the region's development. The purpose of this study is to determine the key areas of digital transformation of the Arctic, as well as to identify the requirements for digital technologies that can be used in the development of the Arctic zone of the Russian Federation.

Literature review

The state of scientific research on existing Arctic development strategies in the world

The issue of Arctic research is relevant and important for all circumpolar countries. Each of these countries has its own views on the development of its Arctic territories, many of them have a developed and adopted program for the development of the Arctic.

As part of the work on this article, an analysis of the programs (in original sources and in scientific reviews) for the development of Arctic territories of the following circumpolar countries was made: Iceland [5], Canada [6], Finland [7], the USA [8], Sweden [9]. A review of documents and scientific papers [4]–[10] allowed drawing the following conclusions about the key methods for the development of Arctic territories in circumpolar countries:

1. Regardless of the size of the Arctic part of the country's territory, each of the circumpolar countries notes the forced need to develop their northern territories with the help of modern technologies (and, accordingly, the development of the use of these technologies in the north), since in some places only they make it possible to reach remote territories.

2. Delivery of social benefits to the population living in the northern territories and equalization of the level of provision of the population with social benefits within the country (including in the Arctic territories) occupy a rather important place in the strategies for the development of

[5] Iceland's Policy on Matters Concerning the Arctic Region. Parliamentary Resolution 25/151. 2021. Arctic Portal Library. URL: http://library.arcticportal.org/2007/1/Icelandic_Arctic_Policy.pdf (accessed 16 September 2023).

[6] Arctic and Northern Policy Framework. Government of Canada. URL: https://www.rcaanc-cirnac.gc.ca/eng/1560523306861/1560523330587#s0 (accessed 16 September 2023).

[7] Finland's Strategy for Arctic policy. URL: https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/163247/VN_2021_55.pdf?sequence=1&isAllowed=y (accessed 16 September 2023).

[8] National Strategy for the Arctic Region. URL: https://www.whitehouse.gov/wp-content/uploads/2022/10/National-Strategy-for-the-Arctic-Region.pdf (accessed 16 September 2023).

[9] Sweden's strategy for the Arctic Region. URL: https://www.government.se/contentassets/85de9103bbbe4373b55eddd7f71608da/swedens-strategy-for-the-arctic-region-2020.pdf (accessed 16 September 2023).

the Arctic territories of circumpolar countries. The authorities of circumpolar countries promise to solve the problem of delivering vital social benefits to remote northern regions with the help of high-speed Internet and digital technologies [11]. For example, the problem of the availability of medical services is partly planned to be solved with the help of telemedicine.

3. There is a need to develop infrastructure in the northern regions of circumpolar countries for life and tourism: in some countries, it is planned to create reliable network communications in order to make navigation in the region and tourism activities safer. At the same time, it is planned to use the collection of climate data and cloud computing to determine the timing of the navigation period in the region more accurately, making the Arctic territories more attractive from logistical and economic point of view.

4. The last obvious common feature in the Arctic development strategies of circumpolar countries is sustainable development and "green" production. All Arctic countries note the importance of preserving Arctic nature in its original form and plan to use advanced production technologies for this purpose. For example, with the help of the Internet of Things (IoT), it is planned to flexibly manage harmful emissions from enterprises, reducing them to minimum.

Summarizing the above-mentioned general trends in the Arctic development strategies of circumpolar countries, it can be concluded that the governments of Arctic countries consider digitalization of the Arctic territories to be a fundamental factor in their development.

Relevance of digitalization projects for the Arctic Zone of the Russian Federation

The Russian Arctic is an extremely resource-rich region. According to experts [12], the Arctic zone belonging to Russia contains 52% of all Arctic oil and gas reserves, and the total resource reserves of the Russian part of the Arctic exceed 510 billion tons of oil equivalent. Speaking about the distribution of hydrocarbons in the Russian Arctic, the authors of the monograph "The Arctic Space of Russia in the 21st Century: Development Factors, Management Organization" note that according to preliminary expert estimates, the Russian Arctic shelf alone contains approximately 100 billion tons of oil equivalent [13]. However, despite this great potential, the shelves currently remain less studied compared to the onshore oil and gas-bearing territories [12].

In many respects, the study of these territories is complicated by difficult conditions. Summarizing the published materials [13]–[16], the following factors can be listed: low temperatures, high humidity, salt water, permafrost, lack of solar energy, the presence of ice that impedes navigation in the region, the need to take measures to protect nature and Arctic biological species from traces of human activity, the need to reconcile the cultural and value aspirations of the indigenous population with production activities, high resource intensity of the organization of economic activity, lack of infrastructure for organizing the lives of workers in mining and processing enterprises in the Arctic region, including access to medical care.

A number of Russian scientists see the digitalization of the Arctic as a potential solution to these problems. For example, in the article [17], the authors analyze the outflow of population

from cities and settlements in the territories of the Far North and the reasons for this outflow. The authors, using the example of urban communities of Murmansk and the tools described in the article, identified the top reasons why the northern territories of the Russian Federation are difficult to populate: natural and climatic conditions, quality of life (provision of social benefits) and the apparent lack of prospects for the development of the city. In order to correct the picture of demographic population decline, the authors give recommendations to municipal authorities on making changes to city management and introducing new technologies in the development of urban and regional territories. One of such technologies could be digital solutions in various spheres of life of residents of the Far North, which will improve living in these territories and will make it more attractive for people.

It is quite obvious that it is impossible to develop industry, especially in the Far North, without qualified personnel. Employers of infrastructure and processing facilities beyond the Arctic Circle in the territory of the Russian Federation note an acute shortage of personnel in the field of industrial digitalization. Researchers [18] analyzed trends in the training of industrial specialists and surveyed employers in the territories of the Far North of the Russian Federation. In their article, the authors came to the conclusion that employers are ready to implement digital technologies at their facilities, but, unfortunately, they lack personnel for such large-scale projects. This study is a good illustration of the current stage of the process of implementing digitalization at enterprises in the Far North of the Russian Federation — economic efficiency has been proven, plans have been made, and personnel are being trained to implement them. According to recent data [18], companies operating in the Far North are actively signing contracts for targeted training of their future digitalization specialists in higher education institutions.

Another interesting example of the impact of digitalization on settlements and cities in the Far North of the Russian Federation can be the case discussed in the article [19]. In this work, the author considers the case of Norilsk as a single-industry town in the Far North in the context of growth, development and radical changes that can turn it into a city of federal significance. As the author notes, this transformation cannot occur without the widespread implementation of digitalization in all spheres of life of residents. The use of the Internet of Things (IoT), artificial intelligence (AI) and other advanced information technologies will help to achieve “unity of transformation of external, agglomeration connections and internal connections in the economy”, which in turn will ensure the achievement of “centrality” for Norilsk [19].

Russian scientists note the relevance of digitalization and its technological solutions not only in the demographic and urban areas of the Russian Far North. The authors [20] note the importance of skills related to the use of digital technologies and artificial intelligence among applicants of the labor market in the region. In the article [21], the authors note the emergence in recent years of such a phenomenon as smart tourism, which is becoming popular in the Arctic region. The peculiarity of such “smart” tourists, who have recently appeared as a completely new category in the tourist flow, is the active use of predominantly digital communication channels. In

this regard, when talking about the development of tourism in the Arctic region, it would be quite logical to focus on the development of digital infrastructure.

A final example of the use of digitalization in the development of Arctic territories is the creation of digital twin of the Arctic population [22]. Having data from the population census of the Arctic regions of the Russian Federation, the authors of the work created an analytical dashboard that can be used to forecast the demographic situation in the cities and regions of the Arctic region of the Russian Federation. The usefulness of this website with analytical functionality does not need to be proven. As the authors note in their article, their product can be used at both the municipal and federal levels to plan measures for the development of the northern territories of the Russian Federation.

The development of the Arctic is a strategically important task for the Russian Federation. During the entire period of research, scientists have considered different approaches to the development of the Arctic region, and it is important to note here that the Arctic as a region is highly heterogeneous. In order to be able to come to applied results in research, it is necessary to segment the region in question.

This study uses the approach proposed by the St. Petersburg Polytechnic University's scientific school in the field of Arctic research under the leadership of N.I. Didenko and D.F. Skripnyuk, which consists in dividing the territory of the Russian Arctic into target subspaces [23]–[25]. In this case, subspaces are understood as a part of the Arctic space that has distinctive properties that, in turn, allow for the functional division of the Arctic territory into its constituent parts. Each subspace is described by its own development goals [23].

According to [23], it is possible to distinguish the following subspaces within the Russian Arctic:

- base cities — large and medium-sized industrial and populated areas;
- mobile shift camps — one of the possible ways of developing Arctic territories, especially those where it is impossible to establish a permanent place of residence;
- territories of mineral resource extraction — developed deposits and industrial facilities associated with the processing of mineral resources;
- territories allocated for fishing purposes — infrastructure for industrial fishing, as well as territories where industrial fishing is carried out;
- territories of recreational focus — tourist attractions of the Arctic region;
- Northern Sea Route — a shipping route in the Russian part of the Arctic, which also passes through the territorial waters of Denmark, Canada and the USA;
- infrastructure for the protection of safe existence — a subspace that performs the functions of protection and development of the Arctic region, ensures the strategic development of the Arctic.

Results

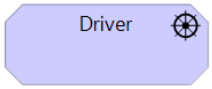
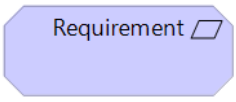
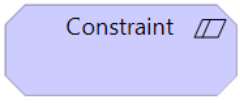
The formation of requirements for digital technologies for the selected subspaces will be based on the concept of enterprise architecture. This concept can be applied not only to enterprises, but also to any socio-economic systems — industries, institutional environments, regions, states.

Enterprise architecture is understood as a set of various elements that, in the process of their interaction, make up the internal structure of business management, starting from strategy, goals and business models and ending with business processes, technological processes, organizational structure, IT infrastructure, information systems and production equipment [26; 27]. The enterprise architecture concept allows the requirements of the processes implemented in the system to be aligned with the IT and digital technologies supporting them by forming requirements for these technologies and providing services in response.

In this paper, the concept of motivational expansion from the architecture approach will be used. Motivational expansion allows formalizing the goal-setting of the socio-economic system under consideration through the interrelated description of certain elements [26]. Their description is presented in Table 1.

Table 1

Elements of the Archi model

Element	Definition	Designation in the Archi model
Stakeholder (interested party)	Reflects the role of the person, team or organization that has an interest(s) in the effects of the architecture.	
Driver	Represents the condition that motivates an organization to define its goals and make the changes necessary to achieve them.	
Goal	Presents a high-level statement of intent or desired end state for the organization and its stakeholders.	
Requirement	Defines a required feature that applies to a particular system.	
Constraint	Reflects a factor that limits the achievement of goals.	

1. Stakeholders — main interested parties of a given subspace.
2. Drivers — external or internal conditions that motivate defining the goals of subspace development.
3. Goals — desired final state of the subspace.
4. Requirements — necessity that determines the attribute that a given subspace should have.

5. Constraints — factors that limit the implementation of goals for a given subspace.

Defining the elements of the motivational expansion of each target subspace and modeling their relationship contributes to the formation of requirements for digital technologies that can facilitate the development of the Arctic region.

The results of the analysis of information on the subspaces of the Arctic zone of the Russian Federation — the drivers of their development, their goal setting, constraints — can be summarized in the form of models of motivational expansions — Figs. 1–7.

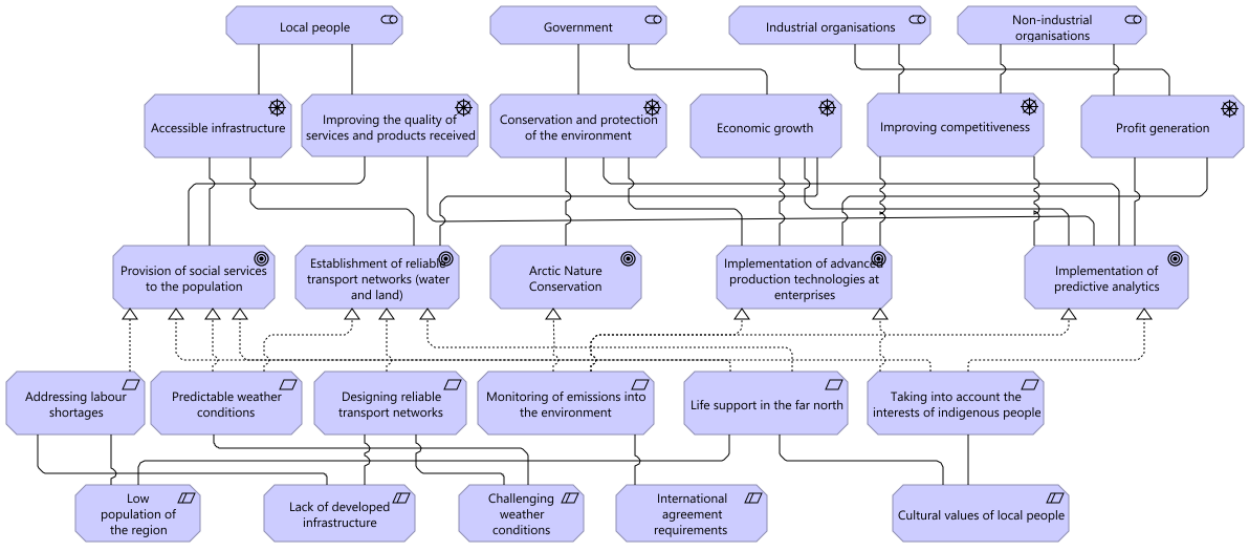


Fig. 1. Motivational expansion “Base cities”.

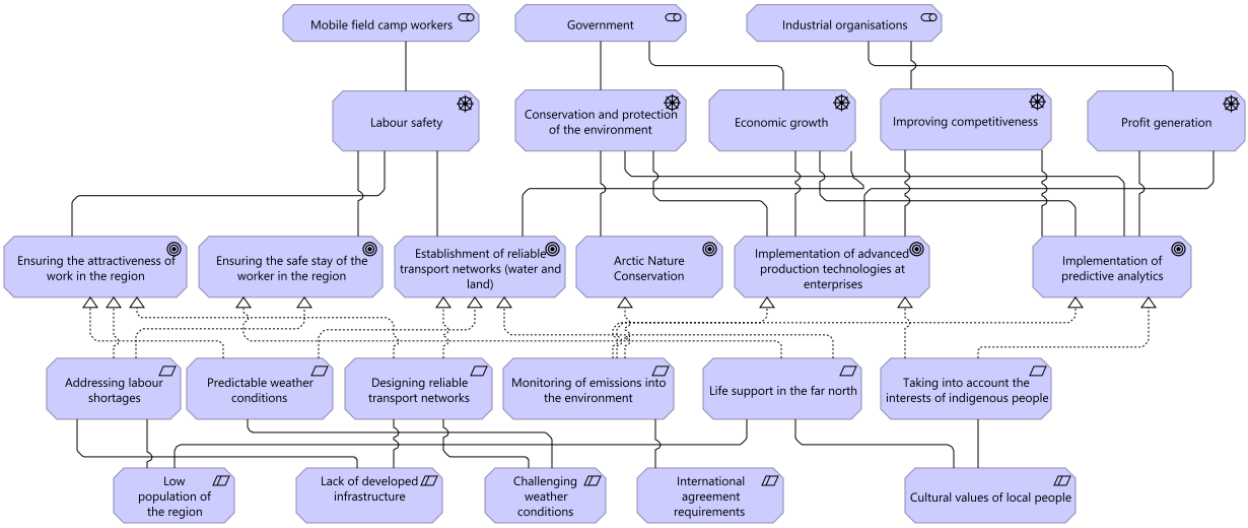


Fig. 2. Motivational extension “Mobile shift camps”.

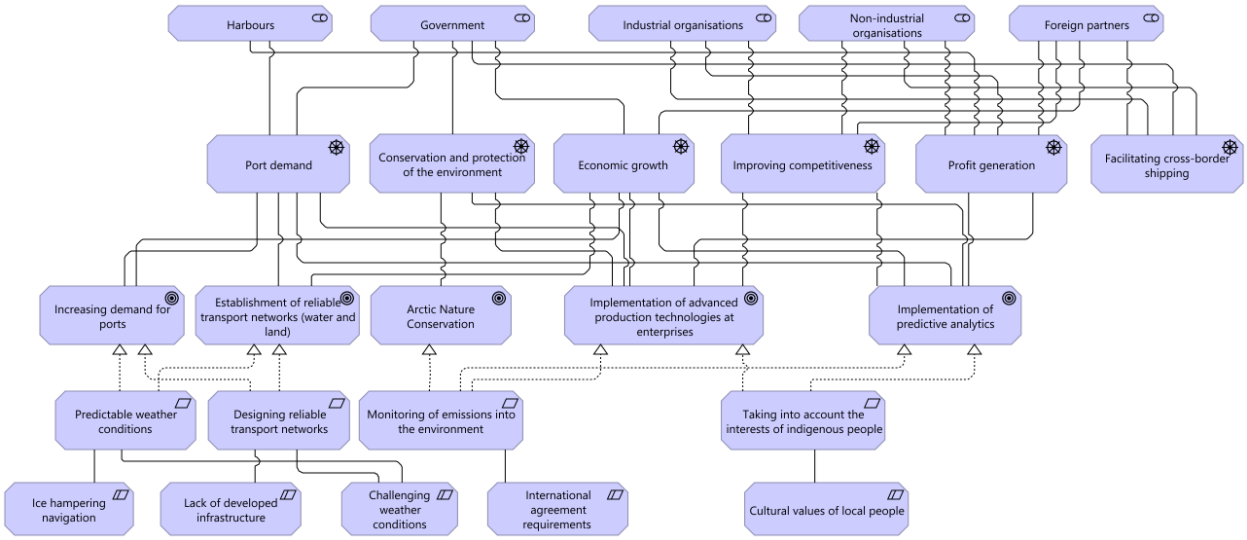


Fig. 3. Motivational extension “Northern Sea Route”.

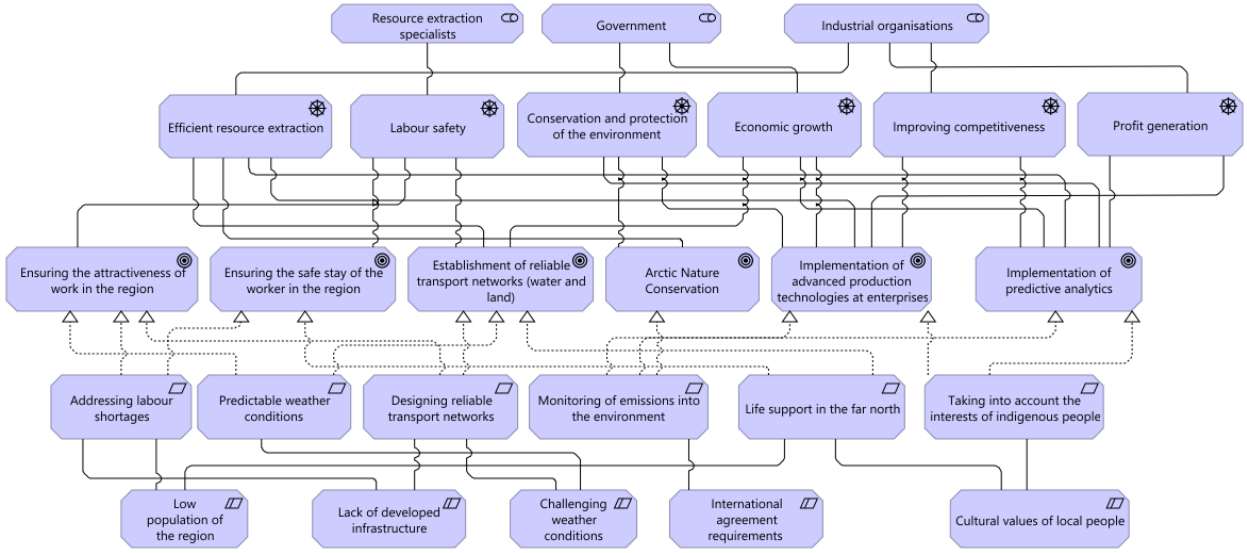


Fig. 4. Motivational extension “Territories of mineral resource extraction”.

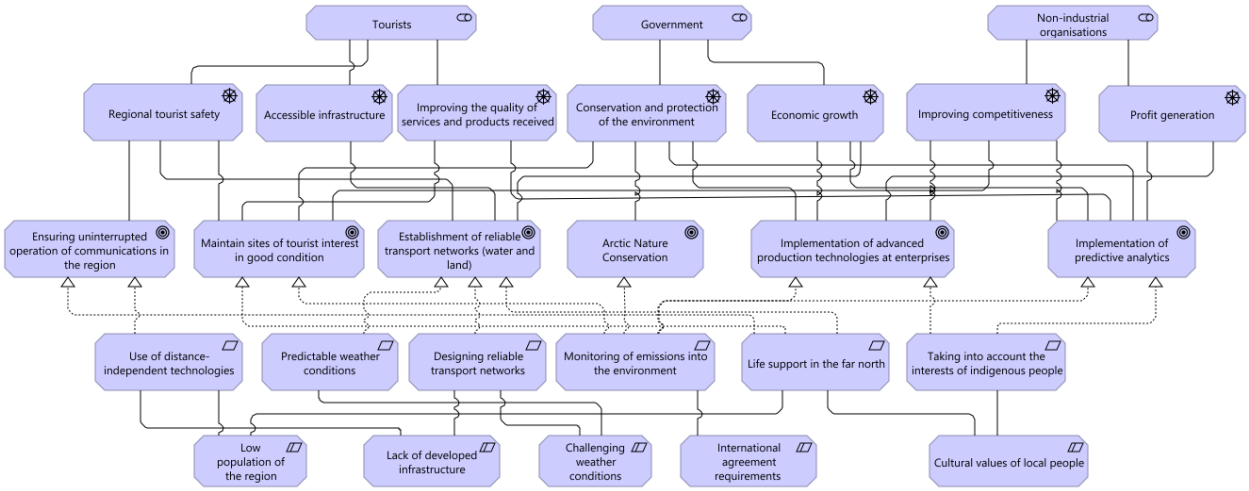


Fig. 5. Motivational extension “Territories of recreational focus”.

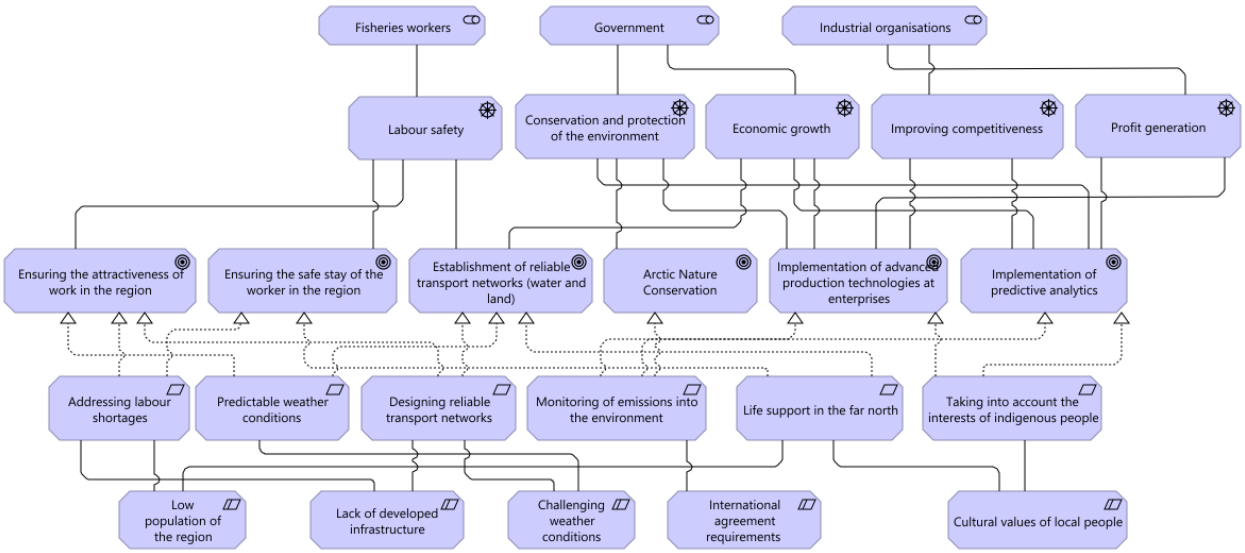


Fig. 6. Motivational extension “Territories allocated for fishing purposes”.

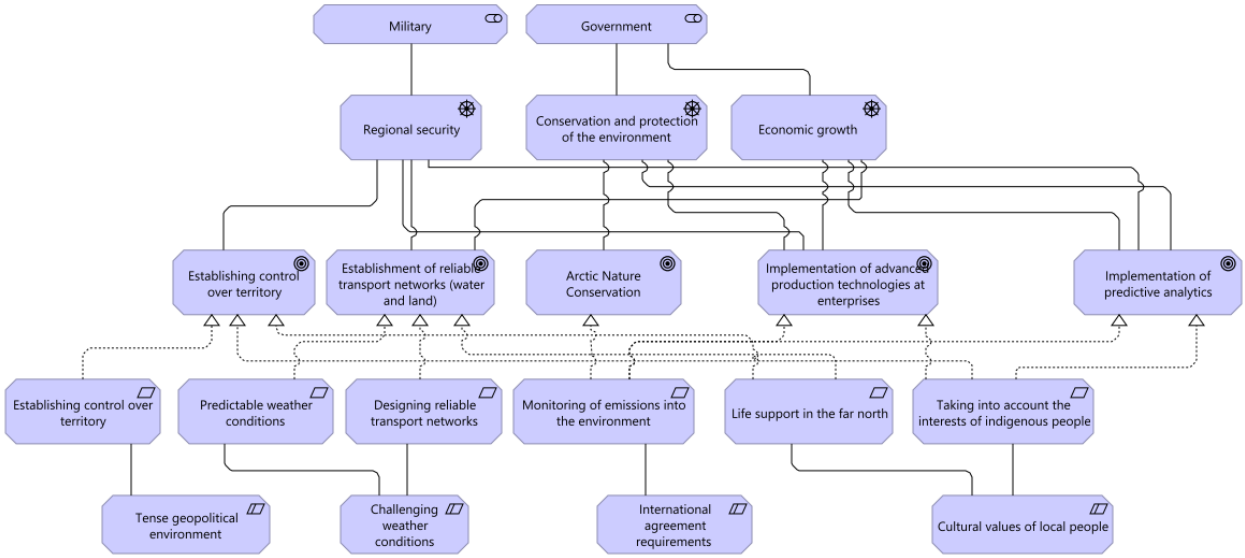


Fig. 7. Motivational extension “Infrastructure for the protection of safe existence”.

Analyzing the obtained models, one can notice an objective similarity of the motivational expansions of the subspaces under consideration. This similarity can be explained by a number of reasons. The most obvious of them is the climatic conditions. The Arctic is a region with undeniably harsh natural conditions that impose their own imprint on any sphere of activity in the region. Each of the subspaces under consideration is identified as part of the Russian Arctic and, accordingly, this subspace should develop and exist in the extreme conditions of the Far North, which should be reflected in each model of motivational expansion.

Another common limitation, the existence of which should also be taken into account when building a development strategy for each of the Arctic subspaces, is the strong emphasis on intergovernmental agreements and Russian regulatory legal acts in the field of preserving the Arctic nature, minimizing human impact on it and counteracting climate change. In modern realities, all socially responsible governments understand and take into account the “green” agenda, build plans for the development of their regions taking into account environmental protection.

These models have also in common the need to take into account the interests of the local and indigenous population of the Arctic region, as well as the fact that the state is directly interested in the development of each of the seven subspaces.

At the same time, the models have a number of notable differences. The first and most important difference of these motivational expansions for the identified seven subspaces is the stakeholders. It is logical that their composition will change from subspace to subspace, since, for example, manufacturing enterprises will be less interested in the development and maintenance of tourist infrastructure facilities in good condition. Similarly, foreign partners do not have a commercial or any other direct interest in the pace of development of social services for the local population of the Russian Arctic.

In addition, some goals and drivers for different subspaces are of equal importance, for example: preservation and protection of the environment and preservation of the Arctic nature, economic growth, implementation of predictive analytics, and application of advanced production technologies in enterprises.

Based on the obtained models of motivational expansions for the seven subspaces of the Russian Arctic and the compiled list of digital technologies applicable in the development of Arctic territories, the following requirements for digital technologies that can simplify human exploration and stay in the Arctic region and work in the harsh conditions of the Far North can be formulated:

1. Remote provision of social services (telemedicine technologies, 5G). These technologies will ensure the satisfaction of the population's need for medical care and will make staying in the Arctic region safer for people.

2. Real-time data collection (IoT and IIoT, M2M). Providing real-time data, it is possible to form a reliable pool of information on the current state of infrastructure and technical systems in operation, as well as information on weather conditions.

3. Data analytics with visualization and forecasting capabilities (Big Data, AI, BI, cloud computing). Having reliable data obtained using technologies from paragraph 2, this technology will facilitate the implementation of data-driven management, which will ensure rational decision-making when ensuring the functioning of subspaces.

4. Efficient resource extraction without environmental impact (robotisation of production, digital twins, cyber-physical systems (CPS)). With the help of these digital technologies, it will be possible to model the structure of boreholes in oil and gas bearing regions, which will make the process of hydrocarbon extraction more predictable and safe.

5. Security (blockchain). In the development of the Russian Arctic, security (of living, working, and the region as a whole) plays a rather important role. Undoubtedly, it is very important to ensure not only physical security, but also information security (prevention of data leaks, data falsification, etc.).

Conclusion

The programs for the exploration and development of the Russian Arctic have always been a high priority for the Russian Federation. The Arctic is an incredibly rich and at the same time difficult to develop region. The current stage of development of digital and data technologies can contribute to combating the challenges of this region: what is beyond human capabilities can be achieved by remote data exchange technologies, remote control, and efficient analysis and forecasting technologies.

In the course of this study, the theory of dividing the Russian Arctic into target subspaces was used to structure the task of determining the requirements for digital technologies that can simplify human development of the Arctic. The generated models of motivational expansions for each Arctic subspace made it possible to clearly demonstrate the chain from the specifics of the subspace to its needs for digital services. After analyzing the individual requirements of the subspaces, the commonality of these requirements was formulated. It is important to consider the subspaces of the region and the digital infrastructure created for them as a whole. In case of uneven development, technologically less developed subspaces will not be able to interact effectively with technologically more advanced subspaces, and therefore the desired synergistic effect will not be observed.

The following general business requirements for digital technologies in demand in the development of the Arctic were identified:

- ability to provide social services to the local population and tourists remotely;
- collection and transmission of data in real time from subspace objects;
- data analytics with the ability to visualize and forecast;
- ability to control machines and units remotely;
- effective geo-navigation and meteorological systems.

Satisfaction of each of the formulated consolidated requirements implies the development of digital complexes that include a wide range of digital and data technologies. The conducted research to identify requirements is the basis for further work, including the following steps:

- determining the current state of satisfaction of subspaces in digital services;
- designing digital complexes that meet the general and individual requirements of Arctic subspaces;
- determining the gap between the current and target states;
- forming a set of stable and effective intermediate plateaus when moving towards the target state;
- developing a roadmap for the development of digital infrastructure in the Arctic zone of the Russian Federation, detailed in the form of a plan of specific project programs.

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Effectiveness of State Mechanisms for Supporting Small and Medium-Sized Enterprises in the Arctic (On the Example of the Komi Republic)

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Abstract. The development and exploration of the Arctic territories of Russia is important in the current conditions. The purpose of the study is to analyze the effectiveness of state mechanisms for supporting small and medium-sized enterprises (SMEs) in the Arctic conditions (on the example of the Arctic territories of the Komi Republic). On the basis of the results of the study, proposals to improve the effectiveness of these mechanisms for the survival of SMEs in the Arctic conditions have been developed. To improve the competitiveness and investment attractiveness of SMEs in the Arctic, the authors suggest developing a set of measures to strengthen the interaction between the state and business, primarily in the social, environmental and scientific and technological spheres within the framework of the public-private partnership (PPP) mechanism. To ensure the innovative development of SMEs in the Arctic, it was recommended to develop the "Arctic Venture" model as a high-tech tool for innovative development within the existing Russian venture capital industry. The importance of creating project-oriented business structures that conduct strategic analyses on an ongoing basis, study the impact of the external environment on business, identify existing development problems and develop projects to solve existing problems was noted. It was also proposed to elaborate tools for the development of corporate governance system in small and medium-sized enterprises in order to ensure their competitiveness and investment attractiveness.
Keywords: *Arctic, state support mechanisms, small and medium-sized enterprises, project management, corporate governance*

Introduction

In the current conditions of high strategic risks, there is an objective need to increase the effectiveness of state mechanisms for SMEs support, to develop the potential of the Arctic, to intensify the development of small and medium-sized businesses in order to reduce the outflow of population and to address the issues of ensuring national and economic security of the country.

Small and medium-sized enterprises in the Arctic are developing under a variety of social and natural constraints. Issues of Arctic urbanization, in contrast to the phenomena of viability and sustainability of cities in the temperate zone, require the development of new concepts and directions of state policy [1, Pilyasov A., Molodtsova V., pp. 99–127].

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Natural constraints have both negative and positive impacts on the regional economy [2, Tol R.S.J., pp. 29–51], including in the field of energy [3, M. de Witt, H. Stefansson, A. Valfells et al., pp. 144–156]. However, SMEs have already made a significant contribution to the creation of new jobs and increased the dynamism, flexibility and innovativeness of the Russian Arctic economy.

There is a lack of effective tools to ensure the survival and development of SMEs in the Arctic conditions, the use of the Arctic potential for the growth of gross domestic product and ensuring economic security in general.

The presence of competitive enterprises in the Arctic requires both reasonable protectionist support measures from the state and the provision of Arctic SMEs with opportunities to establish partnerships with large enterprises and integrate into their sphere of activity. A consistent state policy is needed to ensure effective interaction and mutual benefit between large and small enterprises in the Arctic.

At the present stage, the socio-economic development of the country is carried out by deepening regional disparities in the standard of living of the population and socio-economic development of individual subjects of the Russian Federation, which negatively affects the formation and development of SMEs, including in the Arctic [4, Dmitrieva T., Buriy O., p. 86–99].

At the same time, the given development vector is interdependent with the priority of the innovative socially-oriented scenario; in this regard, the urgent task is to provide special support to the entrepreneurial ecosystem. SMEs are recognized as determinants of economic growth and social stability in general.

In order to analyze the objective necessity of SMEs development in the Arctic, we will cite the opinion of the President of the Russian Federation V.V. Putin, who noted that since large-scale investment projects are being actively developed in the Russian Arctic, the key task, along with large industrial, energy and other projects, is to lay the foundations for the development of the service economy in cities, to form the basis for strong small and medium-sized businesses in order to solve the problems that arose in the past and have not yet been comprehensively resolved, the problems of single-industry towns [1].

Due to significant strategic risks of doing business and external challenges, in order to ensure the survival of SMEs in the Arctic, one of the central components of the ecosystem is the mechanism of state regulation (state support). In other words, state control is a key component of the entrepreneurial ecosystem in the Arctic.

The growing importance of natural monopolies and the state does not reduce the role of SMEs. The state is aware of the significant role of entrepreneurship in the formation of the budget through tax payments; along with the jobs created by business, it plays an essential role in the stable development of the economy. These facts make it possible to conclude that ensuring acceptable conditions for doing business is in the focus of state interests. It is important to secure

[1] Putin V.V. Message of the President to the Federal Assembly. URL: http://kremlin.ru/events/president/news/56957/ (accessed 25 February 2024).

the growth of the share of small and medium-sized businesses in the country's gross domestic product.

In China, one of the fastest growing economies in the world and the second largest in terms of GDP, SMEs account for 60% of the economy, 79% of jobs are created exclusively by SMEs, and the tax share of SMEs in the national budget exceeds [2].

In 2018, in his speech on the state of affairs in the country and the main directions of domestic and foreign policy, the President of the Russian Federation noted the importance of developing small and medium-sized enterprises as a major reserve for economic growth [3]. According to the President, by 2024, the contribution of SMEs to GDP will approach 40%, and the number of jobs created at these enterprises will amount to 19–25 million.

However, today even in the regulatory documents on the development of small and medium-sized businesses there is no key indicator — the share of SMEs in the gross domestic product. An increase in the number of people employed in small and medium-sized enterprises is accepted as a significant indicator. In accordance with the theory of expanded reproduction, it remains unclear why and how it is possible to increase the number of employees of enterprises, if there is no growth in the output of the final product. Therefore, it is objectively necessary to accept the increase in the share of small and medium-sized businesses in the country's GDP as a key indicator of SMEs development at the state level, which will lead to real activation and increased responsibility of institutions for the development of entrepreneurship, including government agencies, and will make the prospects and final results of the SMEs development clear and transparent.

Literature review and research materials

Currently, there is a need to continue research on entrepreneurial and Arctic topics using scientific tools, identifying patterns with the help of modern information technologies in the field of modelling economic processes and building entrepreneurial ecosystems in the Arctic.

A number of regulatory documents on the development of the Arctic have been adopted in Russia. The most important of them are: The Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035 [4], The Main Directions of the State Policy of the Russian Federation in the Arctic until 2035 [5].

[2] Kizimov V. Report of the Commissioner for the protection of entrepreneurs' rights under the President of the Russian Federation "Register of Systemic Problems of Russian Business — 2022". URL: https://journal.open-broker.ru/economy/malyj-biznes-i-ego-rol-v-ekonomike-rossii/ (accessed 25 February 2024).
[3] Putin V.V. Message of the President to the Federal Assembly. URL: http://kremlin.ru/events/president/news/56957/ (accessed 25 February 2024).
[4] Decree of the President of the Russian Federation "On the Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035" dated October 26, 2020, No. 645. URL: https://www.consultant.ru/document/cons_doc_LAW_366065/f816e270336e0e2d9c1e07a4faf1fd0241a911b4/ (accessed 05 April 2024).
[5] Decree of the President of the Russian Federation "On the Fundamentals of the State Policy of the Russian Federation in the Arctic for the Period until 2035" dated 05 March 2020, No. 164. URL: https://www.consultant.ru/document/cons_doc_LAW_347129/ (accessed 05 April 2024).

The State program for the Socio-Economic Development of the Arctic Zone of the Russian Federation [6] assumes intensification of the development of the Arctic territories of Russia by creating new jobs with extra-budgetary investments and increasing international recognition through the organization of international events. The priorities and goals of state policy in the field of implementing the State Plan are related to the development of the socio-economic potential of the Arctic zone of the Russian Federation and improving the quality of life of its residents.

Taking into account the importance of the role of the state in the development of entrepreneurship in the Arctic, the basic Federal Law "On State Support of Entrepreneurial Activity in the Arctic of the Russian Federation" was adopted, which defines the legal system of the Arctic, the methods of state support and the procedure for implementing entrepreneurial activity [7].

It is important that the Government of the Russian Federation approved [8] a list of support settlements (municipalities) of the Arctic territories of the Russian Federation, including those performing the functions of ensuring national security and (or) bases for the development of mineral resource centers, economic facilities and (or) infrastructure in the Arctic zone of the Russian Federation.

Russian and foreign scientists are engaged in the issues of entrepreneurship development in the Arctic. Thus, A.N. Pilyasov made a significant contribution to the study and analysis of entrepreneurship in the Arctic [5]. He gives a definition of entrepreneurship in the Arctic, which includes, in addition to other categories inherent to entrepreneurship, the characteristics associated with the development of business in polar regions under certain restrictions caused by climatic and natural conditions. In his monograph [5], A.N. Pilyasov characterizes entrepreneurs in the sphere of business and services and nomadic entrepreneurs typical for the Arctic.

The specifics of SME development are described by such scientists as T.P. Skufina, E.A. Bazhutova and V.P. Samarina [6, pp. 51–68], who examine entrepreneurial activity in the regions of the Russian Arctic and compare it with the situation in Russia as a whole. They emphasize that the development of such entities as business and the state in the Arctic depends on regional features.

The peculiarities of entrepreneurship development in the Arctic are considered by such researchers as D.A. Vladimirskaya, M.V. Kutepova and V.A. Plotnikov [7, pp. 16–23]. They note that entrepreneurship in the Arctic macro-region has a number of important differences that should be taken into account in its regulation. The methodological basis for regulating entrepreneurship in the Arctic zone of the Russian Federation should be a program-targeted approach [7, pp. 16–23].

Taking into account the social significance of entrepreneurship in the Arctic, the issue of distributing social functions between the state and enterprises becomes important [8, Ivanova

[6] RF Government Resolution "On approval of the state program of the Russian Federation "Socio-economic development of the Arctic zone of the Russian Federation" dated March 30, 2021, No. 484. URL: https://www.consultant.ru/document/cons_doc_LAW_381261/ (accessed 05 April 2024).
[7] Federal Law "On State Support for Entrepreneurial Activity in the Arctic Zone of the Russian Federation" dated July 13, 2020, No. 193-FZ. URL: https://consultant.ru (accessed 05 April 2024).
[8] Order of the Government of the Russian Federation dated November 28, 2023, No. 3377-r. URL: https://consultant.ru (accessed 05 April 2024).

M.V., Yakusheva U.E., pp. 56–69]. At the present stage, socially oriented non-profit organizations operating in the northern territories are becoming increasingly important [9, Novoselova I.Yu., Novoselov A.L., pp. 62–70]. Small and medium-sized enterprises are the main source of food for most Arctic regions and could help solve the problem of the food balance of the Arctic population. For example, A.V. Fedotovskikh considers small enterprises to be a driving force for the development of the Arctic [10, pp. 3–8]. The authors of this article fully share this position.

Of particular interest are the functional directions of the Arctic Institute of Entrepreneurship in various areas, including legal regulation [11, Zhura S.E., Ershova I.V., Goltsov V.B., pp. 78–84].

The results of studies of factors of entrepreneurship development in the Arctic region as a whole and in the Arctic zone of the Komi Republic are published in the monograph "Entrepreneurial Ecosystems: Problems and Opportunities" [12, Shikhverdiev A.P., Vishnyakov A.A., Chemashkin A.Yu. et al.]. One of the main conclusions of the study is that the state is the main driver of the entrepreneurial ecosystem in the Arctic, ensuring its effective regulation and support [13, Shikverdiev A.P., Vishnyakov A.A., Oganezova N.A. et al., pp. 34–58].

Study of the main factors of the effectiveness of government structures in supporting SMEs in the Arctic (on the example of the Komi Republic)

The Research Center of Corporate Law, Management and Venture Investment of the Pitirim Sorokin Syktyvkar State University conducted a study on the efficiency of Arctic entrepreneurship and building entrepreneurial ecosystems in 2022–2023. The study analyzed the mechanisms of state support for SMEs, public-private partnership development mechanisms, personnel and enterprise management, SME information support systems, financial support for SMEs, and opportunities for innovative SMEs development.

The study conducted by the authors revealed the following negative components of SMEs development in the Arctic (see Fig. 1).

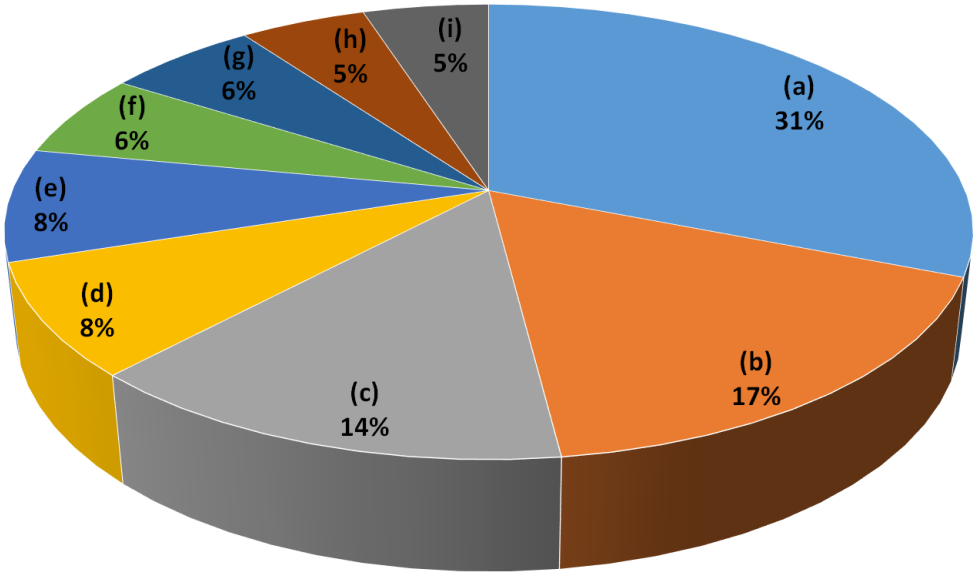

Fig. 1. Negative components of SMEs development in the Arctic: (a) — financial, (b) — high taxes, (c) — imperfect legislation, (d) — insufficient level of qualification of employees, (e) — technical and technological, (f) — ineffective management, (g) — remoteness, expensive logistics, (h) — informational, (i) — administrative barriers [9].

A significant number of study participants (31%) believe that one of the main problems of SME development is the financial component.

The development of SMEs is negatively affected by the problems of insufficient efficiency of the state regulation and support system for SMEs, in particular: taxation, legislative and administrative regulation (in total — 36% of participants).

Problems associated with the ineffective management system and low level of qualification of personnel, identified in total by 14% of participants, are also of great importance.

In this regard, there is an urgent need to improve the level of enterprise management and address the issue of increasing the professionalism of personnel. This requires risk management mechanisms, high-tech financial mechanisms, a large-scale securities market, project management methodology, organizational culture and a system of corporate and social responsibility, as well as an infrastructure for responding to changes in the external environment.

[9] Source: prepared by the authors.

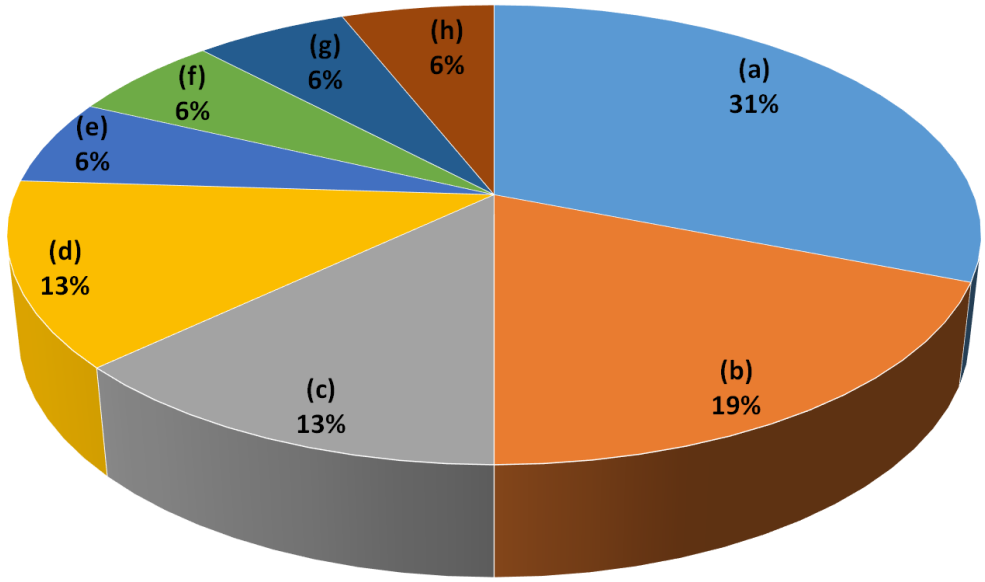

Fig. 2. Components of state support for SMEs in the Arctic (on the example of the Komi Republic): (a) — none, (b) — subsidies, (c) — leasing for the acquisition of machinery, equipment, and technologies, (d) — preferential lending, (e) — simplified taxation regimes, (f) — co-financing of activities to introduce new technologies and modernize production, (g) — financial, organizational, advisory, and information support for R&D, (h) — functioning within special economic zones [10].

The analysis shows that 31% of respondents do not use state support mechanisms at all, which is a cause for serious concern (see Fig. 2). There are two possible explanations for this. One of them is that these schemes are inefficient and therefore not widespread; the other is the lack of information about existing mechanisms and schemes from the state for small and medium-sized businesses. It is advisable to increase the efficiency of all institutions for the development of entrepreneurship in the system of state support for SMEs.

At the same time, popular schemes of state support for SMEs are subsidies (19%), preferential loans and leasing schemes (13% each).

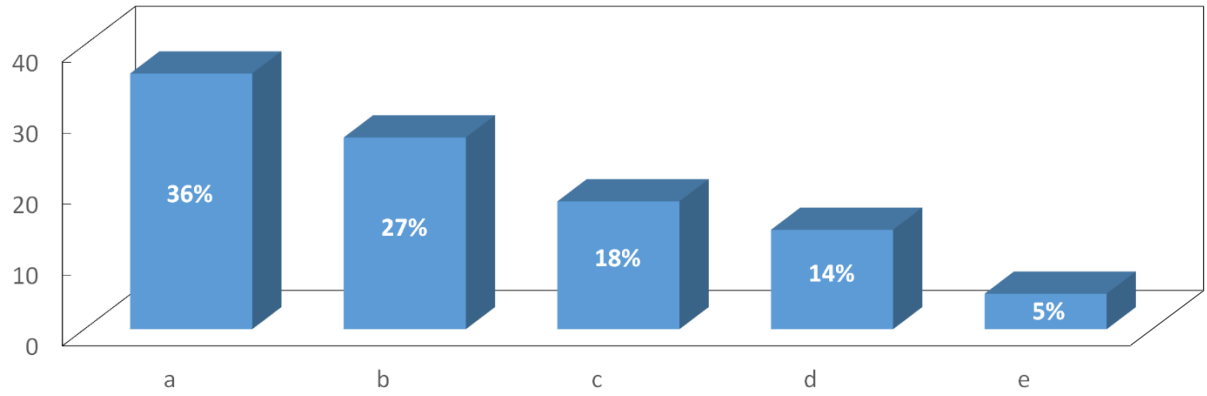

Fig. 3. Forms of interaction between enterprises and the government to improve the competitiveness of SMEs: (a) — information and legal consulting centers at regional and local government bodies, (b) — joint programs for retraining and advanced training of personnel, (c) — conferences, scientific and practical seminars, round tables, (d) — public-private partnerships, (e) — publication of reference, information and analytical materials [11].

[10] Source: prepared by the authors.
[11] Source: prepared by the authors.

The respondents named consulting and information and legal cooperation (36%), training and retraining of personnel familiar with the Arctic specifics (27%) as the most convenient forms of interaction between business and government (see Fig. 3), which indicates the need to provide information and personnel support to SMEs. This suggests a need to improve the effectiveness of business development agencies and chambers of commerce and industry. It should also be noted that some respondents pointed to the insufficient development of such institutions as partnership between the state and business.

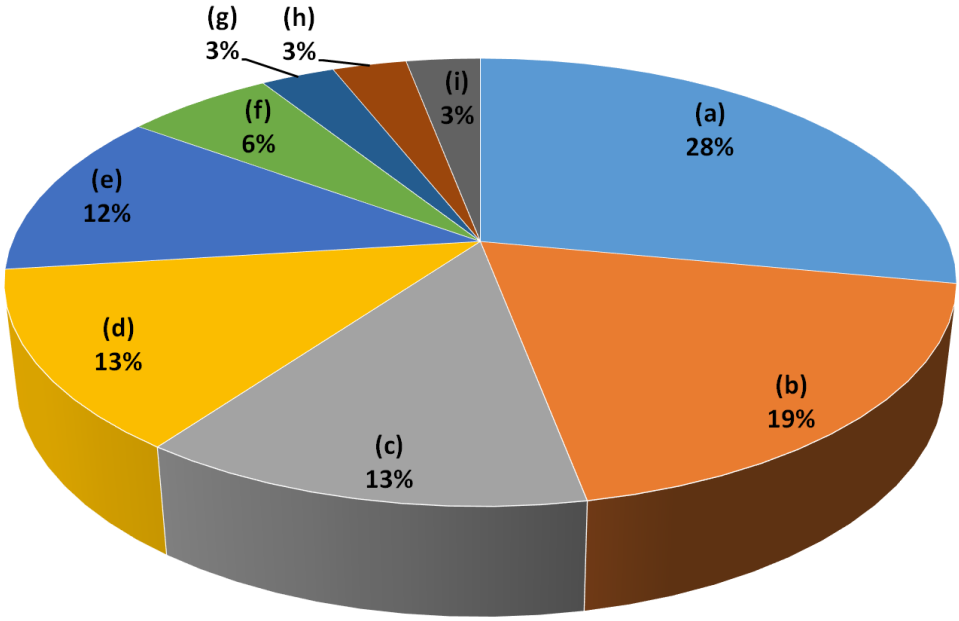

Fig. 4. External negative factors affecting the development of SMEs: (a) — high cost of loans, (b) — constantly changing "rules of the game" and poor information from the authorities, (c) — insufficient level of qualification of personnel in the labor market, (d) — high taxes, (e) — limited access to other sources of financing, (f) — other, (g) — annual increase in prices for sold products (imported), (h) — decrease in purchasing power of the population over several years, (i) — expensive rent [12].

More than 50% of negative external factors (see Fig. 4) hindering the development of enterprises are: high cost of loans (28%), high taxes (13%) and lack of alternative sources of financing (12%). This shows the need for serious changes in the sphere of financial support for Arctic entrepreneurship.

Frequently changing legislation and insufficient level of information transparency (19%), insufficient level of quality of labor force in the market (13%), weak connections between educational institutions and business structures, absence of effective alternative instruments of business financing and shortage of project-oriented SMEs impede development of entrepreneurship. These are very important external factors.

[12] Source: prepared by the authors.

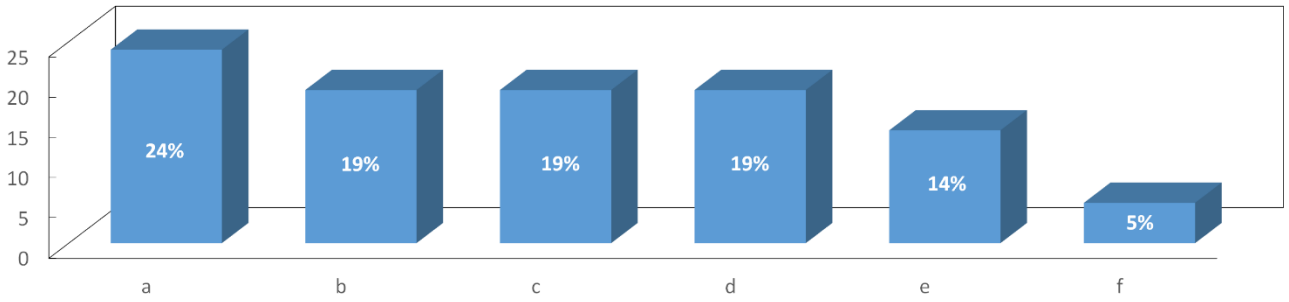

Fig. 5. Internal negative factors influencing the development of SMEs: (a) — other, (b) — insufficient level of modernization and greening of production, (c) — insufficient qualification of personnel, (d) — incomplete information about the situation in priority markets, (e) — absence of own innovative developments, (f) — ineffective interaction with authorities [13].

The participants identified the following as negative components of SMEs competitiveness: lack of information about the state of the external and internal market (19%), unpreparedness of personnel for environmental requirements in the Arctic, as well as a lack of knowledge about the specifics of enterprise management in the harsh Arctic climate (19%), and the absence of innovative activities (14%) (see Fig. 5). In this regard, chambers of commerce and industry and business development agencies should improve their work on the timely and complete provision of information, educational institutions and chambers of commerce and industry should strengthen their work on training personnel specifically for work in the Arctic and improve the implementation of innovative development programs at the national level to generate innovative developments.

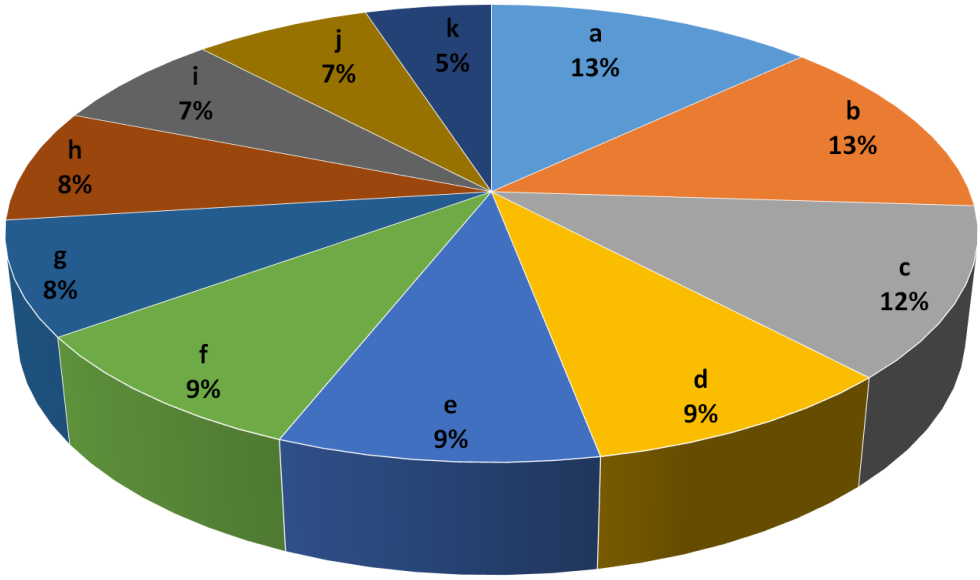

Fig. 6. The most popular instruments for SMEs development in the Arctic territories of the Komi Republic: (a) — preferential loans, (b) — regional tax incentives, (c) — subsidies, (d) — property support, (e) — grants, (f) — information support, (g) — educational programs (retraining, advanced training), (h) — assistance in placing government orders, (i) — consulting support, (j) — provision of guarantees for lending, (k) — activities of small business support funds [14].

Effective financial instruments for SMEs development in the Arctic are considered the most important by 50% of respondents. These include loans that do not require repayment, tax incen-

[13] Source: prepared by the authors.
[14] Source: prepared by the authors.

tives, budget transfers and significant grants for the creation and development of entrepreneurship.

Problems in this area require special state mechanisms for solution. An important role here is played by the creation of alternative instruments for SME financing, for example, through the establishment and development of an effective stock market by the state.

Conclusion

As a result of the conducted research, we have identified the following problems:

1. Low level of competitiveness and investment attractiveness of SMEs in the Arctic.

2. Lack of alternative and accessible financial sources as an important part of the mechanism for activating SMEs in the Arctic. It is objectively necessary to create an infrastructure of long-term investments for the development of entrepreneurship in the Arctic.

3. Lack of specialized financial resources for the innovative development of SMEs in the Arctic.

4. Risk that the relationship between Arctic residents and indigenous peoples are not fully regulated by law.

5. Difficulty in maintaining and preserving the existing business environment (non-resident business structures) as a source of development in the Arctic due to the insufficiency of legislatively established benefits for SMEs in the Arctic.

6. Lack of a clear and targeted system of quantitative and qualitative parameters of the economic state of the Arctic of the Russian Federation, which threatens regional and national economic security.

7. Insufficiently high level of corporate governance in small and medium-sized businesses.

8. Low level of information transparency of small and medium-sized businesses.

9. Insufficiently high level of professionalism of both managers and employees of small and medium-sized businesses.

Recommendations for eliminating the identified problems:

1. In order to increase the competitiveness and investment attractiveness of SMEs in the Arctic, it is required to develop a set of measures to strengthen the interaction between the state and business, primarily in the social, environmental, scientific and technological spheres within the framework of public-private partnership (PPP).

2. For the survival and development of SMEs in the Arctic, it is necessary to develop the stock market as a means of financing SMEs in the Arctic in order to facilitate the creation of an ecosystem of public-private partnerships and the transition from savings to investment.

3. It is necessary to develop incentives to ensure innovative development of SMEs in the Arctic. It is important to create opportunities for the development of SMEs through venture investments within the framework of the innovative scenario in the Arctic.

It is proposed to develop the Arctic Venture model as a high-tech tool for innovative development within the existing Russian venture industry. It is important to stimulate development institutions and the Russian venture industry to develop the Arctic.

4. It is necessary to adopt a legislative act regulating issues of responsibility in relations between Arctic residents and indigenous peoples. The existing Liability Standard adopted by the Ministry of the Russian Federation for the Development of the Far East and the Arctic (Order No. 181 of November 23, 2020) is advisory in nature.

5. It is recommended to extend the benefits provided for Arctic residents in accordance with the federal law "On State Support for Entrepreneurial Activity in the Arctic of the Russian Federation" to all small and medium-sized businesses operating in the Arctic.

6. It is important to correlate the development of Arctic entrepreneurship with the issue of ensuring economic security in all key parameters, defining threshold values for threats to economic security and thus increasing the efficiency of economic decisions.

7. It is essential to ensure the interest of large enterprises in using the capabilities of SMEs. For these purposes, it is necessary to develop a set of measures to stimulate mutually beneficial cooperation between large enterprises and SMEs, the involvement of SMEs in the activities of large enterprises and models of such interaction.

8. It is important to create project-oriented business structures that conduct strategic analysis on an ongoing basis, analyze the impact of the external environment on business, identify existing development problems and develop projects to solve existing problems. In such business structures, the processes of accumulation, expansion and reproduction of capital, improving the quality and quantity of goods and services are more efficient, this is important in the Arctic conditions to ensure the sustainable development of the entrepreneurial spirit.

9. It is necessary to elaborate tools for the development of corporate governance system at small and medium-sized enterprises in order to ensure competitiveness and investment attractiveness. The main components of the required corporate governance system adapted for small and medium-sized enterprises are: information transparency of enterprise activities; efficiency and independence of the enterprise's supervisory body (board of directors); availability of effective tools for preventing conflicts of interest; compliance with corporate procedures and a high level of corporate culture; trust in managers; efficiency of the internal control and risk management system; transparency of the company's ownership structure; minimization and regulation of compliance risks and ensuring control over large and interested transactions; effective management and leadership of managers.

10. It is necessary to stimulate small and medium-sized enterprises to ensure a high level of information transparency, implemented through the enterprise's information policy. This requires implementing a set of principles and tools that the enterprise is guided by to ensure information transparency of its activities. In order to achieve the goal of an effective information policy for

small and medium-sized enterprises, it is especially important to provide the company's stakeholders with information on the structure and volume necessary for making effective decisions.

11. Taking into account the importance of human resources, especially in the Arctic, it is necessary to train management personnel to work in these specific conditions according to a special program. Managers in small and medium-sized businesses should be managerial leaders who possess the following essential qualities: the ability to quickly and correctly respond to changes in the external and internal environment; the ability to adapt to changes in the external environment in order to implement the company's strategy; the ability to consider everything that happens as a system and be able to conduct a system analysis; the ability to prevent and regulate corporate conflicts; the ability to strategic planning; the use of modern methods of financial management; the ability to create an effective system of internal control and risk management.

Conclusion:

In order to ensure sustainable development and economic stability in the Arctic, it is necessary to create conditions for the development of small and medium businesses. For this purpose, it is important to ensure the development of all components of the entrepreneurship ecosystem, and even more importantly, to do this on the basis of a systemic approach (interconnection and interdependence of all components of the ecosystem).

Our research has demonstrated that the quality of almost all factors of the entrepreneurial ecosystem in the Arctic depends on the effectiveness of government regulation. This includes such components as the PPP system, the internal control and risk management system, the stock market, the introduction of project management methodology, the financing and incentive system, security guarantees for enterprises so that small and medium businesses do not "freeze" in Arctic conditions.

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Participation of India in the Arctic Council

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Abstract. The purpose of the article is to examine India's participation in the work of the Arctic Council by analyzing three criteria: the number of delegates sent by India to the meetings of the Arctic Council's Senior Arctic Officials; the number of projects in which India participates as part of the Council's working groups; the content of these projects and their distribution among the Council's groups. The lists of participants in the meetings of the Senior Arctic Officials and the reports India provided to the Arctic Council were studied to identify the indicators. A systematic approach was used as a methodological basis; methods included analysis of documents, comparative analysis, generalization and synthesis. The following conclusions were made on the basis of the results of studying the documents: the composition of India's delegation to the meetings of Senior Officials is represented by a smaller number of participants compared to the delegations of other Asian observer countries of the Council, which indicates that India's environmental policy in the Arctic is not fully formed. Compared to the period 2017–2019, there was a sharp increase in the number of projects in which India participates as part of its activities in the Arctic Council in 2019–2021, which is associated with its re-election as an observer, as well as with internal institutional changes in the country. India shows the greatest interest in the projects of the AMAP, CAFF and PAME working groups, which correlates with the national document published in 2013 and the international commitments made. India is participating in ACAP and SDWG due to its climate and energy policies. India does not participate in EPPR projects. India has not yet fully exploited its potential in the work of the Arctic Council. The practical significance of the work lies in the possibility of using its findings to further build a dialogue with India; its conclusions can form the basis of future scientific research.
Keywords: *Arctic, Arctic policy, Arctic Council, working groups, observer country, climate change*

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Introduction

Since the end of the 20th century, the Arctic has become an object of attention not only for the Arctic states, but also for non-Arctic players. This region has attracted interest from Asian coun-

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tries such as China, India, South Korea, Japan, Singapore, as well as European countries: Germany, Italy and others, including the European Union.

The main subjects of interest were minerals found both on the Arctic mainland and on its continental shelf, and the transport of goods through the Northern Sea Route and the Northwest Passage. In general, the following groups of interests of all states without exception can be distinguished: economic, geopolitical, scientific and environmental.

India is a leading country in many respects. In terms of population, India overtook China in spring 2023. The country ranks 3rd in the world in terms of energy consumption. In terms of carbon dioxide emissions, India is among the top three, along with China and the United States. In 2016, the country joined the Paris Climate Agreement. To fulfill its international commitment, India must switch from using coal to more environmentally friendly sources of energy. So, India has significant weight in the international arena. Its actions can affect the balance of power in the world and lead to certain consequences. Therefore, this article examines India's activities in solving environmental problems in the Arctic region through its participation in the Arctic Council.

In 2022, India published a strategic document "India's Arctic Policy — Building a Partnership for Sustainable Development" (hereinafter referred to as the Arctic Policy). New Delhi identified 4 national interests in it: scientific, environmental, economic and strategic, with scientific and environmental interests being prioritized by the authorities. The Arctic Policy also identifies 6 areas of activity in the region, including: science and research, climate change and environmental protection [1], which are related to research on the atmosphere and ocean, ice, marine ecosystems, biodiversity, geological, geophysical, geoengineering, environmental and biological works [2].

The Arctic is the climate-forming region of the planet, it is home to endemic animals and flora species listed in the Red Book. The Arctic ecosystem is unique.

In recent decades, climate scientists have been talking about climate change, which is occurring most rapidly in the Arctic. Due to the increase in air and water temperatures, permafrost is melting, the area of sea ice is decreasing, the number of dangerous hydrometeorological phenomena is increasing [1, Sun S., p. 351].

The consequences of such changes may have a dual nature. On the one hand, it is predicted that by the middle of the 21st century, the seas of the Arctic Ocean will be completely ice-free in summer, which means that unimpeded passage of vessels along the Northern Sea Route will be possible. In addition, access to mineral resources located on the continental shelf will be facilitated. All countries interested in the development of the Arctic see the benefit in this. On the other hand, due to melting ice and rising water temperatures, the waters of the world ocean will expand, which means that the coastal territories of many countries will be under the threat of flooding [1, Sun S., p. 351].

[1] India, Ministry of Earth Sciences. India's Arctic Policy: Building a partnership for sustainable development, March 17, 2022. URL: https://www.moes.gov.in/sites/default/files/2022-03/compressed-SINGLE-PAGE-ENGLISH.pdf (accessed 16 April 2024).
[2] Ibid.

India, increasing its activity in the Arctic, determines its presence in the region precisely by studying the impact of the consequences of climate change occurring in the Arctic on the economic and social spheres of Indian society. Firstly, the melting of Arctic ice raises the level of the world ocean and threatens to flood the coastal Indian territories with a population of over 100 million people [2, Raikov Yu.A., p. 26]. In addition, studies show that the increase in the intensity of transportation along the Northern Sea Route also leads to an acceleration of the melting of sea ice in the ocean [1, Sun S., p. 351]. Secondly, some scientists suggest that there is a connection between the melting of sea ice and the Indian monsoons. Thus, during the monsoons, India receives more than 70% of its annual rainfall. Indian agriculture, which is the main source of livelihood for approximately 58% of the country's population and provides about 20% of its GDP, directly depends on the monsoons [3]. If their system changes, strengthens or, conversely, weakens, both the India's economy and the social sphere of society may suffer, and the country's food security will be threatened [3, Zaikov K.S., Bhagwat D.V., p. 272]. Thirdly, scientific research on climate change draws attention to the link between the Arctic and the Himalayas. Although these two regions are geographically distant from each other, they are interconnected and have similar problems. Studying the causes of Arctic sea ice melting will help the scientific community better understand the glacial melting processes in the Himalayas, often referred to as the "third pole" and containing the largest reserves of fresh water after the North and South Poles. They are also the source of India's major rivers, including the Ganges and Brahmaputra, whose basins are home to about 600 million and 177 million people [4].

The Arctic Council (hereinafter referred to as the AC) is a regional organization whose activities are aimed at addressing issues related to sustainable development and environmental protection in the Arctic [4, Voronchikhina D.N., p. 306]. The work of this institution is implemented within the framework of activities of 6 working groups: on the elimination of pollution in the Arctic (hereinafter referred to as ACAP), on the implementation of the Arctic Monitoring and Assessment Program (hereinafter referred to as AMAP), on the conservation of Arctic flora and fauna (hereinafter referred to as CAFF), on the prevention, preparedness and response to emergency situations (hereinafter referred to as EPPR), on the protection of the Arctic marine environment (hereinafter referred to as PAME) and on the sustainable development (hereinafter referred to as SDWG) [4, Voronchikhina D.N.; 5, Voronchikhina D.N.].

In 2013, India acquired observer status in this organization. Since the Arctic Council is authorized to implement various projects aimed at solving environmental problems of the region, and India is involved in its work, it seems relevant to consider India's participation in the activities of this organization and thus determine the country's role in solving environmental problems of the Arctic.

[3] Bisen A. MP-IDSA Issue Brief — India's Arctic Policy: Building a partnership for sustainable development, March 17, 2022. URL: https://idsa.in/issuebrief/india-arctic-policy-abisen-170322 (accessed 16 April 2024).
[4] Ibid.

The *purpose* of the study is to examine India's participation in the work of the Arctic Council by identifying and studying three indicators: the number of delegates sent by India to the meetings of the Senior Arctic Officials, the number of environmental projects in which India participates as part of the Council's working groups, as well as the names and content of these projects and their distribution among the working groups of the Arctic Council.

The issue of India's participation in the Arctic Council remains not fully studied. Thus, Zhuravel V.P. [6, pp. 194–200] considered the interaction of Asian countries with the Arctic Council. Salygin V.I., Khubaeva A.O. [7, pp. 1216–1226], Tuinova S.S., Baxter K. [8, pp. 189–200], and Grigoriev N.A. [9, pp. 121–133] touched upon the issue of India's role in the Arctic Council in their works. Among foreign scientists engaged in the study of this issue, it is worth highlighting Singh M.[5], Agarwala N.[6], Sinha U. [10, pp. 113–126]. Hua J. [11, pp. 156–171] analyzed India's activities in the work of this regional institution.

A system approach was used as a *methodological basis*, as well as scientific methods such as document analysis and comparative analysis. Thus, the reports of India, which it sent to the Arctic Council as an observer, as well as the lists of participants in the meetings of the Senior Arctic Officials, are analyzed. The number of delegates sent to the meetings by India and other observer countries is compared. General scientific methods such as generalization and synthesis were also used.

The *relevance* of the study within the framework of this article is that the presented materials complement and develop theoretical and practical knowledge on the issue of India's participation in the work of the Arctic Council.

The *practical significance* of the study is that the presented materials are supposed to be used when reading courses in higher educational institutions; the results can also be used by Russian political actors for further building a dialogue with the Indian government.

Research results

In order to determine India's role in the work of the Arctic Council and the extent of its participation in the activities of this regional institution, the lists of participants in the meetings of the Senior Arctic Officials (hereinafter referred to as SAOs) were analyzed, starting from the meeting held on 22–23 October 2013 in Whitehorse, Canada, i.e. the first meeting after India received observer status, to the meeting held on 1–2 December 2021 in Salekhard, Russia. After this meeting, the documents adopted during the chairmanship of Russia (2021–2023), and subsequently Norway, are not available on the official website of the Arctic Council. Since the start of the special military operation in Ukraine, the AC member states have suspended interaction with the Russian Federation, and in general, after the transfer of

[5] Singh M. India in the Arctic: Legal Framework and Sustainable Approach. The Arctic Institute. 2024. URL: https://www.thearcticinstitute.org/india-arctic-legal-framework-sustainable-approach/ (accessed 16 April 2024).

[6] Agarwala N. India and the Arctic: Evolving Engagements. Research Gate. 2022. URL: https://www.researchgate.net/publication/369176607_India_and_the_Arctic_Evolving_Engagements (accessed 16 April 2024).

chairmanship from Russia to Norway in May 2023, the activities of this organization have not resumed in their previous form. In February 2024, Moscow announced the suspension of annual payments to the Arctic Council [7]. The consequences of such a decision by Russia will negatively affect the entire work of this regional organization, since Russia makes a significant financial contribution to the work of the AC and its working groups [5, Voronchikhina D.N.]. In addition, the reports of India submitted to the Arctic Council by the observer country were studied. There are only three reports from India on the AC website: for 2017, 2019 and 2021.

On the basis of the analyzed documents, three criteria were identified by which one can assess the degree of India's participation in the work of this organization: the number of delegates sent by India to participate in the meetings of the Senior Officials of the AC; the number of projects implemented within the framework of the work of a particular AC working group in which India participates; the name and content of environmental projects in the Arctic region in which India participates [5, Voronchikhina D.N., pp. 47–48], as well as their distribution among the working groups of the AC.

Number of delegates sent by India to participate in the meetings of the SAO AC

Table 1

Number of delegates sent by India to participate in the meetings of the SAO AC

No.	Place of meeting	Date of meeting	Number of delegates	Name of delegates
1	Whitehorse, Canada	22–23 October 2013	1	Verma Nirmal HoD
2	Yellowknife, Canada	26–27 March 2014	2	Verma Nirmal Kumar; Aisola Ravi Shankar
3	Yellowknife, Canada	22–23 October 2014	1	Arora Shammi India
4	Whitehorse, Canada	4–5 March 2015	No data	No data
5	Anchorage, USA	21–22 October 2015	2	Sandhu Taranjit Singh; Das Gourangalal
6	Fairbanks, USA	16–17 March 2016	1	Tarun Mohindra
7	Portland, Maine, USA	5–6 October 2016	0	-
8	Juneau, Alabama, USA	8–9 March 2017	1	Venkatesan Ashok
9	Oulu, Finland	25–26 October 2017	1	Milind Wakdikar
10	Levi, Finland	22–23 March 2018	1	Krishnan Kottekkatu Padinchati
11	Rovaniemi, Finland	30 October — 2 November 2018	1	Vani Rao
12	Ruka, Finland	13–14 March 2019	2	Vani Rao; Krishnan Kottekkatu Padinchati
13	Hveragerdi, Iceland	19–21 November 2019	No data	No data
14	online	17–19 November 2020	2	T. Armstrong Changsan; Vijay Kumar
15	online	16–18 March 2021	2	T. Armstrong Changsan; Krishnan Kottekkatu Padinchati
16	Salekhard, Russia	1–2 December 2021	2	Rahul Kumar Rakesh; Harveer Singh

[7] Russia suspends payment of annual dues to Arctic Council, 2024. URL: https://ria.ru/20240214/vyplata-1927224969.html (accessed 16 April 2024).

Based on the data presented in Table 1 [8], it can be concluded that a total of 16 meetings were held from autumn 2013 to December 2021. Delegates from India attended 13 of them. The list of participants is missing for two meetings: Whitehorse, Canada, March 4–5, 2015, and Hveragerdi, Iceland, November 19–21, 2019. No representatives from India attended the meeting held in autumn 2016 in Portland, USA. This circumstance can be associated with the situation that occurred in March 2016, when the Indian authorities refused visas to the US Commission on International Religious Freedom [9], which resulted in a slight cooling of relations between the countries. New Delhi sent 1 delegate to 6 of the 13 meetings, and 2 representatives to 7 ones. That is, India is represented in the Arctic Council by a delegation consisting of 1–2 people.

In May 2013, along with India, such countries as China, Japan, the Republic of Korea, Singapore and Italy acquired observer status. In this regard, let us consider the average number of participants represented by the delegations of these countries.

Table 2

Number of delegates sent by China, Japan, the Republic of Korea, Singapore and Italy to participate in the SAO meetings

Dates of meetings	Number of delegates				
	China	Japan	the Republic of Korea	Singapore	Italy
22–23 October 2013	2	2	3	3	1
26–27 March 2014	2	2	2	2	1
22–23 October 2014	2	2	2	2	2
4–5 March 2015	No data	No data	No data	No data	No data
21–22 October 2015	2	2	2	2	0
16–17 March 2016	2	2	2	2	2
5–6 October 2016	2	2	2	2	1
8–9 March 2017	2	2	2	2	1
25–26 October 2017	2	2	2	2	1
22-23 March 2018	2	2	2	2	1
30 October — 2 November 2018	2	2	2	2	1
13–14 March 2019	2	1	2	2	1
19–21 November 2019	No data	No data	No data	No data	No data
17–19 November 2020	2	2	2	4	1
16–18 March 2021	2	2	2	3	1
1–2 December 2021	1	2	2	3	3

[8] Participant lists from the meetings held for 2013–2021. URL: https://arctic-council.org/ru/ (accessed 16 April 2024).
[9] India has refused to issue visas to the US government delegation. URL: https://ria.ru/20160304/1384165033.html (accessed 16 April 2024).

Table 2 [10] shows that the average number of delegates is 2 people. Since the meeting held in November 2020, there has been an increase in the number of participants from Singapore. This circumstance can be explained by the fact that the meetings of autumn 2020 – spring 2021 were held online due to the spread of the COVID-2019 viral infection in the world. Italy sends the minimum number of delegates — an average of 1 representative.

If we compare these indicators with those of India, it turns out that India sends, on average, fewer representatives than other Asian states that have achieved rapid growth in their economies, which may indicate that the Arctic policy in general and in the field of environmental protection in the Arctic is not fully formed. J. Hua came to similar conclusions in his study, writing: "India has not sent enough experts to the Arctic Council working groups since 2013, which has prevented it from influencing the creation of new rules. This is largely due to the minor role of the Arctic in India's foreign strategy, which is one of the reasons why the Arctic policy was not published until 2022." [11, Hua J., p. 166]. One cannot but agree with this position.

Number of environmental projects implemented within the framework of the Arctic Council working groups in which India participates

Table 3

Number of environmental projects implemented within the framework of the Arctic Council working groups in which India participates

Year	ACAP	AMAP	CAFF	EPPR	PAME	SDWG
2021–2023			1. Actions to conserve Arctic biodiversity; 2. Arctic Migratory Bird Initiative		1. Expert Group in support of implementation of the Framework for Action on Black Carbon and Methane	
number	0	0	2	0	1	0
Total: 3						
2019–2021	1. Geochemistry of mercury and emerging contaminants in the benthic zone of Arctic fjords and coastal waters of Svalbard; 2. Atmospheric aerosol studies and their	1. Long-term monitoring of Arctic fjords to study climate change; 2. Monitoring of Arctic precipitation; 3. Integrated monitoring of glaciers in Svalbard, Arctic; 4. Climate change and trends; 5. Pollutants.	1. Microbial diversity in different niches of Svalbard with a special focus on fjords and coastal waters; 2. Arctic Migratory Bird Initiative; 3. Arctic Coastal Biodiversity Monitoring Plan; 4. Arctic Invasive Species Strategy and Action Plan; 5. Actions to conserve Arctic biodi-		1. Arctic vessel traffic data; 2. Invasive species; 3. Underwater noise; 4. Black carbon emissions; 5. Marine debris; 6. Interaction with observers on shipping-related	1. Toolkit for Sustainable Energy in the Arctic; 2. Blue Bioeconomy in the Arctic

[10] Participant lists from the meetings held for 2013–2021. URL: https://arctic-council.org/ru/ (accessed 16 April 2024).

	characterization over the Arctic; 3. Platform for thematic research on black carbon.		versity.		issues.	
number	3	5	5	0	6	2
Total: 21						
2017–2019	1. Mercury geochemistry in sediments of Kongsfjord, Ny-Ålesund, Arctic; 2. Studies of atmospheric aerosols and their characteristics over the Arctic in the summer season.	1. Long-term monitoring of the Kongsfjord system of the Arctic region to study climate change; 2. Monitoring of Arctic precipitation; 3. Integrated monitoring of glaciers in Ny-Ålesund, Svalbard, Arctic.	1. Bacterial diversity in different niches around Ny-Ålesund, Svalbard; 2. Actions to conserve Arctic biodiversity; 3. Arctic Migratory Bird Initiative.		1. Expert Group in support of implementation of the Framework for Action on Black Carbon and Methane	
number	2	3	3	0	1	0
Total: 9						
2015–2017	1. Characterization of polar aerosols: initial processes and climatic impacts; 2. Biochemical assessment and characterization of biomarkers from Arctic fjord sediments; 3. Benthic studies of Kongsfjord, west coast of Svalbard, Svalbard.	1. Monitoring of precipitation in Arctic clouds; 2. Paleoecological reconstructions of late Pleistocene sediments of Kongsfjorden in the Svalbard region based on a multi-proxy approach; 3. Multi-proxy study of late Quaternary paleoclimate with emphasis on marine and terrestrial palynomorphs; 4. Sedimentological and geochemical studies of surface and subsurface sediments of lakes in the Crossfjorden and Kongsfjorden systems,	1. Functional diversity of heterotrophic bacteria in the water column and surface sediments of Kongsfjorden, with particular emphasis on those involved in the carbon cycle; 2. Long-term ecological monitoring of fjord ecosystems, Ny-Ålesund; 3. Effects of glacial runoff and associated Arctic freshening on microbial community structure: a case study in Kongsfjorden; 4. Soft-bottom meiobenthic fauna as an indicator of the functional character of selected Arctic fjords; 5. Investigation of		1. Understanding Arctic ice dynamics using Indian remote sensing satellite data; 2. Expert Group in support of implementation of the Framework for Action on Black Carbon and Methane	

		Svalbard - paleo-climatic conse-quences; 5. Climate change in the Quaternary and sedimentation patterns in the Ny-Ålesund area, Svalbard; 6. Mass balance and dynamics of individual glaci-ers of Svalbard, Svalbard; 7. Long-term monitoring of the Kongsfjord system of the Arctic region for studying climate change.	zooplankton ecol-ogy and planktonic food web dynam-ics in Kongsfjorden (using in-situ and satellite oceanog-raphy); 6. Primary produc-tivity and bio-optical studies to understand the dynamics of Kongsfjorden and Krossfjorden in summer; 7. Actions to con-serve Arctic biodi-versity; 8. Arctic Migratory Bird Initiative.			
num-ber	3	7	8	0	2	0
Total: 20						
2013–2015			1. Actions to conserve Arctic biodiversity; 2. Arctic Migratory Bird Initiative			
num-ber	0	0	2	0	0	0
Total: 2						

When analyzing the number of projects in which India participates, the following circumstances should be taken into account:

- The official website of the Arctic Council contains data from only 3 reports: for 2017, 2019 and 2021.
- The section of the AC website that presents India as an observer country states that India has been participating in the implementation of 2 projects of the AC CAFF working group since 2013: actions to conserve Arctic biodiversity and the Arctic migratory bird initiative, and since 2015 the country has been a member of the expert group in support of implementation of the framework for action on black carbon and methane of the PAME working group [11]. However, these projects do not appear in India's reports. The author has included these projects in the table: 2 of them for the periods 2013–2015, 2015–2017, 2017–2019, 2019–2021, 2021–2023; 1 — for the periods 2015–2017, 2017–2019, 2019–2021, 2021–2023.

[11] Republic of India. URL: https://arctic-council.org/ru/about/observers/republic-of-india/ (accessed 16 April 2024).

- India's 2017 report presents 17 projects [12] that are being implemented by Indian scientific institutions in the Arctic region. However, unlike the 2019 and 2021 reports, in which all projects in which India participates are divided into groups depending on the Arctic Council working group within which they are implemented, the 2017 report does not divide the projects into such groups, so the author has taken the responsibility of independently dividing India's projects into working groups depending on the subject matter of the project.

Thus, based on the data in Table 3 [13] and the circumstances mentioned above, the following conclusions can be made. Firstly, due to the absence of a report for 2015, it turns out that in 2013–2015, India participated in only 2 environmental projects of the CAFF working group. Similarly, for the period 2021–2023, the lack of data leads to the conclusion that India participated in only 3 projects during these years, which is most likely incorrect, since India's interest in the Arctic is only growing every year, which means that the country is interested in implementing projects, including in the field of ecology. India also prioritizes studying climate change in the Arctic and protecting the environment in the region. This area is also highlighted in India's Arctic Policy, adopted in 2022. Therefore, further detailed research on this issue requires India's 2023 report, which is not currently available.

Over the period 2015–2017, there has been an increase in the number of India's projects. Their total number is 20. For the period 2017–2019, one can see a decrease in the number of projects to 9. In 2019–2021, there is again an increase in the projects in which India is involved to 21 projects.

However, it is difficult to trust the data contained in the report for 2017 due to the fact that the projects implemented in the Arctic territories are not distributed among the working groups of the Arctic Council, and the table presented in the report is titled "Current projects of Indian institutes/universities in the Arctic region" [3, Zaikov K.S., Bhagwat D.V.]. In addition, the report does not contain information on three projects implemented by India from 2013/2015 to the present within the framework of CAFF and PAME, which are mentioned on the official website of the AC.

In the reports for 2019 and 2021, all projects are distributed among groups. As can be seen from the table, there was an increase in the number of projects being implemented from 9 in 2017-2019 to 21 in 2019–2021. Firstly, the sharp increase in the number of projects may correlate with the fact that in 2018, the specialized scientific institution of India responsible for conducting expeditions and other scientific activities at the Poles [4, Voronchikhina D.N.] changed its name

[12] Observer Activities report of Republic of India, 2017. URL: https://oaarchive.arctic-council.org/server/api/core/bitstreams/f61dbf95-11fa-422e-b5a6-d42a1106001d/content (accessed 16 April 2024).
[13] Observer Activities report of Republic of India, 2017. URL: https://oaarchive.arctic-council.org/server/api/core/bitstreams/f61dbf95-11fa-422e-b5a6-d42a1106001d/content (accessed 16 April 2024); Observer Review report of Republic of India, 2019. URL: https://oaarchive.arctic-council.org/server/api/core/bitstreams/dc6b5a0f-b571-4703-b603-f55dbb984643/content (accessed 16 April 2024); Observer report of Republic of India, 2021. URL: https://oaarchive.arctic-council.org/server/api/core/bitstreams/3b685e92-8caa-4e8a-b275-23491a9a4d1d/content (accessed 16 April 2024).

from the National Centre for Antarctic and Ocean Research (NCAOR) to the National Centre for Polar and Ocean Research (NCPOR) [3, Zaikov K.S., Bhagwat D.V., p. 266]. The renaming of NCAOR to NCPOR indicates India's increased interest over the past five years in scientific research of the Arctic region, which is closely related to the study of the ecology, ecosystem, biodiversity of the Arctic, and climate change in the region. Secondly, 2018 is the year when India and the Arctic states, namely Russia and Canada, issued joint statements in bilateral meetings, which discussed the development of mutually beneficial cooperation in the Arctic, including joint scientific research on issues such as melting ice, climate change, marine life and biodiversity [14]. Thirdly, in 2019, India was re-elected as an observer to the Arctic Council, which allowed it to establish itself in this role and increase its presence in the implementation of projects carried out within the framework of the AC working groups.

The increase in the number of projects may indicate India's increased interest in participating in the Arctic Council, and therefore in addressing environmental issues in the Arctic region.

Environmental projects of the Arctic Council working groups, in which India participates

The conclusions on this criterion are based on the analysis of the data in Table 3 [15].

It is worth noting that India does not participate in the projects implemented by the Emergency Prevention, Preparedness and Response working group (EPPR). The largest number of projects is implemented by India within the framework of the working groups on the implementation of the Arctic Monitoring and Assessment Programme (AMAP) and the Conservation of Arctic Flora and Fauna (CAFF) [4, Voronchikhina D.N.]. AMAP has focused its activities on measuring and monitoring the impact of pollutants and climate change on ecosystems and human health in the Arctic. CAFF focuses on conservation of Arctic biodiversity and the sustainability of Arctic flora and fauna. If we look at the names of the projects in which India is participating, under AMAP, all of them are devoted to studying climate change issues in the Arctic, including through monitoring certain indicators (precipitation, fjords, glaciers, etc.). Within the framework of CAFF, projects are related to the study of biodiversity, microbial diversity, invasive species, and migratory birds in the Arctic.

In 2019–2021, India focused on the projects of the PAME working group (Protection of the Arctic Marine Environment). 6 projects out of 21 were implemented within the framework of the

[14] Ministry of External Affairs. India-Canada Joint Statement during State Visit of Prime Minister of Canada to India, February 23, 2018. URL: https://www.mea.gov.in/bilateral-documents.htm?dtl/29512/indiacanada+joint+statement+during+state+visit+of+prime+minister+of+canada+to+india+february+23+2018 (accessed 16 April 2024); Ministry of External Affairs.India-Russia Joint Statement during visit of President of Russia to India, October 05, 2018. URL: https://www.mea.gov.in/bilateral-documents.htm?dtl/30469/indiarussia+joint+statement+during+visit+of+president+of+russia+to+india+october+05+2018 (accessed 16 April 2024).

[15] Observer Activities report of Republic of India, 2017. URL: https://oaarchive.arctic-council.org/server/api/core/bitstreams/f61dbf95-11fa-422e-b5a6-d42a1106001d/content (accessed 16 April 2024); Observer Review report of Republic of India, 2019. URL: https://oaarchive.arctic-council.org/server/api/core/bitstreams/dc6b5a0f-b571-4703-b603-f55dbb984643/content (accessed 16 April 2024); Observer report of Republic of India, 2021. URL: https://oaarchive.arctic-council.org/server/api/core/bitstreams/3b685e92-8caa-4e8a-b275-23491a9a4d1d/content (accessed 16 April 2024).

activities of this group. The main objective of PAME is to protect and sustainably use the Arctic marine environment [12, Voronchikhina D.N.]. Here, India focused on the problems of shipping, marine debris, underwater noise, and emissions of black carbon and methane.

It was mentioned earlier that India has been participating in 2 projects within the CAFF framework since 2013 and in 1 project within the PAME framework since 2015.

On June 10, 2013, the Ministry of External Affairs of India published a document entitled "India and the Arctic". The document emphasizes that climate change in the Arctic has redefined the status of the region and generated interest in it. The main interests of states in the Arctic are hydrocarbons, biological resources, a short route connecting the Pacific and Atlantic oceans, the impact of melting sea ice on local communities, marine ecosystems and climate change. India, on the other hand, highlighted scientific, environmental, commercial and strategic interests in the document. The main objectives of the research in the Arctic region are as follows: study hypothetical links between the Arctic climate and the Indian monsoon by analyzing sediment and ice core records from Arctic glaciers and the Arctic Ocean; monitor Arctic sea ice using satellite data to assess the impact of global warming in the northern polar region; study the dynamics and mass balance of Arctic glaciers, with particular attention to the impact of glaciers on sea level change; comprehensively assess the response of Arctic flora and fauna to anthropogenic activities [16]. As can be seen from the document, India has focused on climate change research in the polar region, as it is considered to have negative consequences for the country's economy as well as for the biodiversity of the region. We cannot rely on the provisions of the strategic document "Arctic Policy" adopted in 2022 within the framework of this study, as we have data only from reports up to 2021.

That is, back in 2013, India identified issues that would be studied by Indian researchers in the Arctic. As we can see, the tasks set out in the document "India and the Arctic" resulted in participation in the projects of the AMAP and CAFF working groups.

Additionally, we would like to draw attention to the fact that in February 2020, the Conference of the Parties to the Convention on the Conservation of Migratory Species was held in Gandhinagar, India, where, among other things, the issue of migratory bird migration was considered [17], which correlates with India's participation in the Arctic Migratory Bird Initiative (CAFF). India's participation in the PAME working group projects is motivated by India's leading position in greenhouse gas emissions, which include carbon and methane. Despite this, at the end of 2020, India had made significant progress in meeting its climate change commitments made under the 2015 Paris Agreement, becoming one of the few countries and the only major economy to do so [18]. By 2023, India's greenhouse gas emissions had fallen by 33%, faster than expected in 14 years,

[16] India and the Arctic, 2013. URL: https://www.uaf.edu/caps/resources/policy-documents/india-and-the-arctic-2013.pdf (accessed 22 January 2024).
[17] Gateway House. India at the Arctic Council, 2021. URL: https://www.gatewayhouse.in/india-at-the-arctic/ (accessed 16 April 2024).
[18] Ibid.

as renewable energy generation increased and forest cover expanded [19]. Some scientists believe that Arctic Ocean shipping is accelerating the melting of sea ice in the ocean [2, Xiuwen S., p. 351], which could eventually lead to the threat of flooding of Indian coastal areas. Therefore, this issue is also an object of India's attention in the framework of its participation in the projects of the PAME working group.

Black carbon and atmospheric aerosols are the subject of study within the ACAP working group with participants from India (2–3 projects), which can also be linked to the state's climate policy aimed at reducing greenhouse gas emissions. India is pursuing a consistent policy to reduce emissions, which should ultimately lead to zero greenhouse gas emissions. To achieve this, the country seeks to increase its renewable energy use; to improve energy efficiency in sectors such as transport, energy and electricity, industrial production; to switch to the use of electric vehicles; to preserve and increase its forest cover and biodiversity, and to apply reasonable natural resource management strategies [20].

India's climate and energy security are linked to the Sustainable Development Working Group (SDWG) projects: sustainable energy in the Arctic and blue bioeconomy in the Arctic. The Arctic is a favorable region for the development of alternative energy. It's not only hydrocarbons that the Arctic continental shelf is rich in. The Arctic region as a whole can be considered a leader in renewable energy development, with the share of electricity generated from renewable resources more than double the global average. Countries such as Iceland and Norway obtain almost 100% of their heat and power from renewable sources. The United States is actively working with partners across the region to share best practices and improve the region's overall energy resilience. In about 250 locations, diesel fuel is supplemented by locally available renewable energy sources such as hydropower, wind, solar, biomass, and marine hydrokinetic or geothermal energy. Alaska has played a leading role in integrating renewable resources into community-scale microgrids: more than 75 community energy grids are partially powered by renewable energy sources, including small hydropower, wind, geothermal, biomass, and solar systems [21]. India can adopt the experience of the Arctic countries in using renewable energy.

As we can see, the tasks of the working group on Emergency Prevention, Preparedness and Response (EPPR), related to assistance in prevention, preparedness and response to environmental and other emergencies, accidents, as well as search and rescue [22], are not listed in India's documents, are not included in agreements with Arctic countries, and are not related to India's national

[19] India succeeds in reducing emissions rate by 33% over 14 years — sources, 2023. URL: https://www.reuters.com/world/india/india-succeeds-reducing-emissions-rate-by-33-over-14-years-sources-2023-08-09/ (accessed 16 April 2024).
[20] India's Steps Towards Net Zero Emission, 2024. URL: https://www.hmel.in/blog/india-steps-towards-net-zero-emissions (accessed 16 April 2024).
[21] Arctic energy office, 2020. URL: https://www.energy.gov/arctic/articles/arctic-energy-office-factsheet-energy#:~:text=As%20a%20whole%2C%20the%20Arctic,and%20power%20from%20renewable%20resources (accessed 16 April 2024).
[22] Arctic Council. Working Group on Prevention, Preparedness and Response to Emergency Situations. URL: https://arctic-council.org/ru/about/working-groups/eppr/ (accessed 16 April 2024).

security. Therefore, India does not participate in the implementation of the EPPR projects. At the same time, it should be noted that India has the ability to provide assistance in satellite data transmission. For example, India has the South Asia Satellite, which could be used to monitor processes occurring in the Arctic region related to changes in the area of sea ice, permafrost, hydrometeorological hazards, environmental disasters, as well as for the development of telemedicine [23]. In 2024, a joint Indian-American satellite is planned to be launched to study the changing ecosystems on Earth, the mass of ice, the rise in sea levels due to climate change, intended for better management of natural resources and monitoring of hazards around the world, including the Arctic [24] [13, Kanagavalli S.]. The data from these satellites will help to obtain prompt, reliable, high-quality information on all the changes occurring in this region of the planet.

Conclusion

The paper reviewed and analyzed the documents of the Arctic Council, in particular the lists of participants in the meetings of the Senior Arctic Officials, and the reports of India submitted to the Arctic Council. On the basis of these documents, three criteria were identified that can be used to assess the extent of India's participation in the work of this organization: the number of delegates sent by India to participate in the meetings of the Senior Arctic Officials, the number of projects implemented within the framework of a particular working group of the Arctic Council [4, Voronchikhina D.N.], in which India participates, the name and content of environmental projects in the Arctic region, in which India participates.

Based on the data obtained for the first criterion, we can conclude that the Indian delegation consists of 1–2 representatives at the SAO meetings, which is less than the delegations of other Asian observer countries (China, Japan, the Republic of Korea, Singapore), represented by 2–3 participants. In this regard, we can conclude that India's Arctic policy on the protection and conservation of the Arctic environment is not fully formed.

Within the second criterion, we see a significant increase in the number of projects in which India participates through the AC working groups in the period 2019–2021 compared to the period 2017–2019 (9 versus 21). This suggests that India's interest in participating in Arctic Council environmental projects has increased.

Regarding the third criterion, India participates in the implementation of the projects of the AMAP, CAFF and PAME working groups, which correlates with the official document published in 2013 dedicated to India's interests in the Arctic, as well as with the international commitment adopted by India under the 2015 Paris Agreement on Climate Change to reduce greenhouse gas emissions. Participation in ACAP and SDWG is also associated with the climate security policy, to which the country's energy security, i.e. reducing greenhouse gas emissions and developing re-

[23] Venkatasubramanian K.V. South Asian Satellite to boost regional communication. 2017. URL: https://pib.gov.in/newsite/printrelease.aspx?relid=161611 (accessed 16 April 2024).
[24] Kanagavalli S. Third pole's view on the north pole — India's Arctic Policy. The Polar Connection. 2022. URL: https://polarconnection.org/third-pole-india-arctic-policy/ (accessed 16 April 2024).

newable energy, is added. The Arctic has great potential for the development of alternative energy sources, including natural gas, hydropower, wind and solar energy, and geothermal energy. Some Arctic countries have almost entirely switched to renewable energy, and India can borrow their experience and transfer some acceptable solutions to its territory. India is not interested in the projects of the EPPR working group, as the group's objectives do not intersect with ensuring national security of the country and are not enshrined in any of India's Arctic policy documents. At the same time, India has the potential to participate in the projects of this group, since the country has well-developed satellite communications and telemedicine. Therefore, it can be concluded that India has not yet fully revealed its internal resources for implementing activities in the Arctic Council.

In general, based on the analysis of the data, it can be stated that the role and degree of India's participation in the activities of the regional institution in question is small, which is connected, firstly, with the status of an observer rather than a permanent participant of India in the AC, and secondly, with India's internal Arctic policy: the adoption of a strategic document on Arctic policy only in 2022, the late expression of interest in the Arctic region as a whole. However, India has the potential to increase its participation in the work of the Arctic Council.

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Peculiarities of German-Norwegian Cooperation in the Military-Political Sphere (Late 2010s — First Half of 2020s)

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Abstract. At the beginning of 2020s, Germany has faced with the crisis of its strategic presence at the global level: primarily to the east and to the south of NATO zone of responsibility. The possibility to compensate the losses is to ensure powerful positions in the Arctic. Germany has tried to do it through cooperation with Norway. Other NATO member states also show interest in Norway as a potential "bridge" for strategic penetration to the Arctic Ocean. The article examines the security relations between official Berlin and Oslo since the second half of the 2010s, the quality and scope of cooperation. The preservation of Norway's value in German foreign policy planning in the context of Finland's (2023) and Sweden's (2024) accession to NATO is explained. A high level of trust was characteristic of the dialogue at the highest level, remaining unchanged both under Angela Merkel and Erna Solberg and under their successors Olaf Scholz and Jonas Gahr Støre (since 2021). The Bundeswehr Mountain Brigade acquired the functions of Arctic troops as a result of its use in NATO exercises in Finnmark, Norway. The joint use of frigates in the Arctic and the prospects of unification of submarine fleets are considered. The main tracks of cooperation between Germany and Norway in the issues of NATO grouping, arms supplies to Ukraine and training of its armed forces personnel are revealed.

Keywords: *Germany, Norway, Arctic, NATO, political dialogue, Arctic armed forces, Bundeswehr, exercises, military-technical cooperation, "deterrence" of Russia*

Introduction

The dialogue between Germany and Norway was an example of full-fledged cooperation between a large and a small state, with difficult historical background in modern history. In 1940–1945, the Third Reich occupied Norway, used it to carry out aggression against the USSR, and kept a very large (up to 400 thousand military personnel) inter-military grouping here [1, p. 20]. The Nazi regime relied on a very strong collaborationist movement in Norway: it is no coincidence that the name of its leader V. Quisling was used to call the accomplices of Hitler's regime in different countries of Europe [2, Komarov A.A.].

In modern realities, both the FRG and the Kingdom of Norway are among the states that are striving to significantly strengthen their influence in the international arena. The number of such actors within the camp of "Western democracies" is not so great, since the foundations of its internal configuration were formed at the beginning of the previous "cold war" [3, Braterskiy M.V.,

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p. 22]. Moreover, both countries have been organically integrated into the Euro-Atlantic community [1] since its foundation. Norway has been a member of NATO since its foundation (1949). West Germany made the most active efforts to join the Alliance and, upon its accession, carried out a large-scale remilitarization under the auspices of the bloc.

Among the most influential "liberal democracies", Germany is almost the only "rising" power. Taking into account its historical responsibility as the main aggressor in World War II, the natural temporary loss of statehood (1945), the FRG began to secure leadership positions on the world stage much later than other "Western powers" (USA, Great Britain and France). In essence, the process was fully launched only after the resolution of the "German question" (1990) in accordance with the maximum consideration of the interests of the Bonn Republic (and the United States). At the same time, in the late 2010s – early 2020s, Germany faced a crisis of strategic presence in the international arena. Germany was losing a significant part of the military and political positions that it had been building since the 2000s away from the Euro-Atlantic community: primarily in Asia and Africa. It is logical that official Berlin was actively looking for ways to compensate for this. Germany smoothly and consistently increased its contribution to the "containment" of the Russian Federation, which in the early 2020s had already become quite large-scale in military and practical terms. At the same time, Germany tried to find new areas outside NATO's area of responsibility for strategic penetration. For this reason, the creation of military-political positions in the Arctic with its enormous natural resources was of particular value to Germany: the Arctic Ocean basin was adjacent to NATO's area of responsibility, and four of the five Arctic countries were member states of the Alliance (all except Russia: Denmark, Norway, Canada, the United States). At the doctrinal level, this task was relatively clearly formulated in the "Germany's Arctic Policy Guidelines" of August 2019. On the one hand, there was still a limited focus on direct political-military issues [2], but more than in the first such document of 2013 [3]. On the other hand, it was from the late 2010s that the intensive use of the Bundeswehr in the region began, especially in Norway, increasingly presented in the context of "containing" the Russian Federation.

A wide range of NATO and EU member states, including the entire tetrarchy of "Western powers" headed by the United States (although the latter also had extensive possessions of its own in the Arctic) [4, Kuchinskaya M.E.; 5, Konyshev V.N., Sergunin A.A.], also demonstrated increased interest in deepening cooperation with official Oslo. Norway's geostrategic value has led to a noticeable increase in its influence in the Euro-Atlantic community since the second half of the 2010s. Taking into account the prospects for the dynamic development of the "potential race"

[1] In the article, the Euro-Atlantic Community refers to the totality of NATO and EU member states, and they themselves as institutions.

[2] Leitlinien deutscher Arktispolitik. Berlin: Bundesregierung, 2019. S. 22–25. URL: https://www.auswaertiges-amt.de/resource/blob/257426/0c93a2823fcff8ce9f6bce5b6c87c171/arktisleitlinien-data.pdf (accessed 17 March 2024).

[3] Leitlinien deutscher Arktispolitik. Berlin: Auswärtiges Amt, 2013. 24 S. URL: https://www.arctic-office.de/fileadmin/user_upload/www.arctic-office.de/PDF_uploads/Leitlinien_deutscher_Arktispolitik.pdf (accessed 17 March 2024).

in the Arctic [6, Bhagwat D.], Oslo's importance for many other "Western democracies" will increase even more. For Germany, Norway has another huge advantage as a partner: the presence of large hydrocarbon reserves (including on the Arctic shelf). Germany's interest in importing them has increased sharply due to its rejection of inexpensive Russian energy sources.

The objective of the article is to study the causes and peculiarities of the development of relations between official Berlin and Oslo in the field of security and defense in the late 2010s – first half of the 2020s. Domestic and foreign experts have paid increased attention to the intensification of competition in the Arctic as a whole, increasingly trying to fit it into the study of the formation of a new world order [7, Arzamanova T.V.]. It is logical that increased attention was paid to the strategies and tactics of the Arctic states (Russia, as well as Denmark, Canada, Norway and the USA) [4, Kuchinskaya M.E.; 5, Konyshev V.N., Sergunin A.A.; 8, Raikov Yu.A.; 9, Paul M.]. The issues of their cooperation with most countries without direct access to the Arctic Ocean are covered much less. Gaps in the study are also characteristic of the dialogue between Germany and Norway [10, Trunov F.O.]. Moreover, since the turn of the 2010s — 2020s, Germany has been showing military activity in the Far North, the intensity of which has gradually but consistently increased. This tendency was part of a more general trend — a noticeable increase in the proportion of the use of military instruments in the foreign policy of official Berlin. The main reason was the unwillingness to accept failures in ensuring a presence at the global level, the desire to restart the process, which was presented in the information context of "containing" Russia and, in general, the most active non-Western powers (China, Iran). The article uses the provisions of the theory of the development of armed forces [11] in studying the progress of the creation of Arctic troops in Germany and the development of cooperation with the Kingdom of Norway in this regard.

Importance of Norway as an Arctic partner for Germany

Of the five states that had direct access to the Arctic Ocean, four were "Western democracies". What is the reason for the special value of the Kingdom of Norway for Germany? Firstly, compared to Canada and Denmark, Oslo's policy specifically in the northern strategic direction is more predictable (although Norway was not a member state of the European Union), and the volume and quality of interstate dialogue with Germany in the sphere of security and defense are significantly higher. Secondly, the Norwegian territories facing the Arctic Ocean (from Narvik to Kirkenes) had a number of geostrategic advantages for Germany over similar possessions of other Arctic countries. The United States was hardly ready to allow the forces of its European NATO partners to enter the territory of Alaska. A similar position was taken by Canada, as well as by Denmark, which has key possessions in the Arctic Ocean — Greenland and the Faroe Islands. The Arctic territories of all the countries mentioned are located several thousand kilometers away from European states, and the size of the specialized infrastructure and climatic conditions make it very difficult to deploy any large contingents from external players (except the United States). The north of Norway is a single whole with the rest of the country in various respects; there are fairly

well-equipped bases located here. No less important is the fact that unlike Oslo's Arctic possessions, those of Canada and Denmark are located at a great distance from the Kola Peninsula. The main forces of the joint strategic command "Northern Fleet" of the Russian Federation are located here, including almost all motorized rifle and marine infantry formations of the Arctic troops [4]. For this reason, the "Western democracies" de facto regard the build-up of the grouping in the Norwegian province of Finnmark as a very effective element of "containing" the Russian Federation: the increased military-strategic activity there is evidence in favor of this.

The question arises: to what extent will Norway's geostrategic value for Germany change in the context of the accession of previously conditionally neutral Finland (since April 4, 2023) and Sweden (since March 7, 2024) to NATO? The increase in Germany's strategic attention to Northern Europe, already quite noticeable since the late 2010s, will grow even faster. The intensification of the use of the Bundeswehr in maneuvers on the territory of former conditionally neutral countries will inevitably occur. With a high degree of probability, official Berlin may agree to a rotational (and eventually permanent) presence of the Armed Forces in NATO multinational formations — along the lines of those that have existed since 2017 in Eastern Europe (primarily in the Baltic countries and Poland). All these will be steps towards toughening the confrontation with the Russian Federation. In the author's understanding, this task was very important for Germany in the Northern European direction, but still took second place in the unofficial hierarchy. The main task was to ensure full penetration and consolidation in the Arctic Ocean. This will preserve Norway's value in specific terms for the activities of the FRG in the international arena as a whole. It seems that Sweden and Finland, with their small but well-organized military potential, will, under the auspices of the Alliance, provide Norway with extended strategic cover [5] as a "springboard" for the penetration of "Western democracies" into the Arctic.

The nature of political dialogue at the highest level

Chancellor G. Schröder (1998–2005) characterized interstate relations as a kind of pun: "the problem with German-Norwegian dialogue is that it has no problems" [6]. Although somewhat idealistic, the assessment was close to the actual situation in terms of the level of mutual trust. At the same time, the practical volumes of cooperation, especially on security and defense issues, were small. Both of these features were inherent in German-Norwegian relations in the first decade of the "era" of A. Merkel (2005–2021). However, since the mid-2010s, the second position —

[4] The Northern Fleet Joint Strategic Command celebrates its eighth anniversary. Russian Defense Ministry. 15 December 2022. URL: https://function.mil.ru/news_page/country/more.htm?id=12448609@egNews (accessed 17 March 2024).

[5] NATO-Beitritt von Schweden und Finnland Bedeutung für die euro-atlantische Sicherheit. BMVg. 12 October 2022. URL: https://www.bundeswehr.de/de/organisation/weitere-bmvg-dienststellen/zentrum-innere-fuehrung/nato-erweiterung-um-schweden-und-finnland-5493288 (accessed 17 March 2024).

[6] Von Misstrauen (bis) zur zuverlässigen Interessengemeinschaft. 19 December 2014. URL: https://www.bpb.de/themen/deutschlandarchiv/197834/von-misstrauen-bis-zur-zuverlaessigen-interessengemeinschaft/ (accessed 17 March 2024).

the volumes of cooperation — has begun to noticeably change in favor of a significant increase. What is the reason for this position of the FRG?

The start of the confrontation with the Russian Federation had certain significance, but this determinant should not be overestimated: it was an important pretext rather than a cause. Germany's transition to a system of "containing" Russia only made a problem that had existed for a long time more pronounced. This is the insufficient influence of the FRG (in terms of compliance with its ambitions) in many countries and regions of the Euro-Atlantic community as a result of the relatively limited volumes of use of German political-diplomatic and especially military instruments. The start of the confrontation between the West and Russia (since 2014) aggravated this "bottleneck", but at the same time provided Berlin with additional opportunities to overcome it. By playing up the thesis about a certain "Russian threat" in the informational sphere, the establishment of a number of small and medium-sized countries from among the "Western democracies" began to show interest in the emergence of a foreign presence under the auspices of NATO, the basis of which was made up of contingents from large member states of the Alliance. Potentially, this provided particularly great opportunities for geographical expansion of the Bundeswehr deployment, allowing the FRG to partially retouch the historical memory of Germany as the key aggressor in World War II.

In comparison with the countries of Eastern Europe, and in the early 2020s — also with Finland and Sweden, Norway was less active in declaring its desire to ensure a permanent foreign presence on its territory under the auspices of NATO [7]. At the same time, official Oslo showed high interest as a recipient of military exercises, including large-scale ones, under the auspices of the Alliance. Norway's desire to host the largest Trident Juncture 18 exercises (2018) and its full support for the internationalization of the previously national Cold Response exercise since the turn of the 2010s–2020s are indicative. The Kingdom did not follow the path of any noticeable increase in the number of armed forces (20–23 thousand military personnel in 2014–2023 [8] with a population of 5.4 million people, or about 0.4%), but kept military spending per capita at a very high level. According to this indicator, Norway confidently occupied the second place in the ranking of Alliance member states, behind only the United States. The Kingdom's military spending per citizen in the late 2010s – early 2020s ranged from 1.2 to 1.5 thousand dollars per person, while for Germany this figure was from 0.5 to less than 0.7 thousand dollars [9].

[7] See: Norwegian Armed Forces in transition. Strategic defence review by the Norwegian chief of defence. Abridged version. Oslo, 2015. 24 p. URL: https://www.forsvaret.no/en/news/archive/chief-of-defence-presents-strategic-defence-review/Strategic%20Defence%20Review%202015.pdf/_/attachment/inline/90fb5ae7-58c0-4bd5-ada4-5af212697044:f86eb1b8d34497ac7770386572795f1c6afa0671/Strategic%20Defence%20Review%202015.pdf (accessed 17 March 2024).

[8] Defence Expenditure of NATO Countries (2014–2023). 7 July 2023. Brussels: NATO, 2023. P. 12. URL: https://www.nato.int/nato_static_fl2014/assets/pdf/2023/7/pdf/230707-def-exp-2023-en.pdf (accessed 17 March 2024).

[9] Ibid, p. 11.

These tactics of Norway together with its exceptionally favorable geographical position as a "springboard" for a full-scale "strategic breakthrough" of the bloc's member states into the deep waters of the Arctic Ocean since the mid-2010s provided Oslo with great political weight in NATO. It far exceeded the potential that the Kingdom's resource capabilities provided in modal (absolute) terms. One illustration of this is the ten-year (2014–2024), a very long term by NATO standards, tenure of the Norwegian J. Stoltenberg as Secretary General of the Alliance. This is even more illustrative given that he replaced the Dane A. Fogh Rasmussen (2009–2014). For this reason, it can be argued that there is a 15-year "Northern European era" at the level of the NATO Secretary General, with a predominant "tincture" of Norway.

Germany made a significant contribution to achieving this. It was A. Merkel who came up with the initiative to nominate J. Stoltenberg for the post of Secretary General of the Alliance [10]. Thus, Germany secured two winning positions in the dialogue with the leadership of Norway. In addition to a more than noticeable increase in the Kingdom's influence in the Alliance, the prime minister's main competitor from the Conservative Party, E. Solberg, was out of national domestic politics for a long time. She became head of the cabinet of ministers of the Kingdom in November 2013, replacing J. Stoltenberg (2000–2001; 2005–2013), who simultaneously headed the Labor Party. For this reason, A. Merkel's initiative was doubly valuable for E. Solberg, contributing to the formation of their negotiating tandem.

In the second half of the 2010s, high-level negotiations were held every 1–1.5 years. Not being represented in the G7 and G20, Norway delegated the representation of some of its interests (in particular, on the energy agenda) to Germany at these venues. A. Merkel informed E. Solberg in detail on all the issues raised, emphasizing her readiness to defend not only her position, but also that of her partner [11]. As the leading (along with France) participant in the Normandy format (2014–2022) from the West, Germany regularly informed Norway about the situation in eastern Ukraine, "synchronized watches" to ensure Kyiv's rapprochement with the EU and the Euro-Atlantic community as a whole.

The rapprochement of the parties became even more noticeable in the late 2010s. Oslo viewed the increased use of the Bundeswehr in Norway and adjacent waters as an investment in its defense and security, demonstrating its readiness to support Berlin in its efforts to ensure strategic penetration into the Arctic. The negotiations between A. Merkel and E. Solberg on the eve of the large-scale Trident Juncture 18 maneuvers in Norway are illustrative, and the summit itself

[10] Von Misstrauen (bis) zur zuverlässigen Interessengemeinschaft. 19 December 2014. URL: https://www.bpb.de/themen/deutschlandarchiv/197834/von-misstrauen-bis-zur-zuverlaessigen-interessengemeinschaft/ (accessed 17 March 2024).

[11] Pressekonferenz von Bundeskanzlerin Merkel und der Ministerpräsidentin des Königreichs Norwegen, Solberg in Berlin. Bundeskanzleramt. 8 November 2016. URL: https://www.bundesregierung.de/breg-de/suche/pressekonferenz-von-bundeskanzlerin-merkel-und-der-ministerpraesidentin-des-koenigreichs-norwegen-solberg-843592 (accessed 17 March 2024).

took place in Berlin [12]. This reflected Germany's role as a senior partner in the dialogue, without the Kingdom disputing it. It provided assistance to Germany in launching the "N5+1" format, i.e. a platform for high-level contacts between the five Nordic countries (Denmark, Iceland, Norway, Finland, Sweden) and Germany. The first meeting in the "N5+1" format took place in Reykjavik, Iceland, in August 2019. The negotiations were almost entirely devoted to environmental issues [13]. The precedent of launching the format as a symbol of a noticeable strengthening of Germany's position in Northern Europe is noteworthy.

By the end of 2021, Germany and Norway had undergone chronologically almost parallel leadership changes. Moreover, in both cases, the government changed from center-right to center-left. Following the parliamentary elections on October 14, 2021, E. Solberg (the head of the Conservative Party) was replaced as head of the Norwegian government by I.G. Støre, who headed the Labor Party (after the resignation of its leader J. Stoltenberg in 2014). On December 8, 2021, O. Scholz, who headed the SDPG, became Chancellor of Germany instead of A. Merkel (who had previously announced her resignation from the top post in the cabinet and the CDU) [12, Basov F.A., p. 278]. The governments in both countries were coalition: in Norway, the Center Party became the "satellite" of the Labor Party; in Germany, the role of junior partners of the SDPG was taken by the Alliance 90/Greens and Free Democrats.

The "change of milestones" at the highest level did not affect the development of the interstate dialogue — moreover, it continued to develop dynamically. This trend was closely linked to the preservation of continuity of the parties against the backdrop of a personal change in leadership in matters of "containing" the Russian Federation: both Norway and Germany took the path of toughening. Germany sought to play up the growth of its contribution to the confrontation with the Russian Federation as much as possible for the sake of further rapprochement with its Nordic partners. Thus, in 2022, O. Scholz and I.G. Støre held three personal negotiations, two of which were organized in Berlin; in November 2022, the Norwegian Prime Minister attended a security conference organized here [14]. The second "N5+1" meeting was held in Oslo a little earlier, in August 2022, with a focus on political and military issues. Increased attention was paid to the refusal of Finland and Sweden of their conditionally neutral status; however, cooperation with Norway remained Germany's top priority [15]. This was demonstrated not only by the venue of the "N5+1", but also by the dynamics of O. Scholz's bilateral meetings at the highest level. The intensity of his

[12] Pressestatements von Bundeskanzlerin Merkel und der Ministerpräsidentin des Königreichs Norwegen, Erna Solberg im Bundeskanzleramt. Bundeskanzleramt. 16 October 2018. URL: https://www.bundesregierung.de/breg-de/suche/pressestatements-von-bundeskanzlerin-merkel-und-der-ministerpraesidentin-des-koenigreichs-norwegen-erna-solberg-1538950 (accessed 17 March 2024).

[13] Pressestatements von Bundeskanzlerin Merkel und der Ministerpräsidentin Islands, Katrín Jakobsdóttir im Bundeskanzleramt. Bundeskanzleramt. 19 March 2018. URL: https://www.bundesregierung.de/breg-de/aktuelles/pressestatements-von-bundeskanzlerin-merkel-und-der-ministerpraesidentin-islands-katrín-jakobsdóttir-845270 (accessed 17 March 2024).

[14] Norwegen — ein „für uns ganz besonderer Partner". Bundeskanzleramt. 30 November 2022. URL: https://www.bundeskanzler.de/bk-de/suche/scholz-empfaengt-store-2146560 (accessed 17 March 2024).

[15] Bundeskanzler besucht Norwegen. Bundeskanzleramt. 15 August 2022. URL: https://www.bundeskanzler.de/bk-de/aktuelles/bundeskanzler-besucht-norwegen-2071538 (accessed 17 March 2024).

negotiations with I.G. Støre was so high in 2022 that not a single summit meeting was held in 2023: the key issues were considered to have been sufficiently worked out. In order to avoid even formal hints of stagnation in the dialogue, the Norwegian royal couple visited Germany in August 2023, and the monarchs were received by both Chancellor O. Scholz and Federal President F.-W. Steinmeier [16]. The dynamics of cooperation in the Armed Forces became an indirect confirmation of the truly favorable situation with the political dialogue in interstate relations.

Evolution of the forms of using the Bundeswehr on Norwegian territory

Until the late 2010s, Germany did not send any significant ground contingents to participate in exercises in Norway. The transition to "containing" the Russian Federation (since 2014) for Germany was naturally accompanied by a gradual refocusing of the Bundeswehr from ensuring a presence away from NATO's area of responsibility (primarily in the conflict-prone countries of Asia and Africa) to intensifying efforts within it.

Germany began to implement relevant measures deep inside the Alliance member states since 2014–2015 (under the auspices of the Rapid Reaction Forces, RRF; NATO Response Force, NRF), in Eastern Europe — since 2016–2017 (through the Forward Presence, FP). In 2018, this activity of the Bundeswehr fully started in Northern Europe: Germany sent a joint contingent of 8 thousand military personnel, 2 thousand units of combat and support equipment to participate in NATO maneuvers Trident Juncture 18. Taking into account the transport forces, these figures were even higher: more than 9 thousand personnel and 4 thousand vehicles of various purposes [17]. The Trident Juncture 18 exercises (October 25 – November 7, 2018) became the largest for NATO since the beginning of the confrontation with the Russian Federation: in total, about 50 thousand military personnel, 250 aircraft and 65 ships took part in them [18], i.e. the use of an analogue of a reinforced joint group of army level in late autumn in subarctic conditions was practiced. Germany's contribution in most key parameters amounted to 20%, second only to the United States and the host country. The transportation of the Bundeswehr ground and auxiliary forces was carried out by a combined route: by air and by sea (mainly to the port in Fredrikstad) and then by rail to the camp in Rena. The FRG even considered the issue of temporarily relocating the Bundeswehr transport department to Norway. In this way, the Bundeswehr worked out the transfer of a large group of forces to the Kingdom, i.e. in practice, building a military-logistics chain that connected the two countries.

[16] Bundeskanzler empfängt den norwegischen Kronprinzen Haakon und Kronprinzessin Mette-Marit. Bundeskanzleramt. 09 November 2023. URL: https://www.bundeskanzler.de/bk-de/aktuelles/bundeskanzler-empfaengt-den-norwegischen-kronprinzen-haakon-und-kronprinzessin-mette-marit-2234920 (accessed 17 March 2024).
[17] TRIDENT JUNCTURE 18 — Germans deploy to Trident Juncture 18. DVIDS. 20 October 2018. URL: https://www.dvidshub.net/video/634371/trident-juncture-18-germans-deploy-trident-juncture-18 (accessed 17 March 2024).
[18] Trident Juncture 2018. NATO. 29 October 2018. URL: https://www.nato.int/cps/en/natohq/157833.htm (accessed 17 March 2024).

During the exercises, a scenario of a powerful counterattack from deep inside (central Norway) against a simulated enemy was played out. The key role in the counterattack group was assigned to the Very High Readiness Task Force (VJTF). The role of the "core" of its ground component was performed by units of the 41st Motorized Infantry Brigade (MIB) of the 1st Tank Division (TD) of the Bundeswehr [19]. They were actively supported by contingents from other participating countries, primarily Norway. The noticeable contribution and role of Germany was also explained by the fact that from January 2019, it assumed the functions of the "framework state" for the VJTF for a year [20], and not only for the duration of important, but relatively short (2 weeks) exercises. Germany made the decision on the VJTF for 2019 in addition, out of turn, and was the only large and medium-sized member state of the Alliance to do so in the 2015–2022 cycle. It is interesting that during Trident Juncture 18, the Bundeswehr deployed one of its brigade (41st Motorized Infantry Brigade) to perform the functions of the VJTF "framework nation", and in 2019 — another one (9th Tank Training Brigade; both formations from the 1st Tank Division). The increased burden of the FRG in staffing the most significant and largest multilateral NATO groups was aimed, among other things, at demonstrating an increasing willingness to contribute to ensuring the security and defense of Norway.

Indeed, the scale of the Bundeswehr's participation and activity during Trident Juncture 18 stimulated political dialogue. However, at the very end of the 2010s, Germany's contribution to the exercises on Norwegian territory and adjacent waters again became relatively limited in scale. The pandemic factor was important, but still by no means of primary importance. During the long-term reductions in the armed forces of the FRG in the 1990s–2010s, the ground forces (army) were subject to the largest reductions (both in absolute and specific terms). Thus, between 1989 and the mid-2010s, the number of divisions in their composition decreased: from 12 to 3 formations, and brigades — from 36 to 7.5 formations [21]. The growth in the number of the armed forces, which began in the late 2010s, was initially carried out at a slow pace: no new brigades were created until 2023 inclusive. For this reason, it was difficult for the FRG to determine those units, especially from the army, that were intended for active use in Norway.

The contribution to Trident Juncture 18 was rather an exception in this case: these were very large NATO exercises, and they did not last long, which made it possible to use the main forces of the brigade (41 MIB) for a short time, which was not intended for use in the North in terms of profile and equipment. Thus, since 2021, the 41 MIB has been used to staff the multinational FP battle group in Lithuania.

[19] Panzergrenadierbrigade 41. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/heer/organisation/1-panzerdivision/panzergrenadierbrigade-41 (accessed 17 March 2024).
[20] Germany steps up to lead NATO high readiness force. NATO. 1 January 2019. URL: https://www.nato.int/cps/en/natohq/news_161796.htm?selectedLocale=en (accessed 17 March 2024).
[21] See: Weißbuch 1985 zur Sicherheit der Bundesrepublik Deutschland und zur Entwicklung der Bundeswehr. Bonn: Bundesministerium der Verteidigung, Presse- und Informationsamt der Bundesregierung, 1985. 417 S.; Heer. Organization. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/heer/organisation (accessed 17 March 2024).

The 23rd Mountain Rifle Brigade (MRB), the only formation with such a profile in the Bundeswehr, was assigned from the German Army for use in Norway. This decision was finally made in 2023, when the 23 MRB was transferred from the 10th TD to the rapid reaction forces division [22]. The 1st and 10th Tank Divisions of the Bundeswehr were responsible for general-purpose tasks and were used primarily within NATO's area of responsibility, becoming increasingly involved in staffing the Alliance's multinational groups (NRF and FP). The Response Force Division included formations designed for specific tasks in terms of distance from NATO's area of responsibility (primarily the 1st Airborne Brigade, ABB) and natural and climatic conditions. Norway and its coastal waters belonged to the NATO's area of responsibility. However, unlike most other Alliance member states that were located on or near the bloc's eastern borders (the Baltic states, Poland, Hungary, Slovakia, Romania, Bulgaria), there were no multilateral FP formations on the territory of the Kingdom. Potentially, such forces could be deployed in the northern part of Norway, primarily in the county of Finnmark, which is adjacent to the territory of the Russian Federation. The presence in the north of Norway allowed the creator state to establish a foothold or even a geostrategic "springboard" for penetrating into the deep regions of the Arctic Ocean in cooperation with the Kingdom. The White House kept a contingent in Finnmark in 2017–2020 [23] (since 2018, 700 servicemen from the Marine Corps, MC, i.e. the "core" of the battalion tactical group). In June 2022, the Storting ratified an interstate agreement with the United States, according to which they received access (the possibility of using together with the Kingdom) to four military bases, including two in Northern Norway [24]. At the same time, the United States actively participated in NATO-led exercises in this sub-region, i.e., turned to chronologically intermittent (fragmentary) forms of presence.

Official Berlin chose them in the early 2020s to create strategic influence in Finnmark and the surrounding provinces of the Kingdom. Since its formation (1949), the FRG has traditionally preferred to implement steps using the Bundeswehr in the paradigm of multilateralism [13, Arzamanova T.V., pp. 261–262]. This commitment was due to the historical responsibility of Germany as the main aggressor in World War II, the desire to avoid critical perception of the expansion of the geography of the use of the Armed Forces, doing this under the auspices of international structures.

German ground units and subdivisions were sent to northern Norway primarily to participate in the regularly scheduled Cold Response exercises, which became known as Nordic Response in 2024 after Finland and Sweden joined the Alliance. Two A400M transport aircraft from the 62nd

[22] Division Schnelle Kräfte. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/heer/organisation/division-schnelle-kraefte (accessed 17 March 2024).
[23] U.S. Pulls 700 Marines Out of Norway. 7 August 2020. URL: https://www.lifeinnorway.net/u-s-pulls-700-marines-out-of-norway/ (accessed 17 March 2024).
[24] New Norway — USA Defense Agreement Allows Extensive US Authority in the North. 8 June 2022. URL: https://www.highnorthnews.com/en/new-norway-usa-defense-agreement-allows-extensive-us-authority-north (accessed 17 March 2024).

Air Force Squadron [25], sappers and the 232nd Mountain Ranger Battalion from the 23rd Mountain Rifle Brigade were allocated for the Cold Response 20 (March 2020) [26]. In specific terms, the contribution of the FRG amounted to less than 1.5% (150 mountain riflemen and a little more than 30 flight and maintenance personnel out of a total of 15 thousand military personnel [27]). At the same time, the Bundeswehr demonstrated its ability to quickly reinforce the only "North" Brigade in the Norwegian army with units equipped for the conditions of Finnmark.

Germany practiced this task again during the Cold Response 22 (March 2022) involving 27 participating countries. Using military transport aircraft, Germany sent units of the reconnaissance companies of the 26th and 31st parachute regiments from the 1st ABB [28], a company of the 232nd battalion of the 23rd MRB [29] (a unit different from the one involved in similar exercises in 2020) to the north of Norway. The exercises involved ground robotics manufactured in Germany, the capabilities of which (cross-country ability, operation without failures) were tested in conditions of high snow cover and very low temperatures [30].

The fact that the 1st ABB, which had been part of the rapid reaction division since its creation, and the 23rd MRB were used in parallel in Cold Response 22, played an important role in the transfer of the second of these brigades to the division from 2023. Compared to 2020, the volume of Germany's involvement has increased (more than twofold), but the total number of participants has also increased sharply — from 15,000 military personnel during Cold Response 20 to 30,000 in Cold Response 22 [31]. For this reason, the specific contribution of the FRG remained just as small (about 1.5%). However, its practical value for Norway was still significant: the Bundeswehr worked out the reinforcement of the Royal Forces Brigade "North" along the line of two of its brigades at once.

In November 2022, at the Berlin Security Conference in the presence of Prime Minister J.G. Støre, Chancellor O. Scholz summarized the interim results of the cooperation accumulated during

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[25] Cold Response — die „kalte Antwort" aus dem Norden. BMVg. 26 March 2020. URL: https://www.bundeswehr.de/de/organisation/luftwaffe/aktuelles/cold-response-die-kalte-antwort-aus-dem-norden-230516 (accessed 17 March 2024).

[26] Gebirgsjäger zurück aus Nordnorwegen. BMVg. 3 April 2020. URL: https://www.bundeswehr.de/de/organisation/heer/aktuelles/gebirgsjaeger-zurueck-aus-nordnorwegen-247746 (accessed 17 March 2024).

[27] Cold Response — die „kalte Antwort" aus dem Norden. BMVg. 26 March 2020. URL: https://www.bundeswehr.de/de/organisation/luftwaffe/aktuelles/cold-response-die-kalte-antwort-aus-dem-norden-230516 (accessed 17 March 2024).

[28] Fernspäher allein im Eis. BMVg. 31 March 2022. URL: https://www.bundeswehr.de/de/organisation/heer/aktuelles/fernspaeher-allein-im-eis-5384618 (accessed 17 March 2024).

[29] Gebirgsjäger bei Cold Response 2022. BMVg. 1 April 2022. URL: https://www.bundeswehr.de/de/organisation/heer/aktuelles/gebirgsjaeger-bei-cold-response-2022-5385872 (accessed 17 March 2024).

[30] Infanterieroboter besteht Test im Schnee. BMVg. 4 April 2022. URL: https://www.bundeswehr.de/de/organisation/heer/aktuelles/infanterieroboter-besteht-test-im-schnee-5386348 (accessed 17 March 2024).

[31] Fernspäher allein im Eis. BMVg. 31 March 2022. URL: https://www.bundeswehr.de/de/organisation/heer/aktuelles/fernspaeher-allein-im-eis-5384618 (accessed 17 March 2024).

the exercises in northern Norway. The military personnel of the two countries worked out the creation and operation of a joint (from the army, air force, and support from the sea) bilateral grouping of 1.2 thousand servicemen (equivalent to a reinforced BTG) [32].

This practice was repeated during the Nordic Response 24 in March 2024. They took place in the northern regions of Norway (primarily), Finland and Sweden, which had recently joined the Alliance. The Nordic Response 24 exercises were part of a complex of exercises under the auspices of NATO, which took place primarily in the Atlantic (the transfer of US troops to the territory of continental allies in the bloc), in Northern, Central (primarily in Germany) and Eastern Europe [33]. Germany played a significant role in almost all of them [34], cooperating quite closely with Norway. 20 thousand military personnel (from 13 NATO member states) were directly involved in Nordic Response 24, of which 10 thousand were from the ground forces [35]. The core of the Bundeswehr contingent was made up of units from the 233rd Battalion of the 23rd MRB [36].

By 2024, the 23rd Mountain Rifle Brigade consisted of a training center and 6 battalions. One of them was a sapper/engineer battalion (about 600 servicemen), and another was a support battalion (over 750 personnel) [37]. Accordingly, the four remaining battalions were military: the 230th reconnaissance battalion (over 450 servicemen) and mountain ranger units: the 231st (over 850 personnel), the 232nd (over 850 servicemen), and the 233rd (about 800 personnel) [38]. Of these, during three Cold Response/Nordic Response exercises, Germany led a third of the 230th, 232nd and at least half of the 233rd battalions, with the participation of engineers and support

[32] Rede von Bundeskanzler Scholz anlässlich der Berlin Security Conference am 30. November 2022 in Berlin. Bundeskanzleramt. 30 November 2022. URL: https://www.bundeskanzler.de/bk-de/suche/rede-von-bundeskanzler-scholz-anlaesslich-der-berlin-security-conference-am-30-november-2022-2149770 (accessed 17 March 2024).

[33] Steadfast Defender 24. NATO. 2024. URL: https://www.nato.int/cps/en/natohq/222847.htm (accessed 17 March 2024).

[34] Deutschland: Drehscheibe für NATO-Großmanöver. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/weitere-bmvg-dienststellen/territoriales-fuehrungskommando-der-bundeswehr/uebungen-territoriales-fuehrungskommandos/drehscheibe-fuer-nato-grossmanoever-steadfast-defender (accessed 17 March 2024).

[35] Nordic Response 2024. Forsvaret. 2024. URL: https://www.forsvaret.no/en/exercises-and-operations/exercises/nr24 (accessed 17 March 2024).

[36] Was passiert am nördlichsten Punkt Europas? BMVg. 4 March 2024. URL: https://www.bundeswehr.de/de/aktuelles/schwerpunkte/quadriga-2024-nato-landstreitkraefte-ueben-buendnisfall/was-passiert-am-noerdlichsten-punkt-europas-5752476 (accessed 17 March 2024).

[37] Gebirgspionierbataillon 8. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/heer/organisation/division-schnelle-kraefte/gebirgsjaegerbrigade-23/gebirgspionierbataillon-8 (accessed 17 March 2024); Gebirgsversorgungsbataillon 8. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/heer/organisation/division-schnelle-kraefte/gebirgsjaegerbrigade-23/gebirgsversorgungsbataillon-8 (accessed 17 March 2024).

[38] Gebirgsaufklärungsbataillon 230. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/heer/organisation/division-schnelle-kraefte/gebirgsjaegerbrigade-23/gebirgsaufklaerungsbataillon-230 (accessed 17 March 2024); Gebirgsjägerbataillon 231. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/heer/organisation/division-schnelle-kraefte/gebirgsjaegerbrigade-23/gebirgsjaegerbataillon-231 (accessed 17 March 2024); Gebirgsjägerbataillon 232. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/heer/organisation/division-schnelle-kraefte/gebirgsjaegerbrigade-23/gebirgsjaegerbataillon-232 (accessed 17 March 2024); Gebirgsjägerbataillon 233. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/heer/organisation/division-schnelle-kraefte/gebirgsjaegerbrigade-23/gebirgsjaegerbataillon-233 (accessed 17 March 2024).

forces, through the natural and climatic conditions and mountainous terrain of northern Norway. This allows asserting that, as a result of cooperation with the Kingdom, the 23rd MRB is undergoing a gradual "test run" as an Arctic troop unit. Given the speed that Germany has gained, it is reasonable to expect that most units of the 23rd MRB will have developed the skills to operate in the conditions of Northern Norway by the end of the 2020s. In addition, reconnaissance (i.e., strike vanguard) units of the 1st ABB have also acquired this experience. Accordingly, in the current realities, the FRG has a part of the Arctic forces' calculation brigade in the line of ground forces, and in the medium term it will have a full one (or even strengthened, taking into account the component of the 1st ABB).

How large is this figure for the Arctic forces, taking into account the capabilities of other players? The Norwegian Army itself has only one brigade of profile troops ("North", permanent deployment location in Finnmark [39]). The United States decided to create a specialized 11th Airborne Division (ABD; stationed in Alaska) only in June 2022 [14, Zhuravel V.P., Timoshenko D.S.]. It had two brigades: the 1st infantry (former strikers) and the 2nd airmobile. Both of them were transferred from the 25th Infantry Division [40], which is located in the Hawaiian Islands, i.e. in completely different natural and climatic conditions than Alaska. At the same time, both of these US brigades will become real Arctic troops by the end of the 2020s, i.e. in the medium term. Taking this into account, Germany, which did not have direct access to the Arctic Ocean, was not far behind the United States, despite the huge difference in military power as a whole: thus, in 2023, the Bundeswehr had only 7.5 brigades of ground forces, the United States Army (excluding national guard formations) — 32 brigades [41]. It is significant that the training of the 11th ABD (as well as the specialized units of the USMC since 2017) took place largely in the north of Norway: in the spring of 2023, units of the 2nd Airmobile Brigade of the division were transcontinentally transferred here [42]. The attractiveness of the Kingdom as a partner for the United States is due to two factors: the opportunity to adopt the experience of the "North" Brigade, which has been a frontrunner in the use in the coastal zone of the Arctic Ocean, and the desire to have a bridgehead here (in addition to Alaska) for a full-fledged consolidation in the Arctic. These reasons also determined the interest of Germany. Thanks to Oslo's support, it received the opportunity to transform its

[39] Norwegian Armed Forces in transition. Strategic defence review by the Norwegian chief of defence. Abridged version. Oslo, 2015. P. 15, 23. URL: https://www.forsvaret.no/en/news/archive/chief-of-defence-presents-strategic-defence-review/Strategic%20Defence%20Review%202015.pdf/_/attachment/inline/90fb5ae7-58c0-4bd5-ada4-5af212697044:f86eb1b8d34497ac7770386572795f1c6afa0671/Strategic%20Defence%20Review%202015.pdf (accessed 17 March 2024).

[40] Army Forms 11th Airborne Division Amid Focus on Arctic Warfare. Military.com. 6 June 2022. URL: https://www.military.com/daily-news/2022/06/06/army-forms-11th-airborne-division-amid-focus-arctic-warfare.html (accessed 17 March 2024).

[41] U.S. Army. US.gov. 2024. URL: https://www.usa.gov/agencies/u-s-army (accessed 17 March 2024).

[42] Statement of general Christopher G. Cavoli, United States Army. United States European Command. DoD. 26.04.2023. URL: https://armedservices.house.gov/sites/republicans.armedservices.house.gov/files/04.26.23%20Cavoli%20Statement%20v2.pdf (accessed 17 March 2024).

mountain rifle troops (permanently stationed in the Alps, i.e. in the south of Germany) into Arctic troops.

Cooperation of the parties in the northern direction through the Navy and Air Force

In comparison with the Navy army, the FRG was able to determine those forces that could be used in the Norwegian direction. What is the reason for this? The Navy, in comparison with other types of troops, was better prepared for use away from NATO's area of responsibility. First of all, this is due to the presence of two squadrons (2nd and 4th) of frigates in the 2nd operational flotilla: this type was considered the most suitable for presence in the World Ocean. Another reason is also important: the classes of ships that were sent to cooperate with the Norwegian Navy — frigates and submarines —were the only ones that were not involved in NATO's permanent maritime and countermine groups to the north and south of Eastern Europe.

Since the end of the 2010s, in addition to large-scale exercises, the FRG began to send frigates individually for paired patrols and joint small but intensive maneuvers with ships of the Royal Navy of the same class. Most of these activities were carried out in the Norwegian Sea [43]. This cooperation was all the more valuable to the Kingdom because one of the frigates was wrecked (hit the rocks) during Trident Juncture 18, leaving Oslo with only 4 of these ships [44], the most valuable in various ways. In the short and medium term, we should expect an intensification of cooperation between the frigates of the two countries in the Barents Sea in conjunction with the increased activity of the ground forces of the parties in Finnmark. At the same time, scientific and technical cooperation has also developed in this area: in July 2021, it was decided that three German frigates (F124, F125, F126) would be equipped with NSM Block 1A anti-ship missile systems of Norwegian-German development [45].

At the same time, since the end of the 2010s, cooperation between submarine fleets has been developing very dynamically under a similar scheme. In 2019, the U36 submarine of the Bundeswehr's specialized squadron (part of the 1st operational flotilla) was sent for almost six months to conduct various exercises with the Norwegian side [46]. The main objective was to demonstrate the high technical characteristics (especially low-noise and stealth capabilities) of the

[43] „Sachsen" erhält Nikolaus-Preis in Sonderform. BMVg. 18 March 2019. URL: https://www.bundeswehr.de/de/organisation/marine/aktuelles/sachsen-erhaelt-nikolaus-preis-in-sonderform-5022470 (accessed 17 March 2024).

[44] Calculated on the basis of: Norwegian Armed Forces in transition. Strategic defence review by the Norwegian chief of defence. Abridged version. Oslo, 2015. P. 15. URL: https://www.forsvaret.no/en/news/archive/chief-of-defence-presents-strategic-defence-review/Strategic%20Defence%20Review%202015.pdf/_/attachment/inline/90fb5ae7-58c0-4bd5-ada4-5af212697044:f86eb1b8d34497ac7770386572795f1c6afa0671/Strategic%20Defence%20Review%202015.pdf (accessed 17 March 2024).

[45] Deutschland und Norwegen kooperieren bei der Beschaffung von Seeziel-Lenkflugkörper. BMVg. 8 July 2021. URL: https://www.bundeswehr.de/resource/blob/5109088/35bcd4aa8b507eacd49c9f995495ac0d/21-ruestungskooperation-zwischen-deutschland-und-norwegen-data.pdf (accessed 17 March 2024).

[46] Deutsch-norwegische Kooperation: „U36" läuft aus. BMVg. 24 January 2019. URL: https://www.bundeswehr.de/de/organisation/marine/aktuelles/deutsch-norwegische-kooperation-u36-89960 (accessed 17 March 2024).

German Project 212A submarines in order to encourage the partner to purchase them. Norway's plans for the development of the Armed Forces in the mid-2010s, specifically in terms of submarines, were very uncertain [47]. As early as 2017, the Kingdom began to consider the possibility of a solution through purchasing samples from Germany [48]. The final decision was made in July 2021. Berlin and Oslo decided to order a batch of Project 212CD submarines from German manufacturers: the first — 2 submarines, the second — 4 submarines [49]. Project 212CD submarines had improved tactical and technical characteristics compared to Type 212A submarines (all 6 submarines of the 1st submarine squadron of the FRG in 2023 were of this type [50]). Thus, the tonnage was increased from 1.4 to 2.5 thousand tons, which, together with other innovations, made the Project 212CD submarines more suitable for use in the distant sea zone, including the waters of the Arctic Ocean. Norway was supposed to receive the first of the ordered submarines in 2029, Germany — in 2032, and by 2035 all submarines should be delivered [51].

The implementation of this project gave Germany great commercial (financial) and military-strategic advantages. The Norwegian submarine fleet (the equivalent of one submarine brigade) was tied to maintenance and repair by German companies for the long term. In turn, Germany provided its partner with access to its advanced developments; moreover, it was considered one of the world leaders in the field of creating diesel submarines. The German side exported submarines to many countries around the world, but these were mainly ships of a different type (Project 212 of various modifications) than those used by the German Navy itself — with simplified tactical and technical characteristics. This rule did not apply to Norway, although it received the lead submarine of Project 212CD much earlier (by 3 years) than Germany itself. These facts reflected the desire of Germany to emphasize the particularly trusting nature of cooperation with Norway in the field of security and defense, not only in the past and present, but also in the future at a chronologically "long" step. Official Berlin realized the benefits of the bilateral submarine initiative and in turn met its partner's demands for the purchase of anti-ship systems for frigates primarily of its

[47] Norwegian Armed Forces in transition… P. 15, 24. URL: https://www.forsvaret.no/en/news/archive/chief-of-defence-presents-strategic-defence-review/Strategic%20Defence%20Review%202015.pdf/_/attachment/inline/90fb5ae7-58c0-4bd5-ada4-5af212697044:f86eb1b8d34497ac7770386572795f1c6afa0671/Strategic%20Defence%20Review%202015.pdf (accessed 17 March 2024).

[48] Deutsch-norwegische Marine-Kooperation vereinbart. BMVg. 8 December 2017. URL: https://www.bundeswehr.de/de/organisation/marine/aktuelles/deutsch-norwegische-kooperationsvereinbarung-unterzeichnet-5032428 (accessed 17 March 2024).

[49] Rüstungskooperation zwischen Deutschland und Norwegen. Beschaffung zweier U-Boote für die Bundeswehr unter Vertrag. BMVg. 8 July 2021. URL: https://www.bundeswehr.de/resource/blob/5109066/e3a362cf0b87ca7cb68b3f8a41e607ff/20-beschaffung-zweier-u-boote-fuer-die-bundeswehr-unter-vertrag-data.pdf (accessed 17 March 2024).

[50] Ubootgeschwader. BMVg. 2024. URL: https://www.bundeswehr.de/de/organisation/marine/organisation/einsatzflottille-1/1-ubootgeschwader (accessed 17 March 2024).

[51] Rüstungskooperation zwischen Deutschland und Norwegen. Beschaffung zweier U-Boote für die Bundeswehr unter Vertrag. BMVg. 8 July 2021. URL: https://www.bundeswehr.de/resource/blob/5109066/e3a362cf0b87ca7cb68b3f8a41e607ff/20-beschaffung-zweier-u-boote-fuer-die-bundeswehr-unter-vertrag-data.pdf (accessed 17 March 2024).

own (de jure bilateral) design. Both agreements were signed on July 8, 2021, thereby representing a package deal.

Two strategic agreements made it possible to unify the fleets of the parties in a number of specialized weapons (for some frigates) and, most importantly, submarines. This dramatically expanded the opportunities for practical cooperation, including the formation of temporary (for the duration of exercises or for any significant specific event) and permanent naval groups of bilateral manning. First of all, we could talk about a joint group of submarines (2–3 submarines), as well as frigates. At the NATO level, by the mid-2020s, there were no multinational formations of ships of these classes, i.e. such bilateral initiatives of Berlin and Oslo, if implemented, could become precedent-setting and even breakthrough. Moreover, in practice, taking into account the planned speed of receipt of submarines, such a unit can be created only in the first half of the 2030s.

The FRG is likely to use the issue of protection of critical infrastructure (primarily various pipelines and cables) located underwater as an information reason for launching and implementing such an initiative. Germany used the disruption of the Nord Streams in a modal ("pure") form, i.e. without discussing the involvement of a specific party in this, to sharply intensify its naval cooperation with Norway [52].

Coordination between the air forces of the two countries was much less in volume and quality. A partial change in this situation is possible as Norway [53] (instead of the F-16) and Germany [54] (in addition to aircraft developed by EU member states) purchase American F-35s. In this case, the unification of combat vehicle fleets will also have an effect, but much less than in the case of the Navy. The F-35 is a US-made technology, which is one of the reasons, and most importantly, an indicator that the cooperation between the two countries in the Air Force will be through US coordination, but mostly not directly.

Coordination of the parties in the issue of NATO grouping and support for official Kyiv

By the mid-2010s, Germany and Norway (as well as the Netherlands) belonged to one group of the Alliance member states when staffing groups. The Royal Army, as an ordinary member state, was involved in staffing the VJTF as the "spearhead" of the NRF in all the turns of the Bundeswehr as a "framework nation". In 2015 and 2023, this happened at the beginning of each load-

[52] Deutsche Marine beteiligt sich am Schutz der kritischen Infrastruktur Norwegens. BMVg. 4 November 2022. URL: https://www.bundeswehr.de/de/organisation/marine/aktuelles/schutz-kritischer-infrastruktur-norwegens-5519846 (accessed 17 March 2024).

[53] Norwegian Armed Forces in transition… P. 23. URL: https://www.forsvaret.no/en/news/archive/chief-of-defence-presents-strategic-defence-review/Strategic%20Defence%20Review%202015.pdf/_/attachment/inline/90fb5ae7-58c0-4bd5-ada4-5af212697044:f86eb1b8d34497ac7770386572795f1c6afa0671/Strategic%20Defence%20Review%202015.pdf (accessed 17 March 2024).

[54] Rede von Bundeskanzler Scholz anlässlich der Berlin Security Conference am 30. November 2022 in Berlin. Bundeskanzleramt. 30 November 2022. URL: https://www.bundeskanzler.de/bk-de/suche/rede-von-bundeskanzler-scholz-anlaesslich-der-berlin-security-conference-am-30-november-2022-2149770 (accessed 17 March 2024).

sharing cycle between the European member states; in 2019 — additionally [55]. In the third case, Norway's active contribution is most indicative: official Oslo demonstrated its reliability as a junior partner in the context of a noticeable increase in the frequency of Germany's acceptance of the load when staffing the forces of NATO's II strategic echelon. Moreover, the Kingdom's ground forces were small (a brigade, a guard, small reserve-type formations [56]), and an increase in the workload by even several hundred military personnel was noticeable for Norway, especially since almost all combat-ready battalions were located in Finnmark and adjacent areas [57], i.e. in the north of the country.

However, official Oslo did not refuse to bear the burden in various multinational NATO forces to the south of its territory, including in Eastern Europe. Thus, since 2017, Norway has participated in staffing the Alliance's multinational FP combat tactical group on the territory of Lithuania, with Germany acting as a "framework state" for this formation. In 2017–2021, the Bundeswehr's contribution was 500–550 military personnel, the Royal Armed Forces — about 120 personnel [58]. In January 2022, i.e. even before the start of the Russian Special Military Operation, Germany increased its contingent by 350 soldiers and officers, Norway — by 60 military personnel [59], i.e. the parties again acted symmetrically, constantly coordinating plans.

The latter trend was emphasized by O. Scholz, when on June 7, 2022, at the meeting with the leaders of the Baltic states, he announced plans to gradually reorganize the battalion group into a brigade group [60]. At the time of the announcement of these plans, in June 2022, out of a total of 1,632 military personnel, Germany accounted for 1,031 soldiers and officers (63.2%), and Norway — for 188 military personnel (11.5%) [61]. If such a specific contribution were to be maintained, the transition of the multilateral FP formation from a battalion to a brigade would require Norway to deploy 500–600 servicemen at a time, and taking into account the rotation principle, to reserve a total of about 2–3 thousand, or at least 10% of the total number of the Royal Armed Forces. Such a load was extremely difficult for them to implement. This situation became one of

[55] Germany steps up to lead NATO high readiness force. NATO. 1 January 2019. URL: https://www.nato.int/cps/en/natohq/news_161796.htm?selectedLocale=en (accessed 17 March 2024).
[56] Norwegian Armed Forces in transition. Strategic defence review by the Norwegian chief of defence. Abridged version. Oslo, 2015. 24 p. URL: https://www.forsvaret.no/en/news/archive/chief-of-defence-presents-strategic-defence-review/Strategic%20Defence%20Review%202015.pdf/_/attachment/inline/90fb5ae7-58c0-4bd5-ada4-5af212697044:f86eb1b8d34497ac7770386572795f1c6afa0671/Strategic%20Defence%20Review%202015.pdf (accessed 17 March 2024).
[57] Ibid.
[58] NATO's Enhanced Forward Presence. NATO. October 2020. URL: https://www.nato.int/nato_static_fl2014/assets/pdf/2020/10/pdf/2010-factsheet_efp_en.pdf (accessed 17 March 2024).
[59] NATO-Staaten verstärken Nordostflanke des Bündnisses. BMVg. 2 March 2022. URL: https://www.bundeswehr.de/de/organisation/heer/aktuelles/nato-staaten-verstaerken-nordostflanke-des-buendnisses-5364278 (accessed 17 March 2024).
[60] „Russland darf und wird diesen Krieg nicht gewinnen". Bundeskanzleramt. 7 June 2022. URL: https://www.bundesregierung.de/breg-de/suche/bundeskanzler-in-litauen-2047754 (accessed 17 March 2024).
[61] Calculated on the basis of: NATO's Enhanced Forward Presence. NATO. June 2022. URL: https://www.nato.int/nato_static_fl2014/assets/pdf/2022/6/pdf/2206-factsheet_efp_en.pdf (accessed 17 March 2024).

the reasons for the decision of the FRG, which was announced in November 2023. All newly deployed battalions of the brigade, except for the already multilateral one, should be single-national (i.e. only from Bundeswehr servicemen), and be stationed on a permanent basis. One half of the brigade and the headquarters were to be deployed in Lithuania by the end of 2024, the other — by 2026 inclusive [62]. This decision was in the interests of the Kingdom: official Berlin was noticeably increasing and making permanent the German presence in one of the Baltic countries (the situation in which the Northern European states traditionally paid increased attention), Oslo was maintaining its politically significant contribution, but without incurring excessive military costs.

Coordination of efforts of the parties also took place in the matter of providing support to the armed forces of Ukraine. Firstly, Germany and Norway were actively involved in the activities of the Ramstein format. Under its auspices, "Western democracies" created "coalitions of the willing" to supply specific types of weapons and military equipment, especially heavy ones, to the Armed Forces of Ukraine. Official Oslo was interested in Berlin's agreement to the supply Leopard 2 tanks, which were available both to Germany and to NATO partners, including Norway. The FRG authorities made this decision on January 25, 2023. The Government of I.G. Støre allocated eight Leopard 2 tanks to Ukraine already in March 2023 [63]. O. Scholz's cabinet carried out deliveries less quickly; by the summer of 2023, it had allocated eighteen Leopard 2 and thirty Leopard 1 tanks [64]. Taking into account the volume of military reserves in specific terms, Norway's contribution looks noticeably larger than that of Germany.

The Kingdom also took part in the EU military training mission EUMAM UA to train the personnel of the Ukrainian Armed Forces: for 2023, the main task was to train troops and units and then replenish them for the "strategic reserve" brigades of Ukraine's forces. Thus, a group of Norwegian instructors was sent to EUMAM UA training centers in Germany. In total, at least 5 thousand military personnel were trained here in 2023 [65]. First of all, these are the personnel of the 47th Mechanized Brigade of the AFU "Magura" and specialists of technical branches of the armed forces (tank, mechanized, artillery) for other units. The 47th Brigade unsuccessfully attacked in the Zaporozhian direction in the summer and autumn of 2023, and was then transferred to the Avdiivka and Artemivka directions, suffering heavy losses and repeatedly receiving numerous reinforcements of people and equipment. The fact that Norway participated in the activities of EUMAM UA, without being an EU member state, did not seem an anomaly. As in the case of the Permanent

[62] Drei bewährte Bataillone für die neue Panzerbrigade 42. Deutscher Bundeswehrverband. DBWV. 6 November 2023. URL: https://www.dbwv.de/aktuelle-themen/blickpunkt/beitrag/zwei-bewaehrte-bataillone-fuer-die-neue-panzerbrigade-42 (accessed 17 March 2024).

[63] Norske stridsvogner mottatt av Ukraina. Forsvaret. 20 March 2023. URL: https://www.forsvaret.no/aktuelt-og-presse/aktuelt/stridsvogner-ukraina (accessed 17 March 2024).

[64] See: Diese Waffen und militärische Ausrüstung liefert Deutschland an die Ukraine. Bundeskanzleramt. 2024. URL: https://www.bundesregierung.de/breg-de/schwerpunkte/krieg-in-der-ukraine/lieferungen-ukraine-2054514 (accessed 17 March 2024).

[65] Norwegen: Starker Partner in der Ausbildung. BMVg. 19 July 2023. URL: https://www.bundeswehr.de/de/organisation/weitere-bmvg-dienststellen/territoriales-fuehrungskommando-der-bundeswehr/aktuelles/norwegen-partner-ausbildung-5654686 (accessed 17 March 2024).

Structured Cooperation (PESCO) under the auspices of the European Union, Norway contributed in those specific areas that were of interest to it. It is logical that Germany, as the unofficial leader of the EU and an actor very interested in deepening cooperation with the Kingdom, was satisfied with the facts of its cooperation with the EU as an association. In turn, official Oslo, within the framework of EUMAM UA, chose Berlin as the main counterparty for coordinating efforts. Moreover, Norway participated in the training of the Ukrainian Armed Forces personnel not only under the auspices of the EU mission, but also under the auspices of Interflex, where the role of the main organizer was assumed by Great Britain in its national capacity [66]. London has only recently (2021) completed the Brexit, which hit the interests of Germany hard [15, Ananyeva E.V., pp. 111–112]. For these reasons, we can talk about Norway's readiness to provide assistance to Ukraine in various issues, but not always choosing Germany as a key partner.

Conclusion

With a rather limited military resource base, Norway was active not only in its "home" regions (Northern Europe, the Arctic), but also in the forward part of NATO's area of responsibility in Eastern Europe and in supporting the Ukrainian Armed Forces. In the latter two cases, the practical scope of Norway's activities was not so large (within the FP group in Lithuania, the Kingdom's Armed Forces were represented by less than 200 servicemen; in terms of tanks, Kyiv received from Oslo a fleet for a partial company), but the frequency of measures and the exclusive attention to each of them from Germany and other partners are indicative.

Official Oslo demonstrated a readiness to act on the specified wide range of tracks, and this ability was ensured by the nature of support from the partner states of the Alliance. It was based on an increased interest in the Kingdom as a focal ally for penetrating the Arctic Ocean. Norway itself did not accelerate the issue of deploying troops of other "Western democracies" on its territory and adjacent sea areas; NATO powers demonstrated an increased desire to implement this, which is clearly evident in the example of the FRG.

Based on cooperation with the Royal Armed Forces in Finnmark, Germany began to create Arctic troops for the first time since the end of World War II, preparing the forces of the 23rd Mountain Rifle Brigade and individual units of the 1st Airborne Brigade in this capacity. At the same time, the German Navy began to operate in the seas to the west and north of the Kingdom, i.e. also as Arctic forces. Here, the main cooperation would be in the area of frigates and diesel submarines, which confirmed the features of advanced military-technical cooperation. Military cooperation is framed by advanced political dialogue, including at the highest level. A high level of political trust in the dialogue was achieved already in the mid-2010s, thereby ensuring a "spill-over effect" in the military sphere approximately five years later, by the beginning of the 2020s. In addition to the rapid development of cooperation in the Armed Forces and the development of special-

[66] Operation Interflex. Forsvaret. 2024. URL: https://www.forsvaret.no/en/exercises-and-operations/international-operations/interflex (accessed 17 March 2024).

ized equipment, it is also indicative to supplement bilateral contacts with cooperation in the "N5+1" format, as well as the invariability of the progressive development of cooperation against the backdrop of a change in the leadership of each of the countries. This reflected the role of Norway as a focal partner for Germany in matters of not only strategic penetration in the Arctic, but also strengthening its position in Northern Europe as a region.

Germany is extremely interested in ensuring significant military-political positions in the Arctic Ocean. The main reasons are the desire to emphasize successes in gaining full-fledged global subjectivity, as well as to gain access to the vast natural (primarily energy and marine) resources of the Arctic Ocean due to the limited availability of such at Germany's own disposal.

Both official Berlin and Oslo prefer the increasing use of NATO's aegis in the Arctic. Germany's military activity in Norway and adjacent waters, especially in the northern part of the country, is a significant contribution to the system of "containing" the Russian Federation. The threat to its security and national interests is all the more significant because unfriendly military measures are directed against the main forces of the joint strategic command "Northern Fleet" — at present, first of all, against the ground forces (Arctic motorized rifle and coast guard), and in future — against the Navy.

In general, de jure and partly de facto, German-Norwegian relations have strived for the ideal. However, it is still hardly possible to recognize them as sufficiently harmonious as of the early 2020s. The interest of official Berlin in Oslo was greater than the other way around: first of all, due to the growing desire of the FRG to ensure a full-fledged strategic presence in the Arctic Ocean. This created an increased practical dependence of Germany on Norway. Moreover, its open negative manifestations in the near and medium term will be minimal, given the growth of the military resource base that the FRG was ready to allocate for cooperation with the Kingdom.

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"Cultural Compass" of International Sociological Ratings on the "Organizational Culture" of the Arctic States

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Abstract. The article is devoted to a comparative analysis of open data from international sociological Internet resources (Trompenaars Hampden-Turner Connecting Viewpoints, Hofstede Insights Ltd) in relation to the Arctic countries. As it is known, the models of F. Trompenaars, G. Hofstede are focused on the study of differences in business cultures and the analysis of cross-cultural communication, i.e. the study of the national characteristics of the organizational culture of the countries, their "cultural compass". The relevance of the proposed topic is dictated by a number of factors: firstly, the Arctic region is an area of geopolitical competition between Russia and predominantly Western countries; secondly, the most important element in the struggle for geopolitical supremacy is "organizational culture" as the most important element of "soft power"; thirdly, it is important to understand how Western sociological models see the relationship (similarities and differences) of cultural factors on the example of key stakeholders in the Arctic region; fourthly, it is important to determine the place that Russia occupies in these ratings; fifthly, Western attempts to constrain Russia in the region determine the need to include in the sample not only data on the members of the Arctic Council (represented, with the exception of Russia, only by NATO countries), but also on Russia's allies within the BRICS, in particular data on the organizational culture of China, which has long-term interests in the Arctic region. Within this logic, a number of questions arise: what is the "vision" created by Western Internet resources about the organizational culture of different countries, how the data obtained correlate with each other in the light of the current geopolitical situation. Comparing the results of different models and the statistical results obtained on their basis can lead to non-trivial conclusions, in particular about the scientific component of such ratings and their impact on the business image of countries in the world as a whole, and the Arctic region in particular.

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Keywords: *cultural compass, national culture, stakeholder, model, Arctic, correlation of cultures, Arctic Council*

Introduction

Panoptic, or encyclopedic, analysis (and it is the breadth of the scientific view that comes to mind when we talk about the vast expanse of the Arctic and the number of geopolitical parties interested in its development) necessarily implies that new knowledge is found precisely at the crossroads of interdisciplinary methodologies and the intersections of the boundaries of different fields of knowledge and models. A systemic vision always makes sure that big data is not hidden from it by the dry statistics that constantly floats over the "ocean of Arctic information". A comparative-analytical approach should certainly penetrate to a depth of facts and extract relevant knowledge from the darkness for all stakeholders interested in studying and developing the Arctic. It is no secret that not only those countries that border the Arctic, but also those that do not have a direct geographical connection to it, are now interested in exploring the Arctic. Therefore, at the present stage, this interest should be viewed through the prism of significant transformations, the most important of which is the so-called transition from "the Empty World to the Full World". The metaphor of the "Empty World", outlined in the Club of Rome report (2018), reflects the millennia-long history of humankind, when it steadily expanded the boundaries of the world through pioneering movements and outward frontier shifts, but due to the weakness of production systems was not able to make any significant impact on vast natural landscapes for a sufficiently long period of time.

The circles of cultural and economic expansion, emanating from different centers of human civilization, diverging and collectively synchronizing across the planet in a form that can be conventionally associated with spiral autowaves, permanently overlapped, reinforced, or absorbed each other, forming an invisible pattern of potential influence and quite visible contour of state and economic borders, determined both by the specific efforts of individual states and by purely geographical and climatic factors. The well-known "immensity of the world" absorbed the impacts of Man for a time. With the advent of the era of "Full World", humanity not only mastered and occupied everything that could be mastered and occupied, but also reached boundaries that were previously considered undevelopable, in particular, the borders of the Arctic. A distinctive feature of the "Full World" was that the influence of the "economy" began to encroach on the ecosystem, and the growth of the economy was supposed to "bump" into the known limits of the Earth, following the law of conservation of matter and energy (the First Law of Thermodynamics), forcing humanity to seek ways of intensive development. Under such conditions, nature and the ecosystem began to be viewed not as a "workshop" or a bottomless "storeroom" of humanity, but as a stakeholder, i.e. a "living" subject of planetary synergetic and cybernetic relations, which has and "pursues" its "interests". In this case, the relationship between nature and society is increasingly acquiring a noospheric character.

It is noteworthy that society itself is fundamentally changing. K. Popper's famous metaphor of the "clocks and clouds", i.e. an open and closed society, can no longer remain the only guideline and criterion, thanks to which the "open" is always opposed to the "closed", and the "free" to the "unfree". In the conditions of transition from an empty world to a full one, an open society also loses its ideological meaning, since almost everything is already open, in this case it becomes clear that the further development of an open society is a conditionally cyclical transition to its opposite.

Returning to the metaphor of the "ocean of Arctic information", it should be noted that this ocean will be developed precisely in the light of the struggle of the conditional "cloud" and "clock", i.e. mixed strategies of open and closed types of society. This synthesis will give rise to well-known and new cultural dilemmas both in relations between different countries and within them. Isolationism in Arctic development will compete with international co-operation, open data in the development of the Arctic will alternate with closed data of national security and strategic tasks. Common use of the Arctic will determine the so-called "tragedy of the commons" in international "Arctic affairs", when individual users, having open access to the common good of all users and not having exclusive rights to it, will lead to the depletion of the common resource by their uncoordinated actions. The solution to this dilemma lies in the balance between the needs of users and the degree of resource depletion. Consequently, the Arctic becomes a center of attraction for many players, stakeholders. It is clear that modelling such a balance of strategies of Arctic players is complex. The general direction of uncoordinated actions continues to remain within the framework of the so-called "zero-sum game", where a win for one side necessarily funds a complete loss for the other side.

The search for an Arctic "Nash equilibrium", i.e. a set of strategies in a game for two or more players, in which no participant can increase their winnings by changing their strategy if the other participants do not change their strategies, seems to be the most important task of forming "multi-stakeholder governance", the purpose of which is to ensure the best quality in decision-making.

The latter is impossible without the transition from the so-called smart mobs to smart stakeholders.

Interoperability of stakeholders, i.e. their functional compatibility in education, science, production, innovation and, of course, culture, should become a condition for realization of this transition. Soft skills and hard skills should be combined with the functional literacy of all participants in the process.

We should not forget about other problems, such as the "tragedy of anti-commons", when the owners of exclusive rights to breakthrough Arctic technologies or some good maximize only their own profits. For example, patent payments to the author of an invention used in the production of goods can lead to unprofitability of the product if there are too many patents. Moreover,

everyone suffers: authors of patents (underpayments), producers (forced to raise prices and sell less), consumers (buy at triple the price).

Another factor determining the modern development of the Arctic is the so-called disruptive technologies and innovations, which are the essence of "creative destruction" (alternative: German Schöpferische Zerstörung). The term was popularized by the economist Joseph Schumpeter in the 1940s. In other words, the challenges posed by the so-called Industry 4.0 create a problem that can be conventionally designated as Arctic 4.0. It is no longer steam and steel, electricity and nuclear energy, computers, i.e. everything that was the driving force of the past three industrial revolutions, that will determine the sustainable development of the world, but the emergence of intelligent machines, the Internet of Things, big data will set the vectors of economic, social and even cultural development of mankind.

It will be possible to gain the necessary advantages in the undoubtedly competitive Arctic environment only by working with big data, i.e. by extracting elements of not only breakthrough technical information, but also arrays of information about the soft power of geopolitical players, about the organizational culture of countries, their cultural code, their ability to resist "linguistic imperialism", their ability to preserve cultural sovereignty in the era of artificial intelligence and big linguistic models.

In this regard, let us attention to a number of existing methodologies that, through broad longitudinal sociological studies, reveal a number of questions that, on the one hand, relate to the description of how countries act on the basis of the most general cultural and value orientations inherent specifically to these countries, and on the other hand, how these countries can interact, for example, in the context of developing the Arctic, how compatible their organizational cultures are, and how existing models and ratings, built on the basis of broad sociological surveys, reflect this organizational and cultural compatibility/incompatibility.

Methodology of research on the "cultural compass" of the subarctic countries

Among the variety of [1, Ashurbekov R.Kh.] sociological methods, one can highlight the World Values Survey (WVS) and the so-called Inglehart–Welzel cultural map of the World (R.F. Inglehart). It is also impossible to ignore the methods of G. Hofstede (Hofstede's cultural dimensions theory), S. Schwartz (Theory of Basic Values) [2, Kuznetsov A.E.], F. Trompenaars (Trompenaars's model of national culture differences, F. Trompenaars, C. Hampden-Turner) [1]. It is noteworthy that there is already an array of accumulated data over several decades of research. The most famous method is the Hofstede model, which has been the subject of many works [3, Veriga V.L.; 4, Gorbunova O.A.; 5, Minkov M.; 6, Myasoedov S.P.]. Recently, works devoted to the application of models to specific countries, such as the PRC, have been published [7, Mikhelson S.V.; 8, Skalnaya O.A.; 9, He Ya.; 10, Kikot I.N.]

[1] Culture for Business Tool. URL: https://www.thtconsulting.com/dashboard/283th23b8yhfwcerbicgsfberifubr9w8e7fgv98e7tg9w8f73g9bf73gw9b8fgc7b9f78/ (accessed 02 March 2024).

Thus, impressive data has been accumulated, which are expressed in laconic models, for some of which there are dynamic visualizations showing the transformation of a country's position over a certain period of time (for example, the Inglehart–Welzel Cultural Map) (Fig. 1).

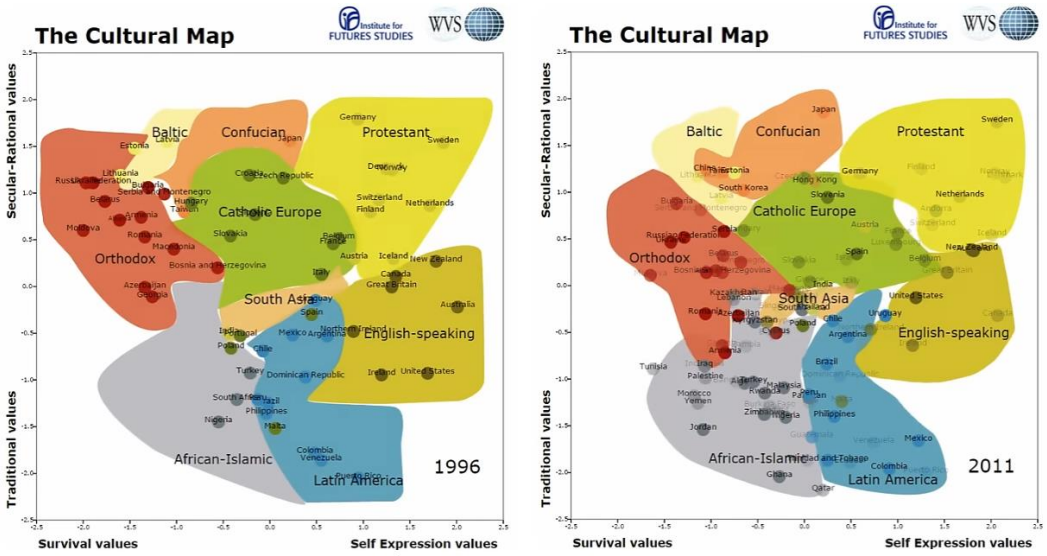

Fig. 1. Inglehart–Welzel "Cultural Map of the World" (1996–2011)

Y-axis: traditional values, secular-rational values; x-axis: survival values, self-expression values [2].

For 2023, the value correlations according to the Inglehart–Welzel Cultural Map are as follows (Fig. 2):

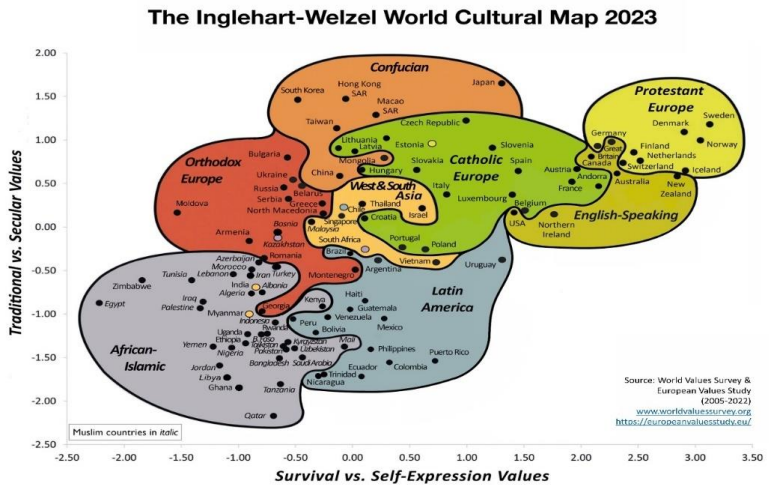

Fig. 2. Inglehart–Welzel "Cultural Map of the World" (2023)

Y-axis: traditional values vs. secular-rational values; x-axis: survival values vs. self-expression values [3].

For other models, online resources have been created that allow entering country names into search engines and seeing their profile, i.e. their structured description using various pre-measured indicators.

[2] Inglehart–Welzel Cultural Map. URL: https://www.worldvaluessurvey.org/WVSContents.jsp?CMSID=findings (accessed 02 March 2024).
[3] Inglehart–Welzel Cultural Map. URL: https://www.worldvaluessurvey.org/images/Map2023NEW.png (accessed 02 March 2024).

For example, the Dutch Internet resource "Trompenaars Hampden-Turner Connecting Viewpoints" is dedicated to the model of F. Trompenaars (Trompenaars's model of national culture differences, F. Trompenaars, C. Hampden-Turner). The developers claim that "the site allows extracting a profile for a specific country from their database to compare it with another profile, and therefore see the main cultural differences in doing business and managing in the selected country. The Trompenaars database is one of the richest sources of social and business data. The original data includes responses from more than 100,000 respondents from more than 140 countries. The database has been subjected to rigorous statistical testing and data mining. Cultural data, cultural stereotypes and differences have been analyzed in different countries, types of organizations, business segments and markets…" [4] (Fig. 3).

The resource allows comparing the indicators of any two countries.

Fig. 3. Trompenaars's model of national cultural differences (Russia / Sweden) [5].

Using this resource, we obtained the result we were interested in, in particular, the indicators of the Arctic Council countries and China, which are presented in Table 1 and Fig. 4.

Table 1

Indicators of the Arctic Council countries and China (F. Trompenaars's model)

		Russia	USA	Canada	Sweden	Norway	Finland	Iceland	Denmark	PRC
1	Universalism/ Particularism	26	92	90	65	82	57	87	86	25
2	Individualism/ Communitarianism	92	91	67	83	95	90	94	76	23
3	Specific/ Diffuse	86	90	76	89	94	92	91	79	21
4	Neutral/ Affective	6	65	67	86	94	91	95	83	90
5	Achievement/ Ascription	16	91	82	86	89	88	95	83	22
6	Past, Present, Future	46	14	5	11	17	10	33	13	28
7	Sequential/	32	68	59	94	92	90	95	89	37

[4] Trompenaars Hampden-Turner Connecting Viewpoints. URL: https://www.thtconsulting.com/culture-factory/culture-explore/compare-countries/ (accessed 02 March 2024).
[5] Ibid.

	Synchronic									
8	Internal/External	51	94	88	34	40	36	77	65	17

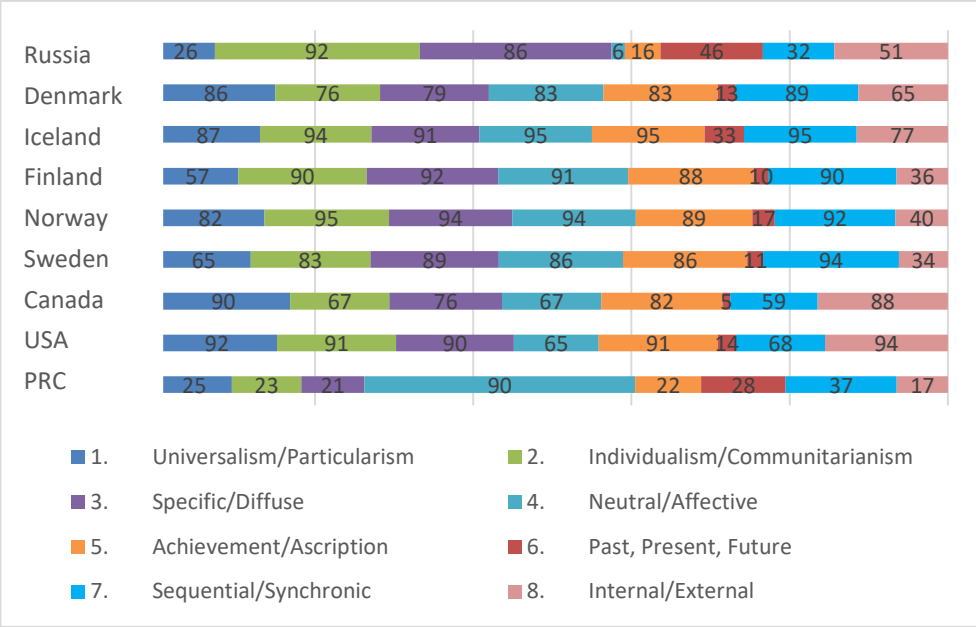

Fig. 4. Comparative indicators of the Arctic Council countries and China (Trompenaars's model).

Besides, the electronic resource "Trompenaars Hampden-Turner Connecting Viewpoints" makes it possible to obtain a decoding of the obtained results. Let us consider what the extreme and average values express on a specific example (Russian Federation — Sweden). The obtained data are presented in Table 2.

Table 2

Decoding of indicators for the Russian Federation and Sweden (F. Trompenaars's model)

1	Universalism/ Particularism	26 — Russians are relationship-oriented.	65 — Swedes tend to value rules in relation-ships.
2	Individualism/ Communitarianism	92 — Russians have a strong personality orien-tation.	83 — Swedes tend to rate individuality highly on this dimension.
3	Specific (special culture)/ Diffuse	86 — Russians have a very low level of person-al involvement in busi-ness.	89 — Swedes tend to rate personal involve-ment in business very low on this dimension.
4	Neutral/ Affective	6 — Russians have a very high tendency to show emotions.	86 — Swedes tend to hide emotions.
5	Achievement/ Ascription	16 — Russians tend to use their given status.	86 — Swedes tend to value achievement (in what they do) very high-ly.
6	Past, Present, Future	46 — Russians' orienta-tion in this regard is balanced between ex-tremes.	11 — Swedes tend to be very future-oriented.
7	Sequential/ Synchronic	32 — Russians are more inclined to multitask than to perform a single task.	94 — Swedes tend to be more task-oriented.
8	Internal/External	51 — Russians' orienta-tion is balanced be-tween extremes.	34 — Swedes tend to "go with the flow" rather than to take control.

It is also necessary to consider the data for other countries.

Attention should be paid to China and the USA.

1. The Chinese, as a rule, highly value relationships in this aspect.
2. — / —, as a rule, highly value groups in this aspect.
3. — / —, as a rule, highly value personal participation in business.
4. — / —, as a rule, tend to hide their emotions.
5. — / —, as a rule, tend to use their status.
6. — / — tend to have a high future orientation.
7. — / — tend to be more inclined to multi -task than single-task.
8. — / — tend to "go with the flow".

USA:

1. Americans tend to value rules very highly in this dimension.
2. — / — tend to value individuals very highly in this dimension.
3. — / — tend to have a very low level of personal involvement in business in this dimension.
4. — / — tend to hide rather than show emotions.
5. — / — tend to value achievements (what they do) very highly.
6. — / — tend to value the future very highly.
7. — / — tend to be more inclined to single-task than multi-task.
8. — / —, as a rule, are very inclined to take everything under control.

Using such data, assuming that they are correct, it is possible to build predictive models of interaction in business, taking into account the strategies of the parties. For example, in this regard, in our opinion, convenient tools would be: the game-theoretic model "Prisoner's Dilemma", "SWOT analysis", etc.

The second resource for analyzing the world of values of different countries is the Geert Hofstede model — not the model itself, but the data obtained on its basis and published by "The culture factor group" — the current brand of Hofstede Insights Ltd.[6] — a Finnish consulting company on cultural analytics and strategy. The company's website states that this organization has offices in 10 countries and strategic alliances covering more than 60 countries.

The concept of the Dutch social anthropologist Geert Hofstede [7], similar in its purpose to the model of F. Trompenaars, also represents a universal model for determining the characteristics of the culture of countries. In its modern form, it is represented by the following indicators: Power distance index; Individualism vs. Collectivism; Motivation towards Achievement and Success (in Russian scientific literature this parameter is called "femininity/masculinity" — editor's note); Uncertainty avoidance index; Long-term orientation vs short-term orientation; Indulgence vs restraint. In sociological and socio-philosophical discourses, Geert Hofstede's model [11, Bataeva B.S.] is also known as the "culture compass". This metaphor expresses a certain research inten-

[6] Hofstede Insights Oy — Finnish limited liability company, registration number 1652415-9.
[7] The culture factor tm. URL: https://www.hofstede-insights.com/models/national-culture/ (accessed 02 March 2024).

tion to search for “cultural barriers” that hinder understanding between people belonging to different cultures and, accordingly, being carriers of different cultural attitudes, values, algorithms and patterns of cultural behavior.

It is also striking that the metaphor of the “compass of values” was expressed quite accurately by W. Heisenberg in his work “Physics and Philosophy. Part and Whole”. He wrote: “The question of values is, after all, a question of what we do, what we strive for, how we should behave. Therefore, it is a question about man and for man; it is a question about the compass, which we should be guided by when finding our way in life. This compass has received different names in different religions and worldviews: happiness, God’s will, meaning and many others. The difference in names speaks of very deep differences in the structure of consciousness of human groups that have called their compasses by such names. I in no way wish to belittle these differences. However, I have the impression that all formulations refer to the attitude of people to the central world order” [12, Heisenberg W.].

On the Hofstede-insights website [8], in the tabs “Our Models” — “Country comparison tool”, one can select a country and see its indicators according to the above criteria (Fig. 5).

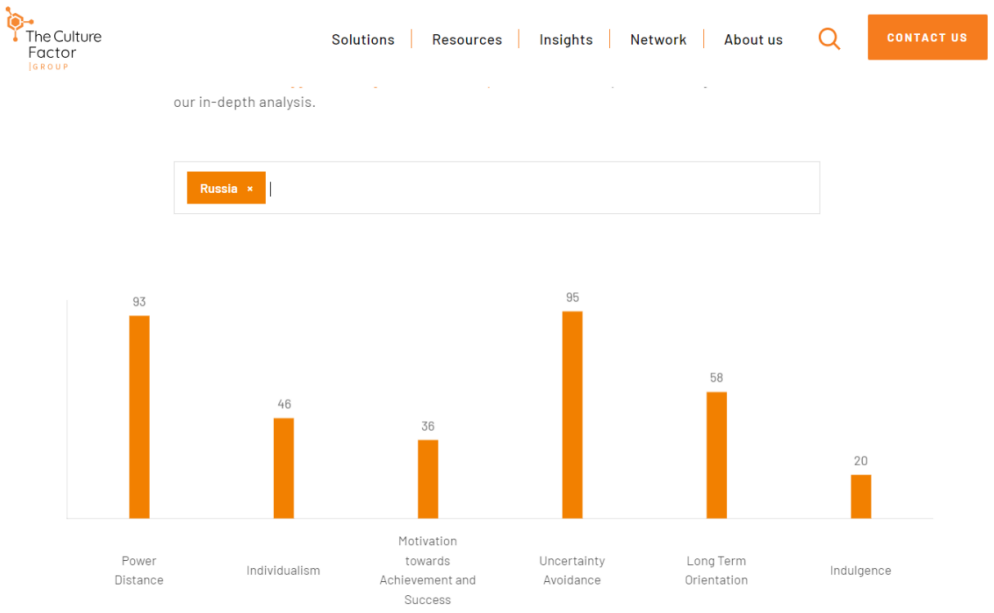

Fig. 5. Russia’s indicators in “Hofstede’s Dimensions of Culture” [9].

By analogy with the model of F. Trompenaars’s, we can build a data table based on G. Hofstede’s model (Table 3, Fig. 5).

[8] Hofstede-insights. URL: https://www.hofstede-insights.com/product/compare-countries/ (accessed 02 March 2024).
[9] Country comparison tool. URL: https://www.hofstede-insights.com/country-comparison-tool?countries=russia (accessed 02 March 2024).

Table 3

Indicators of the Arctic Council countries and China (G. Hofstede's model)

	Russia	USA	Canada	Sweden	Norway	Finland	Iceland	Denmark	PRC
Power distance index (PDI)	93	40	39	31	31	33	30	18	80
Individualism vs. collectivism (IDV)	46	60	72	87	81	75	83	89	43
Motivation towards Achievement and Success	36	62	52	5	8	26	10	16	66
Uncertainty avoidance index (UAI)	95	46	48	29	50	59	50	23	30
Long-term orientation vs. short-term orientation (LTO)	58	50	54	52	55	63	57	59	77
Indulgence vs. restraint (IND)	20	68	68	78	55	57	67	70	24

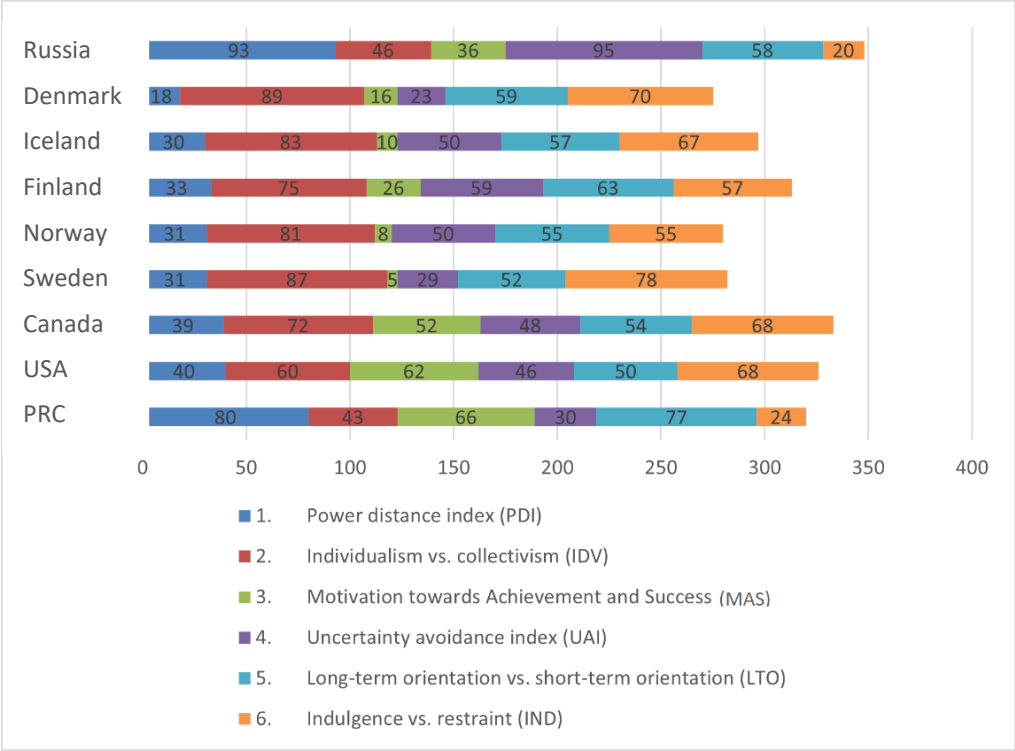

Fig. 5. Comparative indicators of the Arctic Council countries and China (Hofstede's model).

Comparative analysis of organizational culture in Arctic countries and China

Now we can compare the results obtained by two companies based on the Trompenaars and Hofstede models. The comparison provides an interesting picture of the variation in indicators in these models.

The next step is to understand the difference between the indicators of different countries. This can be done by identifying the difference between the indicators of the compared countries. In general, if we take 9 countries, then combinatorial search will give us a finite set of combinations (Table 4).

Table 4

Paired comparison of countries based on sociological data (Trompenaars model (TM) and Hofstede model (HM))

RF	1 RF — USA	2 RF — Canada	3 RF — Sweden	4 RF — Norway	5 RF — Finland	6 RF — Iceland	7 RF — Denmark	8 RF — PRC
TM	316	331	315	328	305	338	331	282
HM	198	195	264	208	177	219	261	134
USA		9 USA — Canada	10 USA — Sweden	11 USA — Norway	12 USA — Finland	13 USA — Iceland	14 USA — Denmark	15 USA — PRC
TM		75	151	130	151	106	109	420
HM		29	122	106	95	97	131	148
Canada			16 Canada — Sweden	17 Canada — Norway	18 Canada — Finland	19 Canada — Iceland	20 Canada — Denmark	21 Canada — PRC
TM			172	181	190	161	94	363
HM			101	77	66	68	106	169
Sweden				22 Sweden — Norway	23 Sweden — Finland	24 Sweden — Iceland	25 Sweden — Denmark	26 Sweden — PRC
TM				59	32	119	82	327
HM				56	97	47	47	234
Norway					27 Norway — Finland	28 Norway — Iceland	29 Norway — Denmark	30 Norway — PRC
TM					49	72	87	362
HM					45	19	75	218
Finland						31 Finland — Iceland	32 Finland — Denmark	33 Finland — PRC
TM						115	102	327
HM						52	92	195
Iceland							34 Iceland — Denmark	35 Iceland — PRC
TM							93	404
HM							56	229
Denmark								36 Denmark — PRC
TM								355
HM								229

Formal analysis of the obtained data allows ranking the countries by the degree of similarity/difference in the two models (Table 5).

Table 5

Comparative table of ranking countries by the degree of differences (in ascending order) in the Trompenaars (TM) and Hofstede (HM) models

Rating	Country	TM	Country	HM
High level				
1.	23 Sweden — Finland	32	28 Norway — Iceland	19
2.	27 Norway — Finland	49	9 USA — Canada	29
3.	22 Sweden — Norway	59	27 Norway — Finland	45
4.	28 Norway — Iceland	72	24 Sweden — Iceland	47
5.	9 USA — Canada	75	25 Sweden — Denmark	47
6.	25 Sweden — Denmark	82	31 Finland — Iceland	52
7.	29 Norway — Denmark	87	22 Sweden — Norway	56
8.	34 Iceland — Denmark	93	34 Iceland — Denmark	56

9.	20 Canada — Denmark	94	18 Canada — Finland	66
10.	32 Finland — Denmark	102	19 Canada — Iceland	68
11.	13 USA — Iceland	106	29 Norway — Denmark	75
12.	14 USA — Denmark	109	17 Canada — Norway	77
Medium level				
13.	31Finland — Iceland	115	32 Finland — Denmark	92
14.	24 Sweden — Iceland	119	12 USA — Finland	95
15.	11 USA — Norway	130	13 USA — Iceland	97
16.	10 USA — Sweden	151	23 Sweden — Finland	97
17.	12 USA — Finland	151	16 Canada — Sweden	101
18.	19 Canada — Iceland	161	11 USA — Norway	106
19.	16 Canada — Sweden	172	20 Canada — Denmark	106
20.	17 Canada — Norway	181	10 USA — Sweden	122
21.	18 Canada — Finland	190	14 USA — Denmark	131
22.	8 RF — PRC	282	8 RF — PRC	134
23.	5 RF — Finland	305	15 USA — PRC	148
24.	3 RF — Sweden	315	21 Canada — PRC	169
Low level				
25.	1 RF — USA	316	5 RF — Finland	177
26.	26 Sweden — PRC	327	2 RF — Canada	195
27.	33 Finland — PRC	327	33 Finland — PRC	195
28.	4 RF — Norway	328	1 RF — USA	198
29.	2 RF — Canada	331	4 RF — Norway	208
30.	7 RF — Denmark	331	30 Norway — PRC	218
31.	6 RF — Iceland	338	6 RF — Iceland	219
32.	36 Denmark — PRC	355	35 Iceland — PRC	229
33.	30 Norway — PRC	362	36 Denmark — PRC	229
34.	21 Canada — PRC	363	26 Sweden — PRC	234
35.	35 Iceland — PRC	404	7 RF — Denmark	261
36.	15 USA — PRC	420	3 RF — Sweden	264

Analysis of the positions of countries at three levels (high, medium, low) gives the following results. According to both models, a high level of similarity of the “cultural compass” can be found only among Western countries, and the level of similarity is quite high among the northern countries. The leaders of the rating are Sweden — Finland (TM) and Norway — Iceland (HM). A high level can also be noted for the pair USA — Canada. At the medium level, Russia is added to the list of countries with common features. It is also noteworthy that in both models, Russia — China share 22nd position out of 36 possible. A low level of compatibility of indicators, according to both models, is noted in those pairs where Russia and China appear. The pair USA — China is the most different according to TM, and Russia — Sweden — according to HM.

One should also note a significant difference of indicators between the models: thus, TM evaluates the level of common values of the pair Russia — Sweden as the lower limit of the medium level, while HM places this pair on the last step of its rating.

In general, it can be noted that both ratings place Russia and China at the lowest level of formation of common cultural positions in relations with Western countries. Both models give very different results for a number of countries. For example, TM evaluates the similarity of the

USA — China as the most negative (36th position), on the other hand, HM puts the same pair on the lower limit of the medium level (23rd position). Other data also look contradictory, for example, the Russian Federation is similar to Finland, just as the USA is similar to China (23rd position), the Russian Federation is similar to Sweden, just as Canada is similar to China (24th position).

The main factors that formed the difference in organizational culture were the following parameters:

- Within the TM: a significant difference between Russia and other Arctic Council countries was revealed for a number of indicators at once (1. Universalism / particularism; 4. Neutral / affective; 5. Achievement / ascription (belonging); 6. Past, present, future; 7. Sequential/ Synchronic). A significant contribution to the difference in the organizational culture of the USA and Canada from such countries as Sweden, Norway, Finland was made by parameter 8. Internal / external.
- Within the HM: "power distance index" in relations between Russia and other countries, with the exception of China; "motivation towards achievement and success" in relations between the USA and Canada on the one hand and the Arctic Council countries, excluding Russia and China, on the other.

Thus, both ratings regarding organizational culture on the example of Arctic countries seem to be relatively coinciding. However, despite the partial coincidence of the ratings' findings, it can be noted that there are also serious contradictions.

Conclusion

Several conclusions can be drawn from the analyses conducted:

1. The development of models of national and organizational culture, as well as their verification through mass sociological research, is an important area of social epistemology, sociology and cultural studies, making it possible to look at the world community as a dynamic, heterogeneous system consisting of many ways of cultural development and intercultural communication.
2. The comparative analysis of foreign sociological studies (the Dutch Internet resource "Trompenaars Hampden-Turner Connecting Viewpoints", the Finnish Internet resource "The culture factor group" Hofstede Insights Ltd), created on the basis of national culture models (F. Trompenaars, G. Hofstede), shows that the results obtained in these surveys in relation to the Arctic countries are generally correlated with each other, but there are also exceptions when the same pair occupies completely different positions in the ratings.
3. The presence of a clear correlation for some countries and the absence of such for others indicate either errors in the use of primary data, or the use of incorrect data.

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Shrinking Cities of the Russian Arctic: Public Discourse of Vorkuta Residents on the Place Identity and the Reasons for Population Outflow

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Abstract. The aim of the article is to identify the most significant causes of population decline in the regions of the Russian Arctic. The object of this study is the urban communities of Vorkuta, represented in social networks. The concept of the declining city, which has received various interpretations both in foreign and domestic scientific literature, and the concept of place identity have been chosen as the theoretical framework for comprehending the problem. The paper presents theoretical approaches to the definition of a shrinking city and provides a justification for the use of the concept of place identity. Shrinking cities are understood as the cumulative result of economic and demographic factors that cause population decline in the form of natural decline and migration outflow. The methodological basis of the work was the method of qualitative text analysis. The narrative analysis method was chosen as the main method of analyzing qualitative data. At the empirical level, a more detailed analysis of the subjective perception of the urban environment and the reasons for the population outflow from Vorkuta, reflected in the public discourse of the participants of the city's online community in the VKontakte social network, was carried out. The initial analysis base included community posts and comments for 2022 (a total of 9032 posts and 191733 comments), the target sample was 64 posts and 366 comments to them. Using open and axial coding techniques, the dominant subdiscourses in the perception of place identity and a group of urban development problems that cause the outflow of population from the city were meaningfully identified. Quantitative analysis of the number of comments (under posts) and likes (under comments) made it possible to identify the most significant and persistent problems, which are certainly of increased interest to representatives of municipal and regional authorities.

Keywords: *shrinking cities, place identity, Arctic Zone of the Russian Federation (AZRF), public discourse, online community*

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Introduction

Vorkuta as an urban settlement in all periods of its existence has been completely dependent on the state support, without which the creation and preservation of urban infrastructure was impossible. From the very beginning, it was an artificially created settlement that appeared as a result of the policy of Soviet industrialization, based on a centrally planned economy with its repressive nature. The changing socio-economic conditions at the end of the 20th century led to a decreasing role of state influence and an increasing role of business structures, which launched mechanisms of intensive decline and returned the state's attention in the form of a policy of controlled compression. Vorkuta is also an example of a city in which the original ethnic population turned out to be a minority compared to the unrooted, socially diverse majority, aimed at temporary stay, but managed to create a unique environment with a special local identity of non-northern northerners [1, Razumova I.A.]. Vorkuta is a city in which visitors and shift workers were the main social resource for the reproduction of urban potential and culture.

The history of Vorkuta begins in the 1920s and has its own specific background, unlike other northern cities, such as Murmansk, although it has a similar history to other cities in the Murmansk Oblast, such as Apatity, Olenegorsk, and Monchegorsk. Vorkuta emerged as a settlement, for the construction and resource production of which a special contingent was brought, consisting of prisoners, including political prisoners, and special settlers who were deported from various areas for social (for example, dispossessed kulaks) or ethnic (Caucasians, Germans, Koreans, etc.) reasons.

Researchers Shabaev Yu.P. and colleagues in their works note three historical stages of the city's existence, within which Vorkuta changed its architectural appearance, the composition of the population, which was reflected in the peculiarities of the perception of urban space by its residents [2, Shabaev Yu.P. et al.]. The first stage is Vorkutlag (1920s–1930s) — a correctional labor camp in the GULAG system of the Komi Autonomous Oblast, the purpose of which was to build and provide industrial facilities related to coal mining and railroad construction. Architecturally, the settlement was a roadless territory of "zones" with mud huts, barracks and the corresponding barrack lifestyle. The social composition of the population consisted of prisoners, special settlers and an ethnic minority. Researchers point to the peculiarities of the established system of relations in the settlements, which was distinguished by strict prohibitions on interactions between locals and visitors and the construction of cultural distances between them.

The second stage of Vorkuta is a city of miners (the settlement received city status back in 1943), which began its transformation in the 1950s; its appearance is associated with the announcement of the general amnesty of 1954, which fundamentally changed both the social composition of the population and its architectural appearance. Since the beginning of the 1950s, the first brick houses and wide avenues have appeared in the city. After the amnesty was declared, many prisoners left the camps and were replaced by hired specialists. Financial incentives in the form of polar allowances, early retirement, preferential leave and improved provision acted as fac-

tors in attracting a large number of professional personnel to the city, consisting of engineers, geologists, managers and the elite of the Soviet working class — miners and metallurgists, who moved in whole teams and families from different regions of the country. The social composition of the population during these years is a complex structure, combining various groups consisting of current (some of whom would be rehabilitated after the 1970s) and former (those who remained in the city due to various circumstances) prisoners, newly arrived specialists who came to Vorkuta by assignment or independently, and an ethnic minority. During the same period, mass housing construction began, new enterprises related to the social infrastructure appeared, and the city's supplies improved. The authors of the research note that the cultural environment and people's fates turned out to be very similar, despite the diverse social capital of the residents due to different levels of education, professional affiliation, different beliefs, etc. "It was precisely belonging to a common cause, social and professional solidarity that became the basis for the formation of Vorkuta identity in the following years" [2, Shabaev Yu.P. et al., p. 83].

The third stage of Vorkuta is the period of urban development after 1989. The restructuring of the economy led to the closure or privatization of city-forming enterprises, which directly affected the reduction of employment, a decrease in wages, and, together with the reduction of subsidies and the high cost of living, led to "stress migration" [3, Averkieva K., Efremova V.]. The population of Vorkuta decreased from 219 thousand people (the maximum recorded in 1992) to 48.3 thousand people in 2023. These consequences also affected the most conservative component of the urban environment — urban housing, which, unable to keep up with the intensity of economic, social and political changes, led to the growth of "porosity" of the urban area [4, Amato R.], in which the balance between densely populated and empty areas was clearly changing [5, Gunko M. et al.]. The "golden age" of the second Vorkuta ends with a change in the dominants in the local identity: the perception of "metropolitanity" is replaced by a feeling of "peripherality" of a ghost town.

Currently, Vorkuta is one of the fastest shrinking cities. According to the results of the 2020 All-Russian Population Census, the population as of October 1, 2021 was 56,985 people, which is 19.2% less than in the 2010 Census and 32.9% less than recorded in the 2002 Census (see Fig. 1).

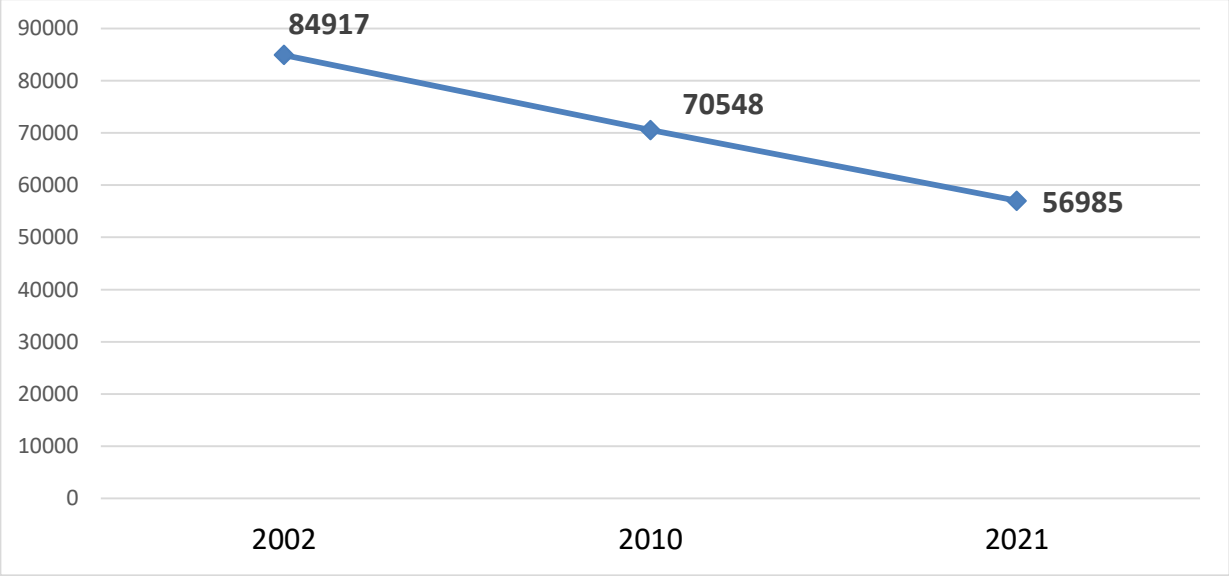

Fig. 1. Population of Vorkuta according to the results of 2002, 2010, 2020 Censuses (persons) [1].

Since 2017, Vorkuta has been implementing a controlled compression program, its goal is to adapt the city to the negative effects of population outflow — people are resettled from half-empty houses and remote areas to comfortable housing in order to disconnect buildings from utility networks and save on maintenance costs [6, Gunko M.S. et al.]. Resettlement from Vorkuta (as well as from other Arctic regions) has been supported at the state level since the 2000s, which was also a factor of population outflow.

Vorkuta is one of the most popular cases in the research of sociologists and urbanists. Speaking about the scientific background on the subject of the study, it should be noted that the features of the perception of the urban environment were most often considered in the context of research on local identity. Special attention should be paid to the works of Shabaev Yu.P. in co-authorship with his colleagues, who have been studying the features of the formation of urban community and cultural environment of Vorkuta for many years, primarily from the historical and anthropological points of view [2; 7; 8, Shabaev Yu.P. et al.]. The authors used methods of analyzing archival documents, museum materials, memoirs, described the history of the city through the eyes of an ordinary person; the work in which mental maps of the First and Second Vorkuta were compiled based on the drawings of prisoners is of interest. A serious sociological contribution to the study of local identity, features of social perception, and life attitudes of the youth of Vorkuta are the works under the supervision of Omelchenko E.L. [9, Omelchenko E.L.; 10, Litvinova S.A. et al.]. Work on the study of the local identity of Vorkuta residents continues by Syktyvkar scientists, for example, Tkachenko M.R., who, using survey methods, identified the transformation of the urban identity of Vorkuta residents at the present stage, the features of its professional component and came to the conclusion about the crisis of social identity. According to the researcher, at-

[1] Number, location, age and gender composition of the population. Results of the 2010 All-Russian Population Census. Komi Republic. Syktyvkar, Komistat, Vol. 1, 2012. p. 13; Results of the 2020 All-Russian Population Census (as of October 1, 2021). Territorial body of the Federal State Statistics Service for the Komi Republic. URL: http://www.perepis2002.ru/index.html?id=13 https://11.rosstat.gov.ru/vpn2020 (accessed 22 March 2024).

tempts to form a positive identity, such as city branding and city symbols, are proving ineffective: in one case — due to the inconsistency with socio-economic realities, in another — due to misunderstanding by the residents, in the third — due to incorrect management [11; 12, Tkachenko M.R.].

Theoretical and methodological framework of the study

Proceeding to the description of the fundamental basis of this work, we will focus on two components of its concept: shrinking city and place identity.

In the scientific literature devoted to the problem of shrinking cities, three main theoretical approaches can be distinguished, which were formed in a temporal sequence one after another. The dynamics of growth and decline are reflected in the theory of the life cycle of cities, in which periods of demographic boom alternating with population decline are interpreted as a natural cycle of urban development [13, Van den Bergl L.; 14, Berry B.J.]. Later studies questioned this point of view and led to the formation of the concept of shrinkage and the hypothesis of a continuous (irreversible) process of decline associated with such driving forces as economic transformations, demographic changes, suburbanization, as well as political and environmental transformations [15, Champion A.G.].

The second approach (the concept of shrinking as urban decline) has accumulated considerable experience in urban research, which reflects (1) the causes of urban shrinking and urban decline [16, Reckien D., Martinez-Fernandez C.; 17, Wiechmann T., Pallagst K.M.]; (2) descriptions and classifications of trajectories of urban shrinking [18, Mykhnenko V., Turok I.; 19, Beauregard R.A.]; and (3) proposals for planning measures [20, Schilling J., Mallach A.; 21, Allam Z., Newman P.].

Three dominant theories can be identified in the scientific literature, which predominantly prevail in substantiating the causes of shrinking. One of the most popular theories is economic. Discussing the key determinants of urban decline, the authors consider economic problems to be of primary importance. For example, in David Harvey's theory, the "pendulum movement" of investment, its withdrawal and reinvestment are the causes of the spatial segregation of cities during capitalist urbanization: while some places successfully attract investment, others fail to do so and suffer from abandonment, their attractiveness and, ultimately, population decline. Moreover, since capital invested in a particular spatial environment quickly depreciates, current investments today may become an obstacle to further accumulation tomorrow, so that urban spaces are constantly remodeled through a new round of spatial changes [22; 23, Harvey D.]. In the domestic scientific literature, the uneven distribution of investment in the regions and cities of Russia is considered in the works of N. Zubarevich [24; 25].

Theories of the territorial division of labor explain inequality through the prism that urbanization is based on different geographic concentrations of specific enterprises, industries and labor force [26, Massey D.B.; 27, Scott A.J.]. The literature on the territorial division of labor emphasizes

the cyclical and cumulative processes of agglomeration of urban and regional development [28, Dundorf M.; 29, Meerovich M.G.]. According to this theory, urban population concentration depends on the actual forms of production and strategic decisions made mainly by transnational corporations as they adapt to economic and technological changes.

Demographic theories explain shrinkage through a reduction in the urban population, focusing mainly on the consequences of declining fertility and increasing life expectancy. Against the backdrop of the second demographic transition [30, Lesthaeghe R., Van de Kaa D.], it is argued that the persistence of fertility rates below the replacement level in most countries of Europe and North America leads to a long-term decline in population. As a result, population growth in European cities has slowed significantly over the past thirty years [20, Mykhnenko V., Turok I.], and is likely to continue over the next twenty-five years. The most frequently expected results include an increase in the average age of the population, a decrease in the working-age population, and a change in the migration structure, which make further population loss a realistic prospect for a growing number of cities. It should be noted that this theoretical approach is one of the most widespread in the domestic literature. For example, Gunko M.S., Antonov E.V. et al. analyze demographic factors as some of the most important in the settlement system [6; 31].

Less developed causes of shrinkage in the theories are environmental and political factors [32, Haase A. et al.]. These factors are practically not covered in the domestic segment of scientific literature.

As for the description and classification of urban shrinkage, cause-effect explanations are often combined in works with proposed classifications and typologies [19, Wiechmann T., Pallagst K.M.; 20, Mykhnenko V., Turok I.; 21, Beauregard R.A.].

Summarizing, it can be stated that all theories consider shrinkage as a general phenomenon that is deeply rooted in the nature of the urbanization of capitalist society or in the demographic transformation itself, but they do not represent a general discussion.

The third approach can be called integrative or, as it is termed by the authors themselves, “pluralistic”, which includes many explanatory factors in the analysis of shrinkage [32, Haase A. et. al.]. Haase A. and colleagues developed a middle-range theory, in which they propose a model consisting of the following characteristics: shrinkage factors, impact factors, and responses. The authors refer to this model as empirically universal for analyzing the shrinkage of specific cities in order to avoid a reductionist approach when using any one theory, especially in comparativist studies.

At the same time, we can state that a characteristic feature of shrinking cities is a steady loss of population, while most often the research focus is on demographic problems and the structural crisis faced by shrinking cities [32, Haase A. et al.; 33, Haase A. et al.; 34, Bernt M.; 35, Hollander J.B.].

Following the integrative approach, in this paper, we will understand a shrinking city as the combined effect of economic and demographic factors that have affected the settlement system

[36, Rink D. et al.]. An indicator of a shrinking city is a reduction in population (both as a result of natural decline and migration processes).

The next concept we focus on in the paper is place identity. We note that the existing body of work on studying the perception of a city as a living environment is based on the concept of "local identity" as part of social identity. We use the concept of "place identity", understanding it as a feature of a person rather than a place. This is a person's self-identification in terms of place, those dimensions of a person's identity that are formed in connection with his physical environment [37, Proshansky H., et al.]. Within this understanding, the city as a place is a means of distinguishing oneself from others, maintaining a sense of continuity, building a positive self-esteem and creating a sense of one's own uniqueness [38, Twigger-Ross C.L., Uzzell D.].

The scientific novelty of our research approach is the use of digital footprints of city residents, which they voluntarily leave online. We are specifically interested in how residents transmit the identity of a place through public discourse and interpret environmental problems that lead to intensive decline, and what pros and cons of life in the city they discuss with each other.

The methodology of analyzing the subjective perception of residents is based on identifying problematic conceptualizations of the state of urban life reflected in the public discourse of online communication. The approach to analyzing qualitative data, which involves the process of collecting, structuring and interpreting qualitative data, was used as a methodological basis in the study. The narrative analysis was chosen as the main method for analyzing qualitative data. Narrative analysis focuses on the messages people leave (in our case, on social networks) and the language they use to comprehend them [39, Lewins & Silver]. We see the following advantages in this approach:

- freely expressed format of opinions and experiences of living through natural language;
- absence of the interviewer effect, which is characteristic of survey methods. It is also necessary to note the limitations of this approach, primarily due to the inability to maintain representativeness.

Anyway, given the level of digitalization penetration into the everyday life of city residents, we can assume that communication in social networks and messengers is a common practice in cities with harsh climatic conditions.

As we noted earlier, the subjective perception of urban development problems is manifested in the discourse of communities through interpretations, assessments, descriptions of personal experience that residents represent in the process of discussions. They can be considered as qualitative characteristics of the subjective image of the city and the experience of living in it, as they reflect the attitudes, preferences, phobias towards the city and city/regional government that are characteristic of the community, as well as reflect the local language formed by the community to describe the surrounding context. In this paper, using empirical material from a digital urban community, we will demonstrate the formation of qualitative characteristics of urban development in public discourse with a focus on the subjective perception of "pain points" by city

residents that influence or explain migration attitudes and intentions. The number and intensity of references to various problems, duration of their discussion, support of specific messages by the number of "likes" can also be considered as quantitative characteristics of the discourse on urban development problems [40, Nenko A.E., Nedoseka E.V.].

Characteristics of the empirical base of the research

As empirical material, this article examines text messages reflecting the public discourse of the online community of the city of Vorkuta, active at the time of writing this paper. In the process of selecting an online community for analysis, groups in the social network "VKontakte" were considered. The community selection criteria were as follows:

- urban community, thematically dedicated to Vorkuta, its history, problems and events;
- high popularity of the community in the information field (determined by the search query method in the VKontakte search aggregator);
- constant high intensity of communication within the community (at least two posts per day over the past year);
- discussion of city problems on the community wall;
- history of the community (at least 5 years);
- positioning of the community as local (urban) [40, Nenko A.E., Nedoseka E.V.].

Thus, a search query for the keyword "Vorkuta" in the social network "VKontakte" provides 2,829 communities containing this word in their names. The group Podslushano Vorkuta [Overheard in Vorkuta], formed in 2017, has 50.9 thousand subscribers, which makes this community the most popular among other communities in the presented social network (see Table 1).

Table 1

Rating of communities dedicated to the city of Vorkuta in the social network "VKontakte"

Name of community	Type of community	Subscribers, thousand people [2]
Podslushano Vorkuta [Overheard Vorkuta]	City's community	50.9
Hello, Vorkuta!	City's community	48.9
Moya Vorkuta [My Vorkuta]	Internet media	36.9
Vorkuta 24 Novosti | PRYAMOY EFIR [Vorkuta 24 News | LIVE]	City's community	16.6
Tipichnaya Vorkuta [Typical Vorkuta]	City's community	22.5
Vorkuta Poymet [Vorkuta Will Understand]	City's community	14.0

Users with active accounts (not blocked or deleted) — 91.1% of the total number of subscribers. Users with available age information are 52.5% of the total number of users and 51.8% of active ones. The most numerous categories of users are 31–40 years old (28.9%), 21–30 years old (23.7%) and 41–50 years old (16.3%). Almost all community users are identified by gender (over 99%), of which 44.4% are men, 55.6% are women.

[2] As of 15 March 2024.

The collection of discussion data in the online community was automated using the Python 3.8.10 programming language. The data collected included text notes — posts and comments — on the community "wall". As a result of parsing, records for 2022 were uploaded to the database: the total number of posts is 9,032 units, the total number of comments is 191,733 units.

Next, the posts were sorted in descending order of the number of comments, and the minimum threshold for their "popularity" was determined at 100 comments. As a result, 344 posts made up the total sample for the primary analysis using the open coding technique with the names of discussion topics (28 topics in total).

For further in-depth analysis, the topics most relevant to the problems of this study were selected (64 posts in total), namely: "pros and cons of life in Vorkuta", "bloggers", "moving to Vorkuta", "farewell to Vorkuta", "memories", "tourism", "returning to Vorkuta". These topics contain posts and comments with the most vivid manifestations of the public discourse of city residents about the identity of the place and the problems of the city, acting as subjectively perceived reasons for the outflow of population.

A total of 11,649 comments were downloaded from the selected 64 posts, which were first sorted and selected by the number of likes (at least 10) as indicators of support from community members (384 units in total). Then, uninformative and irrelevant to the objectives of the study judgments (including prepositions, interjections, punctuation marks, various symbols, etc.) were excluded from this array of comments. The final array amounted to 366 comments and 64 posts, which formed the target sample for a more in-depth analysis.

The main procedures for such analysis were carried out using open and axial coding techniques. As a result of open coding of all posts and comments of the target sample, the main categories were identified (the procedure was carried out until new categories ceased to appear). Axial coding was carried out by selecting relevant messages by keywords from a larger sample — from all 344 posts and the corresponding 59,021 comments. To illustrate the identified categories, we selected dominant opinions (in particular, the most supported comments), as well as those that most fully reveal the meaning of a particular category.

Research results

As a result of processing the posts and comments, the first thing we paid attention to in terms of popularity and public resonance were the messages that represent the place identity of Vorkuta residents. In particular, we identified two sub-discourses that meaningfully reveal the identity of place in public discourse:

The first sub-discourse is conceptualized as "boundaries and distance". Posts and comments thematically related to the advantages and disadvantages of the city often provoke discussions that involve a variety of participants: local residents and residents of nearby settlements, migrants who left and arrived in it, tourists (including bloggers, journalists and their subscribers). The coexistence of these groups in the public space leads to a clash of conflicting discourses. The

"non-local" discourse is represented by a wide range of topics: from searching for an apartment to buy to comments in the spirit of "in Vorkuta, you cannot live, but survive". Along with searching for information about the nuances of moving to the city and admiring the nature of Vorkuta, potential residents of the city and tourists note the impossibility of a full life in the conditions of a "dying city" and the unwillingness of its residents to admit the lack of prospects, point to a feeling of pity caused by the city and its residents. This image of Vorkuta does not correspond to the ideas of local residents about it.

The greatest indignation is caused by the materials of bloggers and journalists who post videos dedicated to Vorkuta in the community. Reproduction of stereotypes about the city's population, distortion and speculation on its history, production of a feeling of pity for the city and its residents, ignoring the positive aspects of city life are the main reasons for the wary attitude of local residents towards potential residents, tourists, especially bloggers and journalists.

"What nonsense??? Again these sub-bloggers are filming all sorts of nonsense about Vorkuta!" (188 likes).

"People are tired of those who come to their city for content, either ridiculing it and its residents, or pushing pity that is across the throat and not really needed by anyone?" (24 likes).

Probably, the negative image of Vorkuta, reproduced in the public (and the media in general), encourages local residents to create boundaries and build distance. This is expressed in the attitude towards "non-locals", as well as in ideas about other regions of Russia.

The community subscribers who present themselves as locals do not hide their hostility towards non-locals who present the city in a negative light. The undesirability of their presence in the city is emphasized.

"Take him out to the tundra and forget about him" (44 likes).

*"If you don't like my city, don't *** (note: there is no need) come here" (33 likes).*

"Why are you all coming here????" (20 likes).

Maximum distance is noted in relation to bloggers: this topic is one of the most popular among the selected posts (14 posts, 2521 comments).

Negative assessments, including humiliation and insults, prevail in the attitude towards bloggers sharing their impressions of Vorkuta:

"... well, what was required to be proven. He did dirt in another city, and the reaction of the citizens was surprising ... we have not seen such idiots before, no monkey has ever come to us to do dirt on))) if he wanted hype, he would have taken a dump right on the square, there would have been hype, and a scandal, and he would have received fame in the emergency center..." (110 likes).

At the same time, there is an alternative position, which is expressed in the recognition of the objective problems of the city, exposed by visiting bloggers:

"It's hard to understand you guys. You whine about how bad everything is here, that no one cares about our city, and then as soon as someone comes to Vorkuta who could highlight Vorkuta's

problems to the whole country, you start foaming at the mouth and yelling some nonsense. Ugh, what an abomination, a disgrace. I am ashamed of my city residents" (75 likes).

In general, the distance helps to strengthen the borders and unite the local community, with the identification of a special group of "real Vorkuta residents":

"Vorkuta is described badly by strangers, those who came, stayed a little bit and then started to criticize. But real Vorkuta residents will never say anything bad about their city" (57 likes).

The construction of borders is expressed in perceptions of other regions of Russia. Thus, the narratives of local residents highlight descriptions of Moscow, to which negative characteristics are attributed along with positive ones. On the one hand, dislike of the city is expressed in ironic remarks about Moscow residents — "Maaascow's guests", "Sharikov-Mascwachi". On the other hand, the authors of posts and comments on this topic refer to the "objective" problems of the city: difficult transport communications, environmental conditions, labor migration and its consequences, difficulties with renting and buying real estate.

"The "smart" girl from Moscow does not want to talk about the terrible places of Moscow, how people live in communal apartments or houses built in 1905 or 1907, without baths and hot water" (75 likes).

"I don't understand how you can live in Moscow and similar cities where you can't breathe, most of your life is spent in metro, it takes at least an hour to get to work, there are constant traffic jams and crazy amounts of money are spent on transport alone. But in Vorkuta, life is peaceful and calm. And yes, the city is beautiful. Other cities are also full of dilapidated houses, shabby buildings, etc." (59 likes).

Another important feature of the perception of Vorkuta, noted by community members, is the distinction between Vorkuta and nearby villages, which, according to local residents, should not be considered as part of the city. It is curious that the abandoned villages shown by tourists, as a rule, correspond to the ideas of Vorkuta residents about the housing situation in Russia.

"Why do bloggers write "city" but film villages? You can write about Moscow by filming abandoned villages near Moscow" (41 likes).

"Half of Mother Russia lives in such cities and towns, and people live and enjoy life" (21 likes).

In addition to Moscow, the southern regions stand out on the map of Russia in the perception of Vorkuta residents, as being contrasted with the "North" and acting as suitable for migration.

"... for them, Vorkuta is beloved and good only when they are somewhere at sea" (20 likes).

"The third year I live in Rostov region, and people are normal!!! It all depends on yourself, what kind of person you are, such attitude to you, I am not drawn to Vorkuta, although I have lived 41 years,..THE SOUTH IS BETTER, there is even enough snow" (14 likes).

Vorkuta is also compared with northern cities — Salekhard, Norilsk, Murmansk. Most often, these are very emotional discussions, where most of the comments are about the crisis situation in Vorkuta.

"Guys, don't make me laugh, the other day I was in Salekhard and Labytnangi, the same Arctic cities! But they are really building there!!!..." (26 likes).

"...they recently closed the last cinema, for example, there is nothing to do, nowhere to go, nothing to see (in comparison with Norilsk or Murmansk, for example)" (7 likes).

Less common are single (without support by likes) comments about the equally dire state of all the cities of the North.

"...Visit Murmansk, Norilsk, Pechora, Inta, Ukhta, Yakutsk, Magadan... All of them are no different from Vorkuta" (0 likes).

The North is of great importance in the identity structure of current and former residents of Vorkuta. As Vorkuta residents understand it, to be a northerner means, on the one hand, to be involved in the northern nature: tundra, deer, white nights and frosts, on the other hand, northerners share a common socio-economic fate due to the special status of residents of the North, expressed in the northern coefficient. However, despite the feeling of belonging to the northerners, Vorkuta residents often emphasize the uniqueness of the city. Thus, Vorkuta is called the "capital of the world", and Vorkuta residents — an ethnic group.

"There is such a nationality — Vorkutian. Those who have lived here for many years will understand. Vorkuta is a city with its own history and mentality. There are special people here and its own unusual atmosphere" (83 likes).

The second sub-discourse is conceptualized as "We and They", it is connected with the first sub-discourse and describes the composition of the distanced groups and their qualitative characteristics. Thus, "foreign" elements are distinguished within the community of local residents: for example, "newcomers" and "youth", considered as the cause of the problems faced by the residents of Vorkuta. It should be noted that "people" is one of the central categories through which the identity of the Vorkuta residents is conceptualized. Local residents and migrants who left the city note the responsiveness, kindness, honesty and straightforwardness of the Vorkuta residents, which are also characteristic of other northerners. The urban community is described as a "big family". At the same time, "people" are often presented as the main or only advantage of Vorkuta, which, thanks to "people", is a "calm" city. "Native Vorkuta residents", according to local residents, belong to those very "people", therefore there is a need to single out a group responsible for "everything bad". One of these groups is the newcomers, belonging to which is determined by the duration of stay in Vorkuta.

"native Vorkuta residents (who were born here), or have lived here for a long time — responsive and friendly!!!!" (35 likes).

"People, people are all good. All that is bad is from a large number of strangers..." (11 likes).

"The northerners, the real ones, who arrived in the 50s, are kind, generous, responsive, there are probably about 20–30% of them left, and the rest of those who call our city a garbage dump are "newcomers" for northern benefits" (10 likes).

Another group that is blamed for the city's problems is "youth". According to some residents, young people are the bearers of practices that threaten the safety of the city, and also demonstrate an unwillingness to defend its interests.

"Disrespected teenagers. Maybe it's time to stop having your parties in Cascade and at the hotel? You are interfering with us, normal people, while we work and relax. Gather in other places, outside or in the stairwell. When we were kids, we didn't disturb adults because we could get a slap on the wrist. You've completely lost your fear. I think the adequate population will support me, something needs to be done about this" (182 likes).

"And what is interesting, justify and defend its young people! Yes, the older generation doesn't accept such jokes, either about their city or about the citizens. Oh, what's the big deal, the guy was joking, and you're all so stupid, you don't understand jokes, etc. No, we understand jokes, but not this nonsense that he was talking, such jokes are impossible to accept. The youth has generally become unprincipled now, their city has been humiliated, so to speak, and they rejoice at how cool this Kulakov is, how funny his joke was." (18 likes).

In user discussions dedicated to the outflow of population, four categories of reasons for the decline of the city are distinguished: infrastructural, commercial, social and climatic. The first include the closure of kindergartens and schools, low quality of medical services, reduction in the number of jobs, emergency state of housing infrastructure, increased tariffs for the use of utilities, unsatisfactory condition of road infrastructure, regional and city management system that is not conducive to development.

The closure of kindergartens and schools is considered by users as a marker of the city's decline and provokes nostalgic feelings. For example, the post that collected the largest number of comments (1303) is devoted to the discussion of schools in Vorkuta and nearby villages where community members studied. According to the table proposed by the author of the post, most of them are closed: 15 institutions out of 47 are still operating. In the users' opinion, such statistics indicates the lack of prospects for the development of the city.

"Wonderful table. Reflects the policy of our state and the state of the city" (12 likes).

Low quality of medical services is another reason for the population outflow. Community members note, firstly, the consequences of the healthcare system optimization (without specifying what they are expressed in), and secondly, the lack of qualified specialists.

"Soon we will "go" to Syktyvkar for an appointment, with this modernization of doctors" (26 likes).

The reduction in the number of jobs associated with the closure of mines is another "marker" of the city's shrinkage.

*"there is nothing good in Vorkuta, all the factories are closed, the villages are closing, in the 3rd district there is no kindergarten, no school, no pharmacy, the apartments are cheap, outside it is *** (note: impossible) to get, in short, a complete *** (note: everything is bad)" (24 likes).*

"We were lucky, we did not see such an attitude towards the city, mining villages, even mines! Vorkuta in my memory is the same as in the USSR!!! People lived in villages, were happy, loved, children ran around, schools and music schools worked, children were sent on vacation to the south, education was at a high level, the Palace of Pioneers was in full swing, the loud laughter of children made everyone happy... And then these came... and everything ended ... " (35 likes).

It should be noted that in the perception of city residents (especially the older generation, whose labor activity fell on the "golden age"), there is nostalgia for the Soviet period, which is associated with development, financial and social well-being, which aggravates the perception of the current state of the city and causes anger and irritation at the federal policy towards the region and business.

"... Oh, if there were not the betrayal in power, then the selection would have achieved its result. The Soviets were for the people" (24 likes).

Users also express "indignation" regarding the emergency state of the housing infrastructure, pointing to the utopian nature of resettlement from emergency housing. Moving without state support within and outside Vorkuta is associated with financial difficulties: lack of savings and high utility bills, the payment of which does not depend on the fact of living in the city. For this reason, city residents who want to leave are faced with the need to renounce the right to ownership of real estate, sell it or rent it out.

"We "spat" on the housing queue, rented out a 5-room apartment to the city with its unaffordable rent, packed up the container and left" (23 likes).

"cheap housing is probably attractive. And to understand that not just for nothing people sell their flats for pennies and leave, apparently, is difficult for some people even with a higher education" (17 likes).

"God I am glad that I left Vorkuta, having lived there for 41 years, I rent out an apartment in the center for pennies, it's not even enough to pay for utilities..." (35 likes).

According to the authors of posts and comments, selling property as one of the ways to get rid of obligations in conditions of low demand leads to a decrease in the cost of real estate. This, in turn, acts as a factor stimulating the population to move to Vorkuta. This observation is reflected in the community's publication activity: 11 out of 344 posts are devoted to discussing the details of migration to Vorkuta: users intending to move or who have already moved to the city are interested in labor market offers, housing costs, and available goods and services. Thus, on the one hand, the state of the housing infrastructure and the size of utility bills provoke an outflow of the population, on the other hand, the reduced level of housing prices, the lack of savings, and living in municipal housing prevent this outflow.

It is also important to note the role of the state of the road infrastructure in the structure of the reasons for the city's shrinkage. Community members point to the automobile isolation of Vorkuta, which hinders intra- and interregional mobility, as well as the emergency condition of the road surface.

"One bad thing is that there is no road and there will never be one because it is not profitable for Russian Railways, and everything else is fine" (23 likes).

"In the center there are potholes on the roads that are already 20 years old ... just one courtyard part of Parkovaya, Donchuk, Yanovskogo streets says a lot....and this is a city....there is nothing to say about the villages at all" (35 likes).

Another reason for the population outflow is the regional and city management system that is not conducive to development. Users note the "indifference" of government agencies, their unwillingness to solve the city's problems. The authors of posts and comments expect the authorities to regulate housing and communal services tariffs, pricing, road conditions, and control over cleanliness in the city. In addition, the lack of support from the state in the form of a decent "northern coefficient" is noted. Community members associate the inaction of the administration with corruption and lack of adequate funding.

"Sergey was a deputy.. But for the entire term, he solved. Problems, of his own business.. I don't care, but you, the voters. You must understand. That for this.. Candidate, only his business is important... He doesn't need you!!!" (29 likes).

"... the authorities are inactive and continue to spend money from the already poor budget of Vorkuta" (17 likes).

"When Vorkuta was equated to the Arctic zone, the bonus should have increased, but the process dragged on for years and people began to forget about it, and here people are indignant that in Syk (note: Syktyvkar) they also pay northern bonuses, but forgot — the entire republican elite is there, they pushed it through" (19 likes).

The second category of reasons reflects the dissatisfaction of the group members with the offers available on the market for goods and services. Thus, the authors of posts and comments point out the unacceptably high prices for essential goods. In addition, users note the low quality of services provided and the lack of alternatives.

"Normal prices if you don't buy anything" (19 likes).

"Aha! And the prices are exorbitant! 15 thousand. For such "comfort" — they've completely lost their minds." (24 likes).

The next category of reasons mentioned by group members is an unfavorable social environment. Visitors, teenagers and "declassed elements" are the main sources of "threat": according to users, they are prone to disorderly behavior and criminal activity.

*"Everywhere is *** (note: bad) and trash, people are scums, drug addicts and alcoholics, half the city is abandoned, there is no work anywhere and if there is, the salary is minimal, all ****

(note: people, mainly teenagers) smoke and drink, we have drug addiction and drug dens in our city and the police are looking for and stopping alcoholics on the streets" (19 likes).

It should be noted that incidents are one of the popular topics for discussion in the community (about 20% of the analyzed posts are devoted to it). Incidents, as a rule, are of a "social" nature: users discuss murders and suicides, traffic accidents, thefts, fights, damage to property, behavior that contradicts normative expectations, facts of improper provision of services. In addition to distributing photos and videos confirming what happened, the community publishes posts aimed at restoring justice: for example, an appeal to the debtor with a request to repay the debt. This observation contradicts the discourse of a "calm" city, popular among the group members. The resolution of this contradiction, apparently, is associated with the identification of groups responsible for the violation of order.

The last category of reasons is harsh climatic conditions. As a rule, users point to long winters and sparse vegetation. This factor is often noted by users who left the city.

"Lived all my youth, left... I don't regret it... All winter darkness from two in the afternoon, like at night, freezing cold, snowstorms. You dress like a cabbage, only your nose sticks out... What second half, I'd rather hurry home to warmth, neither seeing people, nor showing myself." (25 likes).

"I'll tell you a secret. Nobody likes when it's cold, when it's dark for half the winter, when civilization is hundreds and thousands of kilometers away, and water is cut out of the river with chainsaws. There are no such people!" (97 likes).

Interestingly, in the narratives of community members who left Vorkuta, the reasons for the population outflow are articulated in a special way. In addition to the climate, the authors of the posts and comments highlight the lack of prospects and the depressiveness of the city.

"When I return to Vorkuta, there is always a feeling of depression and the meaninglessness of existence." (69 likes).

"I left 10 years ago, and I am glad — Vorkuta has no future." (46 likes).

"We left Vorkuta for Nizhny N., although I always said we would never leave Vorkuta... My husband was born in Vorkuta, we worked at the Severnaya mine all our lives... But after the accident at the mine, the village somehow became empty... That's where depression started... And we decided to leave in one fell swoop... We left everything as it was..." (20 likes).

At the same time, there are also nostalgic feelings, full of love for the small homeland:

"I lived in Vorkuta for 40 years, ... my favorite city, we left 4 years ago, as soon as we see photos or any information about Vorkuta, we cry, our throats are strangled, this is the city of our youth, dear to our hearts, but the cold has tortured us(((we left, we do not regret, but we remember the city with warmth and love!!!" (73 likes).

In general, all the categories of reasons for the population outflow presented in the analysis of messages form sub-discourses, in the center of which the so-called "tension points" are highlighted, expressed in the clash of different positions and views.

Conclusion

A shrinking city is a special phenomenon that can be defined as dying, thereby reflecting the alarmist and eschatological moods of the city's residents, as well as the evaluative view "from the outside" — primarily from visitors, tourists and guests. Such categorization may be centered on a comparison of the present with the past, and then a kind of romanticization of history occurs, expressed by nostalgia for the passing "golden age", which is firmly associated with the Soviet past. This is reflected in the discourse of the "real Vorkuta residents", who were at the origins of the city's formation, and the corresponding local identity based on the socio-professional community — "miners". The restructuring of the economy and, above all, the closure of the mines becomes a turning point, causing a crisis of local identity, loss of grounds for social solidarity, which, together with material factors, leads to an increase in the migration outflow of the population of Vorkuta.

In addition, comparisons with other cities can be made, primarily those located in the central and middle zones of Russia. A special place is occupied by comparisons with Moscow, which becomes the "promised land", the center of attraction for all resources, including human ones, and also a measure for ranking other cities. This discourse is inherent in the residents of other cities who visited Vorkuta, who certainly have something to compare with, but at the same time it can also be found among locals living in the city or having left it. Thus, the attention of bloggers to the city, who defined it as dying, generated a counter-attention of local residents both to the bloggers and to themselves, their place of residence, expressed through the sub-discourses of "borders and distance" and "we and they". The invasion of "outsiders" becomes a kind of trigger that launches the process of building symbolic boundaries and strengthening local self-awareness, up to local "ethnocentrism". The positive image of "real Vorkuta residents" becomes a stronghold of social solidarity, representing an example of city residents who remember the past and love the present Vorkuta.

At the same time, the question of the future of the shrinking city, its prospects in the context of implementing the policy of controlled shrinkage, remains quite open and uncertain. Analysis of subjective perception of life in the city, identification of problems debated in the public discourse of social networks reflects the parameters of social well-being of local residents. The central place in such debates is occupied by the infrastructure agenda and, above all, the housing issue, which requires attention from representatives of municipal and regional authorities.

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Virtual and Augmented Reality Technologies in the Healthcare System of the Arctic Regions of the Russian Federation

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Abstract. Virtual and augmented reality, as one of the end-to-end technologies of the digital economy, currently has wide practical application in the field of healthcare, helping both doctors and patients. VR/AR technologies allow the most effective rehabilitation of patients with diseases of the musculoskeletal system, provide significant assistance in dealing with psychosomatic disorders, and can be used in surgical operations. In addition, virtual doctors and nurses can be used to provide medical care at home; existing VR applications allow for better involvement of patients in therapy. VR/AR solutions developed in close cooperation of doctors and IT specialists have great development prospects. The application of virtual and augmented reality technologies in the medical care system should result in improved quality of medical services, which is especially important for remote regions. The regions of the Arctic zone of the Russian Federation, being geographically distributed, remote areas with difficult natural and climatic conditions, set themselves the task of developing high-tech medical care to improve the quality of life of the population. It becomes important for regional medical institutions to study and apply the best practices of medical IT solutions based on VR/AR technologies.
Keywords: *virtual reality, augmented reality, healthcare system, medical IT solutions, Arctic regions of the Russian Federation*

Introduction

Virtual reality (VR), being an artificial world created on the basis of various hardware (computers, helmets, glasses), is a digital simulation of the real world. VR is perceived by human senses, the effects created are capable of causing sensations that are practically no different from real ones.

Augmented reality (AR) is a technology of interaction between a computer and a person, the basis of which is an optical tracking system. In this case, additional information is superim-

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posed on the picture of the real world, using software tools to visually combine the natural world around a person and the virtual world created on the computer. The camera used in this process recognizes markers from the real environment, moving them into the virtual environment, thereby superimposing one layer of reality on another [1].

Multi-experimentality based on VR/AR technologies is a strategic technological trend in the development of the modern world. VR/AR products are being actively implemented in marketing, retail, industry, education, medicine and many other industries [2].

In accordance with the development roadmap "End-to-end digital technology "Virtual and augmented reality technologies", VR/AR solutions are designed to ensure the technological leadership of the Russian Federation [3]. The effectiveness of the introduction of VR/AR technologies into the healthcare system can not only reduce the number of people who have completely or partially lost their ability to work (through rehabilitation in virtual reality), but also significantly reduce the number of errors made by specialists trained using VR/AR.

Thus, the use of VR/AR technologies in medicine should result not only in an increase in the level of working capacity of the population, but also in an improvement in the quality of medical services, including in remote regions of the Russian Federation. The development of high-tech medical care is a particularly pressing issue for medical institutions in the Arctic regions, which are geographically distributed territories with harsh natural and climatic conditions [1].

VR/AR technologies in the healthcare system

Currently, virtual reality technologies are widely used to solve many medical problems [4]:

1. Performing surgeries

Data obtained from MRI and CT is used to create a virtual model of the patient, which can be used by surgeons to prepare and perform complex surgeries. An example of the use of AR technologies is the first operation performed in 2020 in Stavropol using AR glasses, which allow the surgeon to visualize a hologram in 3D, making it possible to present data, for example, on the patient's medical history, CT scan data, etc. If necessary, with one click of the hand, the doctor can project them in front of him during the operation [5].

2. Rehabilitation of patients after strokes and injuries

[1] EligoVision introduces new markerless augmented reality technology. URL: https://b2blogger.com/pressroom/107882.html (accessed 11 March 2024).
[2] Augmented Reality Technology AR. URL: https://funreality.ru/technology/augmented_reality/ (accessed 11 March 2024).
[3] Roadmap for the development of "end-to-end" digital technology "virtual and augmented reality technology". URL: https://digital.gov.ru/uploaded/files/07102019vrar.pdf (accessed 11 March 2024).
[4] AR and VR for medicine: practical application. URL: https://slddigital.com/article/ar-i-vr-dlya-mediciny-primenenie-na-praktike/#resheniya-vr-i-ar-dlya-meditsiny-na-etape-testirovaniya-i-issledovanij (accessed 11 March 2024).
[5] Stavropol surgeons operate using augmented reality glasses. URL: https://yandex.ru/video/preview/3086181533500027034 (accessed 11 March 2024).

According to medical research, most patients perform less than one third of the exercises necessary to recover from strokes or injuries. VR helmets or VR glasses can make the recovery process more productive and efficient through gamification [2–4].

3. Psychological rehabilitation

VR technologies that allow creating an environment in which the patient can “get in touch” with the objects of their own fears can be effectively used to combat various kinds of phobias [5].

It should also be noted that VR/AR technologies are widely used in training doctors. An example is the computer system for generating images in virtual space developed by employees of the Rostec State Corporation, which allows not only to teach medical students basic endoscopy skills (examination of the patient’s internal organs to make a diagnosis) and practice laparoscopy technology, but also to effectively develop a scenario for an operation by experienced surgeons, determining the leading strategy for performing surgical intervention, taking into account the individual characteristics of the patient. The use of such technologies undoubtedly reduces the level of possibility of medical error, and, accordingly, the risks to the lives of patients [6].

Currently, hardware and software systems are also being developed that allow the use of VR/AR technologies in the field of ophthalmology, treatment of mental disorders, diagnosis of various diseases, development of communication skills, and much more. Let us consider some of them.

Virtual dentistry

Digital systems used in modern dentistry make it possible to create virtual 3D models with a high level of accuracy reflecting the individual characteristics of the patient and, as a result, contribute to the provision of quality prosthetic services of various degrees of complexity. “Smart glasses” displaying a three-dimensional model of teeth allow the dentist to learn and apply the acquired skills in practice when performing various dental procedures, for example, treating a tooth with a virtual drill [4].

Fig. 1. Virtual reality in dentistry [7].

[6] Digital Ocean.RF. "ROSTEKH" has made a virtual simulator for surgeons. It will help to train students. URL: https://digitalocean.ru/n/rostech-surgery (accessed 11 March 2024).

[7] Virtual reality in dentistry is already real. URL: https://stomatologclub.ru/stati/stomatologiya-8/virtualnaya-realnost-v-stomatologii-uzhe-ochen-dazhe-realna-2443/ (accessed 11 March 2024).

Neurorehabilitation

Virtual reality, by simulating the space needed for recovery of the damaged brain, immerses it in an environment in which neural connections are restored (biofeedback algorithm). Neurologists believe that the possibilities of using VR technologies for the rehabilitation of patients who have suffered a stroke are promising. An example is the developed method of "3D audio visualization", which allows restoring hand motor functions based on "stimulation of motor imagination through visual feedback" [2; 3; 4].

Obviously, the above-mentioned areas of medicine are not the only example of the use of virtual and augmented reality technologies. Currently, VR/AR can be used in studying issues of human aging (gerontology) [8]; virtual doctors and nurses can be used to provide medical care at home; existing VR applications allow better involvement of patients in therapy, helping a person to independently overcome chronic pain, anxiety or undergo rehabilitation, for example, restoring joint function.

Currently, open platforms are being formed in the Russian Federation, the knowledge bases of which contain information on current digital technologies (ready-made software solutions and application practices), including VR/AR, in various applied areas, a significant part of which is in the field of medicine. An example can be the Moscow platform of digital solutions ICT.Moscow.

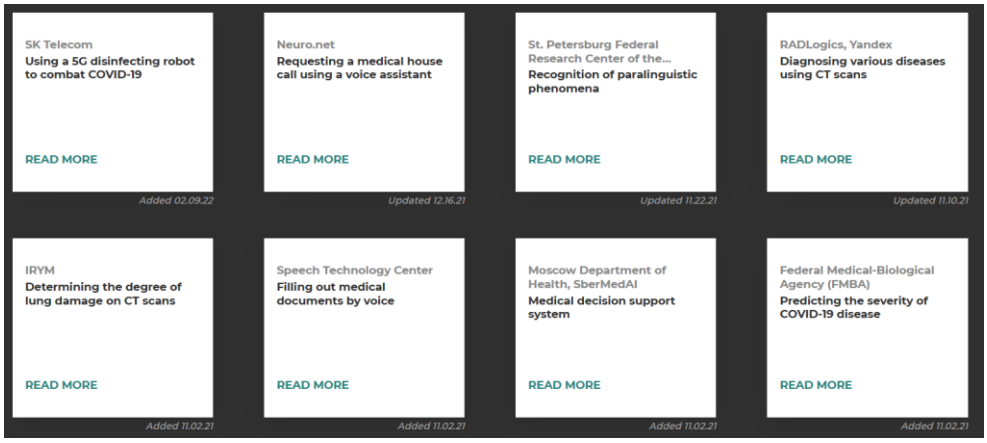

Fig. 2. ICT.Moscow: some cases of using VR and AR technologies in the MedTech sphere [9].

Within the framework of the National Technology Initiative, competence centers are being actively formed to create innovative solutions in the field of end-to-end technologies, one of which is the NTI Competence Center, created on the basis of the Far Eastern Federal University ("Neurotechnology, virtual and augmented reality technologies"). The priority project of the Center is a method of rehabilitation of patients who have suffered a stroke (disorder of the vestibular apparatus and musculoskeletal system), based on tactile feedback using virtual reality technologies. The VR simulator includes a set of exercises of several difficulty levels, containing a motivation system based on gamification elements. The VR simulator is synchronized with the TeslaSuit

[8] Virtual reality for older people. URL: https://evercare.ru/news/virtualnaya-realnost-dlya-pozhilykh-lyudey (accessed 11 March 2024).
[9] ICT.Moscow. URL: https://ict.moscow/cases/?sphere=medtech%2Ccovid-tech&technology=vr%2Car&filtersOrder=category%2Ctechnology (accessed 11 March 2024).

tactile feedback suit, which gives an adequate assessment of the patient's muscle condition as a result of the session and affects non-working/incorrectly working muscle groups, stimulating them. With the use of this complex, it is predicted that the efficiency of the rehabilitation process will increase by at least 25% [10].

Fig. 3. Rehabilitation software and hardware complex [10].

Practices of using VR/AR technologies in the healthcare system in the Arctic zone of Russia

Virtual reality for the prevention and treatment of mental illnesses

Revro Company, a resident of the IT Park "Yakutia", presented a digital solution for the treatment of depressive disorders based on the use of a VR helmet. With the help of a headset and an application, a person finds himself in a digital environment: in a room where there is a crying teenager (similar to the patient), who needs to be calmed down, supported, praised. Once the goal is achieved, the patient finds himself in the place of the teenager and already hears compliments and words of support addressed to him.

Fig. 4. Therapy of mental illnesses based on VR technologies [11].

Thus, the game scenario allows coping with psychological problems associated with low self-esteem, depressive disorders and phobias of various kinds, for example, fear of public speaking.

[10] VR/AR Center NTI FEFU. URL: https://vrnti.ru/med/rpak (accessed 11 March 2024).
[11] FB. How VR glasses are proposed to treat depression: developments from Belgorod and Yakutia. URL: https://fb.ru/post/gadgets-and-gizmos/2023/5/20/385220 (accessed 11 March 2024).

VR technologies for rehabilitation of the musculoskeletal system of children and adults

IT Company “Kinestetika” (Republic of Sakha, Yakutia) implemented the project “Digital platform for the rehabilitation of children with cerebral palsy PlantyGo”. This solution confirmed the feasibility of using virtual reality technologies for the sensory-motor rehabilitation of children with cerebral palsy and other types of musculoskeletal disorders. Three-dimensional images, animation, computer environment allow the child to receive virtual sensory information, feel events and perform real actions/movements [12]. Thus, a child with disabilities develops the musculoskeletal system with the help of a video game, working on reaction and endurance.

Fig. 5. Digital platform “PlantyGo” [13].

In the Yamalo-Nenets Autonomous Okrug (Muravlenko city), the Devirta-Delfi complex [14] operates in the social services center, allowing for neurorehabilitation of limbs (restoration of motor activity) of patients with cognitive and motor disorders after injuries, surgeries and strokes.

Fig. 6. Devirta-Delfi complex [15].

[12] EverCare. Project "Digital platform for rehabilitation of children with cerebral palsy Planty Go". URL: https://evercare.ru/news/proekt-cifrovaya-platforma-dlya-reabilitacii-detey-s-cerebralnym-paralichom-planty-go (accessed 11 March 2024).

[13] Medtech portal. Kinesthetics: Planty Go. URL: https://zdrav.expert/index.php/%D0%9F%D1%80%D0%BE%D0%B4%D1%83%D0%BA%D1%82:%D0%9A%D0%B8%D0%BD%D0%B5%D1%81%D1%82%D0%B5%D1%82%D0%B8%D0%BA%D0%B0:_Planty_Go (accessed 11 March 2024).

[14] Sever Press. In the Muravlenko social services center, city residents will be able to undergo rehabilitation remotely. URL: https://sever-press.ru/news/zdorove/v-centre-socobsluzhivanija-muravlenko-gorozhane-smogut-projti-reabilitaciju-udalenno/ (accessed 11 March 2024).

[15] Virtual neurorehabilitation program for restoring the functions of the upper and lower extremities “Devirta–Delphi”. URL: https://www.istok-reatech.ru/catalog/item/2386/ (accessed 11 March 2024).

Virtual reality technologies, using the principle of biological feedback, allow for more efficient and intensive training in an artificial three-dimensional world, while giving both the patient and the doctor the opportunity to see how the exercises are performed in real time with a real image of the patient. The sounds of dolphins and the game form motivate a person to perform a set of rehabilitation exercises.

Virtual simulators

The Centre for Advanced Professional Training of the Republic of Sakha (Yakutia) hosts master classes in the format of professional trials in the areas of competence for students. As part of the IT Medic competence trial, a step-by-step implementation of the tasks of the virtual simulator "COVID-19 VR Strikes Back" was proposed: students made PCR smear samplings for COVID-19 using VR glasses "Viva Focus Plus" through the virtual simulator "COVID-19 VR Strikes Back". Students were given the opportunity to act as a doctor implementing a specific medical task in virtual reality [16].

At the North-Eastern Federal University named after M.K. Ammosov (Yakutsk), virtual technologies are used to train practicing doctors, physicians and interns using the Shell ultrasound simulator. The virtual simulator allows for training without a patient, improving practical skills and abilities in conducting ultrasound diagnostics in realistic conditions, while reducing the level of possible errors that lead to negative clinical consequences.

Fig. 7. Teaching ultrasound diagnostics [17].

It should be noted that the significance of using virtual simulators in training medical personnel is great. Practical training, development of clinical thinking, acquisition of practical skills

[16] Yakutsk.bezformata. Evening school students auditioned for the Career Trajectory project. UR: https://yakutsk.bezformata.com/listnews/obuchayushiesya-vecherney-shkoli-proshli/105825333/ (accessed 11 March 2024).

[17] New methods of teaching ultrasound diagnostics using simulation technologies. URL: http://ultrasim.ru/index.php/stati/14-novye-metody-prepodavaniya-ultrazvukovoj-diagnostiki-s-ispolzovaniem-simulyatsionnykh-tekhnologij (accessed 11 March 2024).

and abilities are the main tasks of simulation technologies in medicine. In the Russian Federation, there are currently a sufficient number of companies offering ready-made solutions based on the use of virtual simulators in training in such areas of medicine as neurosurgery, ophthalmology, radiology, laparoscopy, dentistry and many others.

Conclusion

Improving the quality of medical care for the population is a priority task in the Russian Federation. Digital transformation in the medical system, defined as "digital health", is designed to solve many problematic situations of providing medical services, including in institutions in the Arctic regions of the Russian Federation. Quite often, current problems are solved using artificial intelligence technologies [1; 6–8].

Today, there is a significant increase in the level of scientific interest in the use of VR/AR in medicine [9–14]. Virtual and augmented reality technologies come to the aid of patients and doctors, solving a wide range of problems, from training and practicing skills of medical personnel to treatment and rehabilitation of patients.

Scientists, IT specialists, representatives of medical institutions and universities are working in a consolidated manner to use the capabilities of VR/AR technologies in medicine. Undoubtedly, the application of advanced practices of medical IT solutions based on VR/AR technologies by regional medical institutions is becoming important.

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Attitude of Residents of an Arctic Single-Industry Town to Tourism Development (Based on Survey in the Murmansk Oblast)

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Abstract. The article raises the question of the tourism development possibilities in the conditions of Arctic single-industry towns from the viewpoint of local residents. On the one hand, the tourism sector is a very dynamic and flexible system of various activities, which has a powerful multiplicative effect on the well-being and quality of life of specific territories. On the other hand, single-industry towns as a special type of settlement are generally characterized by a number of features that limit the development of tourism: lack of social infrastructure, dependence on the position of the city-forming enterprise, and low involvement of the local population in the service sector, which has a special local identity. In the conditions of the Arctic territories, additional restrictions arise due to natural and climatic factors and negative demographic trends. At the same time, the so-called "human factor" is of particular importance, reflecting the willingness of local residents to participate in the tourism industry. In order to identify attitudes towards tourism, including ideas about the problems and prospects of its development in the Arctic single-industry towns of Russia, the authors conducted a sociological survey among residents of the Pechenga municipal district in the Murmansk Oblast (n = 456 people) in 2021. The results of the survey revealed the attitude to living in this territory, perceptions of the prospects and barriers to tourism development, readiness to integrate into the tourism industry. Despite the general positive assessment of the tourism development prospects in single-industry towns and interest in the tourism as a whole, the population demonstrates a rather inert life strategy, including low readiness to receive tourism education.
Keywords: *tourism, single-industry town, Arctic zone of the Russian Federation, quality of life*

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Introduction

In modern society, tourism is one of the most important sectors of the economy, which has a powerful multiplicative effect on the development of specific territories, including improving the quality of life of the population. Thus, in the Strategy for spatial development of the Russian Federation for the period until 2025 [1], tourism is included in the list of promising economic specializa-

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[1] Strategy for spatial development of the Russian Federation for the period until 2025. Approved by the Order of the Government of the Russian Federation No. 207-r of 13 February 2019. URL: http://www.consultant.ru/document/cons_doc_LAW_318094/006fb940f95ef67a1a3fa7973b5a39f78dac5681/ (accessed 29 January 2024).

tions of most subjects of the Russian Federation (in 72 out of 84 regions, 84%), including the Murmansk Oblast. The most general trend is the priority of domestic tourism development, which was formed during the coronavirus pandemic and was intensified in the current geopolitical situation.

In fact, the tourism industry is characterized by high dynamism and uneven development: there is an increase in domestic tourism indicators in the regions of the Russian Federation, with the greatest values in the capital cities (Moscow and St. Petersburg) [2]. Limitations are associated primarily with the lack and quality of appropriate infrastructure in peripheral areas, as well as the seasonality of demand for tourist products in certain regions. In particular, in the subjects of the Arctic zone of the Russian Federation, due to natural and climatic conditions and specifics of economic activity, there is a significant tourism potential, but at the same time, there are phenomena and processes that act as limiting factors for the development of tourism [1, Huber M., Yakovleva O.A., Zhigunova G.V., pp. 99–102].

The Murmansk Oblast as a subject fully included in the AZRF also has a number of features that predetermine the development of the tourism industry. Location beyond the Arctic Circle, prevalence of single-industry economic activity based mainly on the extractive industry, low diversification of economic sectors, steady population decline, dispersed nature of settlement with a predominance of small settlements, etc. — all this determines the profile of the region as a zone of increased discomfort [2, Sharova E.N., Maleus D.V., p. 225].

The Murmansk Oblast is characterized by an abundance of small settlements (92% of the total), including those remote from the regional center, as well as a concentration of single-industry municipalities. Thus, in total, there are 323 municipalities in Russia with the status of a single-industry town (out of 63 subjects of the Russian Federation); there are 16 single-industry towns in the AZRF subjects, and 7 of them are located in the Murmansk Oblast [3].

Foreign science has accumulated a considerable amount of research on towns with a single-industry economy, and a wide variety of names for single-industry towns can be found there (“single-industry towns”, “company towns”, “mill towns”, “mining towns”) [3, Glebova A.N., Zelenskiy V.N., Lazareva A.S., p. 88; 4, Ashmead Ch.P.; 5, Bird D., Taylor A.; 6, Green, H.; 7, Marais L., McKenzie F.H., Deacon L.]. In Russian science, a single-industry town is considered at the conceptual level [8, Malashenko E.A., Mekush G.E., Bartosh A.A.; 9, Kulai S.V.; 10, Bartosh A.A., Malyshev E.A.].

Specific problems of single-industry towns are revealed in the context of regional and spatial development of the country as a whole [11, Artemova O.V., Uzhegov A.O.; 12, Lebedenko O.S.;

[2] Strategy for the development of tourism in the Russian Federation for the period until 2035, approved by the Order of the Government of the Russian Federation No. 2129-r of September 20, 2019. P. 22. URL: http://government.ru/docs/37906/ (accessed 29 January 2024).

[3] List of single-industry municipalities of the Russian Federation (single-industry towns). Approved by Order of the Government of the Russian Federation No. 1398-r of July 29, 2014 (as amended on January 21, 2020). URL: https://docs.cntd.ru/document/420210942?marker=6560IO (accessed 29 January 2024).

13, Pyatsheva E.N.; 14, Ivanova M.V.]. Great importance is attached to issues of state regulation and controlled impact on the development of single-industry towns [15, Vazhdaev A.N., Mitsel A.A.; 16, Knyazeva G.A.; 17, Gladysheva I.V.; 18, Plisetsky E.E., Malitskaya E.A.], problems of economic diversification [19, Belchik T.A., Yakushina T.A.; 20, Sheresheva M.Yu.; 21, Yuryeva T.V.], as well as social well-being and quality of life of the population [22, Volkov A.D., Simakova A.V.; 23, Zhigunova G.V., Sharova E.N.; 24, Zaitsev D.V.; 25, Kashkina L.V.; 26, Nedoseka E.V., Karbainov N.I.].

A number of works are also devoted to the specifics of Arctic single-industry towns, considering the development of Arctic towns through the influence of resource-extracting enterprises on them [17, Gladysheva I.V.; 18, Plisetskiy E.E., Malitskaya E.A.; 27, Korchak E.A.; 28, Shumilova E.B., Avdeeva E.O. Mkhitaryan S.A.].

Among the factors that have a negative impact on the socio-economic development and prospects of single-industry towns in the Russian Arctic, the most general and systemic in nature, according to the authors, is the predominantly resource-based (raw materials) model of economic activity of town-forming enterprises, which, in turn, sets restrictions on the diversification of the economy and the development of entrepreneurship [27, Korchak E.A.]. In addition, the factors of socio-economic distress of Arctic single-industry towns include natural and migration-related population decline, problems with housing and communal services, and poorly developed social infrastructure [23, Zhigunova G.V., Sharova E.N.; 24, Zaitsev D.V.; 29, Zhigunova G.V.].

This circumstance predetermines the nature of local identity, which often merges with corporate identity [30, Nedoseka E.V., Zhigunova G.V., p. 123], industrial mentality [31, Davydov D.A., p. 79], and also determines the choice of specific life strategies of the population, among which various migration practices dominate (including pendulum migration, shift work) [32, Simakova A.V.], participation in the informal sector of the economy (including gathering, fishing) [26, Nedoseka E.V., Karbainov N.I., p. 176], creating the basis for maintaining life in the single-industry towns of the Arctic Zone of the Russian Federation.

Modern researches pay attention to the study of problems and prospects of tourism development at the level of individual territories, including in the subjects of the AZRF [33, Boldyreva S.B.; 34, Zhigunova G.V., Sharova E.N.; 35, Zotkin D.V., Akayev D.V.; 36, Karkhu Ya., Osipov A.Yu.; 37, Lukin Yu.F.], role of tourism in the process of diversifying the economy of single-industry towns [38, Oborin M.S., Frolova N.V., Maltseva M.A.]. The main problems of tourism development in single-industry towns are systematized, among which mainly infrastructure issues and investment risks are identified [39, Plisetskiy E.E., Leonard K.S., Ilyina I.N., p. 131].

Of particular importance are the living standards and opinions of the local population about their region as factors in the development of the tourism industry and the formation of a relevant image of the territory. In this regard, at the empirical level, researchers have recorded the relationship between indicators of regional identity and the assessment of the tourist attractiveness of the region, and substantiated the importance of identifying the assessment of various liv-

ing conditions in the region by the local population [40, Tsvetkova I.V.]. A fundamentally important issue is also related to the position of the residents of a territory with regard to the development of tourism, including their willingness to participate in this sphere.

Materials and methods

In order to identify the attitude of residents of single-industry towns located in the AZRF subjects to the development of tourism, in 2021, the authors conducted a study in the Murmansk Oblast. The focus was on a specific municipality of the region — the Pechenga municipal district, which includes two settlements with the status of a single-industry town (the town of Zapolyarny and the urban-type settlement of Nikel). These settlements were assigned the second category due to the risks of deterioration of the socio-economic situation [4]. In particular, in Nikel, one of the workshops of the town-forming enterprise was closed, which necessitated the diversification of the economy, primarily through the development of the tourism industry. This solution was further elaborated in detail within the framework of the municipal program for the socio-economic development of the district [5].

The main research question concerned the readiness of residents of a single-industry town to the ongoing changes, namely, to participation in the development of the tourism industry at the local level.

The sociological study was conducted using the questionnaire method among the population of the Pechenga municipal district (quota sampling with proportions by gender and age in the amount of 456 people).

Research results

Attitude of the population to living in the Pechenga municipal district

The respondents were asked a set of questions regarding their attitude to living in the settlement, including general satisfaction with living conditions, rating of pressing problems of the territory, migration attitudes. This block of questions made it possible to identify the general context of barriers and opportunities for tourism development in the district.

It was revealed that more than a half of the respondents (60%) are partially satisfied with the living conditions in their settlement; in general, every fourth or fifth person (22%) is satisfied, and 14% are dissatisfied. Analysis of the responses showed that residents of Nikel are less satisfied with the conditions than residents of Zapolyarny: while 18% of respondents of the second settlement are generally satisfied, in the first one, there are almost twice as many of the latter (34%) [6].

[4] List of single-industry municipalities of the Russian Federation (single-industry towns). Approved by Order of the Government of the Russian Federation No. 1398-r of July 29, 2014 (as amended on January 21, 2020). URL: https://docs.cntd.ru/document/420210942?marker=6560IO (accessed 16 February 2024).

[5] The program of socio-economic development of the Pechenga municipal district of the Murmansk Oblast for 2021-2025 (approved on 16.04.2021, as amended on 28.10.2022). URL: https://pechengamr.gov-murman.ru/activities/ProgramSocrazv/ (accessed 16 February 2024).

[6] Hereinafter, the relationship between the characteristics was checked using the chi-square statistical criterion (the significance level of the relationship is not lower than 0.05).

The respondents noted difficulties in obtaining medical services (75%), employment problems (51%), poor quality of public utilities (45%), and insufficient leisure facilities (42%) as the most significant problems of the territory of their residence.

Migration intentions of almost half of the respondents (48%) are characterized by the desire to move from the Far North to other regions, of which 17% are ready to leave in the near future, and 31% have such an intention for the future. Every fourth person (27%) does not deny the idea of moving in the distant future, but does not have specific plans. 22% of respondents plan to stay in the Pechenga district. As reasons for moving, 24% noted natural and climatic factors, 20% — lack of work, 11% — retirement; 10% each — low standard and quality of life, low salaries, degradation of the settlement, lack of territorial development and any prospects in general.

Tourism development prospects in the Pechenga district as assessed by the population

According to respondents, tourists come to the Pechenga district mainly for fishing, hunting, gathering mushrooms and berries (62%); secondarily, for winter recreation (41%). Almost a third of visitors (30%) are interested in exploring historical and cultural sites; 23% are interested in summer outdoor activities (hiking, rafting); 18% come to the region for professional and business purposes. In addition, 14% have not seen tourists in their village, and 12% found it difficult to answer the question.

The most attractive tourist locations in the Pechenga district, according to 66% of respondents, are the Rybachiy and Sredniy Peninsulas, according to 54% — the Pasvik Nature Reserve; 53% of respondents include the Nikel Local History Museum, 49% — the Trifonov Pechenga Monastery, 47% — places of military glory. Other places were also mentioned, but much less frequently, which made it possible not to consider them as promising in the current period.

The attitude to the development of tourism in a single-industry town from the point of view of its residents raises a special question. According to respondents, in the space of an industrial settlement, tourism will primarily contribute to an increase in jobs (58%) and the creation of recreational facilities for rest and leisure (49%). This is followed by investment in regional development (45%), improvement of transport and social infrastructure (39% each). A third of respondents noted an improvement in the reputation and recognition of the territory (34%), and every fourth (25%) — the opportunity to expand social contacts. 10% found it difficult to answer this question, and the same number do not see anything positive in the development of tourism in Pechenga (see Table 1).

Table 1

Positive aspects of tourism development in the Pechenga district, according to respondents

	Frequency	%
new jobs	266	58
improvement of recreational and leisure facilities	225	49
investments in the economy	204	45
improvement of transport infrastructure	180	39
improvement of social infrastructure	177	39
improvement of the reputation and recognition of the region	155	34

	Frequency	%
expansion of social contacts	115	25
nothing positive	47	10
find it difficult to answer	47	10
other	7	2
Total	1 422	312

Among the negative consequences of tourism development in the region, respondents primarily noted the rise in prices for goods and services (54%) and environmental degradation (39%). 17% do not see any negative aspects, 13% of respondents found it difficult to answer (see Table 2).

Table 2

Negative aspects of tourism development in the Pechenga district, according to respondents

	Frequency	%
rising prices for goods and services	247	54
poor ecology	178	39
increased competition for resources	78	17
conflicts between local residents and tourists	74	16
changes in the usual way of life of residents	72	16
increasing crime rate	59	13
nothing negative	77	17
find it difficult to answer	59	13
other	9	2
Total	852	187

Despite the presence of negative views on tourism development in the Pechenga district, their share is only slightly more than half of the positive assessments, which generally gives grounds for making a forecast about the optimistic attitude of local residents.

In response to a direct question about the attitude to tourism development in the Pechenga district, the majority of respondents (58%) noted a positive attitude. At the same time, every fifth respondent has an equal positive and negative attitude, and every tenth respondent has a negative attitude. A correlation was found between attitudes towards tourism and age (the older a person is, the more he or she is inclined to give negative assessments); education (people with higher education have a more positive attitude than people with other levels of education); financial situation (the lower the income, the more negative assessments are given).

Assessing the prospects for tourism development in the Pechenga district, more than half of the respondents (61%) gave a positive assessment, while almost every fifth (19%) is pessimistic about the prospects for tourism in Pechenga, and the same number found it difficult to answer.

Promising areas for tourism development in the Pechenga district coincide with the existing types of tourism in this area, previously named by respondents: winter tourism (69%), safari (fishing, hunting, gathering) (66%), summer types of northern recreation (56%), military-historical tourism (46%). In addition, every third or fourth respondent mentioned industrial, sports, and business tourism.

For their development, according to respondents, it is necessary to remove a number of barriers, which include the lack or absence of the necessary tourist infrastructure (58%), striking attractions (44%), transport infrastructure (43%), and professional personnel in the tourism sector

(42%). Almost every third person also noted the lack of information about the locations and features of the territory (32%) and military facilities located throughout the Pechenga district (28%), which hinder the free movement of tourists around the area and access to facilities (see Table 3).

Table 3

Barriers to tourism development in the Pechenga district, according to respondents

	Frequency	%
lack / underdevelopment of tourist infrastructure	263	58
lack of striking attractions	202	44
poor transport infrastructure	198	43
lack of professional personnel in the tourism sector	194	42
lack of information	145	32
military facilities	127	28
corruption	85	19
competition with other locations in the Murmansk Oblast	76	17
unreadiness of the local population for the flow of tourists	73	16
find it difficult to answer	38	8
other	10	2
no barriers	6	1
Total	1 416	310

Attitude of residents of the Pechenga district to employment and training in the tourism sector

The attitude of the local population to employment and training in the tourism sector was revealed through the characteristics of existing experience and the assessment of the attractiveness of this activity.

It was revealed that the majority of respondents (86%) lacked experience in the tourism industry, while 2% of respondents work with tourists, and 14% had such experience before, but currently do not work in this field.

Of those who had experience in the studied field of activity, approximately every third or fourth (29%) indicated various difficulties that they had to face or are facing. These are, first of all, difficulties in communications, including insufficient communication skills in foreign languages (English, Norwegian, Chinese) (28%), underdeveloped infrastructure / low quality of service / unsatisfactory condition and/or insufficient number of objects of interest (28%), transport inaccessibility, bureaucratic delays, lengthy preliminary preparation due to registration of passes for access to locations (28%), as well as lack of promotion of the territory, small number and unpreparedness of the tourists themselves (2%).

The attractiveness of work in the tourism industry for residents of the Pechenga district was assessed on a five-point scale, where 1 is not at all attractive, 5 is very attractive. Thus, the average score was 2.84, i.e. slightly below average (3 points is the middle of the scale).

The overwhelming majority of respondents do not exclude the prospect of employment in the tourism industry — their share was 71%, along with those who found it difficult to answer (their share was 31%). At the same time, every fourth person considers this employment as additional (26%), almost the same number of respondents is ready to run their own business (23%), including 17% with official registration. 13% see themselves as employees. Slightly less than a third

of respondents noted that they are not attracted to work in the tourism industry (29%).

The barriers that determined the personal readiness of the surveyed residents of the Pechenga district to implement labor activities in the tourism industry were: lack of training (39%), job guarantees (33%), unwillingness to work in the service sector (15%), lack of "flexible" skills for working with tourists (12%) (see Table 4).

Table 4

Barriers to personal readiness to work in tourism, according to respondents

	Frequency	%
lack of specific training	179	39
insecure employment	150	33
unwillingness to work in the service sector	70	15
lack of "flexible" skills for working with tourists	53	12
low wages in the industry	30	7
no barriers	28	6
other	19	4
find it difficult to answer	81	18
Total	609	133

At the same time, the respondents are rather unattracted by the possibility of getting profile education in the tourism industry (43% — the sum of the answers "no" and "rather no"). Slightly more than a third of respondents showed loyalty to training in the field of tourism — 37% (the sum of the answers "yes" and "rather yes"), which generally characterizes the demand for this education at an average level. A fifth of respondents (20%) found it difficult to answer. It is worth noting that 20% of respondents took specific steps towards educational training. In particular, they expressed a definite interest and left their contacts for enrollment in training courses.

As a result of analyzing the empirical study, it was recorded that the attractiveness of tourism education depends on the attitude towards tourism in general, perceptions about the prospects of its development, as well as on the availability of relevant work experience and interest in such work.

Discussion and conclusion

According to the results of the study, it can be concluded that the population of the Pechenga district positively assesses the possibilities for tourism development in their localities, sees the directions promising in terms of attracting tourists, as well as the benefits for local communities. The barriers noted were mainly objective environmental limitations: lack of infrastructure facilities, striking attractions, low transport accessibility. At the same time, special attention should be paid to the fact that the population of the studied single-industry towns, the overwhelming majority of whom do not have experience in the tourism industry, generally do not exclude the prospect of employment and even opening their own business in the tourism industry. The need to obtain special competencies as an important component of professional activity is recognized, but at the same time, not everyone is willing to receive the appropriate education, which can be a limiting factor. At the same time, it is necessary to understand that the involvement of the local population in the tourism sector is possible only if a set of measures to support

this industry in cooperation with representatives of various authorities (from solving infrastructure issues to the content of tourism products and their promotion) is implemented.

Particular attention should be paid to the formation of an internal attractive image of the territory, which would be manifested in the retention and consolidation of the population on the basis of increased satisfaction with living conditions and improvement in the quality of life in general.

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Problems of Arctic Region Development at the St. Petersburg International Economic Forum (SPIEF-2024)

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Abstract. The article analyses the results of the 27th St. Petersburg International Economic Forum (SPIEF-2024). The focus of the Forum was reflected in its motto "The basis of multipolarity is the formation of new growth centers". Discussions on the Arctic agenda were presented at SPIEF-2024 during 3 days. RAS researchers V.P. Zhuravel and N.A. Nevskaya were participants in a number of SPIEF-2024 sessions as part of the Arctic Seminar events at the Institute of Europe of the Russian Academy of Sciences. The Forum devoted two panels to Arctic issues: "The Northern Sea Route: Expanding Arctic Horizons" and "The Arctic Plan. International Perspective". Arctic issues were also raised at the discussion panels "Climate Agenda of the EAEU, SCO, BRICS: Partnership for Sustainable Development", "Inclusive Growth for a Sustainable Future", etc., as well as in speeches and interviews for the media by governors of the Arctic regions of the Russian Federation and officials of the Ministry of Eastern Development and Rosatom State Corporation, who represented the position of the authorities. The view of business was reflected mainly by representatives of a Chinese transport company, as well as heads of large Russian enterprises operating in the Arctic region. Based on the review of panel discussions and conversations with Forum participants, the main results of the dialogue between the government and business on issues of economic support for Arctic projects and directions for stimulating industries in the Arctic zone in accordance with the stated priorities are revealed. The role of state regulation of the economy in the Arctic is shown.
Keywords: *SPEF-2024, Arctic, Roscongress, international cooperation, Northern Sea Route, planning*

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Introduction

As competition between the major global centers of economic power intensifies, the Arctic has become the most important point of intersection between the interests of the world's major economic, political and military actors. The growing role of this region was taken into account in the program of the St. Petersburg International Economic Forum2024, organized by the Roscon-

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gress Foundation on 5–8 June 2024. Two sessions were devoted to Arctic issues. The first session, "The Northern Sea Route: Expanding Arctic Horizons", opened the main program of the Forum. The session "The Arctic Plan. International Perspective" opened the second main working day of the program. Specific issues related to the development of this Russian macro-region were addressed in sessions devoted to energy, climate, transport and logistics, international cooperation and inclusive growth. This structure of the program reflects the multifaceted nature of the Arctic development issues, which requires an integrated approach to their solution from all participants. Arctic issues were presented in the reports of the governors of the northern regions at the stands of the constituent entities of the Russian Federation — the Republic of Karelia, Arkhangelsk and Murmansk Oblasts. The position of the federal authorities of the Russian Federation at SPIEF-2024 was reflected by the head of the Ministry for the Development of the Russian Far East and a representative of the Ministry of Emergency Situations. The problems of the Russian Arctic development from the perspective of business were presented by the management of a Chinese transport company and Russian companies — Norilsk Nickel, NOVATEK, Rosneft, Rosatom, etc. The choice of the discussion participants was justified by the economic role of the Russia's foreign trade relations and export flows from the Russian Federation, reoriented in 2022 towards "friendly" countries, the largest of which are China and the countries of the Middle East. The increasing importance of the Northern Sea Route development issue was indirectly indicated by the first place of this panel in the list of discussions of the 2024 program. All participants emphasized that 90% of world trade is carried out by sea transport. In the context of growing problems in the Suez Canal and the Red Sea, as well as climate transformations, interest in the Northern Sea Route is growing. The Institute of Europe of the Russian Academy of Sciences has been represented at the Forum for several years by leading researchers from the departments of country and economic research [1, Zhuravel V.P.; 2, Timoshenko D.S.].

International business at SPIEF-2024 on the challenges of Arctic development

Representatives of the business community in their views on the development of the Arctic and the Northern Sea Route are primarily focused on commercial interests — increasing profits by maximizing the volume of products sold and taking a larger share of the market at the initial stage of its formation. The assessment of prospects is associated, first of all, with the transport and logistics advantages of the development of the Northern Sea Route, as well as with access to hydrogen raw materials and the possibilities for developing new technologies within the framework of "green" and sustainable economy [3, Leonov S.N., Zaostrovskikh E.A.].

Representatives of China were among of the most important foreign trade partners interested in the development of the Northern Sea Route. At SPIEF-2024, the Chinese side was represented by the General Director of the China freight forwarding company Mr. Ke Jin and the Chairman of the Chinese logistics company NewNew Shipping Co. Ltd Ms. Fan Yuxin.

Ke Jin noted in his report at the session "The Northern Sea Route: Expanding Arctic Horizons" that, having been actively working on the Northern Sea Route since last year, the Chinese company has accumulated extensive experience in new conditions and can highlight the advantages of this route:

- advantageous logistics via Arkhangelsk, which is located near Moscow, the main transport hub of Russia;
- involvement of the timber industry in the logistics network, along with fuel and energy goods;
- value of the Northern Sea Route both as a transit route to Europe and as a final destination for the delivery of goods to Russia [1].

In an interview at the SPIEF-2024 stand, Ke Jin noted that the most important thing for Chinese partners is logistics, since it allows saving about 30% of fuel and the delivery time will be 2-3 weeks faster compared to the standard route [2]. Cars, equipment and consumer goods are delivered from China to Russia, and cargo from Rusal and Ilim Group comes from Russia to China. According to Chinese business estimates, the price level with icebreaker assistance is about the same as passing through the Suez Canal, but the cargo is delivered faster. At SPIEF, a Chinese company signed an agreement with Rosatom (the infrastructure operator of the Northern Sea Route since 2018) on the possibility of jointly building ice-class vessels that can sail longer along the Northern Sea Route (class from ARC 7) [3]. We would like to believe that nothing will prevent its fulfilment.

Fan Yuxin spoke at the session "Arctic Plan. International Perspective". She noted that the company has been represented in Russia since 2009 as part of the "One Belt — One Road" project. The aggravation of international relations and the growth of trade with China contributed to an increase in the company's trade turnover by land and sea. The initiative for the Arctic development of Russia and China will contribute to the growth of the well-being of all parties involved. The company has launched 7 routes, which is very significant for the Chinese side. Both new routes and a security system for the transportation of goods are being developed. The company plans to launch a new project, "Arctic Express No. 1", which covers the main ports of China: Shanghai and Ningbo through the north to Arkhangelsk and then by rail to Moscow and St. Petersburg. This route takes 25–27 days. Currently, the route from Shanghai to St. Petersburg is 12,600 miles, and through the Arctic — 6,700 miles, which reduces the travel distance to a third. The Chi-

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[3] Rosatom intends to transport up to 3 million tons of transit cargo via the Northern Sea Route in 2024. URL: https://neftegaz.ru/news/transport-and-storage/837475-rosatom-v-2024-g-nameren-perevezti-po-smp-do-3-mln-t-tranzitnykh-gruzov/ (accessed 30 June 2024).

nese company plans to create a joint venture in St. Petersburg to develop new routes and technical solutions for the development of the Arctic [4].

According to the Atommedia agency, in continuation of the development of relations between Rosatomflot (an enterprise of the Rosatom state corporation) and the Chinese company Newnew Shipping Line, on July 5, 2024, a container cargo was shipped from the logistics center near Moscow to Arkhangelsk by the first railway "Northern Sea Route Express No. 1". The cargo was delivered to China via the Northern Sea Route [5].

Japan was represented online by Hide Sakaguchi, President of the Ocean Policy Research Institute (OPRI) of the Sasakawa Peace Foundation. He noted the high potential of the Northern Sea Route due to its economic and geographical location, logistics and tourism opportunities of the territory. This potential is being revealed through investments in tourism and the development of container hubs, which will give impetus to development in the entire region. Japan is following the situation with interest, since the economic and investment dynamics in the Arctic will affect all territories within the waters of the Northern Sea Route. He noted Russia's potential role in new environmental projects, as the Russian Arctic has large hydrogen reserves and new technologies for its utilization, and hydrogen is a driver of the transition to a green and sustainable economy. The position of the Japanese colleague differs from the point of view of the Chinese representatives on the issue of freight prices on the Northern Sea Route and coincides in assessing the advantages of speed. The speaker believes that the freight cost of the Northern Sea Route is significantly higher than freight through the Suez Canal, but the delivery speed is 2–3 times higher, which is important for manufacturers of goods with high added value. Japan is looking forward to the opportunities to participate in the development of the Northern Sea Route [6].

The session "Arctic Plan. International Perspective" was attended online by the Executive Director of the Arctic Economic Council Mads Qvist Frederiksen, a citizen of Norway, which chairs the Arctic Council in 2023–2025. Russia's pronounced reorientation to the East and support for the development of the Northern Sea Route by the most important counterparties in Southeast Asia were factors in softening Norway's rhetoric towards Russia, which was reflected in the expert's restrained and balanced assessment of the situation in the Arctic zone. He doubted the possibility of predicting the development of relations with Russia in the near future, but noted that in fact, work in the Arctic is ongoing and shipping has not stopped. It was noted that the Arctic Council understands the importance of the Northern Sea Route, and companies from these countries have increased cargo transportations along the Northern Sea Route. Norway recognizes the difficulties of insurance due to sanctions, but this does not diminish the role of the NSR [7]. The Director of the

[4] Roscongress Foundation. The Northern Sea Route: Expanding Arctic Horizons. URL: https://www.forumspb.com/programme/business-programme/131409/ (accessed 30 June 2024).
[5] New logistics route to China were launched in Moscow region. URL: https://atommedia.online/2024/07/08/v-podmoskove-zapustili-novyj-logist/ (accessed 27 August 2024).
[6] Roscongress Foundation. Arctic Plan. International Aspect. URL: https://www.forumspb.com/programme/business-programme/131511/ (accessed 30 June 2024).
[7] Ibid.

Arctic Economic Council emphasized the relevance of the problem of global warming and climate change, which are an objective reason for changing the map of sea routes with an increase in the number of shipments along the Northern Sea Route. In conclusion, the expert expressed hope for cooperation, noting the impossibility of specific solutions at the present time [8].

Federal authorities of the Russian Federation at SPIEF-2024 on the challenges of Arctic development

Representatives of government authorities consider the development of the Arctic and the Northern Sea Route not only from an economic, but also from a political and military standpoint, taking into account the importance of the geostrategic position of the region and pointing out the problems of the militarization of the Arctic. Russian President V.V. Putin announced the formation of a Commission on the development of the Northern Sea Route and Arctic regions in the State Council [9]. The Commission will unite and coordinate the work of federal departments and corporations with the authorities of the Arctic subjects. Master plans have been proposed as tools for the development of Arctic territories, which should have a certain limit and priority financing in projects within the framework of national development goals [10].

The head of the Ministry for the Development of the Far East and the Arctic A.O. Chekunkov outlined the importance of developing the Arctic within the framework of the state policy of the Russian Federation, noted the growing interest of the countries of Southeast Asia and the Middle East in the Arctic and the Northern Sea Route. In addition to the new transport route, interest in the Arctic is associated with the development of green energy and energy transition policy. The Arctic is rich in rare earth metals — products of Norilsk Nickel, hydrocarbons from Yamal, products of the woodworking and cellulose industries of Arkhangelsk, diamonds from Yakutia, and copper from Chukotka [4, Ampilov Yu.P., Grigoriev M.N.]. Trade turnover on the Northern Sea Route has increased 36-fold in 12 years. Such dynamics require accelerated investments in the social base of the territory. Russia has built the largest Arctic cities, the development of which will be carried out within the framework of the formula “3 D: home, wealth, leisure”. Arctic development programs involve increasing the availability of comfortable housing, increasing the well-being of Arctic residents, forming a cultural environment and creating conditions for diverse cultural leisure for citizens [11].

[8] Key Arctic participants of SPIEF-2024 on the development prospects of the most important macro-region of Russia. Project Office for Arctic Development. URL: https://porarctic.ru/ru/comments/ke-dzin-logistika-na-sevmorputi-dlya-kitaya-ochen-vygodnaya/ (accessed 30 June 2024).
[9] Meeting of the Council for Strategic Development and National Projects and the State Council commissions on socio-economic development. URL: http://kremlin.ru/events/president/news/74162 (accessed 30 June 2024).
[10] Decree of the President of the Russian Federation of 07 May 2024 No. 309 "On the national development goals of the Russian Federation for the period until 2030 and for the perspective up to 2036". URL: https://www.consultant.ru/law/hotdocs/84648.html (accessed 29 June 2024).
[11] Roscongress Foundation. Arctic Plan. International Aspect. URL: https://www.forumspb.com/programme/business-programme/131511/ (accessed 30 June 2024).

In his speech at the SPIEF-2024 regional stand, A.O. Chekunkov noted the problem of building up the Armed Forces in the Arctic. The United States, Canada and the Scandinavian countries, on the one hand, recognize Russia's sovereignty and freedom of action in the Arctic, and on the other hand, contribute to increasing tension and militarization of the Arctic macro-region. For the Russian Federation, the main factor of stability in the Arctic is the presence of the Northern Fleet as a key element of the nuclear triad. At the same time, the development of the Northern Sea Route and adjacent coastal territories is impossible without a comprehensive civil security system. They are necessary for the implementation of mega-projects for liquefied natural gas of the Rosneft-VostokOil company, for new projects of Norilsk Nickel in the field of development of the Baimskaya ore zone. In order to sell the products of these projects, it is necessary to develop the Northern Sea Route. No less important are point projects that make it possible to increase the efficiency of Arctic routes for Russian settlements, primarily for northern delivery. One of the ways to develop the Arctic and the Northern Sea Route is the creation of a single maritime operator to improve the delivery of goods along northern routes. Chukotka is the pilot region. In order to make the delivery of goods along the northern route more efficient, transparent and profitable for shippers, the Russian Government subsidizes transportation, paying special attention to cabotage [12].

The most important condition for the development of the Arctic macro-region is the socio-economic situation of people living in the harsh climatic conditions of the Arctic [5, Grigoriev M.N.]. Therefore, the Head of the ministry puts his hope in the arrival of large developers in the Arctic. The four-year experience of the Far Eastern mortgage mechanism is taken as a basis.

The Head uses the following statistics: for a long time, the average price per square meter of an apartment in the Far East was higher than the average price per square meter in Russia. The introduction of the program managed to reverse the situation, doubling the volume of housing construction, since the increased supply reduces the price. Currently, the Far Eastern square meter costs 12% less than the Russian average. For the Arctic, building new houses is a big step, since not a single new house has been built in many Arctic regions since Soviet times. However, the problem of population outflow from the regions of the Far East and the Arctic persists. This indicates that the "housing availability" factor is insufficient to assess the well-being and attractiveness of the territory for living [6, Nevskaya N.A.].

The development of the Northern Sea Route is closely related to the security of the Arctic zone territory and prevention of emergency situations [7, Grigoriev M.N.]. The Ministry of Emergency Situations of the Russian Federation is working on the creation of an integrated security system. At SPIEF-2024, the work of the Ministry of Emergency Situations was represented by A.I. Bondar, Director of the Department of Educational and Scientific-Technical Activities of the Rus-

[12] Alexey Chekunkov: Creative, peaceful development of the Arctic is protected by the Northern Fleet. Project Office for Arctic Development. URL: https://porarctic.ru/ru/comments/aleksey-chekunkov-sozidatelnoe-mirnoe-razvitie-arktiki-zashchishcheno-severnym-flotom/ (accessed 30 June 2024).

sian Ministry for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters. The Ministry of Emergency Situations presented at SPIEF-2024 an integrated civil security system based on new-type rescue centers. Such a center was opened in Pevek in Chukotka, and the system covering the entire Arctic without blind spots is planned to be launched by the end of 2027. A.I. Bondar noted that "until recently, Russia's marine rescue infrastructure in the Arctic region was represented by centers in Murmansk, Arkhangelsk, Vorkuta, Naryan-Mar, and Dudinka" [13]. However, they were created before the idea of year-round use of the Northern Sea Route emerged. New conditions and challenges require new solutions. The Ministry of Emergency Situations has developed a strategy to cover the eastern part of the Arctic with new centers. "New challenges have required the formation of a new attitude to ensuring security in the Arctic, and the Russian Ministry of Emergency Situations has developed a strategy to cover the eastern part of the Arctic with new-type rescue centers. This means that the center includes, in addition to the rescuers themselves, a day-to-day management body. These are those who monitor and develop management decisions, interact with other federal executive bodies (with the marine rescue coordination center, with the subject of the Russian Federation on whose territory they are located), support decision-making, launch unmanned aerial vehicles into the air, allowing seeing the picture. The third most important component of the center is the aviation link, which in each of the centers will be represented by two Mi-8 and Mi-38 helicopters with a range of 750 km, which, upon completion of this project, will allow to reach any point along the Northern Sea Route from the aviation bases of the Russian Ministry of Emergency Situations."[14].

In his speech at the SPIEF-2024 stand, A.I. Bondar once again emphasized the target function of the availability of rescue infrastructure for users of the Northern Sea Route and residents of the region. "A very important component is the developed emergency rescue infrastructure to cover the Northern Sea Route. Now the safety of the residents of the Arctic region and those small settlements that until now could see a rescuer in a day or two or three, or maybe later, depending on weather conditions, is guaranteed. Today, rescuers are becoming much closer to them. In order to reach any point in the Arctic region and successfully return back with the help of the Russian Ministry of Emergency Situations aviation, we are considering, together with Rosatom, the possibility of basing the Ministry of Emergency Situations aviation on the Project 22220 nuclear icebreakers. Rosatom is currently doing everything to ensure that the icebreaker is capable of receiving not only the Mi-8, which were initially included in the design documentation for these vessels, but also the Mi-38, taking into account the possibility of refueling on a nuclear icebreaker, the ca-

[13] Representative of the Russian Emergencies Ministry on the progress of creating a comprehensive security system in the Arctic. URL: https://porarctic.ru/ru/comments/aleksandr-bondar-aviatsionnym-krylom-mozhno-budet-dostat-do-lyuboy-tochki-sevmorputi/ (accessed 30 June 2024).
[14] Ibid.

pabilities of the Ministry of Emergency Situations aviation for delivering doctors or rescuers become limitless." [15]

Governors at SPIEF-2024 on the challenges of Arctic development

At SPIEF-2024, governors of the constituent entities of the Russian Federation in the Arctic region made reports at the session "The Northern Sea Route: Expanding Arctic Horizons". The reports were made by Alexander Tsybulskiy (Governor of the Arkhangelsk Oblast), Andrey Chibis (Governor of the Murmansk Oblast), Vladislav Kuznetsov (Governor of the Chukotka Autonomous Okrug). The ports of Murmansk and Arkhangelsk are the basic sea ports, and their development as the main container hubs of the Arctic is one of the main goals of the Northern Sea Route development [8, Furuichi, M., Otsuka, N.]. In the Murmansk Oblast, the seaport of Lavna, the first modern port since the Soviet era, is under construction, and there are plans to create a ship repair complex and to gasify the region.

The Arkhangelsk Oblast is attracting the attention of Chinese investors. To develop the infrastructure of the Arkhangelsk port as the most important point on the Northern Sea Route, an agreement was signed between the government of the Arkhangelsk Oblast, EUROSIB and Sberbank at SPIEF-2024. The large development group "Samolet" signed an agreement on the comprehensive development of the capital of Pomorie, Arkhangelsk. By 2030, it is planned to build a road connecting the Kirov and Arkhangelsk Oblasts.

The Northern Sea Route is extremely important for the Chukotka Autonomous Okrug (ChAO). The first direction of using the Northern Sea Route in the ChAO is northern delivery: more than 80% of goods — food, POL and fuel — are brought by sea. Last year, Federal Law No. 411-FZ of 04.08.2023 "On Northern delivery" [16], was adopted, which systematizes the process taking into account the growing ambitions in using the Northern Sea Route. The ChAO, the Ministry for the Development of the Russian Far East and the Rosatom Corporation are working in coordination to create a Unified Marine Operator for northern delivery for the transition to the medium-term planning horizon. The second area of use of the Northern Sea Route is the export of mineral resources from the region. The head of Chukotka places hopes on two deposits of non-ferrous metal ores. The first major project is the development of the world's largest copper deposit, which will ensure a cargo flow of about 2 million tons per year. The second major project was explored in the 1970s, but was not developed — this is a tin deposit, which is also the largest in the world. It was not possible to develop these deposits, since they could not be exported. Due to the development of the Northern Sea Route, work on ore mining began.

[15] Key Arctic participants of SPIEF-2024 on the development prospects of the most important macro-region of Russia. Project Office for Arctic Development. URL: https://porarctic.ru/ru/comments/ke-dzin-logistika-na-sevmorputi-dlya-kitaya-ochen-vygodnaya/ (accessed 30 June 2024).

[16] Federal Law of 04 August 2023, No. 411-FZ "On Northern Delivery". URL: https://www.consultant.ru/document/cons_doc_LAW_453883/ (accessed 30 June 2024).

The master plans of the regions of the Arctic zone of the Russian Federation are the main tool for their development [9, Zhuravel V.P.]. In these plans, the authorities of the AZRF subjects justify the development of Arctic agglomerations of local importance — core settlements — and the allocation of investments in infrastructure projects. Master plans for core cities of the Arctic Zone of the Russian Federation were presented at the stands of SPIEF-2024. All over the world, the criterion of population size is used to determine the importance of a settlement, which is not applicable to the Arctic Zone. The population there is significantly smaller than average, but the importance of a city in the economic development of a region is not determined in the Arctic by population size. The importance of a settlement in providing services to the surrounding area is significant: these are the "entry points" to hard-to-reach territories, Northern Sea Route bases, large deposits of natural and mineral resources, points of ensuring and maintaining national security and human safety in the Arctic and the Far North.

During the discussion of this issue, a system of criteria was developed to form a list (16 agglomerations) of core settlements of the Arctic Zone of the Russian Federation. In accordance with the presented methodology, the following criteria were identified:

- Criterion 1. Performing functions in the field of ensuring national security Subcategories: "CATU", "Border zone point";
- Criterion 2. Performing the function of a base for the development of mineral resource centers. Subcategories: "Strategic mineral resources", "Provision of metallurgical enterprises with critical raw materials";
- Criterion 3. Implementation of economic or infrastructure projects Subcategories: "Investment projects", "Logistics centers" [17].

Presenting master plans for their regions at the SPIEF-2024 stands, the governors linked their functioning with the problems of the Northern Sea Route, as well as with the general economic problems of the subjects of the Arctic Zone of the Russian Federation: combating the population decline, stimulating the growth of well-being and increasing comfort for residents of the region. Of the Arctic regions, Karelia, Murmansk Oblast and Yamalo-Nenets Autonomous Okrug had separate stands at SPIEF-2024. Presentations of master plans were held as part of the Arctic Day.

The Governor of Karelia presented investment projects of the Kemsko-Belomorskaya agglomeration, which is included in the list of Arctic development support points at the VEB.RF site [18]. The Murmansk Oblast presented three agglomerations: Murmansk, Kirov-Apatity and Monchegorsk. It should be noted that the Murmansk Oblast is currently the leader among the Arctic regions in terms of the number of investments and jobs created, which is due to the function-

[17] Support settlements are the framework of the Russian Arctic. URL: https://minec.gov-murman.ru/about/obsch_sovet/rab/2023-god/opornye_naslennye_punkty_karkas_rossiyskoy_arktiki_final_19122023.pdf (accessed 30 June 2024).

[18] SPIEF 2024. Karelia Head Artur Parfenchikov presents potential of Kemsko-Belomorskaya agglomeration to investors. URL: https://gov.karelia.ru/news/06-06-2024-pmef-2024-glava-karelii-artur-parfenchikov-predstavil-investoram-potentsial-kemsko-belomorskoy-aglom/ (accessed 30 June 2024).

ing of preferential regimes: the priority development area (PDA) “Capital of the Arctic” and the Arctic Zone of the Russian Federation. The head of the Sakha Republic (Yakutia) spoke about the Tiksi-Naiba agglomeration as a way to preserve the traditions and culture of small indigenous peoples and new opportunities for industrial development of the territory within the framework of the master plan [19]. Chukotka presented master plans for the development of Egvekinot, Bilibino and Pevek [20].

The master plan of the Arkhangelsk agglomeration was at the last stage of development during SPIEF-2024, but the main elements were presented at the session “Arctic Plan. International Perspective”. The Arkhangelsk agglomeration has a key development element — a transport hub.

As part of the business program of the Roscongress Urban Hub platform, a separate session of SPIEF-2024, “New Master Plans for Cities — How to Implement Them”, was devoted to the creation and implementation of master plans. Olga Vovk, Deputy Governor of the Murmansk Oblast, took part in the discussion from the Arctic region. The session discussed the problems of theory and practice of effective city management, as well as new mechanisms of state territorial planning.

Conclusion

SPIEF-2024 is an important meeting place for business and government representatives to formulate and implement coordinated policies, achieve development goals, and expand business projects. The aggravation of international relations in recent years has affected the circle of representatives of countries, and the general tone of the discussions has become polarized. The relevance of projects, objective changes in the development of territories, and achievements of scientific and technological progress show that there are issues that are of interest to the main participants in international processes. SPIEF-2024 has shown that Arctic problems are attracting the interest of the global community. The forum theme, “The Basis of a Multipolar World — Formation of New Growth Points”, was very closely related to the Arctic as a tool capable of changing the geopolitical balance on the economic map of the world. The development of the Northern Sea Route concerns not only the interests of friendly countries of South-East Asia and the Middle East. Representatives of Japan and Norway were involved in the events. The problems of development of the Northern Sea Route and the Arctic zone were discussed in a remote format, which is especially important in the conditions of limited political, economic, scientific and technical cooperation. With the reserved position of the representatives of Japan and Norway, China is taking a very active part in the development of the Northern Sea Route. As a result of the Arctic sessions, agree-

[19] The Head of Yakutia spoke at the SPIEF-2024 session dedicated to the development of the Arctic. URL: https://yakutsk.mid.ru/ru/press-centre/news/glava_yakutii_vystupil_na_sessii_pmef_2024_posvyashchennoy_razvitiyu_arktiki/ (accessed 30 June 2024).

[20] Chukotka delegation participates in St. Petersburg Economic Forum. URL: https://goo.su/YS9esN (accessed 30 June 2024).

ments were reached on a number of cooperative steps in transport and logistics issues, coordination of efforts of the constituent entities of the Russian Federation with representatives of Russian and international business. A month after the Forum, the declared Arctic "Northern Sea Route Express No. 1" set off on its journey. In August 2024, master plans for the development of the supporting territories of the Arctic regions of the Russian Federation were approved. Much attention of the federal authorities was paid to the problems of the Arctic. In addition to the speech of the head of the Ministry for the Development of the Far East on an extensive list of Arctic issues, an official of the Ministry of Emergency Situations of the Russian Federation presented a report with the results of work on human safety in the Arctic. This indicates the implementation of an integrated approach to the development of the Arctic territory. The weak point of the approach to the development of large, sparsely populated territories of the Arctic is the insufficient consideration of market mechanisms in the implementation of state programs and projects. The achievement of national goals is based on the existing structure of the Arctic economy with a weakly competitive market, which was established in the system of planned economy relations. This entails a costly approach to financing Arctic projects, often without the possibility of assessing the positive effect on the residents of the region. In the state planning system, a new approach for our country to the development of territories through the development of master plans for key settlements of the Arctic zone is being implemented. This tool is actively used in the Far East and has been extended to the Arctic under the coordination of the Ministry for the Development of the Far East. The document links the national goals of the country's socio-economic development and the development of territories with difficult natural and climatic conditions and rich economic potential. The main problem of such tools is the high level of involvement of federal companies in the implementation of projects and the decreased participation of local companies in the construction and improvement of their native territory.

Expanding the circle of participants with the involvement of the scientific community in the discussion of Arctic development issues will help avoid shortcomings in the implementation of measures to achieve national goals in the Arctic region.

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Dialectal Diversity of the Arkhangelsk Oblast: Thematic Dictionary and Digital Platform

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Abstract. The article discusses the “Thematic dictionary of Arkhangelsk dialects”, which is a single-dialect, non-differential explanatory dictionary, and the digital platform that supports the printed materials of this dictionary. The Northern Russian dialects maintain archaic linguistic features, making them attractive for linguistic research. The “Thematic dictionary of Arkhangelsk dialects” contains unique linguistic material collected during dialectological expeditions in the Arkhangelsk Oblast. The distribution of material according to topics contributes, on the one hand, to more in-depth and detailed representation of lexemes and expressions, and, on the other hand, to systematic organization of individual aspects of the worldview of the speakers of the Northern Russian dialects. Within the grant project “Thematic dictionary of Arkhangelsk dialects with electronic support”, conducted by the Northern (Arctic) Federal University named after M.V. Lomonosov, the first three volumes of the dictionary have been published and an independent corpus of dialects has been developed and hosted on the university’s servers. The digital platform consists of desktop and mobile applications for the collection of dialect words, as well as a database and electronic dictionary accessible via a web interface, supplemented by an interactive lexical atlas. The developed lexical atlas provides a visual representation of geographical distribution of dialect words. The dialect material presented in the dictionary and on the platform will be useful both for specialists and for individuals interested in the culture and lifestyle of the Russian North.
Keywords: *Arkhangelsk dialects*, *dialect lexicography*, *corpus linguistics*, *dialect dictionary*, *thematic dictionary*, *electronic lexicography, digital platform*

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Introduction

In recent decades, philologists have repeatedly noted the special, unique position of the Northern Russian dialects in the dialect system of the Russian language. Being the "periphery" of the literary language, dialects preserve archaic linguistic features to a greater extent and resist innovations in it longer. Following this logic, the Northern Russian dialects can be considered a "periphery of the periphery", as they, due to the territory of their existence, are too remote not only from the innovations of the literary language, but also from the interaction with other dialects; such remoteness contributes to the greater preservation of archaic linguistic features in them [1, p. 53]. In addition to data important for the history of the Russian language, the dialects of the Russian North also reflect the realities of everyday life and culture of its speakers, their perception of the world and human, their mythological and religious ideas. The linguistic picture of the speakers of these dialects has been formed for centuries by the remoteness of the northern territories, their special nature and the crafts developed there.

"Revealing" the picture of the world embedded in dialects is facilitated by recording the speech of their speakers and its further studying. Arkhangelsk dialects, in particular, need such research. Unique linguistic material collected during dialectological expeditions in the Arkhangelsk Oblast and currently stored in the card index of the Department of Russian Language and Speech Culture of NArFU allows us to compile a thematic dictionary of Arkhangelsk dialects. Distribution of material by topic contributes, on the one hand, to a deeper and more detailed presentation of lexemes and expressions united by a common theme, and, on the other hand, to reflection and systematization of separate large layers of the world picture of the speakers of Arkhangelsk dialects. Each issue of the dictionary is an attempt to carefully "collect" one of these large layers, which in the future should form the most complete (within the compilers' capabilities) idea of the world picture of Arkhangelsk dialects. The dialect material presented in the dictionary can be useful for philologists, ethnographers, historians, local historians, museum workers, lecturers, teachers, as well as a wide range of people interested in the culture and life of the Russian North.

In the grant project "Thematic dictionary of Arkhangelsk dialects with electronic support", in addition to creating the first issues of the dictionary (three issues have been published so far), an independent corpus dedicated to Arkhangelsk dialects was created, which is hosted on the university server; the dialect corpus website is available at https://arkhdialect.narfu.ru/index.html. The creation of the dictionary and dialect corpus dedicated to Arkhangelsk dialects was discussed in the article "Electronic Dictionary of Arkhangelsk Dialects" [2].

Thematic dictionary

"Thematic dictionary of Arkhangelsk dialects" includes dialect vocabulary arranged by thematic groups. The dictionary is planned to be published in several editions. The first edition of the dictionary "Clothes, shoes, headwear, accessories, fabrics" was published in 2023 (Fig. 1) [3], the second edition "Residential and household buildings and their parts" (Fig. 2) and the third edition

"Traditional northern dishes and drinks and methods of their cooking" (Fig. 3) were published in 2024 [4; 5].

Fig. 1. First edition.

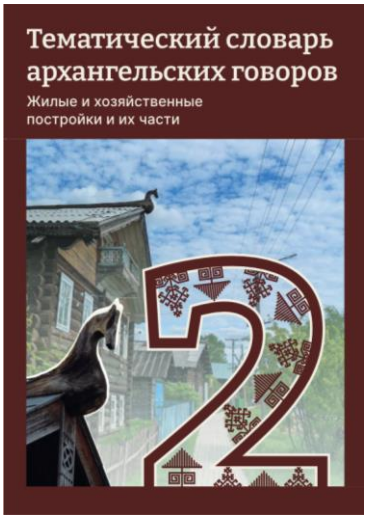

Fig. 2. Second edition.

Fig. 3. Third edition [1].

[1] The cover design was made by the artist S.D. Ivanova.

"Thematic dictionary of Arkhangelsk dialects" refers to single-dialect explanatory dictionaries of a non-differential type [6]. In addition to the dialect words, the dictionary records some commonly used words related to these thematic groups, such as: *jacket, shirt, alley, barn, crust, pie, sweet, cheese*. Such words are included in the dictionary because they are still actively used in the speech of rural residents. However, the illustrative material shows that their use in dialects is often specific. Thus, the adjective *сладкий* [sweet] (as well as its derivative *сладенький* [sweetie]), in addition to its basic meaning in the literary language, acquires the meaning "delicious" in Arkhangelsk dialects: Всёгды́ мно́го ры́бы-то бы́ло, э́ки сла́дки бы́ли. [There have always been a lot of fish, they were so sweet.]// Су́п сла́денькой, ка́ша сла́денькая. [Sweet soup, sweet porridge.] (Kargopolskiy district); at the same time, to express the main meaning, an adjective with a full-vowel root *солодкий* [sweet] can be used: Соло́дкий бо́льно ча́й де́лаешь. [You make tea too sweet.]// Соло́дка карто́шка в я́ме за́ зиму ста́ла, хо́лодно, вида́ть, в я́ме, ме́лка, неглубо́ка я́ма-то. [Potatoes in a root cellar have become sweet during the winter, it seems cold in a root cellar, it is shallow, it is not deep.] (Krasnoborskiy district)

The commonly used word *сыр* [cheese] is used in Arkhangelsk dialects in three meanings, none of which corresponds to the main meaning of this word in the literary language: **СЫ́Р** [cheese], m. — 1. *Cottage cheese*. На́до сы́р дави́ть [It's time to press cheese] (Verkhnetoyemskiy district); Ра́ньше тво́рог сы́ром зва́ли да. [Previously, cottage cheese was called cheese, yes.] // Со́чни пекли́, на и́х кла́ли сы́р и́ли чё́-нибудь ишшо́, и ша́ньги получа́лись [They baked sochni [cottage cheese patty], they put cheese or something else on them, and they got shangi [type of pastries]] (Lenskiy district). 2. *Food — cottage cheese, stewed in the oven and seasoned with sour cream, sugar or salt*. Сы́ра-то с молоко́м холо́дным хорошо́ пое́ли [We ate cheese and cold milk] (Vilegodskiy district); Наклады́т смета́ны, промеся́т, склады́т в ця́шу, поло́жат в пе́ць. Ка́к сы́р испеке́ццe, вы́ймут и вы́пружат из ча́ши на таре́лку [They will add sour cream, knead it, put it in a bowl, and put it in the oven. As the cheese is baked, they take it out of the bowl and put it on a plate] (Leshukonskiy district). 3. *Curd Easter*. Сла́дкий-то сы́р де́лали на Па́сху все́ [Sweet cheese was made for Easter by everyone] (Verkhnetoyemskiy district); К Па́схе сы́р ка́жной го́д де́лали [Cheese was made for Easter every year] (Kholmogorskiy district).

The words in the dictionary are divided into thematic groups, and within each issue — into thematic subgroups. In the subgroups, the words are given in alphabetical order. In the first issue, the vocabulary naming clothes, shoes, headwear is divided by gender: vocabulary that names women's clothing (shoes, headwear); vocabulary that names men's clothing (shoes, headwear); a separate subgroup contains vocabulary that names clothes (shoes, headwear) worn by both men and women. This issue includes the groups "Bedclothes", "Tablecloths, towels, napkins".

The second issue contains a separate subgroup of words naming parts of a residential area; words naming outbuildings are divided into two subgroups, taking into account their location in relation to the house: words denoting outbuildings and places for livestock that are located under the same roof as the residential part of the house, for example, a shed, a stall, and outbuildings

that are separate from the residential building, for example, a barn, a drying house [6]. A separate subgroup is made up of words naming a stove and its parts. The appendix to the second issue contains photographs of parts of a northern house, as well as schemes of a Russian stove and a northern peasant house in section, with parts of the stove and house indicated on the scheme.

The third issue of the "Thematic dictionary of Arkhangelsk dialects" consists of dialect vocabulary related to the group "Traditional Northern dishes and drinks". Taking into account the fact that many names of dishes made from mushrooms and berries are derivatives of their names, the compilers of the dictionary considered it necessary to supplement the lexical-semantic group with thematic subgroups "Names of mushrooms" and "Names of berries". In addition, the studied dialectological material allows us to single out a separate thematic group, which consists of vocabulary denoting food for livestock.

A dictionary entry consists of:

- heading word; it is given at the beginning of the dictionary entry;
- grammatical notes: the gender of nouns is indicated: *м*. — masculine, *ж*. — feminine, *ср*. — neuter; if the word is used in the plural, the note *мн*. is given; adjectives have gender endings; verbs have the form: *сов*. — perfective form, *несов*. — imperfective form; adverbs — *нар*.;
- interpretation of the meaning of the word or meanings, if the word is polysemantic; word meanings are indicated by Arabic numerals;
- examples of the use of the word;
- geographical information: only areas are indicated without specifying settlements [6].

The interpretation of the meaning of the word sometimes contains ethnographic (encyclopedic) descriptions that allow revealing the specifics of northern life, traditions, local products and dishes, the features of their cooking. For example, the adjective *межо́ный* refers to fish that is salted in a special way in the Plesetskiy district; the following explanation is used to characterize this salting: **МЕЖО́НЫЙ**, ая, ое — *Special salting (about fish). The fish is undersalted and kept warm or in the sun until its meat becomes loose, "ashy", with a special smell. Rye fish pie with such fish is the first course for a festive table in the Plesetskiy district*. Есь и межо́на ры́ба, кото́ру поме́ньшо посоля́т да на со́лнце подёржат, дак он как пе́пел де́лается. Люблю́ межо́ну ры́бу. [There is also fish, which is lightly salted and exposed to the sun, so it becomes like ashes. I love such fish.]// Поди́-ко, ры́ба-то межо́на, а ты не хо́чешь, попро́буй-ко [Come on, it's a mezhonaya fish, but you don't want it, try it] (Plesetskiy district). The adverb *ма́ком*, which denotes a common way of eating food among speakers of Arkhangelsk dialects, also has the necessary explanation: **МА́КОМ**, adv. — *The way of eating food (usually fish, dishes with gravy) with hands — a piece of bread is dipped in gravy, and then a piece of fish is put on it and eaten*. Трешшо́чку-то я ма́ком то́лько и ем, карто́шку отварю́ да ма́слица подолью́ [I eat cod only with hands, I boil potatoes and add some oil] (Mezenskiy district).

Often the specifics of the dish and the features of its cooking are explained by the informants and reflected in the contexts, the narrative of which in these cases is similar to the narrative of culinary recipes, for example: Окро́шку де́лаем: лу́ку, яи́цко накро́шим да карто́шки варёной, смета́ны, квас — вот и всё [This is how we cook okroshka: we chop onions, eggs, boiled potatoes, add sour cream, kvass — that's all] (Verkhnetoyemskiy district).

Illustrative material showing how a dialect word functions in the language includes examples from dialect speech, which reflect vivid dialectal phenomena of Arkhangelsk dialects; the linguistic material is given in orthographical note, but with elements of transcription.

Digital platform: electronic corpus of Arkhangelsk dialects

For processing, analyzing and presenting dialect materials to a wide audience, a digital platform — an electronic corpus of Arkhangelsk dialects — has been developed. Additional components are being developed to make working with the corpus more convenient and efficient.

The digital system currently consists of the following components (Fig. 4):

- the desktop application “Word Bank”, which automates the collection and processing of dialect material and provides tools for dialect analysis (classification of dialect words by type) [7];
- the mobile application ArkhDialect, designed to collect dialect materials, can be used in the field;
- the desktop application “Scanner”, which allows converting scanned handwritten dialect materials into electronic form (under development);
- a server for data processing and storage, including:
  - a web interface to organize moderation of added content;
  - a database in which dialect material is stored;
  - a dialect corpus in the form of a web service where materials from the database can be viewed in a convenient form.

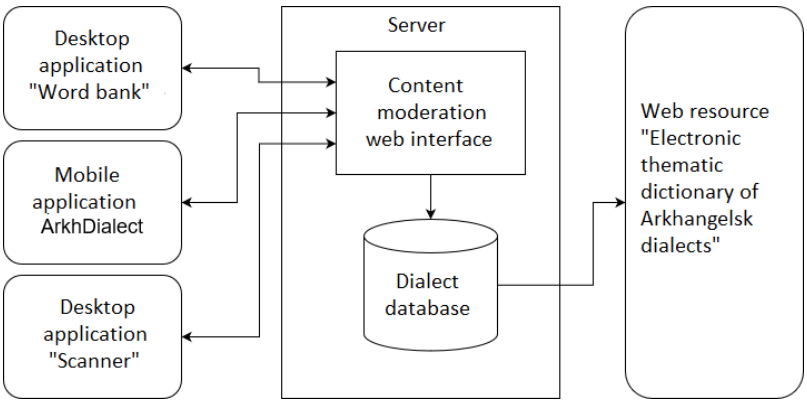

Fig. 4. Schematic diagram of the information system.

The schematic diagram of the information system is shown in Fig. 4. The dialect material is uploaded to the server using one of the three developed applications. Before a word or text enters the database and, consequently, the dialect corpus, it must be checked by an expert. Content moderation is carried out manually using the web interface. The web resource “Electronic themat-

ic dictionary of Arkhangelsk dialects" provides free access to the materials uploaded to the dialect database [7].

The developed application "Word bank" was previously described in detail in [7].

The web interface allows finding the necessary words: either a specific word form, or words with specified characteristics, for example, related to a certain thematic group, used in a particular region or belonging to specific parts of speech (Fig. 5).

The found words can be sorted in direct or reverse alphabetical order, in direct or reverse order by thematic groups.

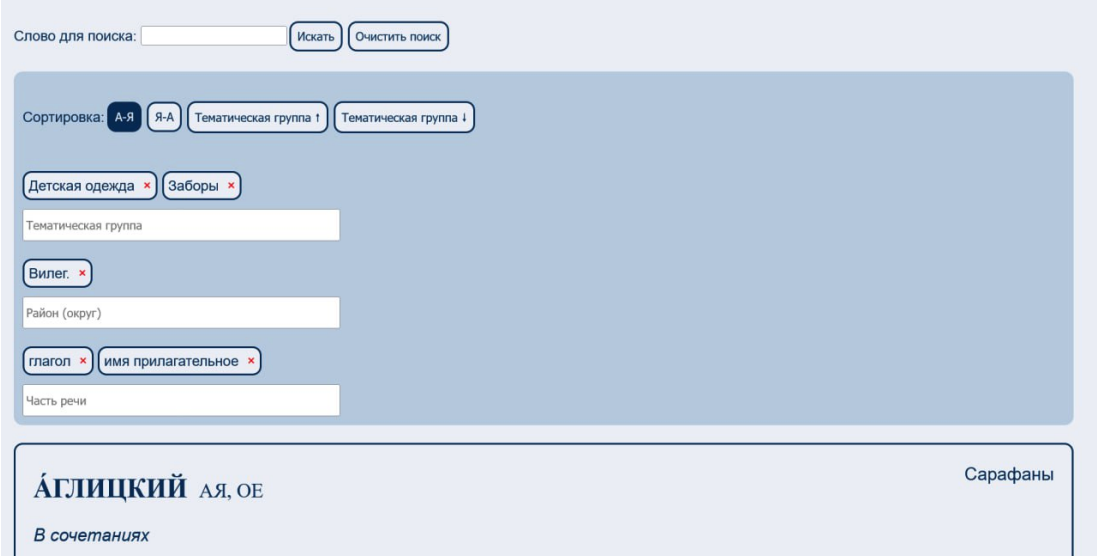

Fig. 5 "Electronic thematic dictionary of Arkhangelsk dialects".

The electronic dictionary entries are presented in the form of dictionary cards. The word, its grammatical characteristics, and thematic group of the card are highlighted separately. The main section of the card contains the meaning of the word and examples, divided by districts.

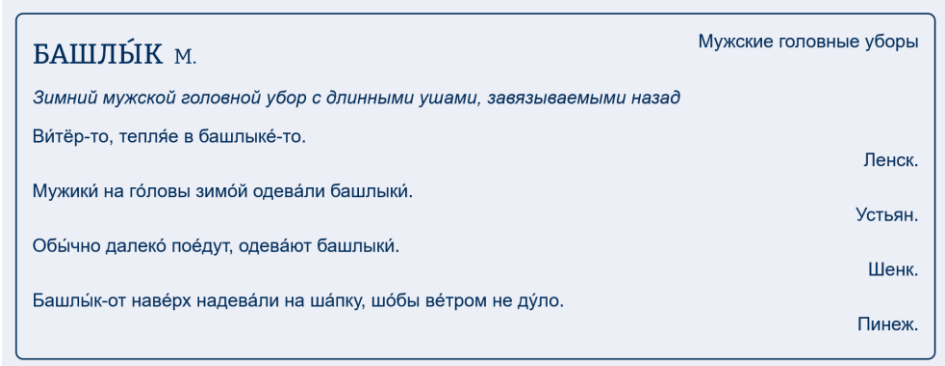

Fig. 6. Dictionary card.

A dialect lexical atlas of the Arkhangelsk Oblast has been developed for visual clarity, where one can see the areal of a word from the dictionary (corpus) or compare the areals of several words.

Similar lexical atlases have been developed for other regions.

For example, in the linguo-geographical system "Dialect" [8], offered by the Izhevsk State Technical University in cooperation with the Udmurt State University, words that relate to the se-

lected topic are placed on a map of the region. As an example, the placement of words united by the topic “wolf” on the map is presented (Fig. 7).

A similar system has been implemented by the Laboratory of Information Technologies for Education at the Volgograd State Pedagogical University. The lexical atlas of the Volgograd Oblast [9] is based on pre-designed question-maps. Each such map reflects, firstly, dialect words united by a common theme (for example, “wild animals”); secondly, the areas in which these words are found. The areas of use are also marked on the regional map with special symbols (Fig. 8).

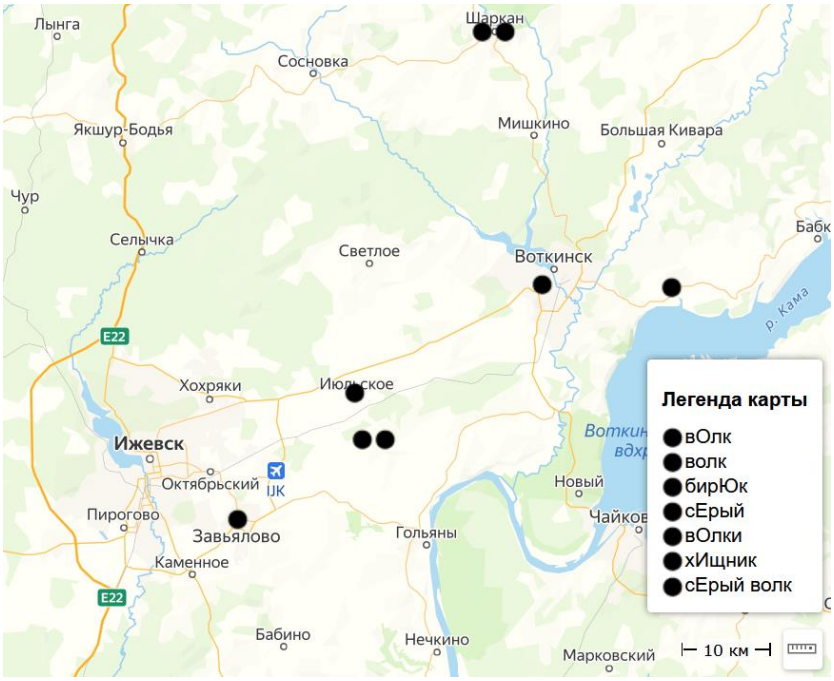

Fig. 7. Map of the distribution of words related to the theme “wolf” in the linguo-geographical system “Dialect”.

Fig. 8. Question map “Wild animals” in the lexical atlas of the Volgograd Oblast.

The options presented above demonstrate thematic design. In the thematic dictionary of Arkhangelsk dialects, voluminous thematic categories are highlighted, the words related to them are difficult to display on the map due to their number. Therefore, a different approach was used in developing the lexical atlas of the Arkhangelsk Oblast: a word or several words specified by the user are directly placed on the map (Fig. 9).

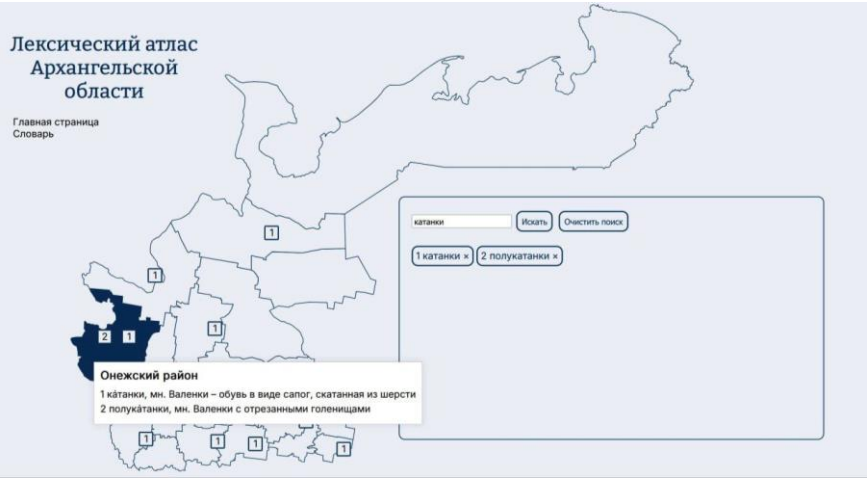

Fig. 9. Lexical atlas of the Arkhangelsk Oblast.

When putting the cursor over a particular district, the following information appears:

- the name of the district;
- a list of words requested by the user from those found in this district;
- their lexical meaning and grammatical characteristics.

For the convenience of working with the search, protection from incorrect input has been implemented. Entering Latin or non-alphabetic characters is prohibited, uppercase characters are automatically converted to lowercase. It is recommended to work with the atlas using a personal computer, since the full map may be too small on the screen of a mobile device.

Conclusion

The first several volumes of the multi-volume thematic dictionary of dialects of the Arkhangelsk Oblast were published as part of a project implemented at the Northern (Arctic) Federal University named after M.V. Lomonosov. On the basis of these materials, a dialect corpus was developed, which became the basis for an electronic dictionary that allows a wide range of readers to get access to dialect materials. An interactive lexical atlas was also developed, which displays the areas of use of different dialectisms and serves as a tool for analyzing the areas of distribution of dialect words.

The dialect corpus, filled with thematic dialect materials, will become a valuable resource for specialists engaged in the study of Russian folklore. Dialect materials, divided into thematic groups, will help in organizing museum and ethnographic activities, in works on social history and ethnography, in studies of folk costume and life. The research results can be used in educational projects introducing the richness of northern culture to the audience; in local history projects; in the preparation of cultural events dedicated to the language of the Russian North; in the teaching of Russian literature in universities and schools.

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